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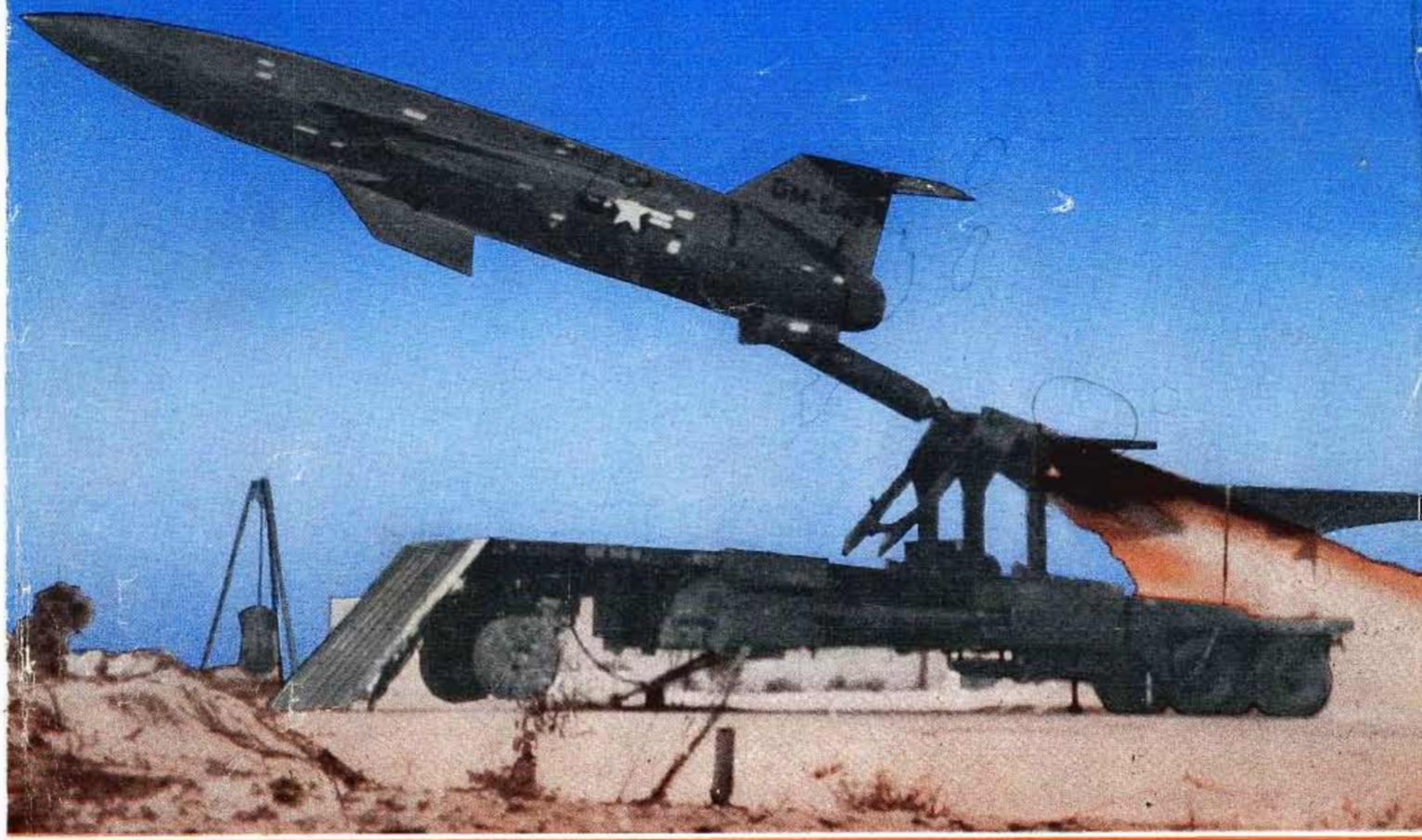

USAF B-61 Matador, pilotless bomber, launched on test flight. It will be tracked by radar stations down range and will telemeter information to base

How the Newest Lawrence Color-TV Tube Works

Ceramic Capacitors in Circuit Miniaturization

"Reps" Directory

November • 1951

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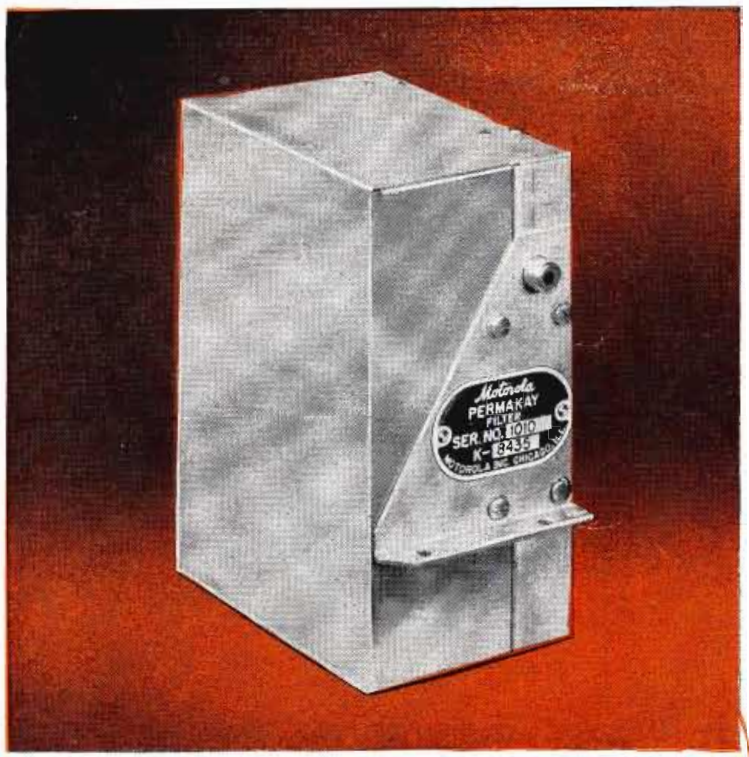


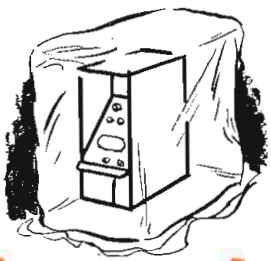
In Sensicon exclusive design the

Motorola Wave Filter removes 15 nuisance tuning adjustments

More tuned circuits and superior performance with *fewer* tuning adjustments in the SENSICON Receiver are achieved using the PERMAKAY IF Wave Filter. The modified constant-K, m-derived band pass filter contains 15 tuned circuits . . . BUT . . . you are not burdened with field alignment and complex tuning adjustments. The filter, tuned and sealed during manufacture, requires no further adjustments . . . *ever.* This combination provides over 100 db signal rejection at the *edge* of the adjacent channel while providing a broad bandpass at 6 db for full modulation deviation acceptance.

Motorola's unique Permakay system of linear phase shift adjustment solves the problem of reflection and pulse noise control to provide maximum signal-to-noise ratio for the phenomenally high interference-rejection.

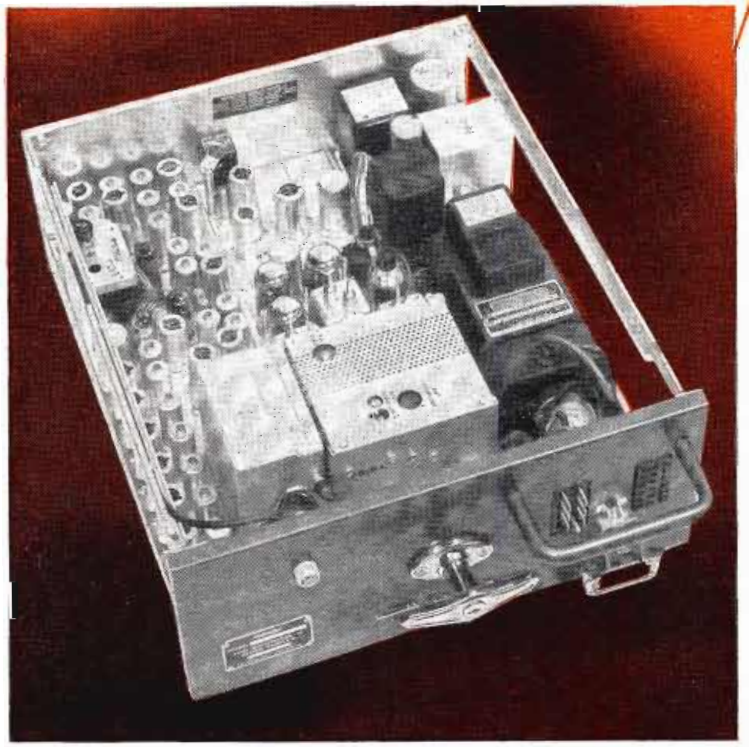
DUST AND HEAT-PROOF



WATER AND COLD-PROOF

TAMPER AND SHOCK-PROOF

Motorola 2-way radio



and guarantees permanent selectivity

The PERMAKAY Filter characteristics are made permanent by casting the entire unit in a solid block of polyester-styrene plastic. Never can the precisely tuned circuitry be affected by water, dirt, heat, cold or mechanical shock. Temperature compensation insures constant performance even at extreme temperatures as demonstrated in all rigid laboratory torture tests. Motorola's *unconditional* guarantee of the PERMAKAY Filter for the life of the set again demonstrates that Motorola is still your best investment.

Over 22 Years of Leadership in Mobile Radio . . .

Year in and year out, Motorola installations number more than *twice* those of all other manufacturers *combined* and more than *five times* those of the nearest competitor.

Motorola

Communication and Electronics Division
4545 Augusta Blvd., Chicago 51, Illinois

TELE-TECH

RADIO-TELEVISION-ELECTRONIC INDUSTRIES

Edited for the 15,000 top influential engineers in the Tele-communications and electronic industries, TELE-TECH each month brings clearly written, compact, and authoritative articles and summaries of the latest technological developments to the busy executive. Aside from its engineering articles dealing with manufacture and operation of new communications equipment, TELE-TECH is widely recognized for comprehensive analyses and statistical surveys of trends in the industry. Its timely reports and interpretations of governmental activity with regard to regulation, purchasing, research, and development are sought by the leaders in the many engineering fields listed below

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AUDIO AMPLIFYING EQUIPMENT
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Research, design and production of special types
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Installation, operation and maintenance of telecommunications equipment in the fields of

BROADCASTING • RECORDING
AUDIO & SOUND • MUNICIPAL
MOBILE • AVIATION
COMMERCIAL • GOVERNMENT

NOVEMBER, 1951

FRONT COVER—THE B-61 MATADOR ROBOT BOMBER: This new radio-controlled pilotless plane developed by the Air Force, is an example of the fantastic new weapons the United States is developing. Such pilotless bombers can carry an atomic warhead, outrace the fastest jet, and serve as long-range artillery for front-line ground troops. The Navy has also announced that the coming Atlantic Fleet maneuvers will simulate tactical use of a new small-size A-bomb for carrier use.

* *ELECTRONIC INDUSTRIES for DEFENSE . . . See articles marked with asterisks*

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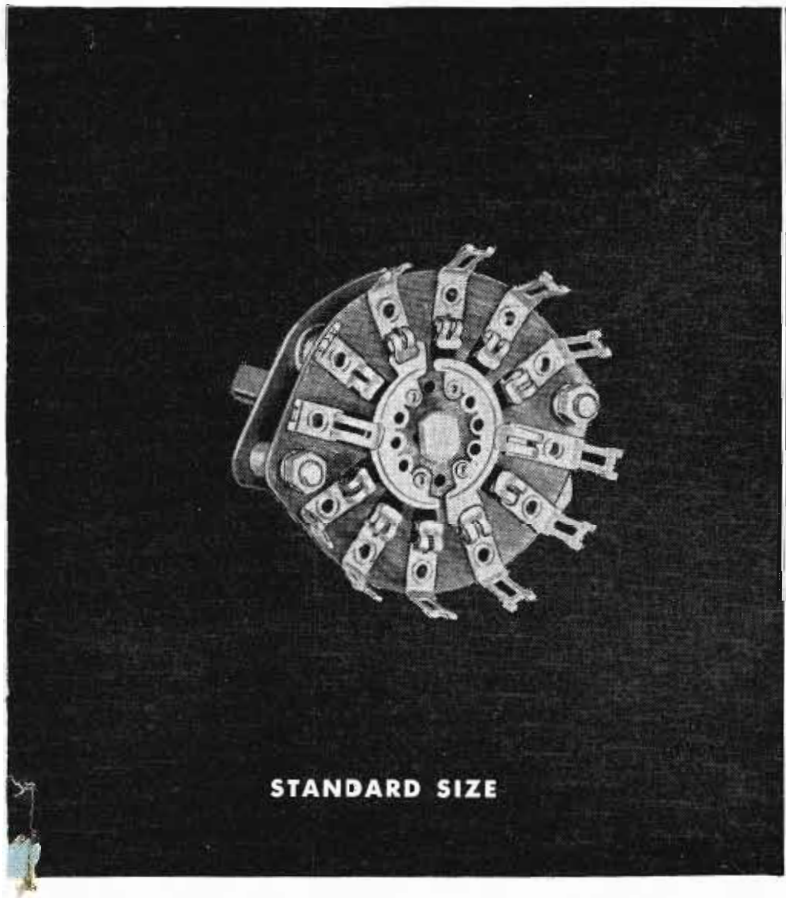
NEW
MINIATURE SWITCHES
BY CENTRALAB

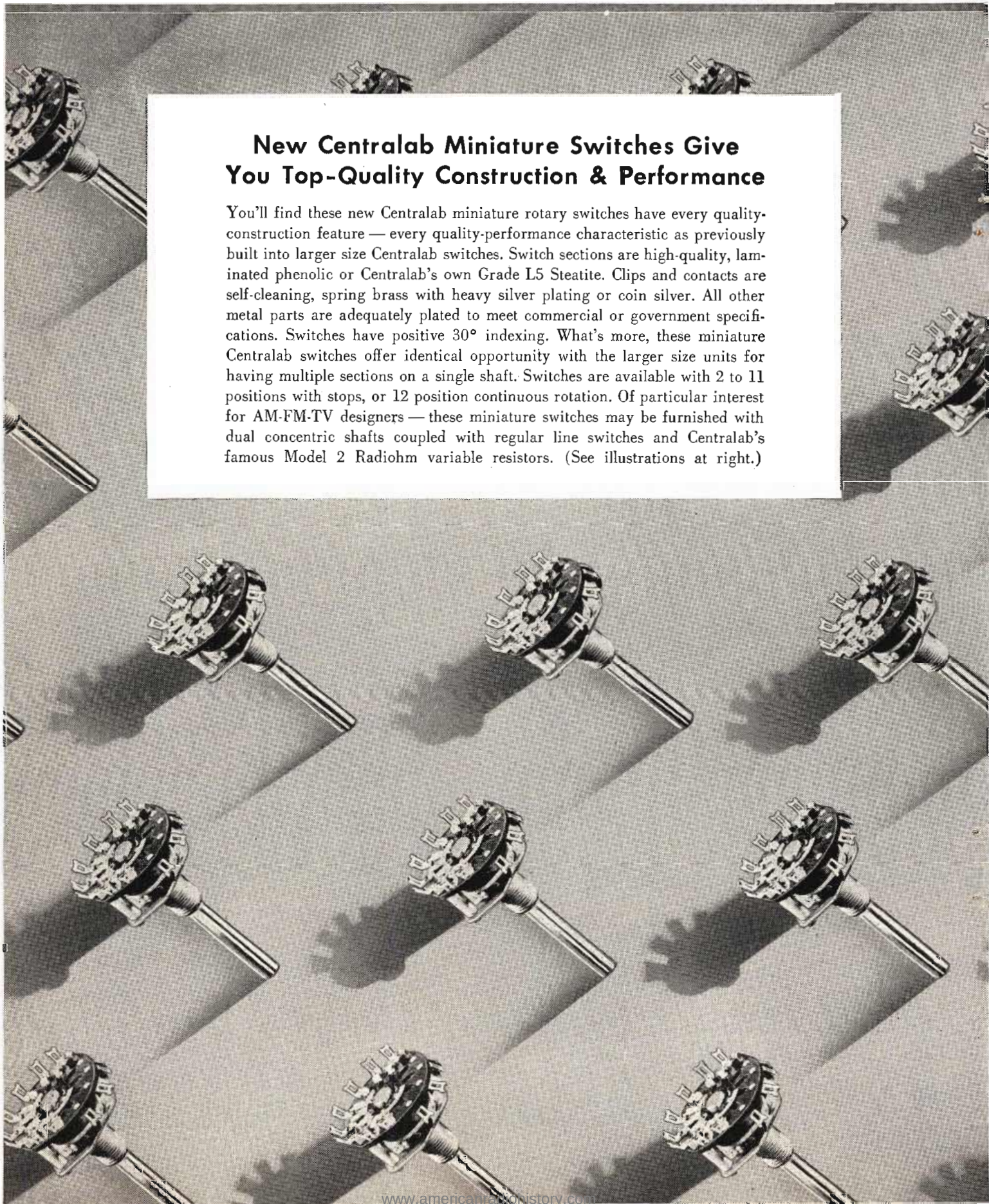


Now, Centralab, the first name in Electronic Components, offers new design possibilities in an entirely new line of truly miniature, top-quality, rotary switches for radio, TV and similar high-frequency, low-power applications.

WANT MORE INFORMATION? **SEE NEXT 2 PAGES ➡**

CENTRALAB ANNOUNCES A COMPLETE

FOR COMMERCIAL OR



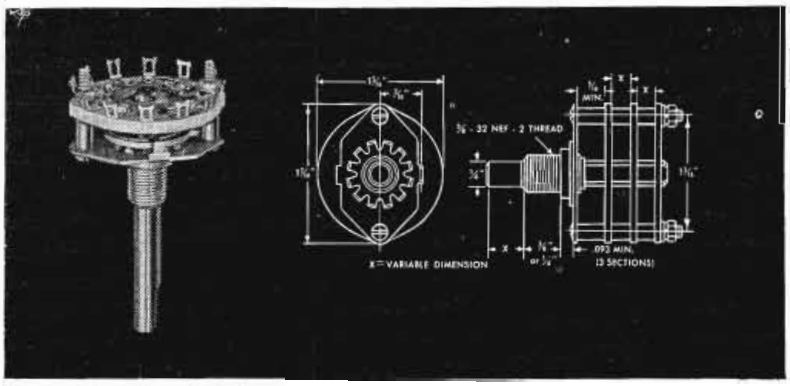
New Centralab Miniature Switches Give You Top-Quality Construction & Performance

You'll find these new Centralab miniature rotary switches have every quality-construction feature — every quality-performance characteristic as previously built into larger size Centralab switches. Switch sections are high-quality, laminated phenolic or Centralab's own Grade L5 Steatite. Clips and contacts are self-cleaning, spring brass with heavy silver plating or coin silver. All other metal parts are adequately plated to meet commercial or government specifications. Switches have positive 30° indexing. What's more, these miniature Centralab switches offer identical opportunity with the larger size units for having multiple sections on a single shaft. Switches are available with 2 to 11 positions with stops, or 12 position continuous rotation. Of particular interest for AM-FM-TV designers — these miniature switches may be furnished with dual concentric shafts coupled with regular line switches and Centralab's famous Model 2 Radiohm variable resistors. (See illustrations at right.)

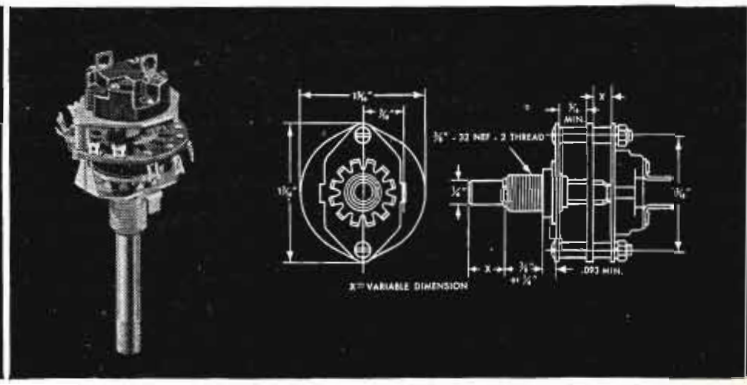
NEW LINE OF MINIATURE SWITCHES

MILITARY APPLICATIONS

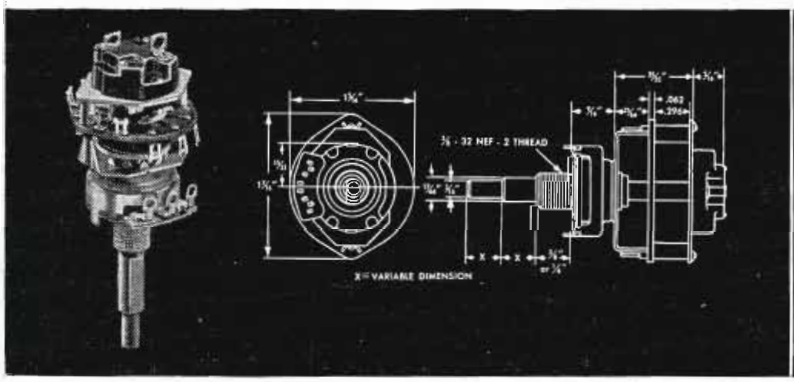
Now Centralab offers a completely new, unusually small rotary switch line — available in a variety of multi-pole, multi-position, multi-section models and in combination with line switches and variable resistors.



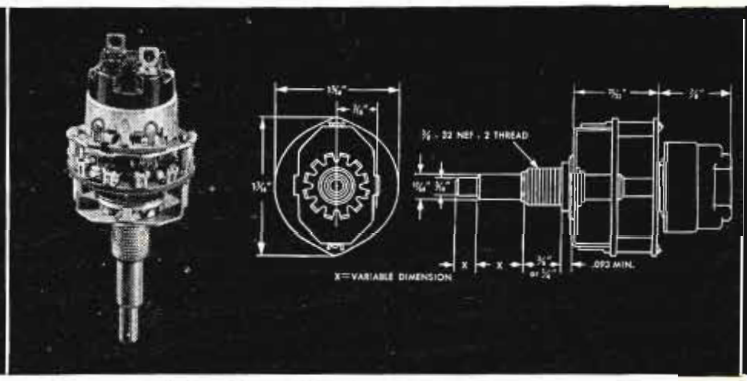
New Centralab Series 20, miniature, single section, phenolic switch. Available in 2 to 11 positions with stops, or 12 position continuous rotation — and with multiple sections.



Here's standard Series 20 miniature switch with standard shaft and phenolic section with conventional off-on switch added. Also available with multiple sections.



Combination Series 30 miniature switch unit with dual concentric shaft — permits independent operation of miniature switch including off-on switch, and Model 2 variable resistor.



Same combination Series 30 unit as shown at left, *except* that Model 2 variable resistor is mounted at rear of miniature switch. Position of resistor provides convenience of wiring.

If you need a truly small size, long-life switch, Centralab's new miniature Series 20 and Series 30 switches are the answer. They have been specifically designed to meet the modern trend toward greatly reduced size in electronic equipment for high-frequency, low-current applications. Extremely compact design and small size, plus availability of separate sections and index assemblies provide an adaptability that is invaluable to design engineers and manufacturers. For complete specification information on the new Centralab Miniature Series 20 and Series 30 Switch line, mail the coupon today. *Manufacturer's samples promptly.*

Centralab

Division of GLOBE-UNION INC • Milwaukee

CENTRALAB Division of Globe-Union Inc.
938 East Keefe Avenue, Milwaukee 1, Wisconsin

Please send me complete specification information on Centralab's new Series 20 and Series 30 Miniature Switch line.

Name .....

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TELE-TIPS

WHEW! In all the array of big figures provided by the Bell System concerning its new coast-to-coast TV-telephone relay, the biggest number of all was overlooked—the total voltage amplification on the transcontinental microwave radio relay. So here, for your amazement, we present the magic multiplier. Written compactly, it is "10 to the 364th power." Or if you like your statistics in full, put down the figure 1, then write after it 364 zeros! If we tried to print it for you, the number would stretch as a line of zeros clear across this page and the page opposite, and would even turn over into a second line also two pages in width.

FIRST COLOR-DISC investigator, did you know, was Sir Isaac Newton, 1642-1727, (who also defined the laws of gravitation). In his revolving color-disc experiments, Newton was trying to find what size color-sectors, rapidly rotated, would produce white or gray. He came up with sector angles as follows: Red 61°; orange 34°; yellow 54°; green 60°; blue 54°; indigo 34°; and violet 60°.

RESEARCH is becoming a top consideration with investment companies. One group, Growth Companies, Inc., Philadelphia, provides venture capital for smaller firms, making its investing decisions partly on basis of research programs of firms. American Research and Development Corp., Boston, supplies capital for new ideas and developments.

HOME GARAGES seem destined to play a big part in electronic history. It will be remembered that radio broadcasting itself was first launched in the garage of Dr. Frank Conrad, in Pittsburgh, in 1920. And Dr. Allen B. DuMont did important cathode-ray-tube pioneering in his garage during the depression years. Now comes the atom-famed Dr. E. O. Lawrence of Berkeley, Calif., whose new simplified color-tube was handmade on his garage workbench during recent summer months, then flown to New York for demonstration.

(*Continued on page* 12)

edi expands facilities to meet demand for unique lines of selenium rectifiers

New and improved designs already used in military and civilian applications. In order to facilitate better deliveries of selenium rectifiers manufactured by its Precision Rectifier Division, EDI has inaugurated a large scale expansion program. A new, fully staffed plant, complete with the latest rectifier manufacturing and test equipment, has been set up. This plant will produce all of Precision's selenium rectifiers in addition to new and improved designs, many of which have already been adapted for military applications.

ENCASED MINISEL LINE USED IN GOVERNMENT SUBMINIATURIZATION PROGRAMS

The MINISEL line is now being used in such applications as synchro overload transformers, relay spark suppressors and special control instruments. Their long life, rugged construction, high operating temperatures (as high as 90°C.), matched plate characteristics and extremely small size have made them especially useful in these military applications. Under specified conditions these rectifiers are guaranteed for as long as 2000 hours or 2 years, whichever comes first.

INSTRUMENT RECTIFIERS NOW MADE FROM SELENIUM CELLS

MINISEL rectifiers are also being manufactured in a complete line of instrument rectifiers. It is the first time that selenium rectifiers have been successfully adapted to this purpose. This has been made possible by the perfecting of a selenium rectifier cell which has even more stability and uniformity than that which is normally associated with copper oxide cells.

NEW MOLDED-IN S.R.'S CUT PRODUCTION COSTS ON ELECTRONIC ASSEMBLIES

The PLASTISEL line of selenium rectifiers through 200 M.A. are molded-in to plastic casings which give them the appearance of small condensers. (From 250-500 M.A. an improved type of open stack construction is used.) These molded-in units eliminate the usual open stack rectifier problems encountered on electronic assembly lines. They can be used to replace any vacuum, gas filled, or dry disc diode rectifier. In multiple they can be used to replace multiple groups of these rectifiers in such circuits as center tap and bridge rectifiers.

FREE ENGINEERING SERVICE

Electronic Devices, Inc. maintains a complete rectifier engineering service which is available to you without any cost or obligation.

Write or wire 429-12th Street, Brooklyn 15, N. Y. or telephone SOuth 8-3530.

edi

ELECTRONIC DEVICES, INC.
429—12TH STREET, BROOKLYN 15, N. Y.

FIG. 1. Typical MINISEL units.

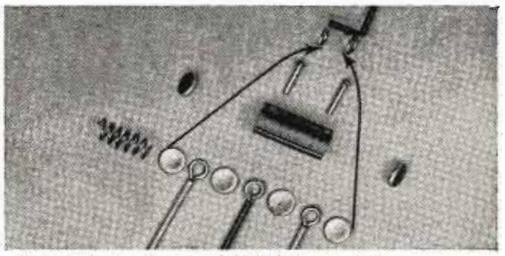

FIG. 2. Exploded view of MINISEL type MS.

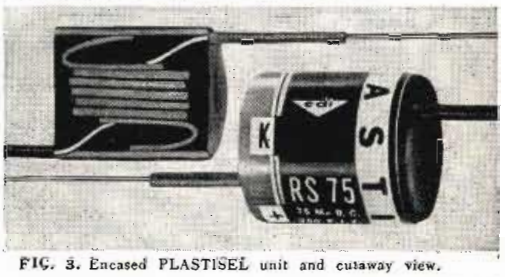

FIG. 3. Encased PLASTISEL unit and cutaway view.

FIG. 4. Typical hermetically sealed cans used for MINISEL type MS-HM or any PLASTISEL rectifier.

Send for complete product information hand book today!

ELECTRONIC DEVICES, INC.
429-12th St., Brooklyn 15, N. Y.
Gentlemen:
Please send me at no cost your hand book of EDI rectifier products.

Name_____
Title_____
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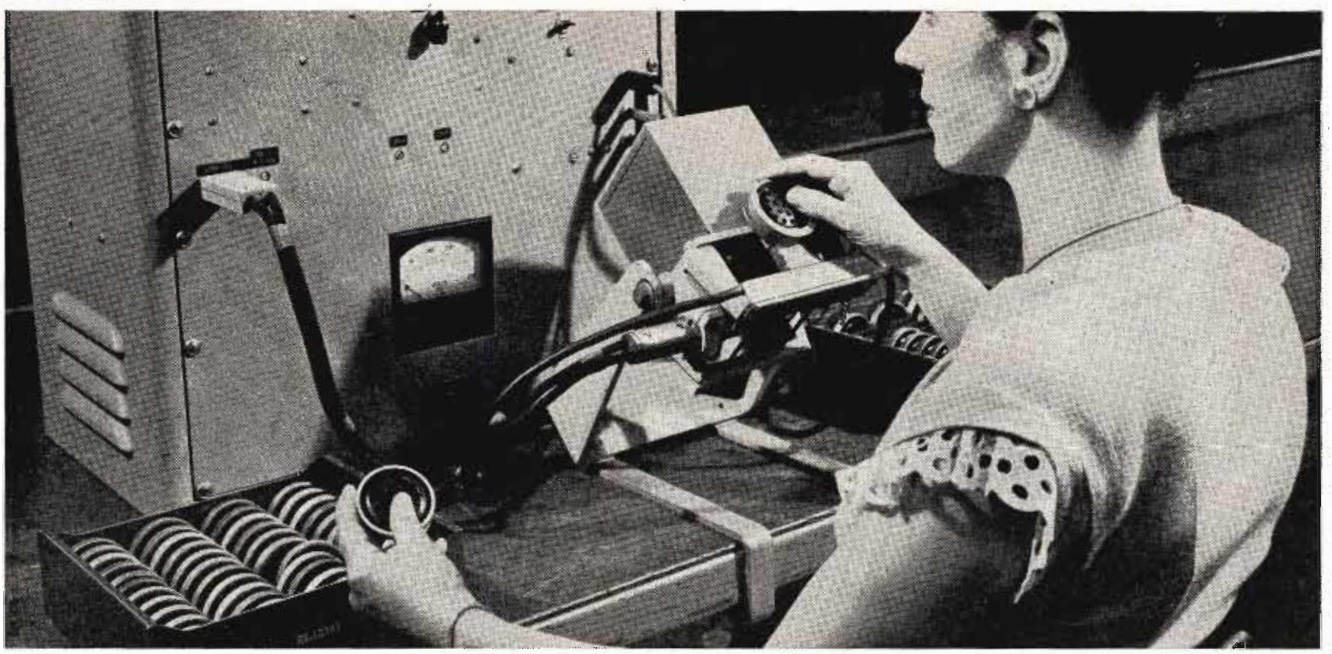
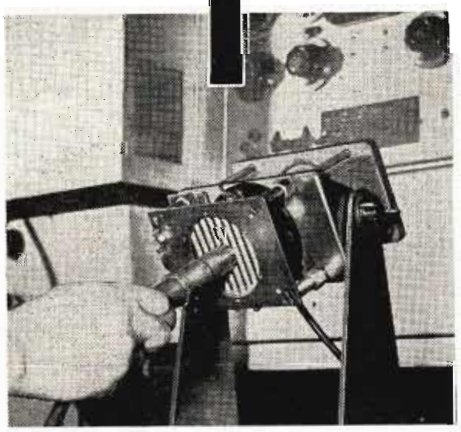
State_____
Main Products_____



This Western Electric employee mounts a transmitter in the test fixture which is swung down to face an artificial mouth at 45-degree angle, just as transmitters are held in use. More than a million transmitters are tested each year.

This mouth speaks to millions



At Bell Laboratories a scientist employs a condenser microphone to check the sound level from another type of artificial mouth, used in transmitter research.

To serve the changing needs of telephone subscribers millions of telephone sets have to be moved each year. Before being put back into service most of them are returned to the Western Electric Company's Distributing Houses where they receive a thorough checkup.

Western Electric engineers needed a rapid method of testing transmitters over a range of frequencies. At Bell Telephone Laboratories, scientists had just the thing—a technique they had devised for fundamental research on transmitters. In co-operation with these scientists, Western Electric engineers developed the practical tester in the illustration.

The transmitter is removed from the handset and put in front of an artificial mouth which emits a tone that swings several times per second over a band of frequencies. A signal lamp tells whether the transmitter is good. Each test takes 5 seconds.

This new tester illustrates how Bell Laboratories research and Western Electric manufacturing skill team up to maintain your telephone service high in quality yet low in cost.

BELL TELEPHONE LABORATORIES

• EXPLORING AND INVENTING, DEVISING AND PERFECTING, FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE

You won't find today's most widely used military capacitors listed in JAN!

Joint Army and Navy component specifications were never meant to limit engineering progress—and, with Sprague, they most certainly haven't!

. . . Sprague subminiature capacitors have pioneered size and weight reductions plus high-temperature operation that would have been impossible with conventional capacitors. You'll not find these unique, hermetically-sealed capacitors listed in the current issue of Joint Army-Navy specification JAN-C-25. In every case, however, they have been fully approved for use. The reason is simple: In effect, Sprague subminiature capacitors are *super*-JAN types. They greatly exceed the already high minimum quality limits established by JAN specifications.

As the long-time leader in capacitor development, Sprague clearly recognizes that its engineering obligation extends far beyond conventional standards—*so markedly so that much of today's tremendous production of Sprague components for military use is based on types for which no JAN specifications yet exist!*

Thus, to equipment manufacturers faced with the problems of reducing size and weight or of paving the way to higher temperature operation, Sprague offers help along many lines—from the subminiature capacitors shown here to Vitamin Q☆ photo-flash capacitors to Ceroc☆ 250°C. ceramic-Teflon insulated magnet wire and many others.

...opening new horizons to critical equipment design

You can do miniaturization jobs with these capacitors thot were hitherto impossible!

Conservatively rated in designs for either 85°C. or 125°C. operation and with voltage ratings from 100 to 1000 volts, Sprague subminiature hermetically-sealed paper capacitors are available in physical sizes materially smaller than JAN types. Rigid mounting is greatly simplified by a variety of new mounting designs—also pioneered by Sprague.

For complete information write for Bulletin 213B.

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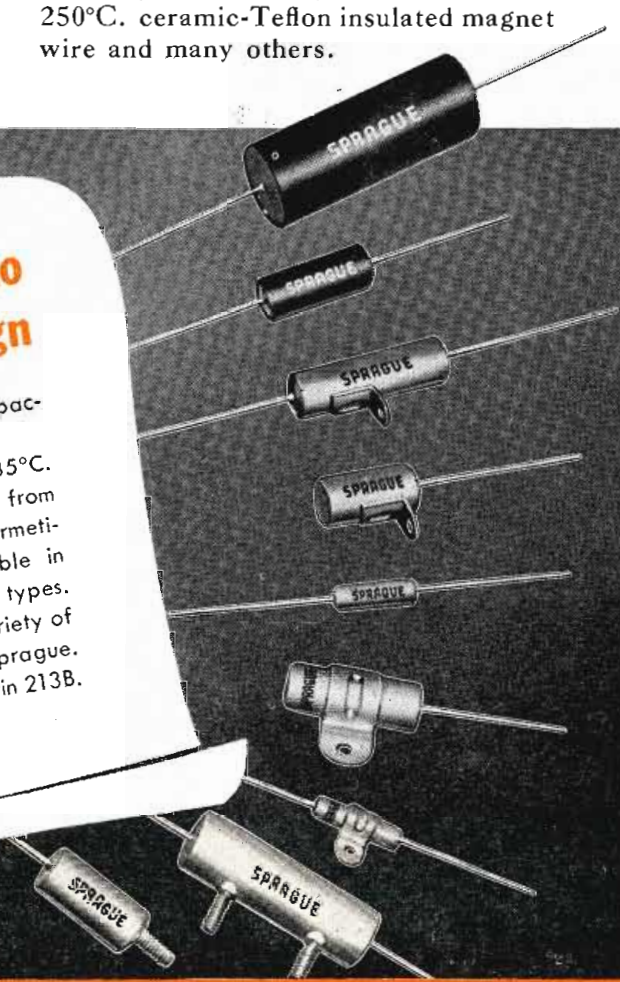


SPRAGUE

PIONEERS IN ELECTRIC AND ELECTRONIC DEVELOPMENT

SPRAGUE ELECTRIC COMPANY • NORTH ADAMS, MASSACHUSETTS

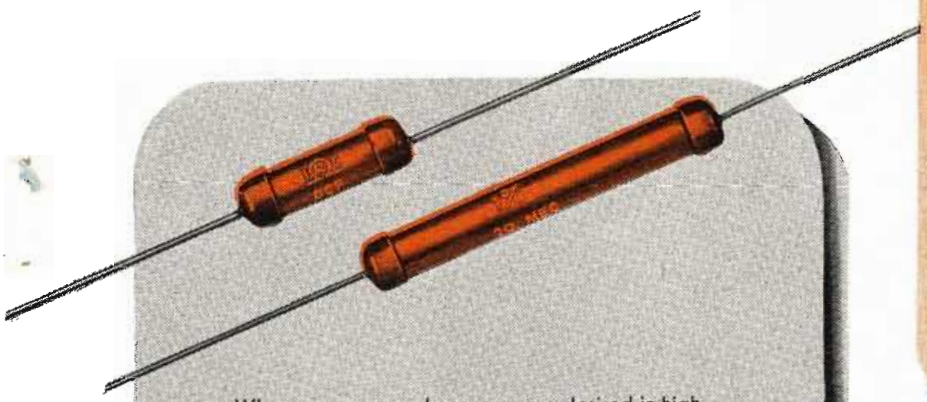
Quality control *for resistors too!*

You can test a Quality Control Program in several ways . . . Does it begin *outside* your plant—with rigid specification of materials? Does it include detailed, continuous production-line inspections? Are these supplemented by laboratory and field-testing of your parts and products? And finally—do you reject on the basis of minor flaws? *IRC answers "YES" to all these yardsticks!* But the real proof of our Quality Control Program is the multitude of customers who specify IRC resistors—year after year.

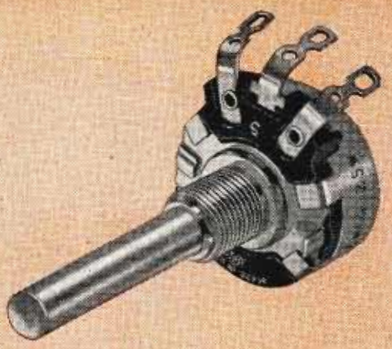
Typical products of quality control, IRC Advanced BT Resistors meet and surpass JAN-R-11 Specifications. In standard RTMA ranges, Advanced BT's are designed to operate with moderate temperature rise and provide efficient power dissipation. Reason is the combination of IRC's filament-type resistance elements with exclusive construction features. Resistance material is permanently cured and bonded to special glass. Leads extend into filament for rapid heat dissipation. Molded bakelite seals element against moisture and prevents grounding. Advanced BT's are available in ⅓, ½, 1 and 2 watt ratings. Send for full details in 12-page technical data Bulletin B-1.

Meet and beat JAN-R-11 Specifications.
⅓, ½, 1 and 2 watts—available in ±5%, ±10% and ±20% tolerance.
Low noise level and temperature coefficient.

is essential



Where accuracy and economy are desired in high frequency applications and circuits requiring high stability and close tolerance, use IRC PRECISTORS. IRC makes 2 sizes of PRECISTORS *to customers' specifications*, rather than to standard RTMA values (subject, of course, to maximum and minimum values for each type). You'll find PRECISTORS excellent where carbon compositions are unsuitable or wire-wound precisions too expensive. Coupon brings full particulars in Catalog B-4.



Quality control assures maximum uniformity in IRC's small 15/16" Type Q Controls. Construction features one-piece dual contactor of special alloy—simplified single-unit collector ring—molded voltage baffles—special brass element terminals that will not loosen when bent or soldered. Type Q Controls have unusual durability and efficiency—adapt to a great variety of small-space applications. Send coupon for full details in Catalog A-4.

Exacting tests and inspections control every step in the processing of IRC Power Wire Wound Resistors—assure balanced performance in every characteristic. In essential electrical and mechanical characteristics, these rugged wire wounds are ideal for heavy duty applications. Steatite forms are uniformly wound with high-grade alloy wire, and coated with special heat-dissipating cement. PWW's have been specified for over 14 years by leading industrial, commercial, broadcast, maritime and aircraft users. Catalog C-2 contains full information.

Your supplies of standard resistors for pilot runs, experimentation, or maintenance need never get out of control. When you need resistors in a rush, simply phone your local IRC Distributor. We keep his shelves filled with the most wanted types of standard resistors; he can give you prompt, 'round-the-corner delivery. If you don't know his name and address just ask us.

Power Resistors • Voltmeter Multipliers • Insulated Composition Resistors • Low Wattage Wire Wounds • Volume Controls • Voltage Dividers • Precision Wire Wounds • Deposited Carbon Precistors • Ultra-HF and High Voltage Resistors • Insulated Chokes.

IRC *Wherever the Circuit Says*

INTERNATIONAL RESISTANCE COMPANY
Philadelphia 8, Pennsylvania

In Canada: International Resistance Company, Limited, Toronto, Licensee.

INTERNATIONAL RESISTANCE COMPANY
407 N. Broad St., Philadelphia 8, Pa.

Send me additional data on the items checked below:

- ☐ Advanced BT Resistors
- ☐ Q Controls
- ☐ Deposited Carbon PRECISTORS
- ☐ Power Wire Wounds
- ☐ Name and Address of local IRC Distributor

NAME.....

TITLE.....

COMPANY.....

ADDRESS.....

J. F. ARNDT & CO., ADV. AGENCY

TELE-TIPS

(*Continued from page* 6)

ANTENNA CONSTRUCTION AT 1,466 FT.—Falling tools or materials, always a hazard in building construction, are considerably more so when there is wind to help them along and an unbroken quarter mile in which to gain momentum. On the Empire State Tower job, the New York State Safety Dept's Construction Bureau insisted that pliers, hammers, wrenches, drift pins and other tools be tied to the workers using them. Equipment not in use, materials, planks, etc., had to be lashed down. Supplying rivets at such heights was a problem that could not be solved by normal methods. Red-hot chunks of iron freewheeling at such altitudes would guarantee sleepless nights for conscientious safety men. A hollow steel "shooting hose" was developed and powered by a husky air compressor. When the riveter on top was ready for another rivet he signaled a man below. The ruby-hot rivet was pushed into the lower end of the tube and a quick burst of air blasted it 200 feet upstairs!

FIRE PRECAUTIONS: Because of lack of protection against unexpected bursts of wind the regular riveter's needlebaum scaffold could not be used. Four suspended scaffold platforms were lashed together so as to literally box in the tower and provide a working platform surrounding the structure with guard rails. At lower levels a lock-joint pipe scaffold was erected. Solid planking had to be provided at every seven-foot level for workers to stand on. This planking was of fireproof material since there could be no way of escape from a fire at such levels. Scrupulous care had to be exercised in grounding electrical power equipment. To prevent objects from falling to the street below one-half inch wire mesh was stretched under all working areas.

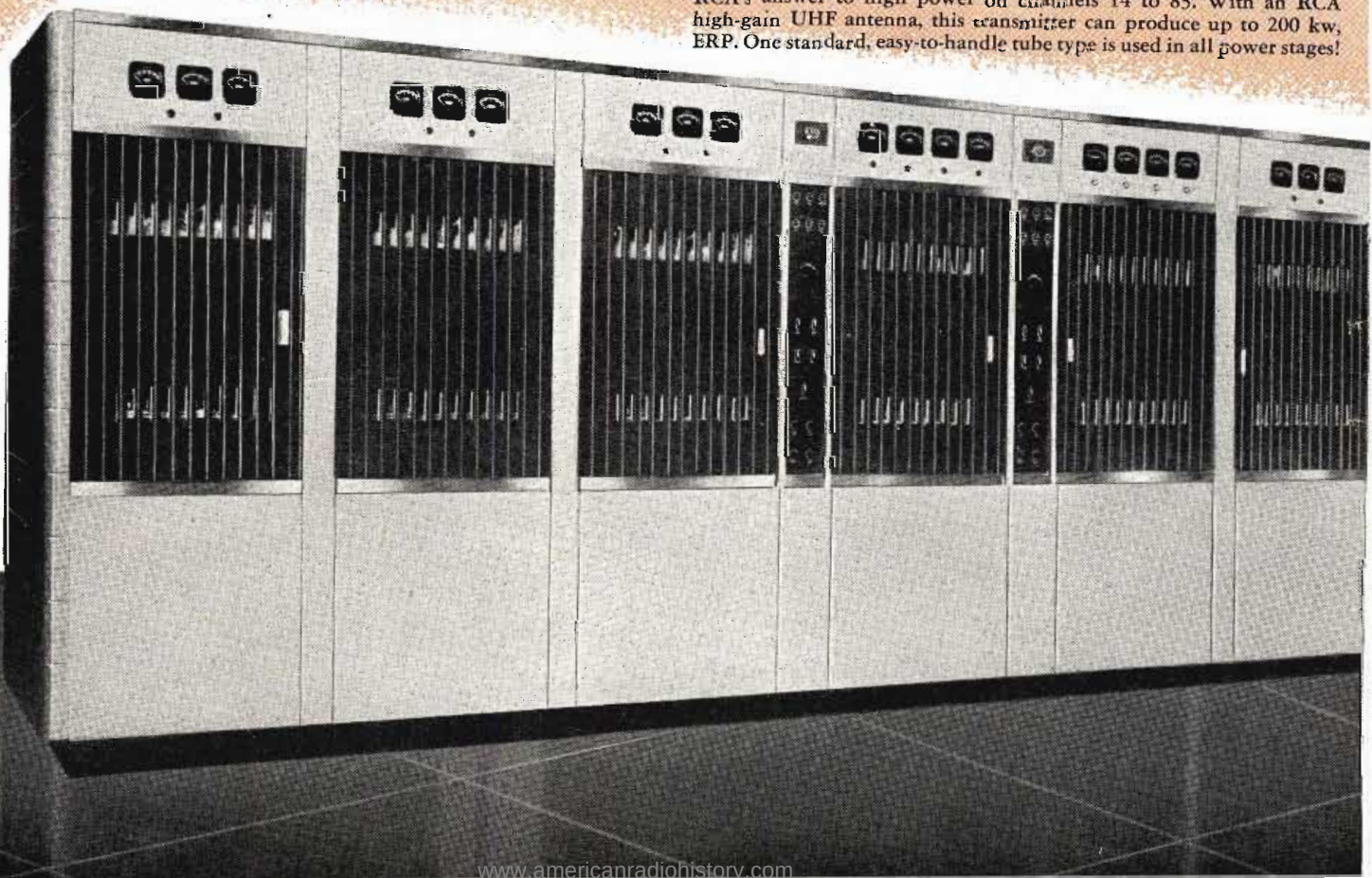
WIND SWAY—From the beginning of the job, violent and unpredictable winds added considerably to the normal hazards of raising structural steel. The tower was designed to withstand wind pressures of 50 pounds per square foot, created by winds blowing around 110 miles per hour. Safety scaffolds had also to be designed to buck such gale winds. Building engineers say that their measurements show that an 80-mile-an-hour wind will rarely cause the building to sway more than 1.45 inches.

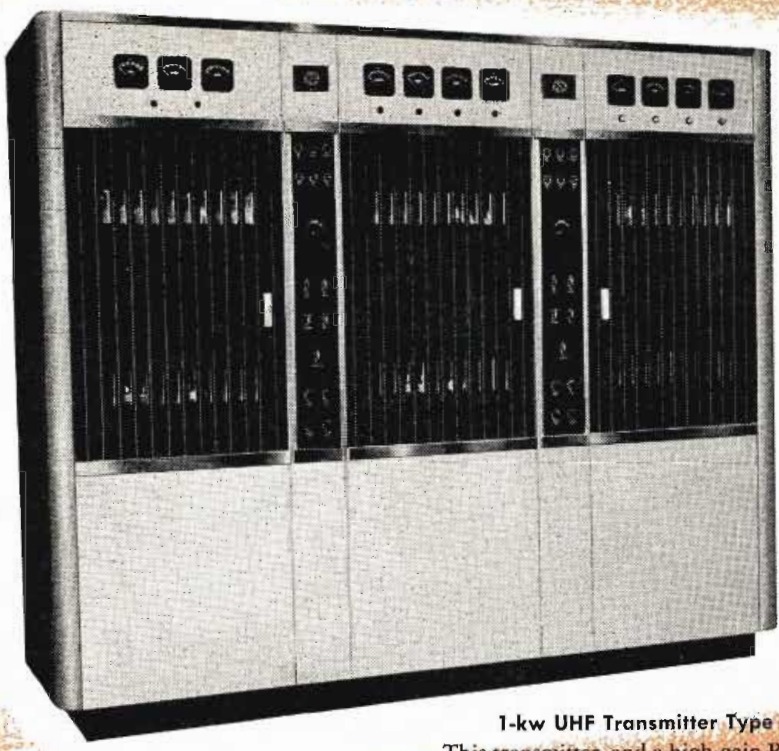
For UHF ...go RCA

Any power to 200 kw*....

10-kw UHF Transmitter Type TTU-10A

RCA's answer to high power on channels 14 to 83. With an RCA high-gain UHF antenna, this transmitter can produce up to 200 kw, ERP. One standard, easy-to-handle tube type is used in all power stages!





1-kw UHF Transmitter Type TTU-1B

This transmitter, and a high-gain RCA UHF antenna, can produce up to 20 kw, ERP on channels 14 to 83! Type TTU-1B is all air-cooled.

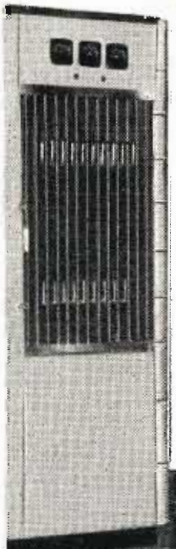
RCA's new 1-kw and 10-kw UHF transmitters (and RCA's high-gain UHF antennas) will give you power combinations up to 200 kw . . . on any TV channel!

If you are planning high power UHF, RCA's new 10-kw transmitter is the answer. If you are planning to start with low power UHF, then RCA's new 1-kw transmitter will meet your needs (increase power later simply by adding matching amplifier units).

Be sure your station planning is correct from the start . . . before you invest a single dollar. Your RCA Broadcast Sales Specialist will show you exactly what equipment you'll need to get on the air at lowest cost.

Available only from your RCA Broadcast Sales Specialist

A 64-page book on RCA's new line of TV broadcast equipment for all channels, 2 to 83! An indispensable reference for station planning.



Call or write the RCA field office nearest you

Chicago 11, Ill.
666 North Lake Shore Drive
Telephone: Delaware 7-0700

Washington 6, D. C.
1625 K Street, N. W.
Telephone: District 1260

Hollywood 28, Calif.
1560 N. Vine Street
Telephone: Hollywood 9-2154

Dallas 1, Texas
1907-11 McKinney Ave.
Telephone: R-1371, 1372, 1373

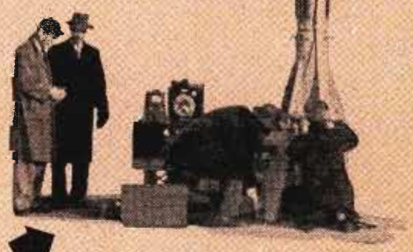
Cleveland 15, Ohio
718 Keith Building
Telephone: Cherry 1-3450

Atlanta 3, Ga.
522-533 Forsyth Bldg.
Forsyth and Luckie Sts.
Telephone: Walnut 5946

Kansas City 6, Mo.
221 W. 18th Street
Telephone: Victor 6410

New York 20, N. Y.
36 W. 49th Street
Telephone: Circle 6-4030

San Francisco 3, Calif.
1355 Market Street
Telephone: Hemlock 1-8300

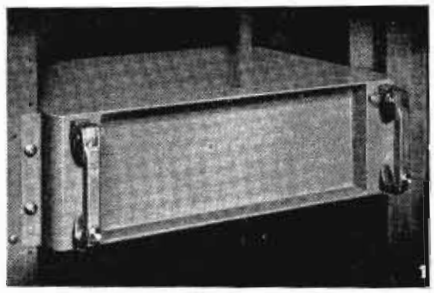


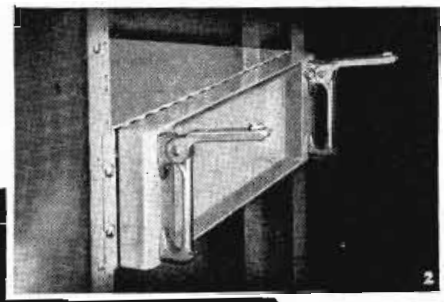
New High-Gain Antenna for UHF

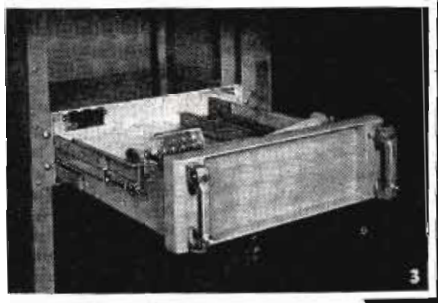
The most economical way known to produce high effective radiated power for UHF—and more kilowatts per dollar. Excellent "close-in" coverage in all directions. Power gain, 24 to 28, depending on channel.

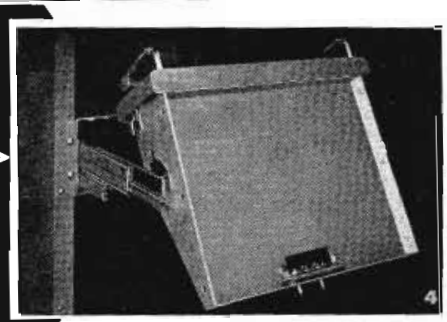
*Effective Radiated Power

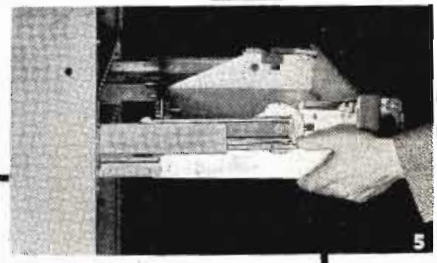
RADIO CORPORATION of AMERICA
ENGINEERING PRODUCTS DEPARTMENT **CAMDEN, N.J.**

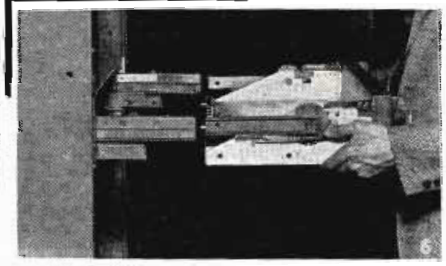


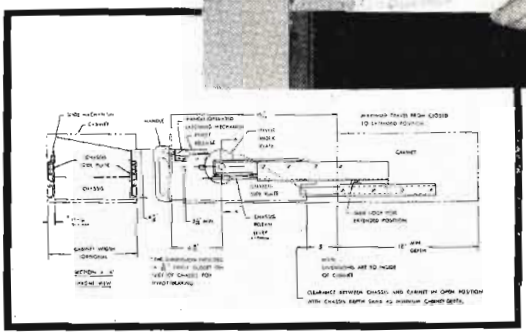












The National slide mechanism is designed to permit removal of a chassis assembly from its cabinet without external support, thus providing quick, easy access for servicing, adjustment or replacement. It offers the maximum in strength, rigidity and simplicity.

Inquiries regarding special applications and problems are welcomed — National's engineering staff is always at your service. Write Dept. 965.

National slide mechanism offers 8 unique advantages

(1) When in the extended position, the equipment may be rotated plus or minus 135° from normal position about a horizontal axis parallel to the front panel. A latch is provided to stop the equipment every 45° in its rotation. (See photos #4 and #5.) (2) Stops and latches at the end of slide travel lock the mechanism in the extended position and may be released easily by downward pressure using the thumbs when the hands are in a position supporting the equipment. (See photo #5.) (3) The equipment may be completely removed from its cabinet by pressing the stop latch as above and pulling the equipment off the end of the slide. (See photo #6.) (4) Slides are designed so that it is possible to change units in a cabinet with a minimum of time and trouble. (5) Slides roll on balls and operate easily, even with loads of 75 pounds. (See photo #3.) (6) Slides can be made of either mild steel or stainless steel. Either metal can be finished to pass Navy corrosion tests. (7) Slide mechanism is built to pass 40T9 vibration in the open position with a 45 pound load (stainless steel model). It will pass the light weight shock test in the closed position (using National handles). (8) National handles feature a toggle action lock and reject mechanism, intended for use with slide mechanisms. This is an extremely useful device where the unit makes connection when in place by means of a multi-connector plug which may be difficult to extricate by hand.

National

©

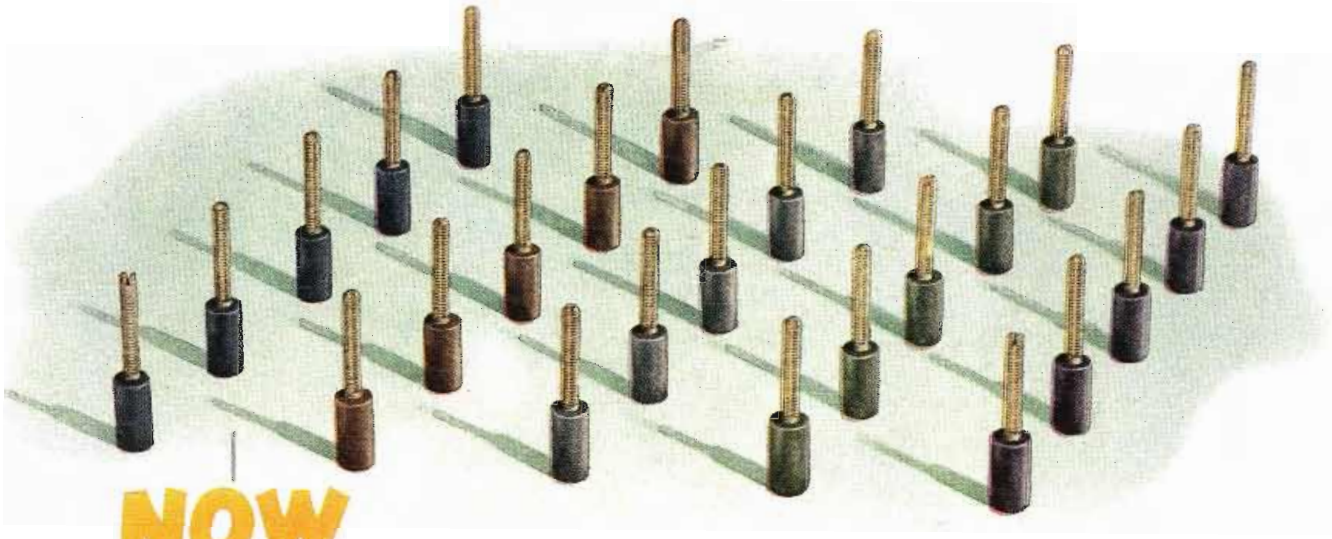
EST. 1914

NATIONAL COMPANY, Inc.

MALDEN, MASSACHUSETTS

COLORED CORES....

prevent costly errors, save time, reduce core selection to a routine



NOW to MANY GRADES . . .

and MANY USES . . .

ADD MANY COLORS . . .

G A & F Carbonyl Iron Powders do a precision job—because they are manufactured to exacting standards of uniformity . . . in particle size, particle shape, purity, permeability, "Q" value, etc. With six different grades, there is a powder for every use.

The cores made from G A & F Carbonyl Iron Powders are designed and made for specific jobs in electronics, and on exacting standards. These cores become the hearts of accurate instruments and dependable receiving sets . . . Each must be used for the application for which it was designed. This means that these cores must be accurately identified or otherwise protected against costly errors of selection.

Instead of embossing, engraving or paint-daubing the finished cores—all slow and expensive processes—Antara Products now offers the simplest and easiest of all possible answers: distinctive, *permanent* dyes, incorporated with the powder, to be built into the cores. With an adequate color choice, these dyes provide the fool-proof identification that cuts down costly errors, reduces production costs, makes core selection routine instead of a mental hazard.

The dyes are strong and easily seen; they withstand the heat of the curing; they are not affected by humidity or temperature; they are satisfactory at a wide range of molding pressures and shapes. They do not improve electrical or magnetic properties, to be sure, but any decrease is very minor and more than compensated by the production advantages. *For further details, kindly contact your core manufacturer and write us for Technical Bulletin.*

gdc ANTARA gaf

ANTARA® PRODUCTS

DIVISION OF

GENERAL DYESTUFF CORPORATION

435 HUDSON STREET • NEW YORK 14, NEW YORK

G A & F® Carbonyl Iron Powders

The Development of CARBONYL IRON POWDERS

Carbonyl Iron Powder is an extremely pure form of iron, the metal content being over 99.99% iron, produced in the form of almost perfect spheres only one to fifteen microns in diameter—the average diameter being 8 microns (.00032 inches). It has been produced commercially for some years, primarily for use in magnetic cores for electronic equipment. Its production is therefore now under perfect control to give absolute reliability in quality and properties.

The production of Iron Carbonyl, from which Carbonyl Iron Powders are made, depends on a unique reaction, which was discovered in 1890 by the distinguished British chemist, Sir Ludwig Mond. When iron is treated with carbon monoxide it reacts to form iron pentacarbonyl, a rare case of a liquid compound of a metal. Each atom of iron combines with five molecules of carbon monoxide to give a compound with the formula $Fe(CO)_5$. This reaction leaves behind any impurities in the original iron.

This liquid is vaporized and the vapor heated above 200°C, when it decomposes into its constituents. The carbon monoxide is driven off and the iron separates from the vapor phase, first in the form of free atoms, then as ultramicroscopic crystals, finally as microscopic, almost perfect spheres. The particle size distribution can be controlled by temperature, pressure and other operating conditions.

Controlled purity and distribution of particle size is essential for use of the powder in electronics, where minor variations in these properties have exaggerated consequences in delicate electrical and magnetic effects.

The only other elements present are non-metals such as carbon, oxygen and nitrogen. In G A & F Carbonyl Iron Powder, they amount to not more than 0.8% carbon, 0.9% oxygen and 0.7% nitrogen.

These unique properties tell why G A & F® Carbonyl Iron Powders are superior:

PROPERTY • ADVANTAGE	
Spherical structure . . .	Facilitates insulation and compacting
Concentric shell structure (some types only) . . .	Low eddy current losses
High iron content . . .	Exceptional permeability and compressibility
Absence of non-ferrous metals . . .	Absence of corresponding disturbing influences
Relative absence of internal stress; regular crystal structure . . .	Low hysteresis loss
Spheres of small size . . .	Low eddy current losses; usable for high frequencies
Variations of sphere size . . .	Extremely close packing

The first large-scale production of Iron Carbonyl was undertaken in Germany shortly after 1920. By 1928 the process had been adapted to the continuous commercial production of Carbonyl Iron Powder. Subsequently, detailed studies and meticulous laboratory-type controls in the plant permitted accurate regulation of purity and particle size for the needs of the modern electronic industry.

The first commercial Carbonyl Iron plant in the United States was opened at Grasselli, N. J. in 1941 by the General Aniline & Film Corporation, primarily to meet the large wartime demand for electronic equipment. Newer and finer grades of the powder were developed for use in high-frequency electronic equipment for radar and television. Later a second plant was put into operation at Huntsville, Alabama.

Thus the G A & F Carbonyl Iron Process is now well established and in steady operation. It is an outstanding case of the succesful precision control of a sensitive chemical reaction to produce a unique material that must meet extraordinary specifications of purity, particle shape and size, and uniformity.

Write today for a free book—fully illustrated with performance charts and application data. It will help radio engineers or electronics manufacturers to step up quality, while saving real money. Kindly address your request to Department #100.

ANTARA® PRODUCTS

DIVISION OF

GENERAL DYESTUFF CORPORATION

435 HUDSON STREET • NEW YORK 14, N. Y.

G A & F® Carbonyl Iron Powders . . . .

MEMBER mpa METAL POWDER ASSOCIATION

Resolving

6 FACTORS

(troublesome)

into

6 POUNDS

(trouble-free)

How **Utility Electronics** paced the design and production of "Handie-talkie" AN/PRC-6

When the six factors of time, cost, weight, design, production engineering and production had to be overcome in a hurry to put a new, better "handie-talkie" into military service, Utility Electronics knew just where to begin.

Out of its experience in producing thousands of mobile police radios, Utility in cooperation with the U. S. Signal Corps engineered a rugged, compact unit that readily satisfied the specifications others had failed to meet. What's more, it is producible in quantity. Today production is rolling in ever-increasing volume from the lines of Utility and cooperating producers.

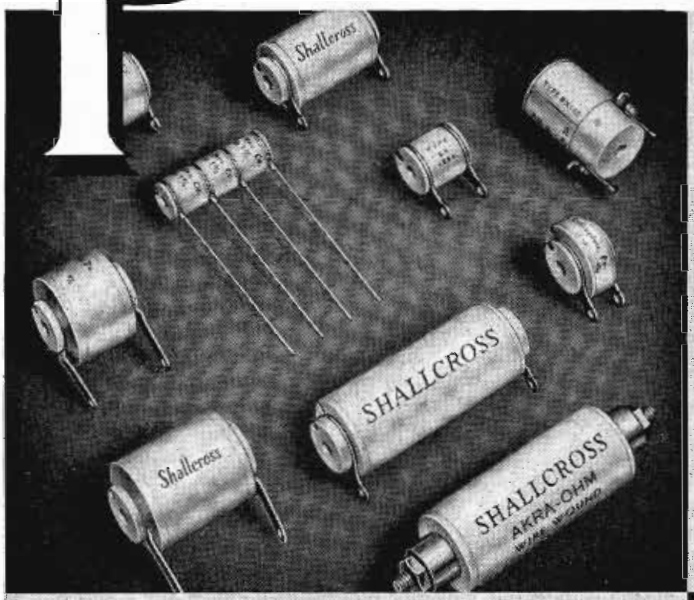
This is only one of the many ways in which Utility's design and production abilities are serving the U. S. Government. *These abilities are available to industry as well.* If you have electronic communication problems, especially those connected with design or production of miniaturized equipment, consult Utility – without obligation. Chances are we have the answer.

Utility Electronics Corporation

231 Grant Avenue . East Newark, New Jersey

Manufacturers of ELECTRONIC AND ELECTRO-MECHANICAL EQUIPMENT

Precision products



◀ CLOSE TOLERANCE RESISTORS

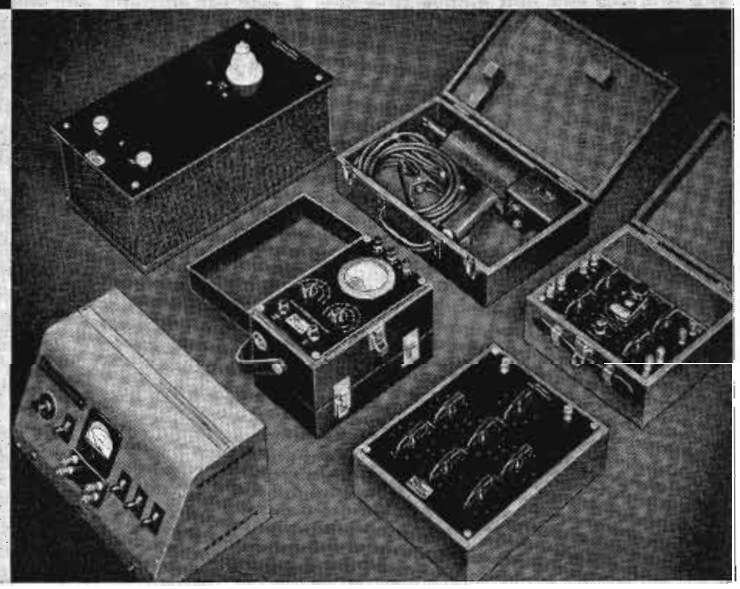
(JAN and standard types)

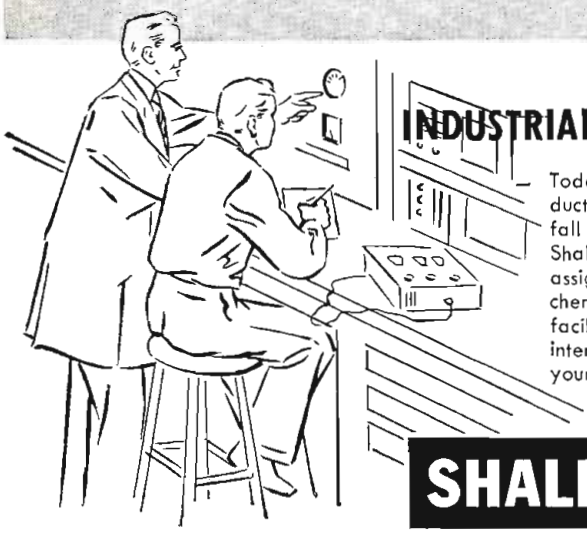
Wire-wound precision resistors have characteristics suitable for many exacting modern circuits. Shallcross Akra-Ohm resistors meet these requirements and are available in several types, shapes, and mounting styles. They are noted for high stability, low temperature coefficients, low noise levels, uniformity, long life, and extreme accuracy in matched pairs and sets. Ask for Bulletin R3.

PRECISE ELECTRICAL ▶ MEASURING INSTRUMENTS

Resistance Standards	Decibel Meters
Decade Potentiometers	Tone Generators
Decade Resistance Boxes	Telephone Test Equipment
Bridges, Wheatstone	Low-Resistance Test Sets
Bridges, Kelvin-Wheatstone	Insulation Test Sets
Bridges, Limit	Bridge Components

Write for Catalog No. 10.



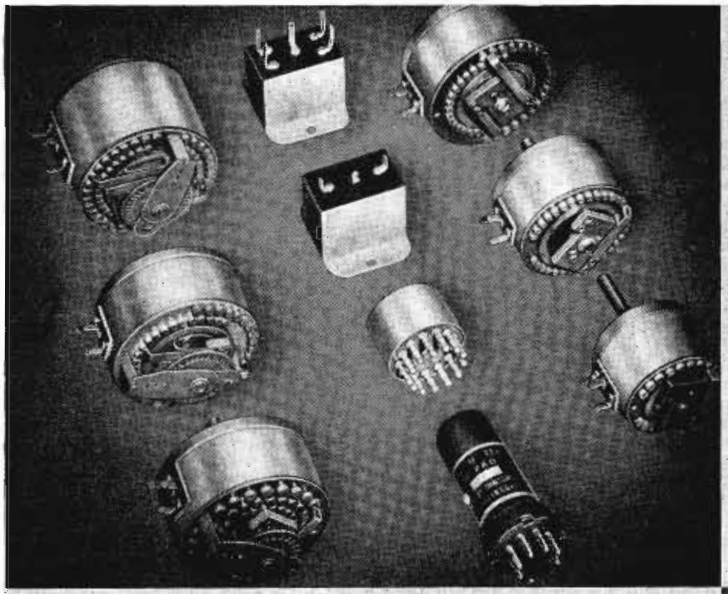


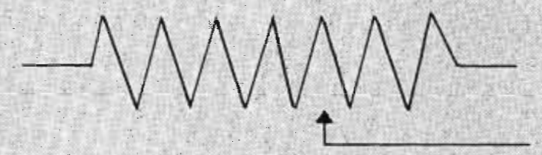
INDUSTRIAL RESEARCH AND DEVELOPMENT SERVICE

Today's complex circuits frequently require the design development, and production of highly specialized components, sub-assemblies, or instruments which fall outside the realm of standard engineering or production facilities. The Shallcross Research Department has been specifically formed to handle such assignments. Composed of electronic, electrical, instrument, mechanical, and chemical engineers of broad experience and backed with adequate modern facilities, this unique service group combines a highly technical as well as an intensely practical engineering-production viewpoint. We invite you to submit your requirements for review and recommendation.

SHALLCROSS MANUFACTURING

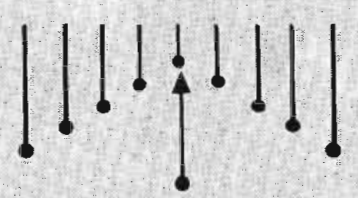
by SHALLCROSS





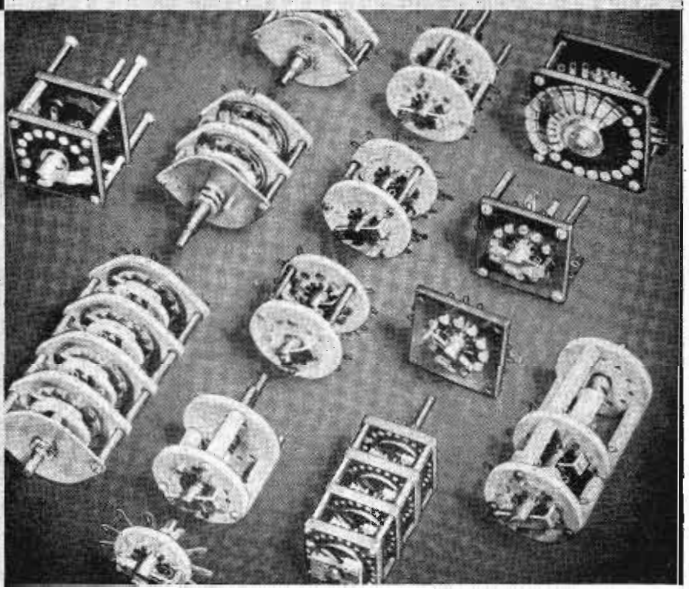
HIGH QUALITY ATTENUATORS

Improved materials and production techniques for Shallcross Attenuators have resulted in a line that sets new higher standards of attenuation performance for practically every audio and communications use. Shallcross Audio Engineering Bulletin No. 4 will be sent on request.



CUSTOM-BUILT SELECTOR SWITCHES

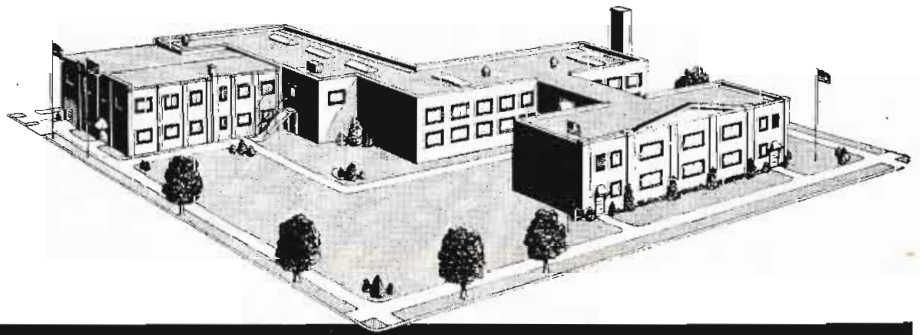
Shallcross builds single or multiple deck selector switches having up to 180 positions. Test units have given satisfactory performance at 250 volts 10 amperes and at 2500 volts 1 ampere A.C. Contact resistance ranges from a low of 0.0005 ohms to a maximum of 0.005 ohms depending upon the size and material of the contact surfaces. You are invited to outline your requirements on Shallcross Specification Sheet No. 6.



HIGH-VOLTAGE

Test and Measuring Equipment

Shallcross high-voltage instruments and corona-protected resistors provide maximum accuracy, safety, and dependability in a broad range of applications, from nuclear physics to electrostatic generators, precipitrons, power supplies, transmitters, and many others. Write for Bulletin F.



COMPANY • Collingdale, Pennsylvania

Glass Code	Type	Principal Use	Viscosity Data				Thermal Expansion Coeff.—/° C	Density (Sp. Gr.)	Refractive Index Sod. D Line (.5893 Microns)	Log 10 of Volume Resistivity		Dielectric Properties at 1 Mc and 20° C		
			Strain Point °C	Annealing Point °C	Softening Point °C	Working Point °C				250°C	350°C	Power Factor	Dielectric Const.	Loss Factor
0010	Potash Soda Lead	Lamp Tubing	397	428	626	970	91x10–7	2.85	1.539	8.9	7.0	.16%	6.6	1.1%
0080	Soda Lime	Lamp Bulbs	478	510	696	1000	92x10–7	2.47	1.512	6.4	5.1	.9	7.2	6.5
0120	Potash Soda Lead	Lamp Tubing	400	433	630	975	89x10–7	3.05	1.560	10.1	8.0	.16	6.6	1.1
0280	Hard Lime	General	515	547	726	—	82x10–7	2.50	1.517	—	—	—	—	—
1710	Hard Lime	Cooking Utensils	672	712	915	1200	42x10–7	2.53	1.534	11.4	9.4	.37	6.3	2.3
1990	Potash Lead	Iron Sealing	334	359	496	—	127x10–7	3.47	—		7.7	.04	8.3	.33
3320	Borosilicate	Tungsten Sealing	497	535	780	—					7.1	.32	5.0	1.6
6750	Opal	Lighting Ware	445	475							—	—	—	—
6810	Opal	Lighting Ware										—	—	—
7040	Borosilicate	Kova									8	.18	4.8	.86
7050	Borasilicate	Series										.33	4.9	1.6
7052	Borosilicate	Kovar										.26	5.1	1.3
7070	Borosilicate	Low Loss										.06	4.0	.24
7251	Borosilicate	Electrical										—	—	—
7720	Borosilicate	Electrical										.27	4.7	1.3
7740	Borosilicate	General										46	4.6	2.1
7750	Borosilicate	Series Sealing									7.7	.20	4.6	.92
7760	Borosilicate	Electrical						2.23	1.473	9.4	7.7	.18	4.5	.79
7900	96% Silica	High Temp.				—	8x10–7	2.18	1.458	9.7	8.1	.05	3.8	.19
7900	96% Silica (Multiform)	High Temp.	820	910	1500	—	8x10–7	2.18	1.458	9.7	8.1	.05	3.8	.19
7910	96% Silica	Ultraviolet Transmission	820	910	1500	—	8x10–7	2.18	1.458	11.2	9.2	.024	3.8	.091
7911	96% Silica	Ultraviolet Transmission	820	910	1500	—	8x10–7	2.18	1.458	11.7	9.6	.019	3.8	.072
8830	Borosilicate	X-Ray	475	510	715	—	48x10–7	2.25	—	7.8	6.3	—	—	—
8871	Lead Potash	Electrical Capacitors	357	384	527	—	103x10–7	3.84	—	11.1	8.8	.05	8.4	.42
8160	Lead Potash	Dumet Sealing	399	433	627	—	91x10–7	2.98	1.553	10.6	8.4	.09	7.1	.64
9010	Lead Free	Television	411	442	650	—	88x10–7	2.59	1.506	8.9	7.0	.22	6.5	1.43
9700	———	Ultraviolet Transmission	517	558	804	1195	37x10–7	2.26	1.478	8.0	6.5	—	—	—
9741	———	Ultraviolet Transmission	407	442	705	—	39x10–7	2.16	—	9.4	7.6	—	—	—

HAVE YOU OVERLOOKED SOME OF THE PROPERTIES OF GLASS?

Glass has proved an important material for electronic equipment—in tube envelopes, special tubing, sealing beads, insulation and a host of other uses. In almost every application the special electrical and physical characteristics are vital to top notch performance—characteristics such as well controlled dielectric strength, proper loss and power factor, desired transparency and corrosion resistance.

Take a fresh look at your present and projected equipment. Glass may help improve performance or lower costs. Then bring your idea to Corning and let our engineers help choose a glass for you. We have hundreds of glasses with widely varying characteristics, the research and pilot plant facilities to develop your idea and a broad variety of production facilities to produce it. For a quick look at some properties of glasses by Corning write for Bulletin B-83 to Dept. T-11, Corning Glass Works, Corning, New York.

PYREX

CORNING GLASS WORKS, CORNING, N. Y.

Corning means research in Glass

ELECTRONIC SALES DEPARTMENT — ELECTRICAL PRODUCTS DIVISION

1851 · 100 YEARS OF MAKING GLASS BETTER AND MORE USEFUL · 1951

Connector Problem?

...We'll take it from HERE

Good ideas for electronic circuitry sometimes run afoul of connector problems. Maybe existing connector units won't hold air pressure gradients, won't stand the heat, aren't rugged enough for the job. Or maybe it's a question of altitude, or under-water application. But if you can sketch the circuit, we'll take it from there. We've engineered so many special connectors, solved so many "impossible" problems, that whatever the requirements are, we can usually provide the answer.

Lightweight actuators for any requirement.

Job engineered, welded-diaphragm bellows.

Flexible conduit and ignition assemblies.

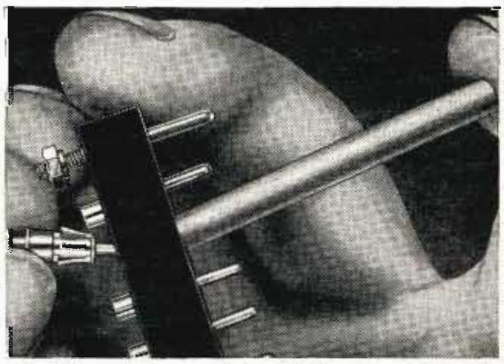
Aero-Seal vibration-proof hose clamps.

WRITE TODAY for specific information, or send us your sketches. We'll forward recommendations promptly.

BREEZE
Special CONNECTORS

BREEZE CORPORATIONS, INC.

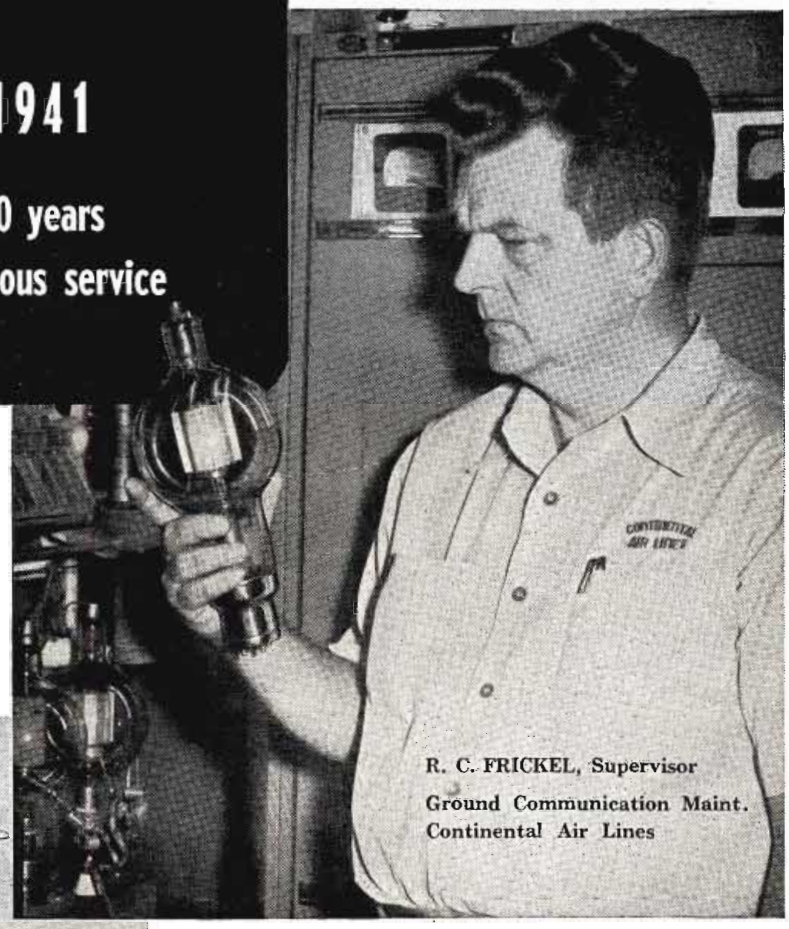
41 South Sixth Street Newark, New Jersey



Removable pins in Breeze connectors speed soldering, save time, trouble. Pins snap back into block.

INSTALLED . . . 1941

Old P-167 gave 10 years of almost continuous service



R. C. FRICKEL, Supervisor
Ground Communication Maint.
Continental Air Lines

CONTINENTAL AIR LINES, Inc.

STAPLETON AIRFIELD
DENVER 7, COLORADO

August 9, 1951

Eitel-McCullough, Inc.
San Bruno, California

Gentlemen:

We finally had to replace old #P-167.* This tube had been in continuous use at Continental Air Lines so long that it almost seemed like the passing of an old friend.

We here at Continental are very proud of our 17 year safety record and we know that dependable plane-to-ground radio communications have played an important part in the maintaining of this perfect record of safety.

Old P-167 was installed on June 17, 1941, and was removed July 28, 1951. During these 10 years the tube has seen almost continuous use at Continental's Denver transmitter, which is the communications control center of the airline's plane-to-ground radio contact.

The dependable performance of your tubes, as demonstrated by old P-167, is all the evidence we need as to where to buy our tubes. We will continue to use Eimac Tubes, as in the past.

Cordially,

R. C. Frickel, Supervisor
Ground Communications Maintenance

RCF:wrs
Attch.

P.S. Tubes P-117 and P-118, which were installed at the same time as P-167 in the same transmitter are still going strong.

The feelings expressed in Continental's letter are not unlike the feelings of thousands of other users of Eimac tubes. Top performance and a low cost to life ratio always make for customer satisfaction.

The new Eimac 450T that replaced "Old P-167" in Continental's transmitter should, because of improved vacuum tube materials and techniques, give even more satisfactory service.

Eimac tubes invariably do a job better . . . and at lower cost. Take advantage of their almost two decades of proved performance.

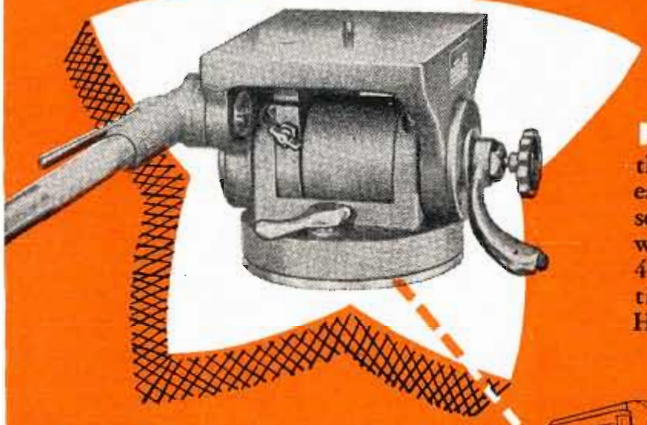
A new "Quick Reference" catalog on Eimac's Wide Variety of Tube Types is yours for the asking.

Follow the Leaders to Eimac TUBES The Power for R-F

EITEL-McCULLOUGH, INC.
San Bruno, California

Export Agents: Frazar & Hansen, 301 Clay St., San Francisco, California

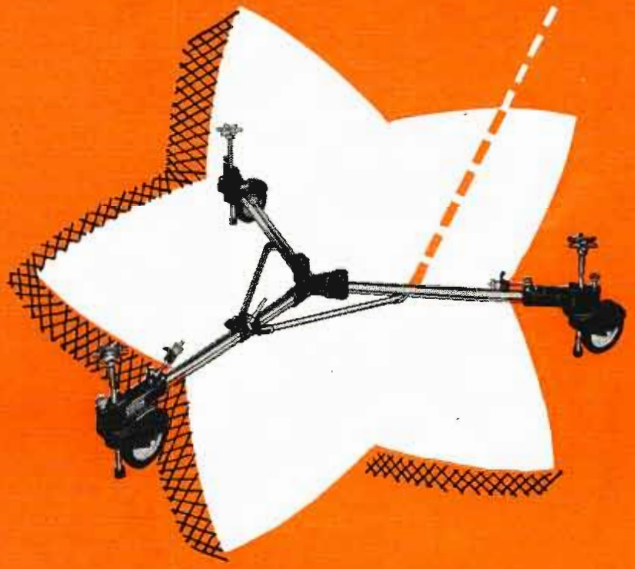
UNSEEN STARS OF TELEVISION



FRICTION HEAD Most TV studios rely on the Houston-Fearless Friction Head for smooth, easy panning and tilting. Pans & Tilts on grease-sealed ball bearings. Can be panned a full 360° with any degree of drag. Tilts 45° forward and 45° backward, accurately counter-balanced at all times. Brakes provided. Handle adjustable. Fits Houston-Fearless tripod, pedestal or dolly.

ALL-METAL TRIPOD

Combines extreme ruggedness, adaptability, rigidity, ease of operation and portability not found in any other tripod. Offers many exclusive, valuable features. Legs level automatically, cannot slip. Calibrations on legs simplify equalizing. Positive wedge locking device operates quickly, easily. Convertible spike and rubber-pad feet. Accommodates all standard heads.



TRIPOD DOLLY Provides convenient mobility for tripod-mounted television cameras. Rubber-tired wheels swivel for easy steering. Or, all three wheels can be locked in parallel position, enabling dolly to track in a straight line for rolling dolly shots. Stabilizer screws can be applied against floor for maximum steadiness. Sturdy construction. Folds quickly and compactly.

Available through your RCA representative

Write for information on specially-built equipment for your specific needs.

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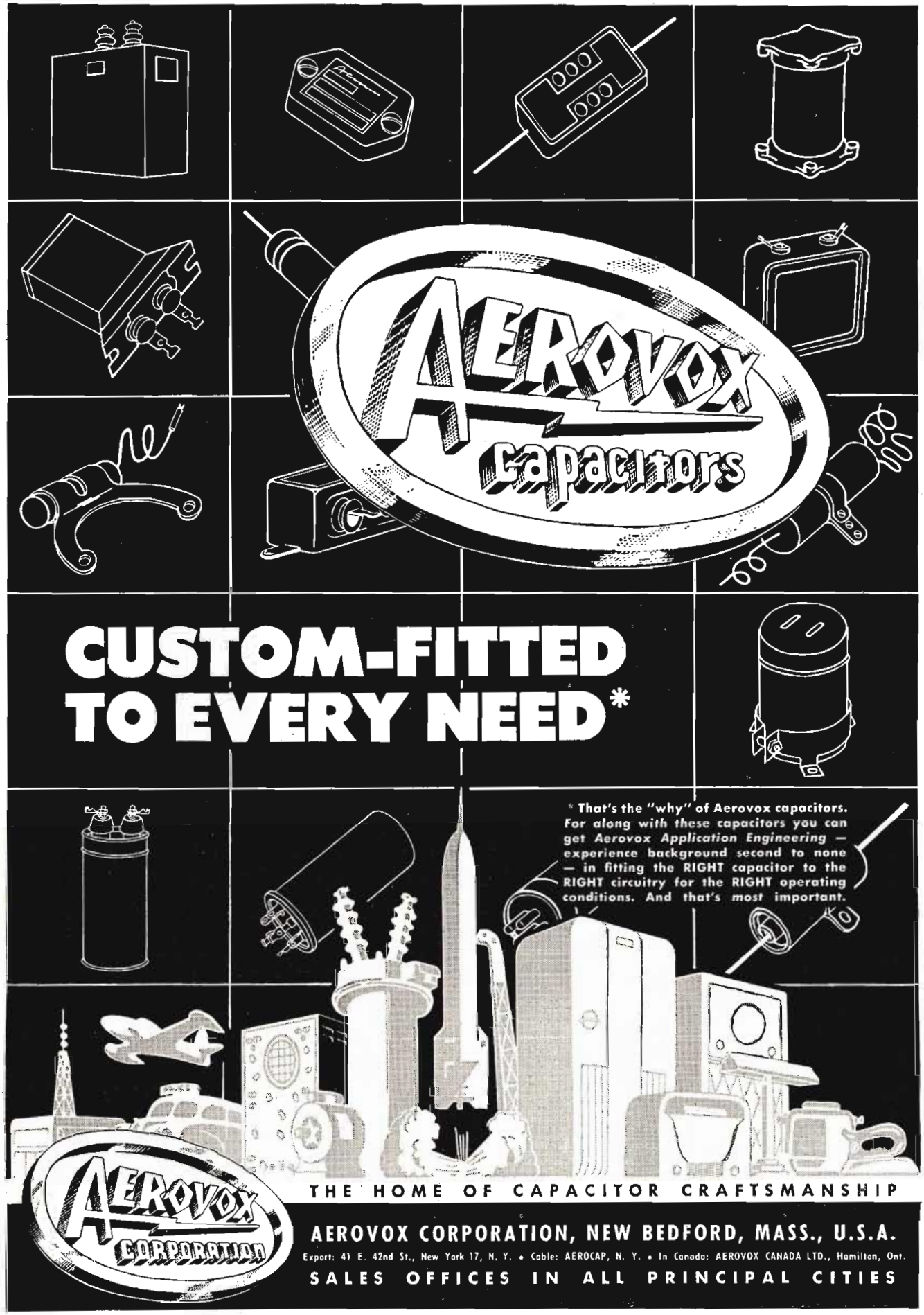
"WORLD'S LARGEST MANUFACTURER OF MOTION PICTURE PROCESSING EQUIPMENT"



TV-DESIGNER'S COST PROBLEM

"...a $5 lower price for our new set —avoid critical materials —simplify the controls!"

Stiff assignment you've been given, Mr. Designer! Fortunately General Electric's brand-new 17RP4 picture tube enables you to carry out your instructions word-for-word.

CHASSIS COSTS ARE TRIMMED because the 17RP4, electrostatic in design, requires no fixed magnet or focus coil with potentiometer. Convert either of these, plus labor, into retail pricing, and you have the desired mark-down in your new receiver.

CRITICAL MATERIALS SAVED! Needing neither fixed magnet nor focus coil, G.E.'s new 17RP4 eases your requirements for cobalt, nickel, and copper . . . thus helps assure steady TV production in your plant.

NO FOCUS CONTROL REQUIRED! The 17RP4 has zero focus voltage, which eliminates a receiver focusing knob or internal adjustment . . . meaning simpler TV operation and extra customer appeal for your set.

Picture performance is equal to other tubes *or better!* Exhaustive tests have proved this. Phone, wire, or write for descriptive Bulletin ETD-102, just off the press! *General Electric Company, Electronics Division, Section 7, Schenectady 5, New York.*

17RP4

Electrostatic picture tube with zero focus voltage.

RECOMMENDED OPERATING CONDITIONS

Anode No. 2, voltage	14,000 v
Anode No. 1, voltage for focus	0 v
Grid No. 2, voltage	300 v
Grid No. 1, voltage for spot cut-off	—33 to —77 v
Ion-trap field intensity (single-field), approximate	35 gausses

You can put your confidence in—

GENERAL ELECTRIC

181-K5

Eight ML-5682's mounted in a Doherty high efficiency linear amplifier designed for 500 kW output.

The ML-5682

A High-Power Coaxial Triode for Full-Power Operation to 88 mc/sec.

The development and commercial production of the ML-5682, a new water- and air-cooled coaxial triode for very high power operation, is an important contribution to all phases of modern electronic development. It is of particular significance in the present effort to provide the highest possible power in international broadcast applications. It finds wide application in high power AM, FM and TV broadcasting, in particle accelerators and in electronic heating. It is the key tube type in the highest power AM transmitters being built today.*

The ML-5682 is an unusually compact, rugged, high-power electron tube ideal for all high-frequency applications. It is an all-ring-seal triode capable of long-life operation at 9kVdc plate voltage and 170 kW plate input at a frequency of 88 mc/s. Operation at 16 kVdc plate voltage and 300 kW plate input is permissible up to 30 mc/s. This tube is ideal for cavity operation and its low impedance makes it advantageous for broad-band service.

*Includes State Department's Voice of America Transmitters.

Outstanding design features include:

- High-conductivity, gold plated kovar glass-to-metal seals.
- Sturdy electrodes.
- Integral anode water jacket.
- Quick-change water coupling.
- High-conductivity, heavy-wall copper anode designed to dissipate in excess of 100 kw.
- Muplti-strand thoriated-tungsten filament cathode completely balanced and stress free throughout tube life.
- Grid capable of unusually high heat dissipation contributing to maximum stability of tube performance and circuit operation.

For full technical information on the ML-5682 or other Machlett tube types write to Machlett Laboratories, Inc., Springdale, Connecticut, or contact your nearest Graybar or Westrex office.

Westrex
Export Distributor

Distributed by Graybar Electric Company

MACHLETT OVER 50 YEARS OF ELECTRON TUBE EXPERIENCE

UNITED SPECIALTIES'

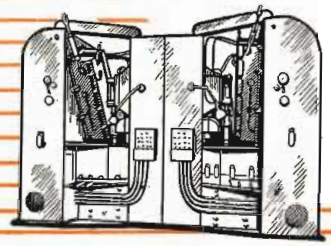
latest in television shells

21-INCH RECTANGULAR

Within the past year United Specialties Company has kept its shell designs right in step with the latest in picture tube requirements. Early in 1950 United produced deep-drawn, 16-inch round shells in quantity. This was followed by shallow 16-inch round shells and 17-inch rectangular shells. Now United is producing 21-inch rectangular shells and stands ready to answer new demands as developments unfold.

Equipped with the very latest in spinning machines, United's television shells meet the most rigid specifications of the industry.

UNITED SPECIALTIES COMPANY
Chicago 28, Illinois



NEW SPINNING MACHINES EXPAND PLANT FACILITIES

With the installation of the most advanced spinning machines available, United has facilities for manufacturing heavy gauge spun products for defense needs. Utilized for television shell production now, these machines can be allocated for military needs whenever necessary.

These leading TV set makers use Sylvania Picture Tubes

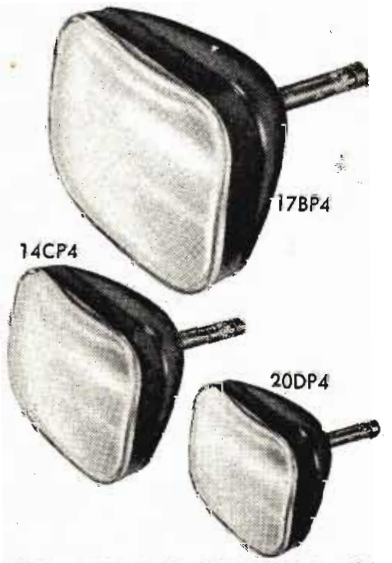
We're PROUD of this picture!

Today's sales picture shows that 75% of the leading television set manufacturers use Sylvania picture tubes.

This popularity is no accident. It's based on a sure foundation of outstanding performance. For, Sylvania picture tubes have won their prized position through years of research and quality production techniques developed during more than a quarter of a century of leadership in radio, electronics, and lighting.

Remember, too, when you choose Sylvania picture tubes, you choose products of nationally recognized excellence . . . products that carry prestige and sales appeal when listed among your sets' specifications.

Send today for new folder giving complete descriptions and ratings of all Sylvania TV Picture Tubes. Simply write a postal card to Sylvania Electric Products Inc., Dept. R-1411, Emporium, Penna. *Sylvania Representatives are also located in all foreign countries. Names on request.*



SYLVANIA ELECTRIC

RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT; FLUORESCENT TUBES, FIXTURES, SIGN TUBING, WIRING DEVICES; LIGHT BULBS; PHOTOLAMPS; TELEVISION SETS.

Home entertainment has changed

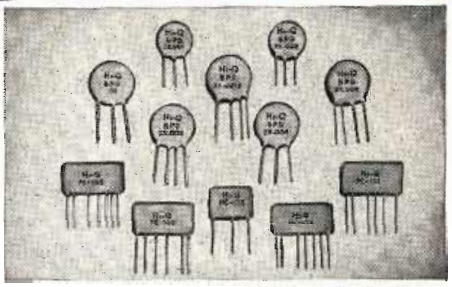
. . . and in producing better and better TV MODERN ELECTRONICS LOOK TO HI-Q*

Capacitors • Trimmers • Choke Coils • Wire Wound Resistors

The fast development of the television industry since World War II has been matched, stride for stride, by **HI-Q.** For TV producers were quick to recognize this organization as their most dependable source for the ceramic components they needed in such profusion. They quickly learned that **HI-Q** engineers were competent and resourceful in developing new components to meet new needs as they arose.

Now, though **HI-Q** output has reached several million capacitors, trimmers, choke coils and wire wound resistors each month, never once have the original precision standards or strict adherence to specifications and tolerances been shaded — or the rigid system of inspection of each individual unit at each stage of production been relaxed. The **HI-Q** engineering staff is just as ready as ever to cooperate with your engineers in the production of special components for special requirements.

JOBBERS — ADDRESS: 740 Belleville Ave., New Bedford, Mass.



HI-Q DISKS AND PLATES

High dielectric by-pass, blocking or coupling capacitors for use where their geometrical shape makes them more adaptable than tubular components. Essentially similar, other than shape, except that in multiple units, **HI-Q** Plates do NOT have to have a common ground, as is the case with the Disk type.

BETTER 4 WAYS

- **PRECISION**
- **UNIFORMITY**
- **DEPENDABILITY**
- **MINIATURIZATION**

*Trade Mark Registered, U. S. Patent Office

HI-Q*

Electrical Reactance Corp.
OLEAN, N. Y.

SALES OFFICES: New York, Philadelphia, Detroit, Chicago, Los Angeles

PLANTS: Olean, N. Y., Franklinville, N. Y. Jessup, Pa., Myrtle Beach, S. C.

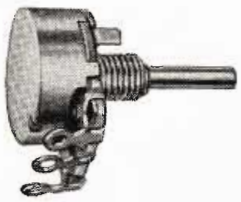
3 New Resistors

−55°C to +150°C

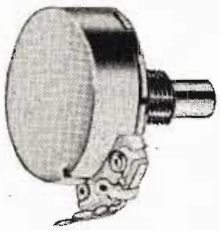
Complete aridity to saturation . . . An *unprecedented* temperature and humidity range

FOR MILITARY APPLICATIONS

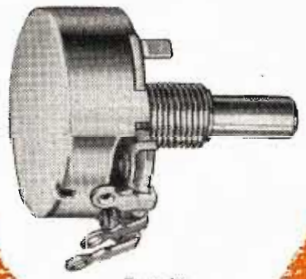
Highly recommended for use in jet and other planes, guided missiles, tanks, ships and submarines, portable or mobile equipment and all other military communications. Manufactured from specially developed materials, these absolutely unique variable resistors are now available in a *complete range of sizes*. (See chart at bottom of page.)



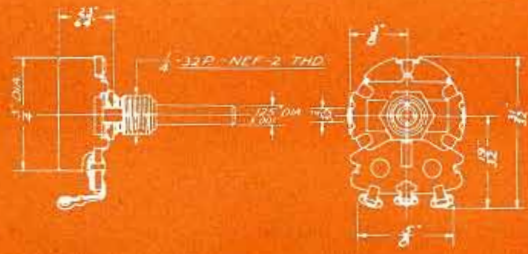
Type 65

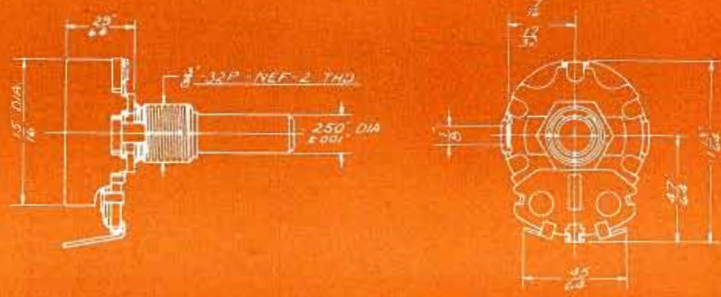


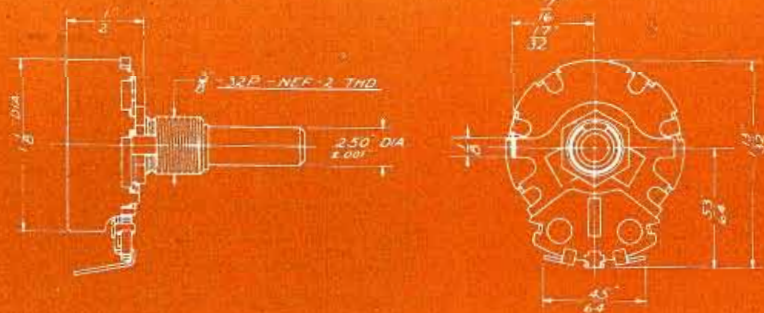
Type 90



Type 95







+150°C to −55°C

DIAMETER	TYPE 95 1 1/8"	TYPE 90 15/16"	TYPE 65 (miniaturized) 3/4"
Wattage and Voltage Rating	2 watts @ 70°C with 500 V max. across end terminals	1 watt @ 70°C with 500 V max. across end terminals	½ watt @ 70°C with 350 V max. across end terminals

Specialists in Precision Mass Production of Variable Resistors

BURTON BROWNE ADVERTISING

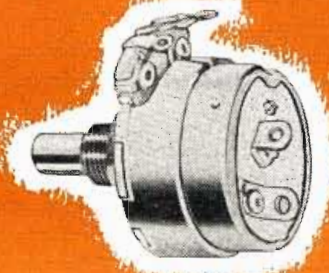
Meets Military Specifications

JAN-R-94, Type RV-3A
CTS Type 35, 1 1/8" Diameter
Composition

JAN-R-94, Type RV-2B
CTS Type GC 45 with Switch
Composition

JAN-R-94, Type RV-3B
CTS Type GC 35 with Switch
Composition

JAN-R-94, Type RV-2A
CTS Type 45, 15/16" Diameter
Composition



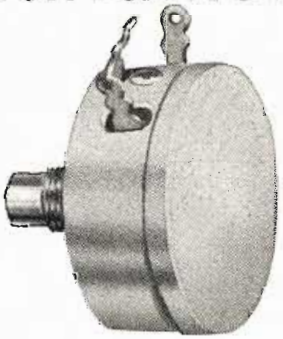
JAN Type RV-4B
CTS Type FGC 95 with Switch
Composition

JAN Type RV-4A
CTS Type 95, 1 1/8" Diameter
Composition

MEETS ALL JAN-R-19 SPECIFICATIONS

JAN Type RA 20A
2 Watt (CTS Type 252)

JAN Type RA 20B
2 Watt (CTS Type GC-252)



JAN Type RA 25A or 30A
3 or 4 Watt (CTS Type 25)

JAN Type RA 25B or 30B
3 or 4 Watt (CTS Type GC 25)

EXCEPTIONALLY GOOD DELIVERY CYCLE on military orders due to enormous mass production facilities . . . Please give complete details on your requirements when writing or phoning for further information.

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AGAIN - it's PRD FIRST!

—with a new line of Broadband VHF-UHF TV Test Equipment

Type 904 VHF-UHF Noise Generator

This calibrated broadband noise source permits direct measurements of noise factors as high as 20db for r-f amplifiers and receivers operating in the range from 10 to 1000 mc/s.

Price $430.00 subject to change without notice

Type 584 UHF Frequency Meter

470-890 MC/S

- DIRECT READING FREQUENCY DIAL, CONTINUOUSLY VARIABLE
- HIGH-Q CAVITY
- PRECISE CALIBRATION
- RESOLUTION BETTER THAN 0.1 MC/S

Type 396 Balun Balance-Unbalance Transition

- FREQUENCY RANGE: 475 TO 890 MC/S
- VSWR: LESS THAN 1.3 OVER THE BAND
- IMPEDANCE LEVEL: 50 OR 75 TO 300 OHMS
- LENGTH: APPROXIMATELY 6 INCHES

AVAILABILITY TO BE ANNOUNCED SOON...

40 to 950 MC/S

Fundamental Sweep Frequency Oscillator

- OUTPUT: 1 VOLT ACROSS 75 OHMS
- MINIMUM SWEEP WIDTH AT 40 MC/S: 15 MC/S

—ASK FOR **PRD TYPE 907**

WATCH FOR COMING ANNOUNCEMENT OF ADDITIONAL VHF-UHF INSTRUMENTS NOW UNDER DEVELOPMENT

Polytechnic RESEARCH & DEVELOPMENT COMPANY, Inc.

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TELE-TECH
RADIO-TELEVISION-ELECTRONIC INDUSTRIES
O. H. CALDWELL, Editorial Director ★ M. CLEMENTS, Publisher ★ 480 Lexington Ave., New York (17) N. Y.

Radio-Guided Missiles

"Command of the Air" Takes on New Meaning as President Truman's "New Fantastic Weapons" Involve Full Control of Electro-Magnetic Radiation in the Field of Military Action

Radio has long been an *adjunct* of the military, for communications and advance warnings.

With the "proximity-fuse" of World War II, however, radio became a vital ingredient of munitions equipment itself,—a factor as important as the explosive, the projectile, or the gun.

Now radio takes on an added essential role in the "fantastic new weapons" recently cited by President Truman. Chief in this new American electronic arsenal is the radio-guided missile—"an unmanned vehicle moving above the earth's surface, whose trajectory or flight path is capable of being altered by a mechanism within the vehicle", according to the Defense Department's glossary,—to which might be added "controlled by radio."

Super-Sonic Speeds

Radio-guided missiles, whether the jet-powered type or the rocket-driven missiles, operate at speeds ranging above that of sound (761 miles an hour at sea level) up to more than 1,000 miles at hour,—far above the sonic barrier. In the case of the big, high-altitude experimental rockets, speeds higher than 3,500 miles an hour (a mile a second!) are reached! These wondrously-contrived, nearly-human, instruments of war obviously have to rely entirely on the radio link between missile and controller. This link must contain all the elements of good radio design. The missile's reliability throughout its extremely short life, must be 100%. There is no operator to make adjustments after launching. The highest grade of components must be used.

The apparatus must be light, and rugged in the extreme, in order to stand the impact of the launching blast. Circuits and tubes must have super-reliability. Here we find electronic components subjected to the greatest of extremes in temperatures,—storage at 40° F below zero, and operation at higher than 300° F. Antennas are restricted in size because of the limited size of the missile and the need for minimum wind resistance.

In announcing such guided flying bombs as that shown on the front cover of this issue, the Army and Air Force have had nothing to say about the methods used for steering and control of the missile on its way to enemy fortifications or troops. (The Navy is developing guided missiles also, but so far all such Navy work has been done in secret and no public announcement has been forthcoming.)

But photographs of military guided missiles officially released show antennas customarily used for reception or transmission of radio impulses which (1) report back to the control station the missile's location in flight and (2) actuate the guiding mechanisms of the missile.

Continued Control Vital

Developers of the guided missile are known to have given great attention to methods which would foil enemy attempts either to jam the radio frequencies on which the guidance signals are sent, or to seize actual control of the missile by use of greater power at the same frequencies, points out E. C. Fay, AP military affairs reporter. For if such switching of control could be accomplished, the enemy might either divert the missile from its intended target or actually turn it around and head it back to strike at the original launchers.

In combat using the new weapons, the old "command of the air" expression will have an added significance.

Not only must air domination be maintained by superior numbers or quality of fighter planes, but—

Command of the ether and the radio waves themselves must be assured.

"Command of the air" now means command, also, of radio—complete command of radio control impulses—through inventive ingenuity and sheer radio power.

The RADARSCOPE Revealing at a Glance

THE PENTAGON

SPREAD DEFENSE CONTRACTS — With the realization that many electronic-radio items of apparatus and equipment needed by the military forces are not adaptable to mass-production techniques used in home radio and television receiver manufacturing, the DPA Electronic Task Group has recommended that military procurement services request radio-electronic prime contractors to place subcontracts in areas having a surplus of skilled labor and facilities for electronic-radio manufacturing. Also it is recommended that radio and television manufacturing companies should seek sub-contracts aggressively through the Armed Forces Regional Council. E. T. Morris, ex-Westinghouse, is chairman of the DPA electronic board and also director of NPA's electronic division. Representing the radio-electronic industry are William Balderston, Philco president, and Benjamin Abrams, Emerson head.

REARMAMENT

"LEADERSHIP PLAN" — The new DPA Electronic Task Group recommends to the radio industry the fullest encouragement of "leader-type" contracts with provision of suitable incentives for contractors and subcontractors. The Group also urges that production companies should be associated with design contractors from the time development contracts are placed; and that electronic component manufacturers submit samples of components for testing by the Armed Services Electronics Standards Agency. The armed services' procurement agencies were also urged to monitor the placing of future contracts on heavily-loaded prime manufacturers to spread the load.

Ad Hoc Committee on Reliability of Electronic Equipment, including representatives of Defense Department, Navy, Air Force, Signal Corps, and Munitions Board, at Owensboro, Ky., plant of GE Co. Left to right are Marvin Hobbs, Munitions Board; Col. D. M. Harvey, Joint Chiefs of Staff; E. H. Fritschel, manager GE government tube sales; Capt. W. H. Beltz, Bureau of Ships; General Harry Reichelderfer, Signal Corps; L. B. Davis, GE manager; Dr. Albert F. Murray, chairman of the Reliability Committee and consulting editor of TELE-TECH; Col. D. P. Graul, U. S. Air Force, and Capt. J. C. Meyers, Bureau of Ships

TRANS-ATLANTIC TV

INTERCONTINENTAL TV BROADCASTING may be a lot closer to reality than many have previously believed possible. It is known that both English and American companies are intensely interested in laying a submarine cable, containing at least four coaxial cables on the inside, between North America and Europe. The project is estimated to cost between $130 and $150 millions. Aside from the tremendous increase in message-handling capacity that would result from such a development, it is conceivable that with properly designed undersea vacuum-tube or transistor amplifiers, TV programs could be carried on the coaxial lines as well. Recent advances in coaxial-cable manufacture (see page 42) may hasten the day.

ACOUSTICS

RECORDING and reproducing engineers now have an authoritative dictionary of terms in which to check their interpretation of a term against that of accepted opinion in the acoustical field. This document—the latest edition of the American Standard Acoustical Terminology, Z24.1-1951—has just been approved and published by the American Standards Association, 70 East 45th St., New York. For the first time more than 150 terms used in connection with mechanical, photographic, and magnetic recording are printed and defined in one document. The various types of instruments used and the various kinds of noises produced are defined. Until a short time ago much of the language used in connection with magnetic recording was slang. Now most of the terms are correlated and presented with standard definitions agreed upon by members of the industry.

CIVIL DEFENSE

RADIO'S ROLE in civilian defense planning was brilliantly brought to public and official attention during the Civil Defense Conference held by the General Electric Co. at Electronics Park, Syracuse, N. Y., in September and attended by 200 Federal, state, county and city officials. Here many technical demonstrations were made under simulated alarm conditions. Even wider usefulness in arousing public consciousness to civil defense needs is promised by the new GE civilian defense film which has been prepared under the direction of Roy Jordan and produced with the aid of The March of Time. This great 25-minute film is now being distributed throughout the nation, and should promptly result in waking up American communities to safeguarding lives and property with radio communications and electronic aids.

AUDIO

NEW USE FOR MAGNETIC TAPE—using it to record audience reactions to pre-recorded television shows. In the past it was common practice for the audience reactions to be dubbed in from a closed loop of film, but while this provided actual laughter it did not have the spontaneity which was desired by some producers, so today some film shows for TV consumption show the films to an audience and then record the reactions—but, we expect, only the laughs!

THEATRE COLOR-TV

LOOK FOR BIG DEVELOPMENTS in the theatre television field if and when the *Eidophor* system is satisfactorily combined with the CBS color system. Although previously planned for showing in October in New York, tests are just now being completed in Zurich using still pictures and inanimate objects to furnish subjects. The screen used measured 3 by 4 meters, the regular American movie size and material, but the equipment was declared to be powerful enough to illuminate adequately a screen eight times as large. About 150 Eidophor units are to be ready for U. S. installation by April, 1952, with ultimate aim of equipping 2,000 theatres. The Eidophor principle by which a regular movie arc is projected through a modulated oil-film, scanned by the TV electron beam, was described in TELE-TECH for February, 1951, page 60. If many problems, including heating of the Eidophor (a very thin film of oil), can be overcome, we may see arc-projection theatre TV in color before too long.

TELEPHONY

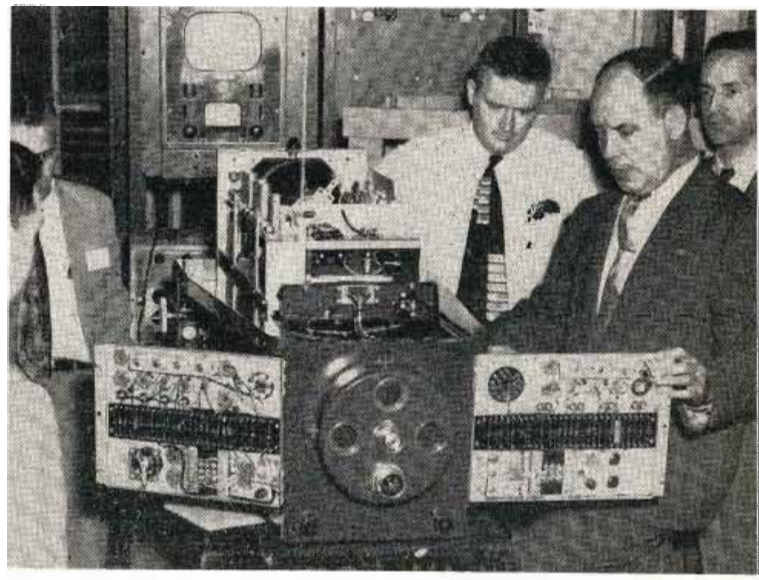
VHF RADIO is destined to be used more and more in the future for telephonic communication purposes. Just as microwave radio relay systems are proving themselves operationally economical and efficient, VHF radio is now also being used where the existing terrain features or local conditions make it difficult to extend or to connect to existing wire facilities. Latest AT&T announcement in this direction indicates that FCC has been requested for authority to provide a private wire and VHF radio telephone system along a new 88-mile, crude-oil pipeline between Lumberton, Miss. and Mobile, Ala. Five of the nine stations will be connected by radio telephone to a base radio transmitter and receiver at Wiggins, Miss., while the other four will be connected to a similar base station just outside of Mobile. These base stations, in turn, will be joined to each other and to the pipeline terminals at Lumberton and Mobile by existing wire-line facilities.

FREQUENCY MODULATION

NEW HOPE FOR FM stations may lie in a new French method of stereophonic transmission using one carrier and modulating the positive and negative (upper and lower) sidebands with the two binaural signals picked up by two audio systems using microphones spaced some distance apart. The system requires sidebands three times as wide as an ordinary transmission. Receiving equipment is said to be simple, requiring only polarized detectors to handle the two signals and feed them to their respective loudspeakers.

RELIABILITY

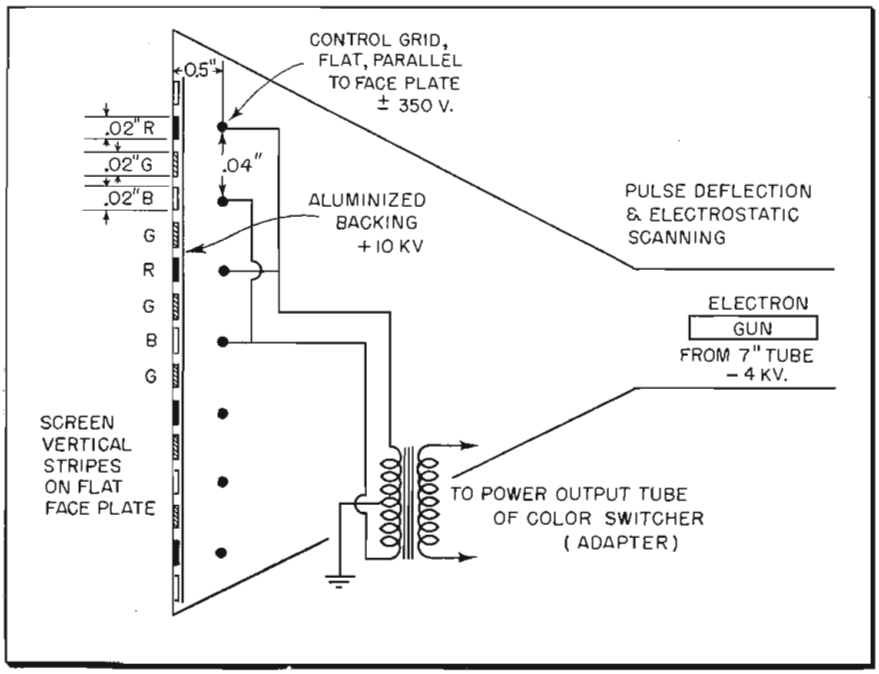
30X LONGEVITY — Tube-life expectancy multiplied thirty times is the result achieved by recent improvements in manufacture and selection of tubes for military use. In other words, the special "reliability" tubes are so processed that, according to information coming out of the GE tube plant at Owensboro, Ky., these tubes when used in commercial aircraft, have at least a 30-to-1 lower failure rate. For instance, the failure rate, over 2000 hrs. for normal commercial 6AL5 tubes is 41%. For the nearest GE 5-Star tube, a GL-5654, (corresponding to a 6AK5,) the failure rate is 0.2%! ! Here are striking results of a valiant effort to lick the well-known "weakest spot" in electronic armor, and to put radio equipment squarely in the reliability column.



Groups of broadcasting engineers have recently been the guests of RCA-Victor at Camden, Princeton, and Bridgeport, to study latest developments in color-TV and UHF. One of the parties is here seen inspecting a studio color-TV camera, with cover removed showing the three tubes, color filters, and related dichroic mirrors

Analysis of Latest

New method of controlling color selection by means of deflection



Schematic diagram of Lawrence Tube. It will be seen that there are control grids for only reds and blues. When the beam is not deflected by the control grid it falls on the green strips. By placing the control grids in the center of the reds and blues, more latitude is provided for the manufacture of the grid

By JOHN H. BATTISON, Contributing Editor

A PREMATURE news item has focussed public and industry attention on the latest version of the color-TV tube developed by Dr. Ernest O. Lawrence of the University of California, winner of the Nobel Prize for his work on the Cyclotron. The Lawrence tube, announced many months ago in another form by Paramount Pictures as being developed by a subsidiary company (Chromatic Television Laboratories) has been described as promising to revolutionize the color-TV field. One of the main features of its latest form is the extremely simple method of forming the color screen, as compared with the RCA color TV tube, which heretofore has been the only working color-TV tube.

As presently constructed, vertical color phosphor strips (each .02 in. wide) are arranged so that the sequence is as follows—red, green, blue, green, red, green, etc. In other words there is a green strip between each red and blue strip. Thus across the screen there are a total of 400 green, 300 red, and 300 blue strips. Each color strip is 20 mils wide and the control wires are placed so that there is one wire at the centre of each red and each blue strip only. These dimensions apply only to the existing hand made tube and may vary in later models. The screen, which is laid on a flat glass plate by means of the silk screen process, thus consists of about 1000 vertical phosphor lines. Earlier versions used a screen made of parallel glass strips clamped firmly together with the phosphor on the edges. Later models will have a much finer screen made by an Eastman Kodak photo etching process.

The control grid consists of thin vertical wires about 4 mils in diameter secured at each end and led out to separate connections. The wires are placed at the centers of the red and blue strips only and there are no wires in front of the green strips. (Thus all wires opposite blue strips are connected together; as are those wires opposite the reds.) Thus when there is no deflecting potential on the grids the beam falls on the green strips; as the control signal rises, or falls, to positive or negative values the beam is deflected to the red or blue strips.

Color selection control of the electron beam is obtained by applying a varying voltage to the grid. This is of the order of plus or minus 350 volts. The beam is deflected to the equi-potential position between each pair of wires of the same color so that it falls on the desired phosphor. Extreme accuracy is not an essential since the beam spot is only 3 mils in diameter, while the phosphor strips are much wider. The color control grid is spaced approximately 0.5 inches from the screen, and the grid elements quite widely placed, of the order of 80 mils separation between each grid of the same color. It was stated that the tube could be operated in any position and that there was no danger of the wires shorting together due to sag or stretching. However, it would seem quite possible that shipping tubes with long unsupported elements of this type might present some problems. But by the time the tube is in production new methods of forming the grids may be used.

Adaptor Unit

It is understood that the new Lawrence color-tube can be used with any standard make of television receiver, but the type of color transmission system determines the type of adaptor required. Details of the circuity of the adaptor have not been divulged, but only three tubes are used in it, and it has been operated with the better grade of RCA, DuMont and other leading makes of receivers. In receivers which have suffi-

Lawrence Color-TV Tube

potentials applied to low velocity beam via a control grid

cient excess power to run the heaters and provide B plus as well as sufficient high voltage, only the three tubes are required. If a power supply and additional high voltage is needed, then more tubes are required in the adaptor unit.

Assuming that the receiver can provide all the required voltages and has been modified for the field-sequential, or any compatable system (RCA, or NTSC, etc.) the only purpose of the adaptor is to control switching of the control grid potential. This is performed by a simple multi-vibrator circuit which generates a square wave for the CBS field sequential system, and a sine wave for the industry system (NTSC). However, the RCA system being somewhat dissimilar requires a non-linear sinewave to perform the switching operation satisfactorily; this is due to the element of "cross-talk" in the transmission system. In any case, the wave applied to the grid swings 350 volts positive and negative and thus controls positioning of the beam on the phosphors.

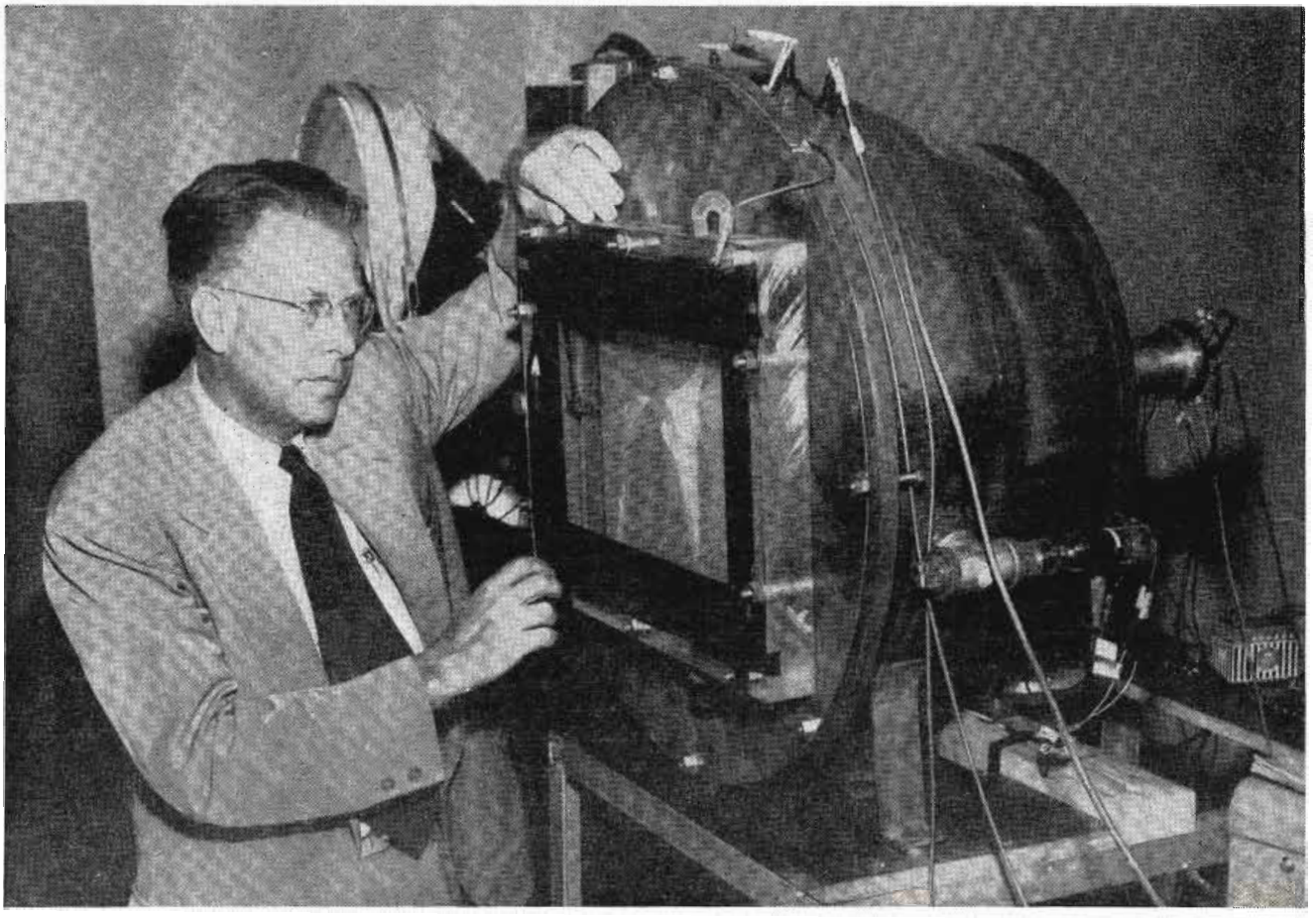
Simple in Construction

The tube exhibited in New York in October was hand-made in Dr. Lawrence's garage and was fabricated from the parts of many other tubes. The gun used came from a 7 inch tube and electrostatic focussing and deflection had to be used due to the iron shell of the tube. As a result an extra magnet was used on the face of the tube to assist in focussing and obtaining linear deflection. In the picture, this magnet can be seen on the top of the lucite face plate in photo, at top right hand side. Varying degrees of magnetization of the iron shell made for variations in the demonstrated picture, but use of standard components here will overcome this shortcoming.

As demonstrated, the tube was not impressive in performance. Only the factors of extreme simplicity of manufacture and the new principles involved gave it promise of being a valuable contribution to the color TV field. The pictures were quite dim, and although a figure of 15 foot lamberts was quoted, the actual brightness seemed more like 10. Of course this is merely the first labora-

(*Continued on page* 115)

Dr. E. O. Lawrence with his garage-built tube. This tube is continuously evacuated although production models will be fitted with adequate vacuum seals. The color screen can be seen behind the lucite block and black masking. The horseshoe magnet on the top right hand side of the lucite block is required to control stray magnetic fields produced in the sheet-iron cone. Part of the three-tube color adapter can be seen on the right



Radiosonde Telemetering

AN/AMT-3 equipment, launched from high altitude aircraft, descends pheric pressure, temperature, and humidity in Morse code. Construction

By JOSEPH A. SIDERMAN,
Meteorological Branch
Evans Signal Laboratory
Belmar, N. J.

THE function of this radiosonde telemetering and recording system is to measure, transmit, and record radiosonde data obtained in areas that are ordinarily inaccessible from the ground. It is designed to operate in and from high altitude aircraft.

For the benefit of those who are not familiar with the general operation of the radiosonde and in order that the overall system of operation may be more readily understood, a brief description of the radiosonde system is provided. The complete radiosonde system is comprised of the components shown in Fig. 1. Fig. 2a illustrates the disassembled radiosonde, showing the meteorological sensing elements and the attaching pick-up arms, the record, and crystal controlled transmitter. Fig. 2b again illustrates the sensory elements, the transmitter, the record-drive motor, and keying relay.

The radiosonde is designed to be launched from any high-altitude aircraft and, with the aid of an automatically operated parachute, drops to the ground at a descent rate of approximately 2000 feet per minute. During the course of the descent, meteorological data are being measured and transmitted in the form of international Morse code. The measured atmospheric conditions are pressure, temperature, and humidity. These atmospheric parameters are detected by means of an aneriod cell, bi-metallic element, and a human-hair hygrometer, respectively.

Such a device makes available meteorological data for weather analysis and forecasting which may be unavailable by ordinary means. In this manner, data may be collected in areas which are ordinarily inaccessible from the ground, such as unexplored territory.

Since the meteorological intelligence is converted to predetermined code groups, it can be deciphered by a radio operator familiar with international Morse code ciphers. The received coded signals are compared with a calibrated radiosonde chart (as illustrated by Fig. 3), from which the measured meteorological data are extracted in numerical form.

Briefly, the radiosonde is com-

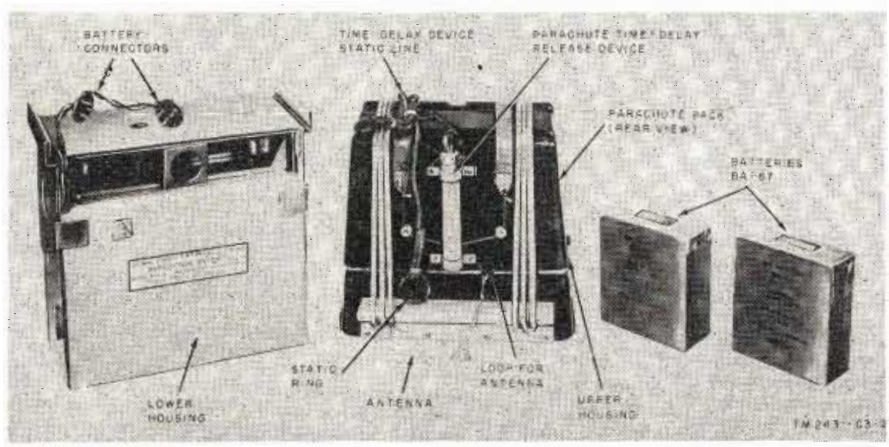
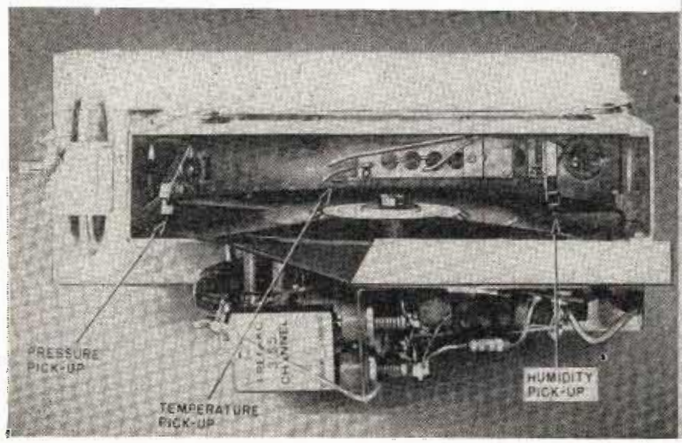
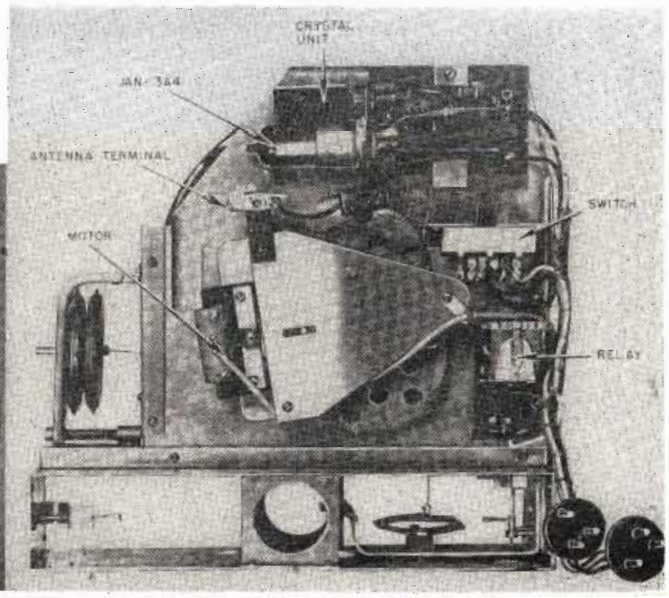


Fig. 1: Equipment components comprising the complete radiosonde AN/AMT-3 assembly

Fig. 2a: (Left) Interior view showing the meteorological sensing elements, attached pickup arms, record, and crystal controlled transmitter

Fig. 2b: (Right) Another interior view illustrating the sensory elements, transmitter, record drive motor and the keying relay





and Recording System

PART ONE
OF TWO PARTS

2000 ft./min. and transmits data describing atmos- of new, automatically synchronized, recorder described

prised of calibrated pressure, temperature, and humidity measuring elements, each mechanically connected to a specially designed phonograph-type pick-up device as illustrated in Fig. 2. As the elements expand or contract, depending upon the conditions measured, the pick-ups are moved across the rotating phonograph-type record. The record consists of 200 concentric grooves, each containing a different code group located in a 90 degree raised section of the record. As the elements and their associated pick-up devices make contact sequentially with a code groove, a small low-voltage type relay is actuated and keyed in accordance with the selected coded groups. The relay contacts key a crystal-controlled transmitter.

Transmitted Signals

The transmitted signals consist of three code groups of two letters each which are transmitted in succession and followed by a pause which indicates the completion of a scanned cycle.

The launching of the radiosonde is accomplished from an airlock provided for this purpose in all pressurized aircraft. Following the release of the radiosonde from the airlock, the remaining tasks are the reception and evaluation of the coded meteorological signals. Radio Receiver BC-348-R is ordinarily used to receive the transmitted signal, although any suitable receiver equipped with a beat frequency oscillator may be used.

Prior to the development of a recorder which presents this type of data in a convenient manner for evaluation, the standard procedure had been to monitor the signals audibly and transcribe them manually on a radiosonde flight chart. This procedure required the exclusive use of a trained radio operator for this singular purpose and delaying the evaluation of the flight data until the completion of the radiosonde descent. It was therefore recognized that the development of a recorder which is capable of performing the function of the radio operator would be advantageous. The release of a man from the duty of copying the received signals would reduce flight fatigue and permit evaluation of radiosonde flight records simultaneous with their reception.

At the inception of the recorded development program, various types of tape recorders were investigated. It was very shortly determined that standard type recorders were not suitable for aircraft operation for the following reasons: Recorders available at the time were not designed to operate from a 400-cycle power source which is commonly found in airplanes, and, in addition, were deleteriously affected by high

DATES OF CALIBRATION P 3-8 T 3-9 RH 3-7

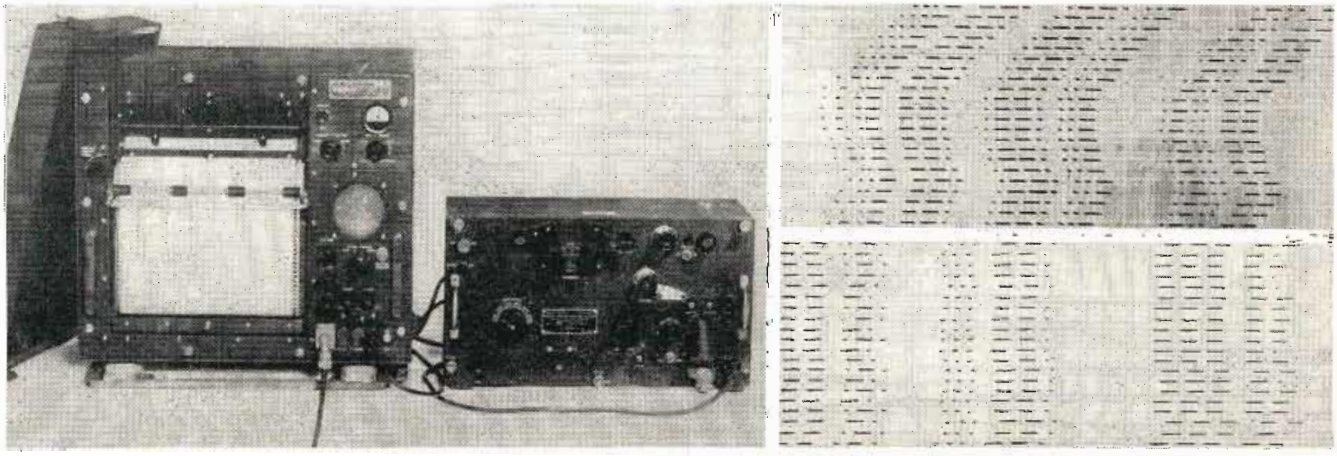
CODE	PRESS MB	TEMP °C	RH %	CODE	PRESS MB	TEMP °C	RH %	CODE	PRESS MB	TEMP °C	RH %
AA				DN	334.	-65.0		LB	463.	-38.0	
AB				DO	338.	-64.2		LD	466.	-37.2	100
AD				DP	341.	-63.5		LG	470.	-36.5	98
AG				DR	343.	-62.7		LK	474.	-35.7	96
AK	226			DS	348.	-62.0		LL	477.	-35.0	94
AL	227			DU	352.	-61.2		LM	481.	-34.2	93
AM	230.			DV	355.	-60.5		LN	485.	-33.5	91
AN	234.			DW	359.	-59.7		LR	488.	-32.7	89
AO	237			DX	362.	-59.0		LS	492.	-32.0	87
AP	241.			EA	366.	-58.2		LV	496.	-31.2	85
AR	244.			EB	369.	-57.5		LW	500.	-30.5	84
AS	248.			ED	373.	-56.7		LX	503.	-29.7	83
AU	251.			EG	376.	-56.0		MA	507.	-29.0	81
AV	255.			EK	380.	-55.2		MB	511.	-28.2	79
AW	258.			EL	383.	-54.5		MD	514.	-27.5	78
AX	261.			EM	387.	-53.7		MG	518.	-26.7	76
BA	265.	-80.0		EN	390.	-53.0		MK	522.	-26.0	74
BB	268.	-79.2		ER	394.	-52.2		ML	526.	-25.2	73
BD	272.	-78.5		ES	397.	-51.5		MM	529.	-24.5	71
BE	275.	-77.7		EU	401.	-50.7		MN	533.	-23.7	69
BK	279.	-77.0		EV	404.	-50.0		MO	537.	-23.0	68
BL	282.	-76.2		EW	408.	-49.2		MP	541.	-22.2	66
BM	286.	-75.5		KA	412.	-48.5		MR	545.	-21.5	64
BN	289.	-74.7		KB	415.	-47.7		MS	549.	-20.7	63
BR	293.	-74.0		KD	419.	-47.0		MU	553.	-20.0	61
BS	296.	-73.2		KG	422.	-46.2		MV	557.	-19.2	60
BU	299.	-72.5		KK	426.	-45.5		MW	561.	-18.5	59
BV	303.	-71.7		KL	429.	-44.7		NA	565.	-17.7	57
BW	306.	-71.0		KM	433.	-44.0		NB	569.	-17.0	56
BX	310.	-70.2		KN	437.	-43.2		NB	573.	-16.2	55
BR	313.	-69.5		KR	440.	-42.5		ND	576.	-15.5	53
BS	317.	-68.7		KS	444.	-41.7		NG	580.	-14.7	52
BW	320.	-68.0		KU	448.	-41.0		NK	584.	-14.0	51
BK	324.	-67.2		KV	451.	-40.2		NL	588.	-13.2	49
BL	327.	-66.5		KW	455.	-39.5		NM	592.	-12.5	48
BM	331.	-65.7		LA	459.	-38.7		NN	596.	-11.7	47

Fig. 3: Typical calibration chart for Signal Corps type AN/AMT-3 radiosonde

altitude or vibration incident to aircraft transportation. Above all, the most serious shortcoming was that the recording of the code radiosonde data on narrow strip tape for the duration of a normal flight consumed many yards of tape which proved cumbersome to handle for evaluation purposes. Based on the shortcomings of the existing equipment found at the time the investigation was begun, it became apparent that it would be desirable to have a recorder possessing such basic characteristics as to present the flight data

(*Continued on page* 86)

Fig. 4: (Left) Recorder developed by Evans Signal Laboratory, U. S. Army Signal Corps and Times Facsimile Corp., N. Y. C. Fig. 5: (Right) In (A), above, sloping recording indicates loss of synchronization while (B) shows effect of automatic sync



New Type Coaxial Cable Permits Appli-

German development conductor. Cables are

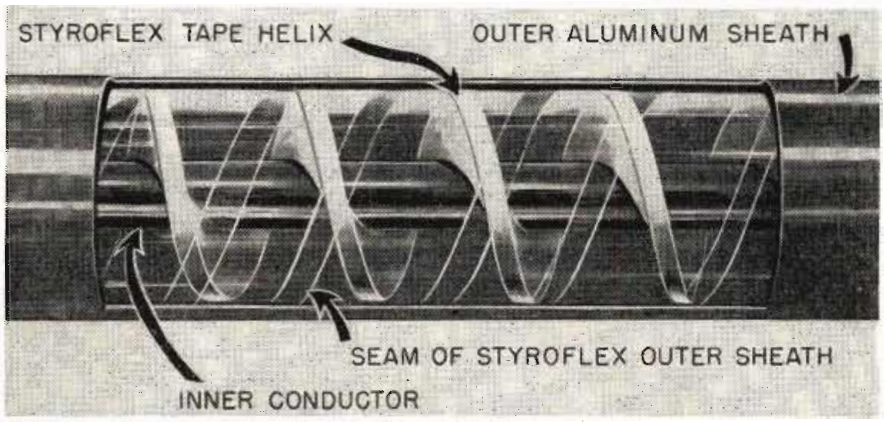


Fig. 1: Cut-away view showing internal construction of styroflex insulated cable

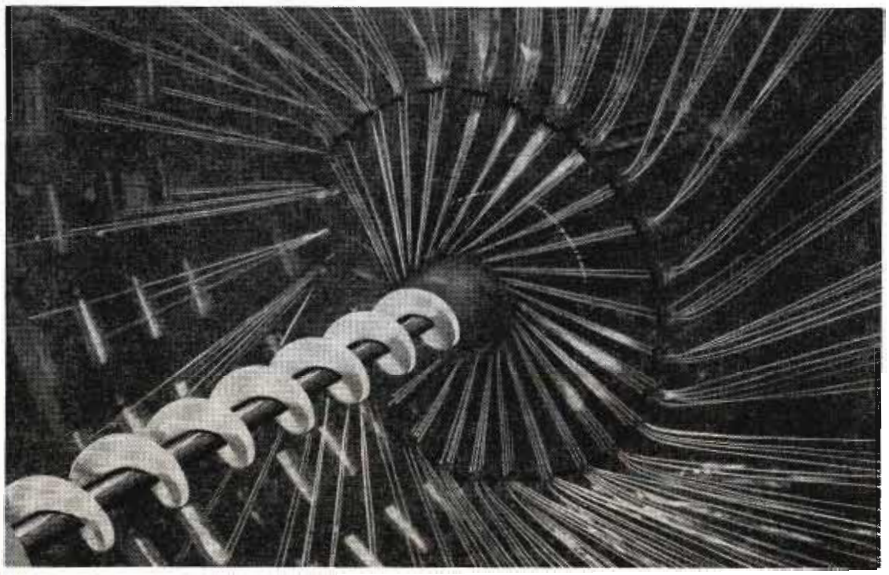


Fig. 2: German styroflex-tape insulated coaxial cable in the process of manufacture

By BERNARD F. OSBAHR, Executive Editor

LAST month TELE-TECH editors were introduced to a new type of coaxial cable, which, because of the materials employed and because of its unusual construction, may find extensive applications in VHF, UHF and microwave frequency ranges. This cable was originally developed in Germany and for some time has been a commercially available product of the Felten & Guilleaume Carlswerk in Cologne-Mulheim, Germany. Consideration is now being given to the possibility of manufacturing this cable in the United States.

Some of the more outstanding features of this type cable are: (a) its reported ability to transmit radio frequencies up to 10,000 MC and hence to become an acceptable waveguide substitute (b) the ability to manufacture this cable (in any desired diameter up to approximately 6 in.) in as long a continuous length as desired (c) the flexible or semiflexible nature of the cable which permits easy handling since it can be wound on standard cable reels for shipment (d) ease of installations resulting from the elimination of intermediate joints between input and output ends of the cable (e) the use of a plastic and air insulator which permits discontinuance of pressureized gas dehydrating systems (f) relatively light weight which simplifies installation and support problems.

Samples Shown Recently

Samples of the German cables were shown at the recent meeting by Messrs. Kenneth S. Wyatt, Engineer of Cables, Phelps-Dodge Copper Products Corp., 40 Wall Street, New York City; Lowell Bellingham, Assistant Sales Manager, The National Varnished Products Corp., Woodbridge, N. J.; Heinz Horn, Director, and H. Peters, High Frequency Engineer, Felten & Guilleaume Carlswerk, Cologne-Mulheim, Germany. Table I provides the salient mechanical and electrical characteristics of five different high frequency coaxial cables currently being manufactured in Germany. It will be noted that the characteristic impedance of all cables is 60 ohms, a German standard, adopted because it enables interconnection of existing 52 ohm solid dielectric and 70 ohm air dielectric cables without any great impedance irregularities and consequent power losses. In actual manufacture, however, any desired impedance characteristic can be obtained without difficulty.

A photograph of a cut-away section of this type coaxial cable is shown in Fig. 1. The inner conductor consists of a solid copper wire (for smaller sizes) or a copper tube (for larger sizes). It is coaxially supported in a homogeneous aluminum tube by means of a polystyrene foil helix. Both the helix and the inner conductor are encased in a thin polystyrene tube approximately a single tape layer in thickness, and this entire assembly is inside the outer conductor. The outer conductor is alum-

cations in 1,000—10,000 MC Range

features multi-layer tape insulating-helix of polystyrene and extruded outer aluminum flexible and can be manufactured in one continuous length in any diameter up to 6 in.

Cable Type	Attenuation db/100 ft. Frequency in MC					Diameter of Inner Conductor—mm	Diameter over Insulation mm	Overall Diameter mm	Z ohms	Min. Bending radius on laying—mm	Weight gr/m
	100	200	500	1000	3000						
3.2/10	0.84	1.2	1.9	2.8	5	3.2	10	12	60	120	180
5.65/17	0.43	0.625	1.05	1.6	(3)	5.65	17	20.2	60	350	770
8/24	0.32	0.46	0.75	1.1	(2)	8.23	24	28	60	500	870
21/61	0.13	0.19	0.33	0.5	(1)	21	61	68	60	1000	3170
32/95	0.087	0.13	0.24	(0.37)	(0.8)	32	95	105	60	1500	6160

Table 1: Mechanical and electrical characteristics of five different types of styroflex insulated coaxial cables

inum, and in the process of manufacture, it is actually extruded over the inner conductor and insulator assembly concurrently as the latter is wound over the former. Copper may also be used as an outer conductor, but such tubing would be drawn rather than extruded.

The polystyrene foil helix gives the cable a highly homogeneous insulation while still using as little material as possible. The stability of the helix is such that even with the sharpest permissible bend, (Table I) the spacing between the inner and outer conductors will not change. Concentricity is also maintained when unequal temperatures exist on inner and outer conductors.

A seamless aluminum outer sheath was chosen because its temperature characteristics permit extrusion and because there is no great problem with electrical losses due to dissimilar conductivities. At high frequencies, the percentage of loss in the outer conductors is relatively small.

Reel Capacity Controls Length

As mentioned proviously, this type cable can be extruded to any desired length. Practically, however, German manufacture limits cable length according to cable diameter. Drum or reel capacity, coupled with ease of handling in shipping, impose this limitation. Another limitation occurs when it is desired to minimize reflections in the transmission lines being used for very high frequencies. Here the controlling factor is the amount of aluminum that the extrusion press is capable of handling at one time. New fills cause joints in the sheath and in turn give rise to slight impedance variations. From a practical viewpoint, therefore, the manufacturing cable lengths have been standardized as follows: (Table

(*Continued on page* 107)

Fig. 3: (Left) Attenuation vs frequency in terms of kilowatts per kilometer and maximum permissible power vs frequency for five commercially available styroflex-insulated cables. Dotted lines are projected values. (Right) Attenuation of cables, db per 100 ft.

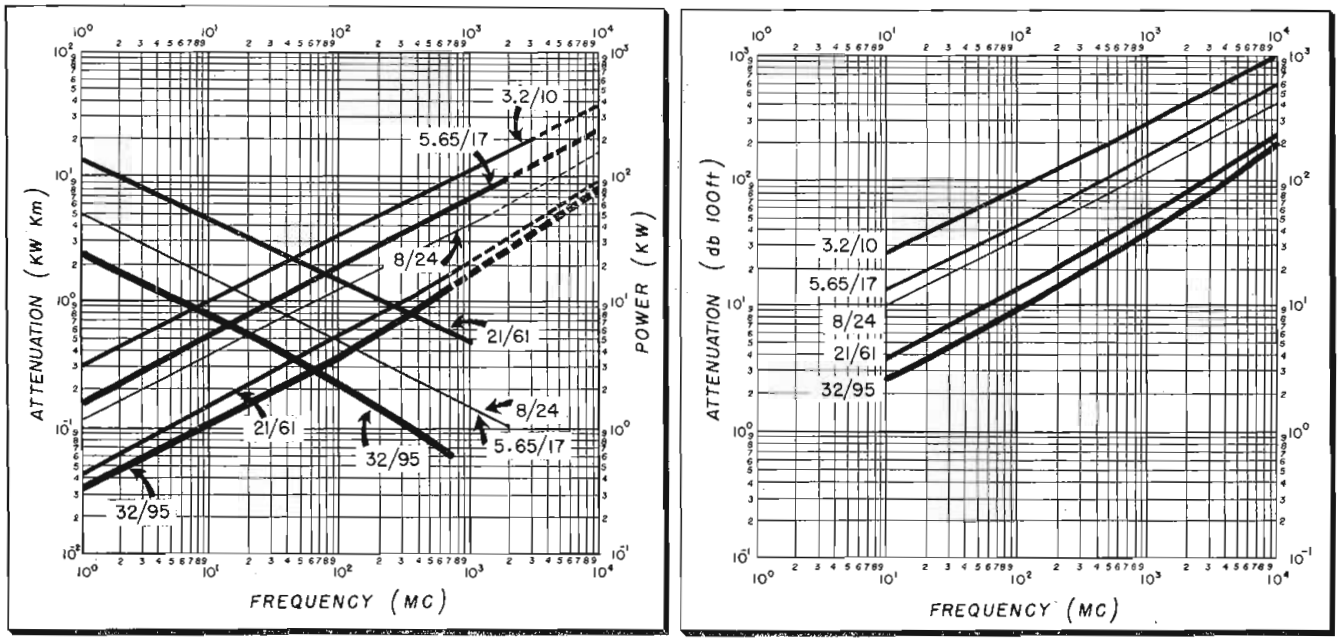


Image Iconoscope

New method for using image iconoscope be used for live as well as film pickup;

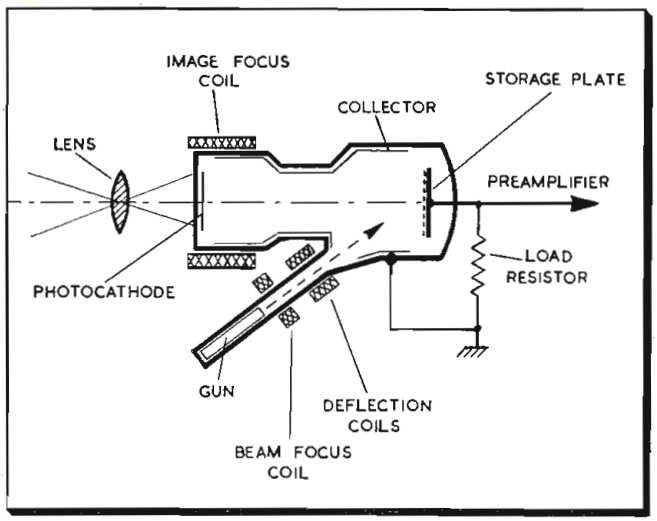


Fig. 1: Schematic diagram of the image iconoscope type of pickup tube, showing elements

By R. THEILE,
Television Research Laboratories, Pye, Ltd. Cambridge, England

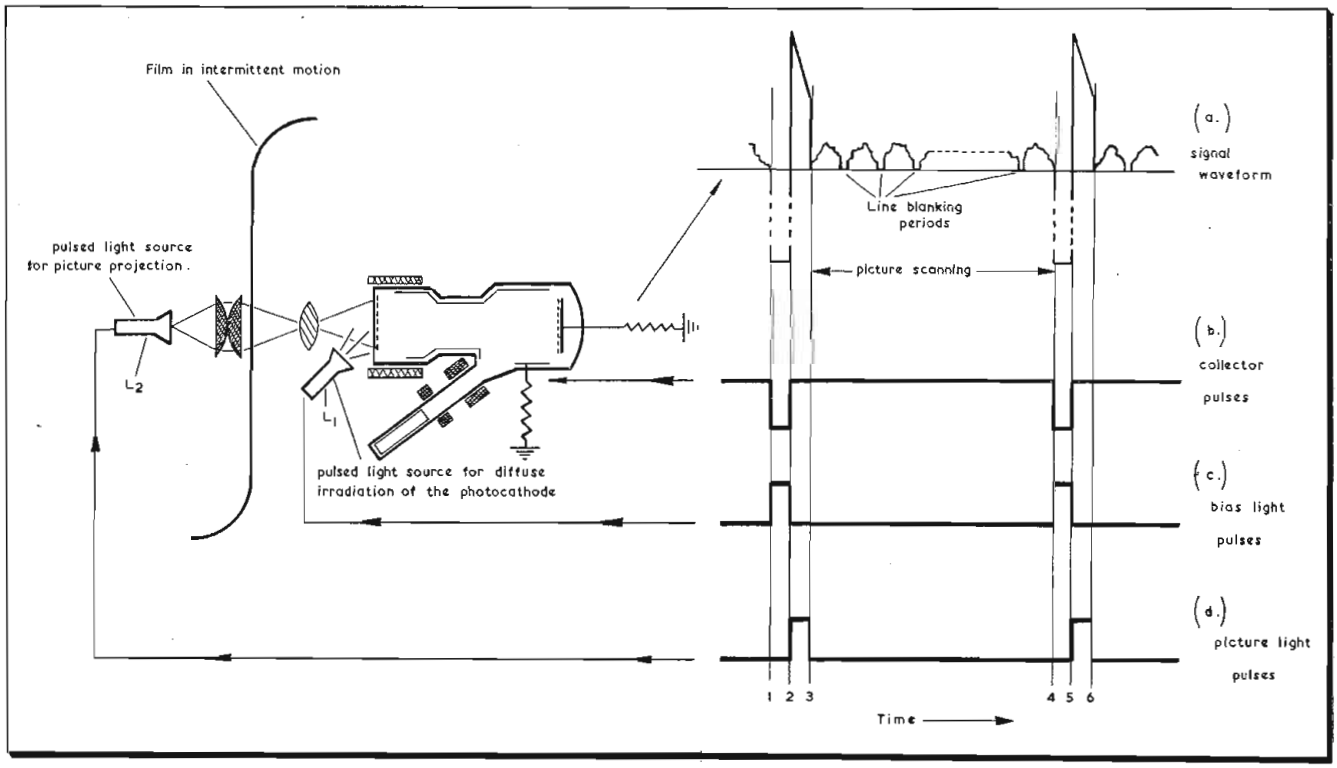
THE modern television station must have provision for the transmission of live pick-up and film. It is economical therefore to use equipment which can serve both purposes. Ordinarily this is not the case, as the iconoscope, widely used for film scanning, is not sufficiently sensitive for studio and field pick-up. Other equipments for film transmission, such as the flying spot scanner and the image dissector tube, are also unsuited for general use.

However, the image iconoscope type pick-up tube has greater possibilities as a universal device because it can be used for both purposes. For studio and field TV, modern tubes of this type have proved to be satisfactory in Great Britain and other European countries. For film scanning, this tube can be operated in the same way as the simple iconoscope, i.e. with intermittent picture projection during the field blanking period (so called "memory scanning") and the results are good, although not without certain undesirable effects such as spurious signals, edge flare, etc. But with the improved method of operation[1], outlined here and described in detail elsewhere[2], the performance of the image inconoscope for film scanning can be appreciably improved.

Fig. 1 shows the general construction of the image inconoscope [3,4]. The tube has a homogeneous photocathode on which the scene to be televised is projected. The electrons emitted are focused on the surface of a storage plate, which usually consists of a thin sheet of mica, one side of which has a layer of conducting material, forming the so called "signal plate", the other side (facing the photocathode) being activated for high secondary emission ratio. This face of the storage plate is scanned by a beam of high velocity electrons (of the order of 1,000 volts), thereby evaluating the charge pattern produced by the photoelectron bombardment.

This tube is a practical and relatively simple device, giving pictures of excellent halftone quality, stable in operation at all light levels and im-

Fig. 2: Pulsed light bias technique for transmission of TV films when using "memory" scanning as in most types of transmission



for Improved TV Film Scanning

tube presents possibilities of producing a universal TV scanning device which can reduces costs and permits telecaster to maintain smaller stocks of spare tubes

mune to target burning or other light overloading. Nevertheless, the picture generation is not without faults due to the use of high velocity electrons for scanning, i.e. the use of secondary emission phenomena for the surface potential stabilization as well as for the formation of the picture charge pattern, which involves secondary electron redistribution effects. The major faults are: spurious signals (dark spot), edge flare and lack of black level information in the signal, which is especially disadvantageous in film transmission, as motion pictures have sudden and frequent changes in scene content and average brightness.

It is not within the scope of this article to discuss the mechanism of picture generation in detail as in the comprehensive paper to be published[2]. Analysis shows that all the major disadvantages can be eliminated or considerably reduced, if redistribution of secondary electrons is avoided or reduced and if the surface charge is supplied instead by a uniform flood of electrons from another source: in other words, if the mean storage surface potential is shifted negatively in relation to the collector and the secondary electrons are not allowed to fall back onto the surface.

Special Charging Period

In the case of film scanning with intermittent picture projection, such an improvement can be easily obtained if a special charging period is inserted between the scanning of the previous field and the projection of the next film frame. It is extremely practical to provide such a charge process using an image iconoscope tube, as a pulsed light source flooding the photocathode diffusely can produce the desired charge on the storage surface. It is only necessary to prevent equilibrium potential stabilization, i.e., all secondary electrons must be returned to the surface during the charging period. This is most easily done by simultaneously biasing the collector electrode negatively. A negative charge—equal to the product of the photocathode current and the flooding time—is then accumulated on the storage surface. None of the secondary electrons reaches the collecting electrode, and their return causes a continuous interchange of charge ensuring a very uniform surface potential. This briefly is the principle of the improved mode of operation: the simultaneous application of light and collector pulses before the picture projection period, an operation which may be called "pulsed bias technique".

Fig. 2 shows a scheme for TV film transmission using an image iconoscope incorporating pulsed bias technique. The charging process and picture projection occur consecutively during the field blanking time (interval 1-3, 4-6, etc.). The "bias" light can be provided by a pulsed gas discharge tube, a cathode ray tube with short screen afterglow or a lamp and shutter arrangement, giving a diffuse irradiation of the photocathode (bias light pulses c). Simultaneously, negative pulses b (of the order of 10 volts) are applied to the wall coating (collector) of the tube. The picture is projected during the remaining time (2-3, 5-6, etc.) of the blanking period. A cathode ray tube can be used for this purpose, the control electrode being fed with the positive going picture light pulses d.

The waveform of the signal gen-

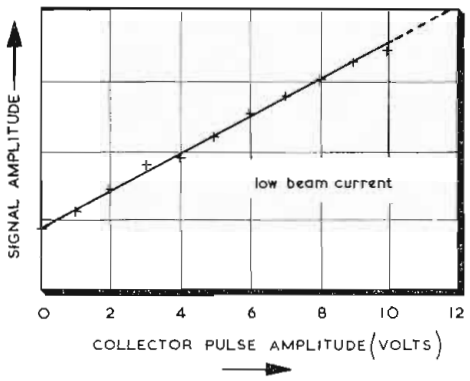
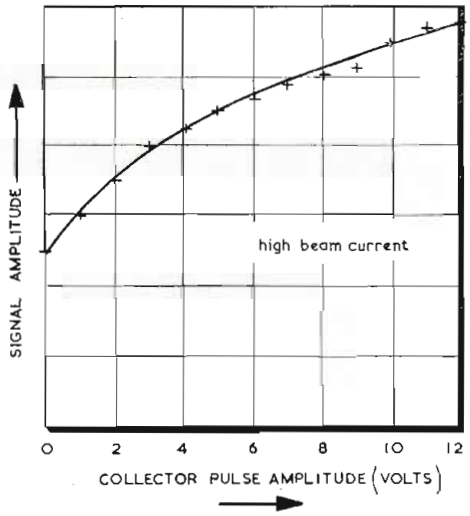
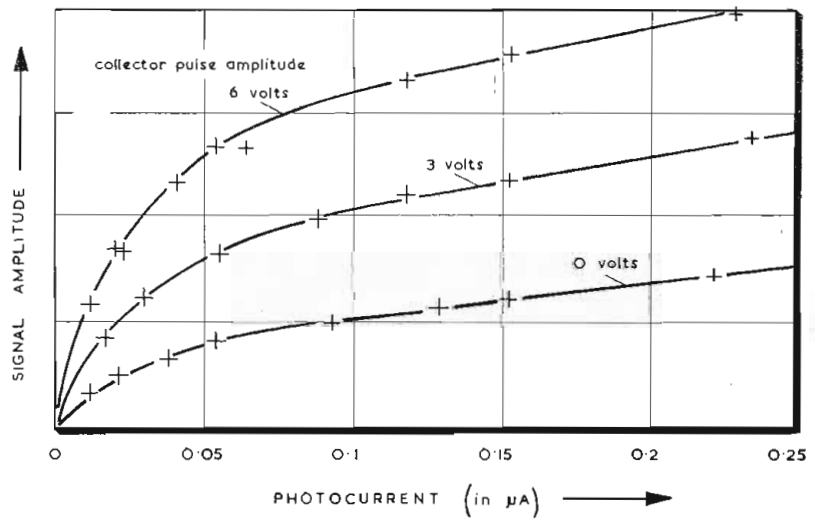


Fig. 3: Signal output shown as a function of the scene brightness with different degrees of pulsed bias techniques (beam current)

Fig. 4: (Below) Signal output shown as a function of collector pulse amplitude





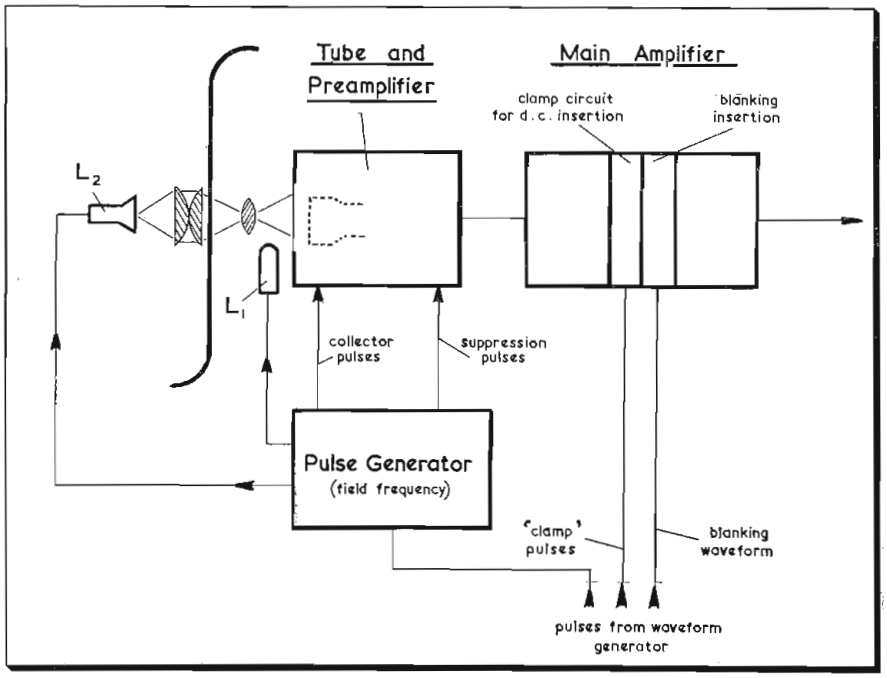


Fig. 5: Block diagram of a film scanner incorporating pulsed bias techniques for TV

erated by the tube is shown at the top (a) of the time scale in Fig. 2. It will be seen that during the charging time a negative pulse is developed due to the primary charging current. This is followed by a pulse in the opposite direction due to the picture projection. As the storage surface potential is now negative in relation to the (normal) collector potential, most secondary electrons are collected, the sense of the signal is positive and those areas of the storage surface, which correspond to bright parts in the picture, discharge towards the normal equilibrium potential (i.e., more electrons leave than arrive). It is obvious that. as the picture charge pattern is formed under a much higher efficiency than possible under normal operating conditions, better use is made of the secondary yield of the storage surface to develop the charge pattern.

Beam Evaluates Charge

After the picture projection, scanning takes place. The beam evaluates the charge pattern, discharging to equilibrium potential those areas corresponding to dark parts in the scene which have still more or less the bias charge level obtained during the charging period. The signal is now a sequence of discharge current pulses of the same polarity as the pulse during picture projection time, and is therefore unidirectional to the zero beam current level, established during the horizontal blanking time. The level of the signal during this "no current" time corresponds about to the signal generated during scanning an area of "peak white". The maximum positive signal pulse corresponds to "black", the halftones being represented by levels between these two limits. The polarity of the signal produced is therefore the same as that obtained without pulsed bias technique, so a continuous changeover is possible.

The picture signal is free of spurious signals because the charge pattern is developed from a uniform level, and any residual redistribution from the scanning beam will be equalized in the following charge period before the next picture is projected.

The excursion of the signal corresponding to black is in a constant relation to the interline level regardless of picture content, which is not the case under normal operation. A "clamp circuit" operating in the interline period will therefore hold the black level constant. However, as the excursion from this interline level to "black" changes with the operating conditions (not with the scene content), such as beam current, bias light flux, etc., it is preferable to insert a small black area in each line of the picture and clamp to this level. To avoid loss of picture transmission time, this "black" must be evaluated during the amplifier blanking time, either before the commencement of each picture line or after its end. It is obvious that the horizontal retrace and blanking time in the camera must be shorter than the amplifier blanking interval.

Experiments have shown that the improvements expected can be obtained and that the pulsed bias technique is very suitable in its application for film scanners. It was found by experience that a medium bias level (potential shift about 1-2 volts) gives optimum results. An improvement in signal amplitude as well as signal to noise ratio of the order of 2 to 3 times is gained with substantial elimination of dark spot and edge flare. If attempts are made to achieve greater efficiency (full suppression of redistribution) by increasing the bias on the storage surface, it is found that second order effects deteriorate the picture quality. Among the effects, introduced by the correspondingly high voltage gradients across the storage surface, are chromatic aberrations in the focusing of the image and scanning electrons and deflection effects due to the excessive transverse fields. Furthermore, the non-uniformities in secondary emission may become apparent, and the transfer-characteristic is appreciably changed, the output signal requiring "degamma-ing".

Film Scanner Graphs

Figs. 3 and 4 are graphs taken on a film scanner with pulsed bias technique applied to a "Photicon" tube (Trade mark for an image iconoscope type camera tube manufactured by Cathodeon Ltd., Cambridge, England). The pulse light source was a small gas discharge tube, triggered by pulses of field frequency, the peak photocurrent caused by the intermittent light flash being about 60μA of 10^{-4} sec. duration. This charging current produced a potential drift of more than a volt on a storage plate of 5000 pF total capacity. The peak to peak amplitude of the signal output was measured while scanning a test pattern of vertical black and white stripes.

Fig. 3 shows how the output increases as the pulse technique is applied. The flooding light was kept constant and the collector pulse amplitude varied, this being a convenient control of storage surface potential shift. At low beam current the signal increases linearly with the collector pulse amplitude (in the range up to 10 volts) and the improvement is considerable, whilst for higher beam currents the rate of signal in-

(*Continued on page* 114)

An Audio Mixer Employing Inverse Feedback

One-tube design has low output impedance and operates from any standard input impedance level. Cross talk is -60 db and insertion loss zero

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AUDIO mixers are an integral part of any complete design for a high quality audio system. To design equipment capable of mixing two or more audio signals it is necessary to consider the following features: (1) frequency response; (2) cross-talk between channels; (3) insertion loss and; (4) the effect on one input channel when another input control is varied.

Several schemes have been employed to accomplish the mixing of two or more audio signals; however, in most applications a compromise must be made between the magnitude of permissible cross-talk and permissible insertion loss.

A useful circuit for audio mixing, applying negative feedback in connection with a passive network, is commonly employed in electronic analogue computers to perform relatively accurate algebraic addition. A high degree of isolation can be attained, resulting in little cross-talk and interaction between channels. An added advantage of this circuit as compared with other electronic mixers is that it requires only one amplifier tube, regardless of the number of input channels. Additional channels may be introduced by adding a control potentiometer and an isolating resistor. (R_c).

Present Audio Mixers

Fig. 1 illustrates three methods of accomplishing audio signal mixing employing linear passive networks. The series type mixer (left) accomplishes additive mixing of signals; however, this circuit requires that all inputs except one remain ungrounded, consequently it is vulnerable to hum and cross-talk. The parallel-type mixer (center) is capable of linear mixing and, because all input channels are grounded, this circuit is considerably less vulnerable to hum than the series circuit. Cross-talk is attenuated by increasing the value of the isolating resistors R_c, with the maximum value of R_c being limited by the maximum permissible insertion loss and the desired risetime of R_c and the shunt capacitance, C_s. The parallel type mixer, right, is quite similar to the circuit illustrated in center except that T-pads are employed to attenuate the signal insuring a bilateral impedance match. Again the isolation between channels is a direct function of the resistor R_c (as in center); however, limitations are placed upon the value of R_c, primarily by the impedance of the T-pads and by the number of input channels involved. It is evident that a practical, realizable circuit involving linear passive networks must always be a compromise design, wherein increased isolation is attained at a sacrifice in signal amplitude and frequency response.

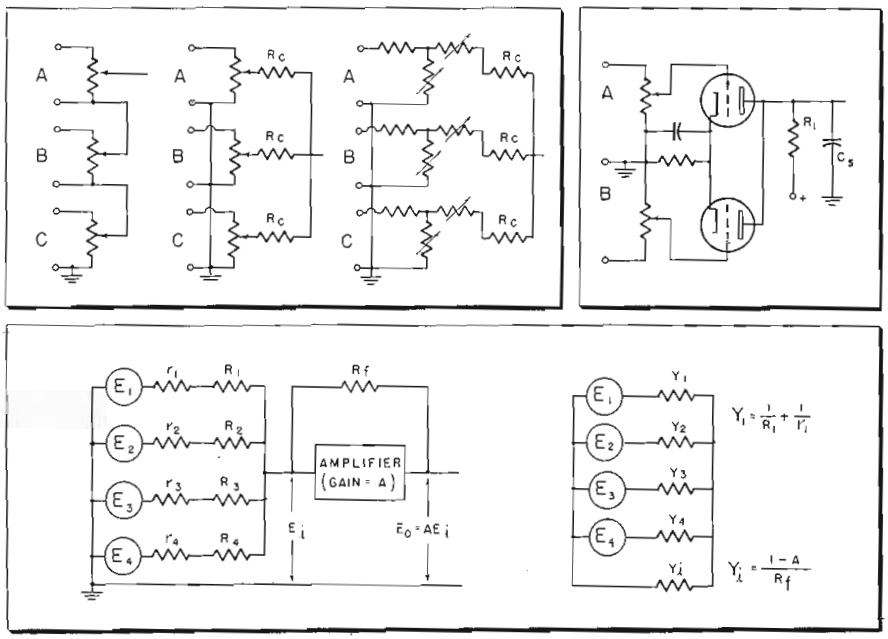
Flexibility of Design

The introduction of active elements introduces greater flexibility in the design of a good audio mixer. Fig. 2 illustrates a type of electronic mixer. Generally the circuit utilizes a double triode for a two-channel mixer. There is no insertion loss; in fact, the signal is amplified. The maximum gain attainable is limited by the tube constant (M) and the number of channels (N) involved. ($K = M/N$). Since all input channels are highly isolated from one another there is little cross-talk or intersection between channels; however, to accommodate additional signal channels more tubes must be added to the circuit. This places additional shunt capacity in the circuit which tends to reduce the frequency response.

Inverse Feedback Audio Mixer

The discrete application of inverse feedback leads to a simple electronic audio mixer. Fig. 3a is a block diagram of a parallel mixer network (similar to the circuit in Fig. 1) connected to mix several input signals. It can be shown that the input impedance of the amplifier is equal to $R_i = (R_f)/(1\text{-}K)$ or $Y_i = (1\text{-}K)/R_f$, where R_f is the feedback resistor and K is the amplifier gain without feedback. An equivalent admittance

Fig. 1: (Upper left) Passive mixer circuits. Series type is at left, parallels at center and right. Fig 2: (Upper right) Schematic of mixer using vacuum tube. Figs. 3a-b: (Below) Block diagram of inverse feedback mixer (left), equivalent circuit (right)



Audio Mixer (Continued)

diagram of the circuit in Fig. 3a, is shown in Fig. 3b.

Applying Millman's Theorem we add the currents at point A and we have

$$E_i\,(Y_1 + Y_2 + Y_3 + Y_4 + Y_l) = E_1Y_1 + E_2Y_2 + E_3Y_3 + E_4Y_4 \quad (1)$$

$$\text{or } E_i = \frac{E_1Y_1 + E_2Y_2 + E_3Y_3 + E_4Y_4}{Y_1 + Y_2 + Y_3 + Y_4 + Y_l}$$

In the audio mixer described R_1, R_2, R_3, R_4, and R_f are equal, hence: $E_i = (E_1 + E_2 + E_3 + E_4)/(4 + K)$. The output voltage, E_o, at the plate of the amplifier is $E_o = E_i K$ Substituting the value obtained for E_i in the preceding equation we have:

$$E_0 = \frac{(E_1 + E_2 + E_3 + E_4)\,K}{4 + K} \quad \ldots\ (2)$$

If the gain (K) is much greater than four ($K \gg 4$) we have $E_o = E_1 + E_2 + E_3 + E_4$ approximately and this indicates that the output voltage E_o is a linear function of the input voltages, and is independent of the amplifier gain.

Cross-Channel Interference

The cross-channel interference between one signal source and another may be defined as the ratio of the voltage developed across the second source impedance to the voltage at the first source which produces it.

This ratio of voltages can be determined upon examining Fig. 3b.

$$\frac{\Delta e_2}{\Delta E_1} = \frac{\Delta i_{21} Y_2}{\Delta E_1} = \frac{\Delta E i r_2}{\Delta E_1} \cdot Y_2 \quad \ldots\ (3)$$

From the equation, $E_o = E_i K$, we have: $\Delta E_i = (\Delta E_o)/K$ therefore,

$$\frac{\Delta e_2}{\Delta E_1} = \frac{\Delta E_0 r_2}{\Delta E_1 K} \cdot Y_2 \quad \ldots\ (4)$$

Examining equation (1) we find $(\Delta E_o/\Delta E_1) = (Y_1/Y_b)$. Substituting in equation (4) we have:

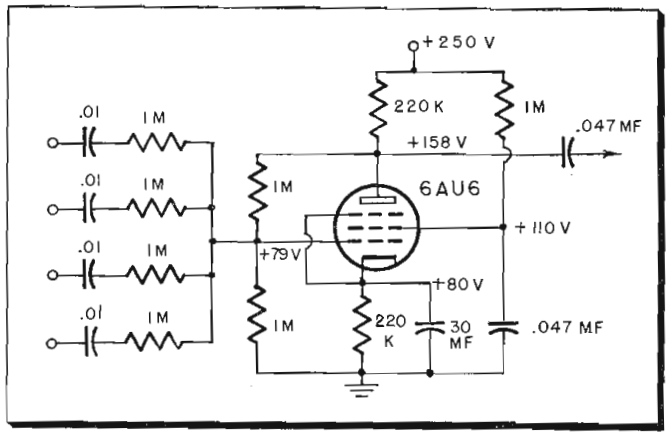


Fig. 4: Schematic diagram of the inverse feedback mixer circuit

$$\frac{\Delta e_2}{\Delta E_1} = \frac{(Y_1 Y_2)}{(Y_f K)}\, r_2 \quad \ldots\ (5)$$

$$\text{or } \frac{\Delta e_2}{\Delta E_1} = \frac{R_f}{R_1 R_2 K}\, r_2 \quad \ldots\ (5a)$$

In the circuit of the audio mixer described $R_f = R_1 = R_2$. Equation (5a) then reduces to $(e_2/E_1) = (r_2/RK)$.

Practical Audio Mixer

An audio amplifier, employing a type 6AU6 pentode, was designed with a gain without feedback of approximately 200. (See Fig. 4) The inverse feedback is introduced by dc coupling from plate to grid through a 1 megohm resistor. In the feedback loop, dc coupling is deemed advisable, since capacitive reactance might result in low frequency oscillations or motor boating. Four input channels were considered desirable, although six or eight channels could be accommodated. The impedance level of the input to the prototype model was 200,000 ohms; however, by simply shunting the control potentiometers with the proper value of resistance any value of impedance match may be obtained.

The output impedance (Z_o) is reduced when inverse feedback is applied; $Z'_o = Z_o/(1 - K\beta)$.

In the mixer circuit described, the amplifier gain, K, is 200 and $\beta = 1$; therefore

$$Z'_o = 1000 \text{ ohms.}$$

The maximum permissible output voltage E_o is 20 volts (RMS). This indicates that the sum of the input voltages E_1, E_2, E_3, and E_4 should not exceed 20 volts (RMS).

Fig. 5 illustrates the frequency response of the audio mixer. The lower half-power point occurs at 65 KC.

From the equation, $(\Delta E_o/\Delta E_1) = (Y_1/Y_f)$ the cross-channel interference may be calculated to be $(\Delta e_{21})/(\Delta E_1) = (r_2)/(RK) = 200{,}000/(106 \bullet 200) = 1/1000$ or a ratio of —60 db. Fig. 6 is a plot of cross-channel interference versus frequency.

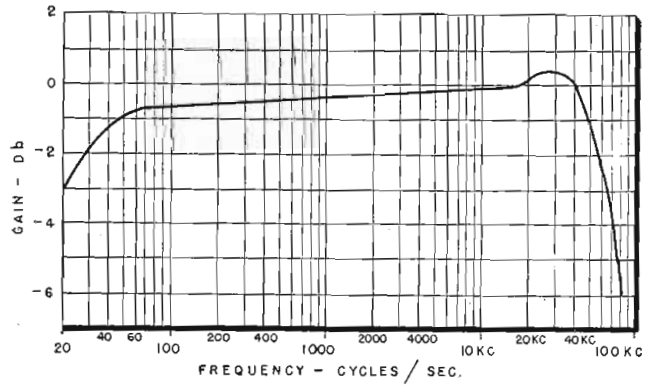
The deviation from the computed values in the low frequency portion of the curve is due to the reduction in frequency response of the amplifier. The decrease in cross-channel interference at the higher frequencies may be attributed to the poor high frequency response offered interference signals by the series isolating resistor and the shunt capacity at the input jack.

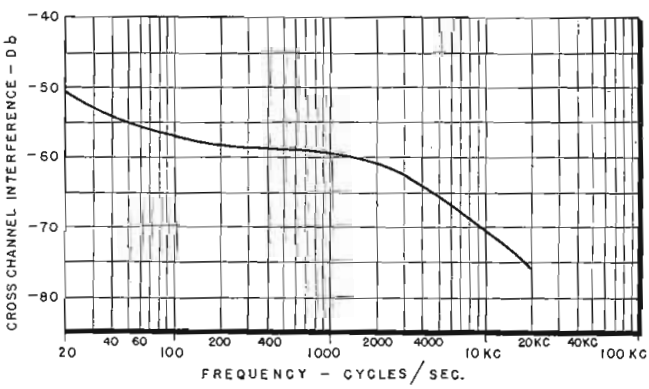
Figs. 7 and 8 are photographs illustrating the construction of the practical audio mixer.

Conclusion

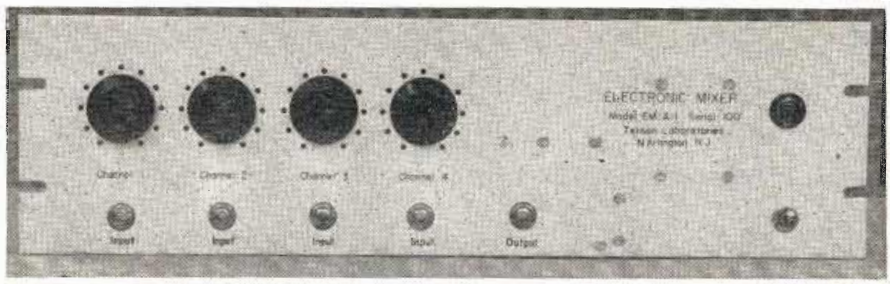
The inverse feedback audio mixer meets the requirements of a good au-

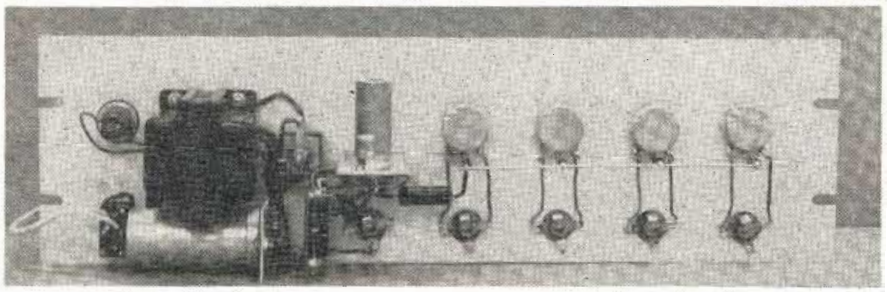
Fig. 5: (Left) Frequency response of audio mixer Fig. 6: (Right) Cross-channel interference vs frequency





dio mixer. (1) It has good frequency response. (2) The cross-talk between channels is reduced to a —60 db below signal level. (3) The effective insertion loss is zero. (4) There is no effect produced in the other channels when one of the input controls is varied. The input impedance level may be varied to match any input device i.e. microphone, phonograph, magnetic recorder or transmission line. The output impedance, Z_o, is relatively low being of the order of 1000 ohms, and further reduction in output impedance could be attained with the addition of a cathode follower.





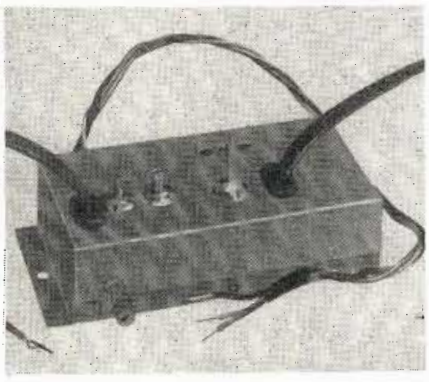
Figs. 7-8: Front and rear view photos of mixer showing layout and construction

Sarkes Tarzian Full-band UHF Tuner Demonstrated at Bridgeport

BEFORE 125 engineers of TV manufacturers, at Bridgeport, Conn., Oct. 3, Sarkes Tarzian, Inc., demonstrated its latest full-range UHF tuner, which is adapted to be operated through extra positions on its new 16-position VHF tuner. Mechanically the two tuners can be so linked that in UHF positions the "fine-tuning" dial becomes the control for the UHF tuner, while a slide indicator shows the UHF position.

Also demonstrated were single-station UHF adapters, to be used in areas where only one or two UHF stations are available. Such stations can then be picked up through the empty positions on the regular VHF tuner, which has a shelf to carry two of the single-station adapters. Only two types of single-station adapters are required, one for the lower half, the other for the upper half of the UHF band. Screw-driver settings enable the adapter to be tuned sharply to the local station.

Pretunable single-channel UHF tuner for use in one or two-station areas

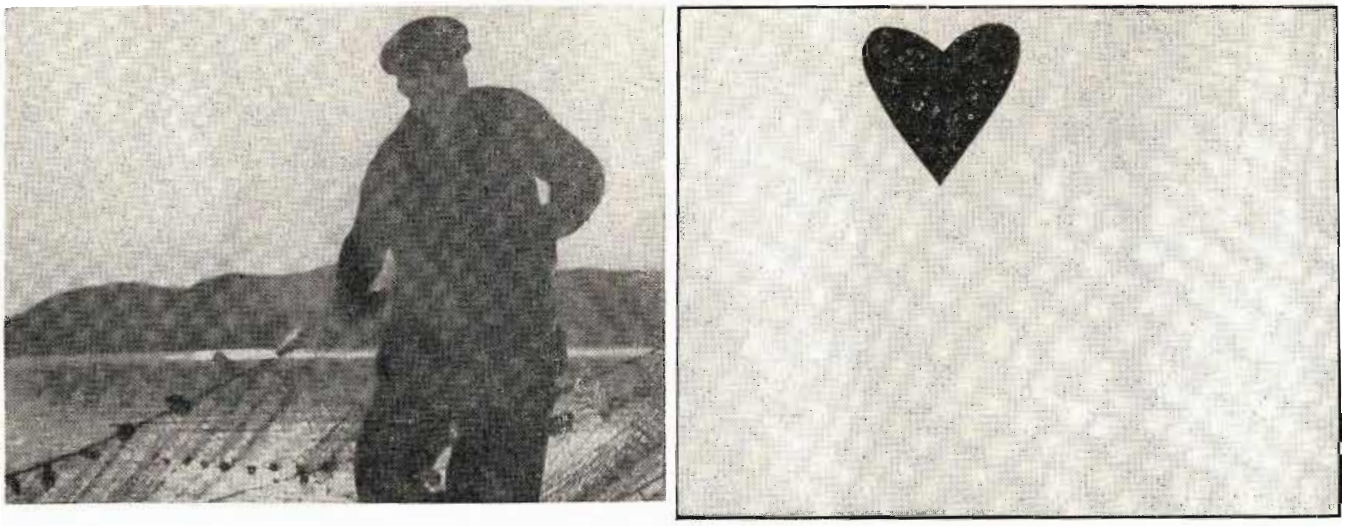


The new VHF tuner, TT16, features full 12-channel VHF performance, plus UHF positions in which the tuner is changed to an amplifier for UHF i-f. These switch positions are in addition to the existing 12, so that full VHF and full UHF are available. Description of the TT16 tuner showed that it is available for 21 MC and 41 MC i-f systems. The VHF performance is improved by newer circuits and tubes, like the 6X8 which provides higher conversion gain. The UHF position changes the tuner to a low-noise 41 MC amplifier in the 41 MC i-f models and to a 130 MC amplifier in the 21 MC i-f model. In this latter case, a double superheterodyne system is used for UHF.

The full-range UHF tuner shown by Sarkes Tarzian connects to a special input circuit in the TT16 tuner. Also, the supply voltages are obtained through the TT16 tuner and controlled by its UHF switch position so that when VHF channels are being used, the UHF tuner is automatically switched off. The full-range UHF tuner is compact and mounts on the regular TV chassis, usually over the TT16 tuner, by means of brackets. In this way, field installation of the full-range UHF tuner is easily made when mounting provisions are made in the TV chassis by the manufacturer. Performance data on the full-range UHF tuner indicates that it covers the range 470-890 MC with a three-sec-

(*Continued on page* 103)

Mr. Tarzian holds his 16-position VHF tuner, from controls of which can also be operated the new full-range UHF tuner, designed for mounting on bracket above VHF unit



Figs. 1-4: Progressive steps in producing heart-shaped insert of a girl's head on a picture of a fisherman. Photos from left

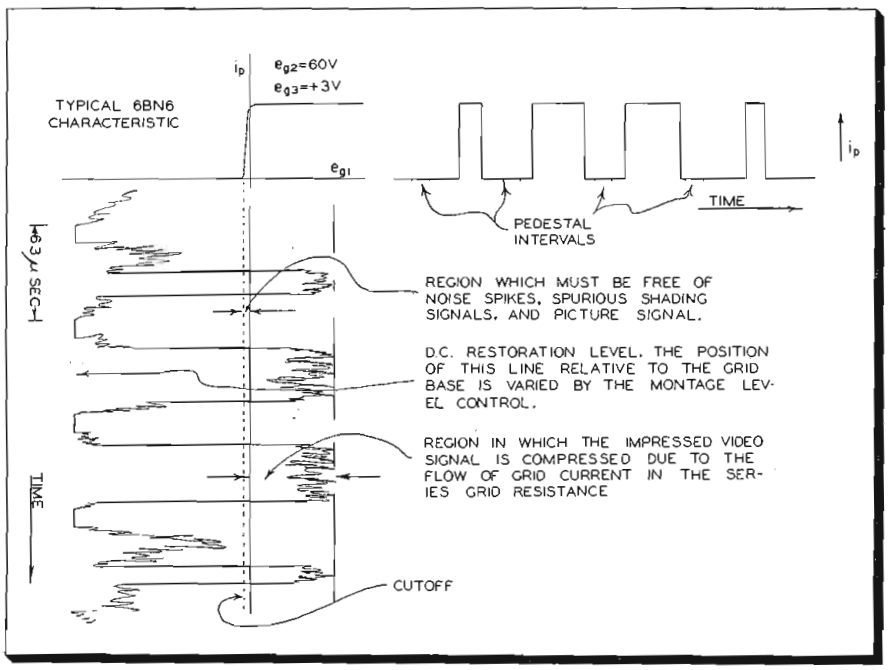
Combined Special Effects

New amplifier makes possible for TV all the pictorial effects previously available only to motion picture producers. Unit has application in military and broadcasting fields

TELEVISION special effects units may be placed in one of two general classifications. The first is a single video input unit. In this type, the picture is altered by the special effects unit. For example, some area may be given an increased contrast to simulate a spotlight; or a marker may be inserted and used to point out objects by a commentator. The second type has a multiplicity of video inputs and a single output which is a composite of the input signals. This includes amplifiers which are capable of producing lap dissolves, fades, superpositions, various wipe effects, and keyed insertions of a portion of one video signal into another.

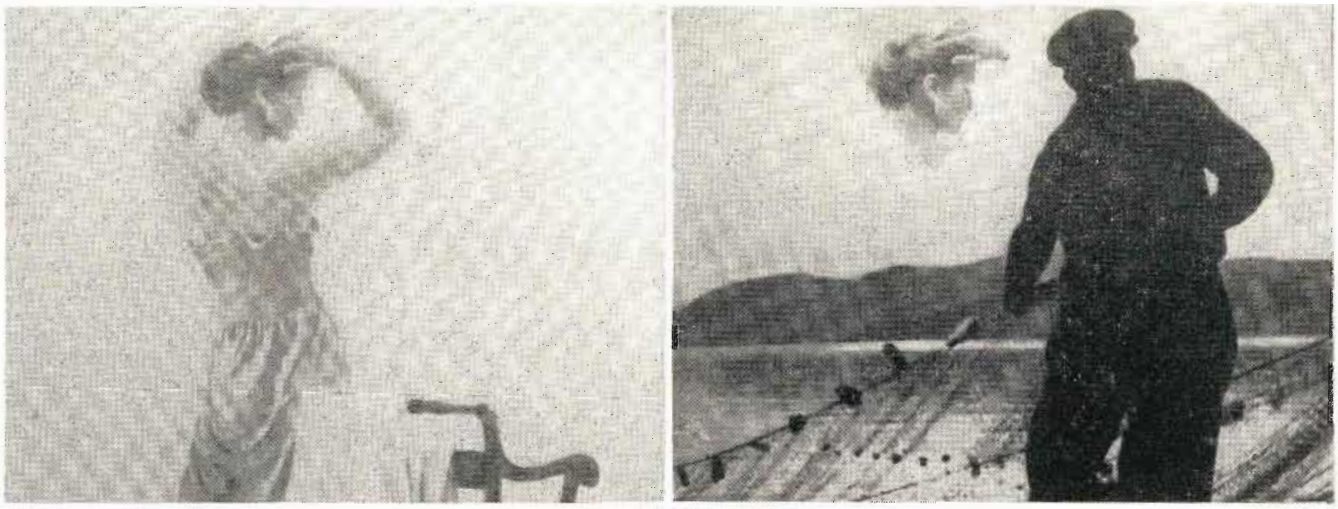
This article describes a unit which is capable of performing the various special effects peculiar to the multiple input-single output type of unit. The General Electric Montage Amplifier Type TV-35-B is capable of performing manually superpositions; horizontal, vertical and wedge, wipes; keyed insertions of parts of one video signal into another video signal; and keyed insertions in response to a third key control video input signal. By recognizing the natural division of units it has been possible to perform all these functions with but little more equipment than was previously required to perform only a horizontal wipe. This unit may also be used in conjunction with an auxiliary motor drive control panel to provide automatic transitions.

Fig. 5: Compression and pedestal waveforms in 6BN6 clamping and dc circuits



Key Control Signal

The third video input, or key control signal, may be obtained from a film chain and slide projector or from a flying spot scanner and fed to the control video amplifier of the montage unit. The iconoscope film chain will produce a signal which may be used for control of spot insertions but will not be satisfactory for com-



to right are: camera #1; slide in slide projector; camera #2; and line monitor showing combination of 2 cameras and slide

Amplifier for Television

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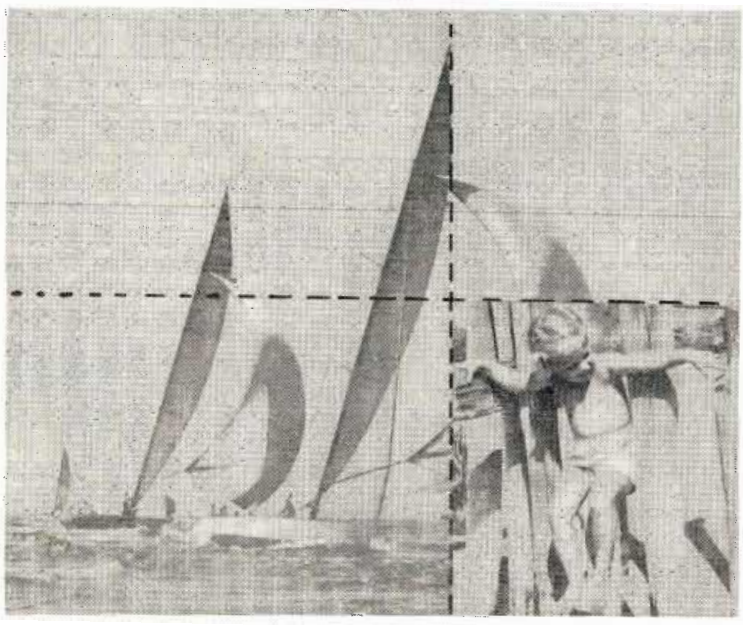
plete wipes from one picture to another because of the spurious shading signal generation which is characteristic of the iconoscope; especially when completely dark. It is for this reason that signal generation circuits for three types of wipes were built into the chassis.

The flying spot scanner, on the other hand, is readily adaptable to the generation of various wipe effects. All that is needed are various shaped opaque shutters or diaphragms which will fit in place of the transparent slides in the flying spot scanner. By manipulation of these shutters, expanding hole, clock type motion, diagonal, and various other special wipe effects may be produced.

When two signals are to share the television viewing screen, it is desirable that the operator of any studio camera involved be able to tell exactly what portion of the picture he is picking up is being used to form the combined picture. In order to accomplish this, a locating signal is combined with the blanking signal fed to the studio camera. This locating signal is derived from the montage unit and produces, on the camera viewfinder, a fine bright line enclosing the area used in forming the combined picture to be transmitted.

One way in which this unit may be incorporated into a television studio installation is illustrated in the block diagram (Fig. 7). The figure

Fig. 6: Multiple insertion showing functioning of the various control grids for each portion of the composite



COMBINED SPECIAL EFFECTS AMPLIFIER (Continued)

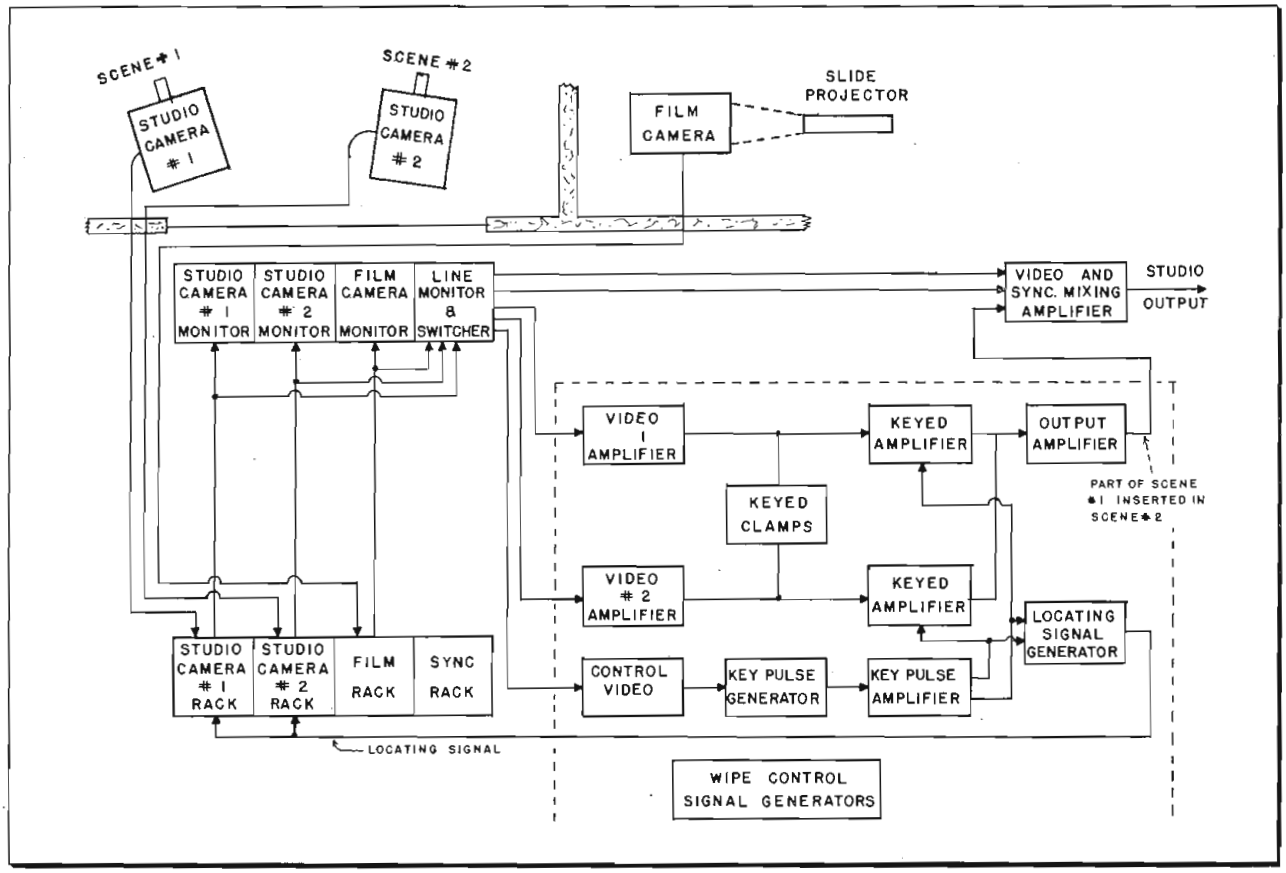


Fig. 7: Typical suggested lineup of montage-wipe amplifier units for a two camera studio using a film or slide pickup also

shows two studio cameras trained on different scenes, and a film camera operated in conjunction with a slide projector. The two scenes will be combined in the montage amplifier in a manner determined by the keying control signal obtained from the film camera chain.

Signals from the studio camera racks are fed to the studio camera monitors and also to the studio control where selection of the video input signals to the montage amplifier is made. The signal from the film chain is fed to the control video amplifier and keying pulses are produced from this video signal in the Key Pulse Generator. These keying pulses are applied to the suppressors of the keyed amplifiers.

One of the studio camera video signals is amplified and fed to one of the keyed amplifiers the signal from the other studio camera is fed to the other keyed amplifier. The key pulses applied to the suppressors are of opposite phase so that when one keyed amplifier is operative the other is blocked. The two video signals thus share the time of each scanning line in a manner determined by the signal from the film chain and insertions of one signal into the other are possible in areas of any arbitrary shape or size. Typical scenes, a slide having an arbitrarily shaped black area and the resulting combined scene are illustrated in Fig. 1-4. These figures also shows the appearance of the camera viewfinder with the superposed locating signal to help the camera operator in keeping his subject properly located. In other methods of operation the montage amplifier may obtain its input signal from the input to the second video amplifier or from the internal wipe control signal generators. In the latter case, either horizontal, vertical or wedge wipes may be obtained.

Montage Amplifier Operation

In all cases the montage amplifier employs two picture inputs and these signals are combined in various manners. Referring to the block diagram, Fig 8, the two input signals are fed through the effects #1 input amplifier and the effects #2 input amplifier where the maximum gain of the channels is set. The outputs of these amplifiers are clamped by the keyed diode clamps to set the black level of the grids of the balanced gain control stage.

This is necessary in order that spurious keying transients produced in wipe-montage operations may be clipped out of the sync regions. To suppress keying transients occurring in the blanking or pedestal periods, it is necessary to mix in additional pedestal in the common plate circuit of the balanced gain control stage, shown as the keyed mixer stages in the black diagram, Fig. 8. This extra pedestal and the set-up of the original signal are then clipped out in the two series crystals clippers. The return potential points for these crystals is set by a cathode follower in the clipper level r-f stage, which is necessary in order that the varying current resulting from different picture content will not produce shifts in the clipping level.

The output of the clipper is fed into a feed-back output stage which provides a low impedance driving source for the main picture output and a full level monitoring output. In order to re-establish set-up at the normal level, pedestal from the blanking mixer stage, is fed into the suppressor of the first stage in the feed back output amplifier. The amount of signal reintroduced in this manner may be varied with the set-

up control to re-establish a given percentage of set-up for any given peak-to-peak video output.

When the unit is used to produce superpositions, the suppressor grids of the effects #1 and #2 input amplifiers have a variable negative potential applied from the effects control panel. The maximum gain of the two effects channels would be set to be equal by means of the gain controls in the cathodes. The cut-off or zero amplification level is set by mean of controls in the control panel. Movement of the control levers then changes the amplification of effects channel 1 from maximum to minimum and at the same time changes the gain of channel 2 from minimum to maximum.

At intermediate positions of the handle the amplifiers will have intermediate gains and, for preset superpositions, the particular portion of picture signal from each channel may be set with the two control levers. The picture signals fed through the balanced gain control stage have pedestal mixed with them and are clipped. Pedestal is then reinserted in the same manner as is done when the pictures are keyed rather than mixed. The suppressors of the keyed mixer stage are grounded through a relay.

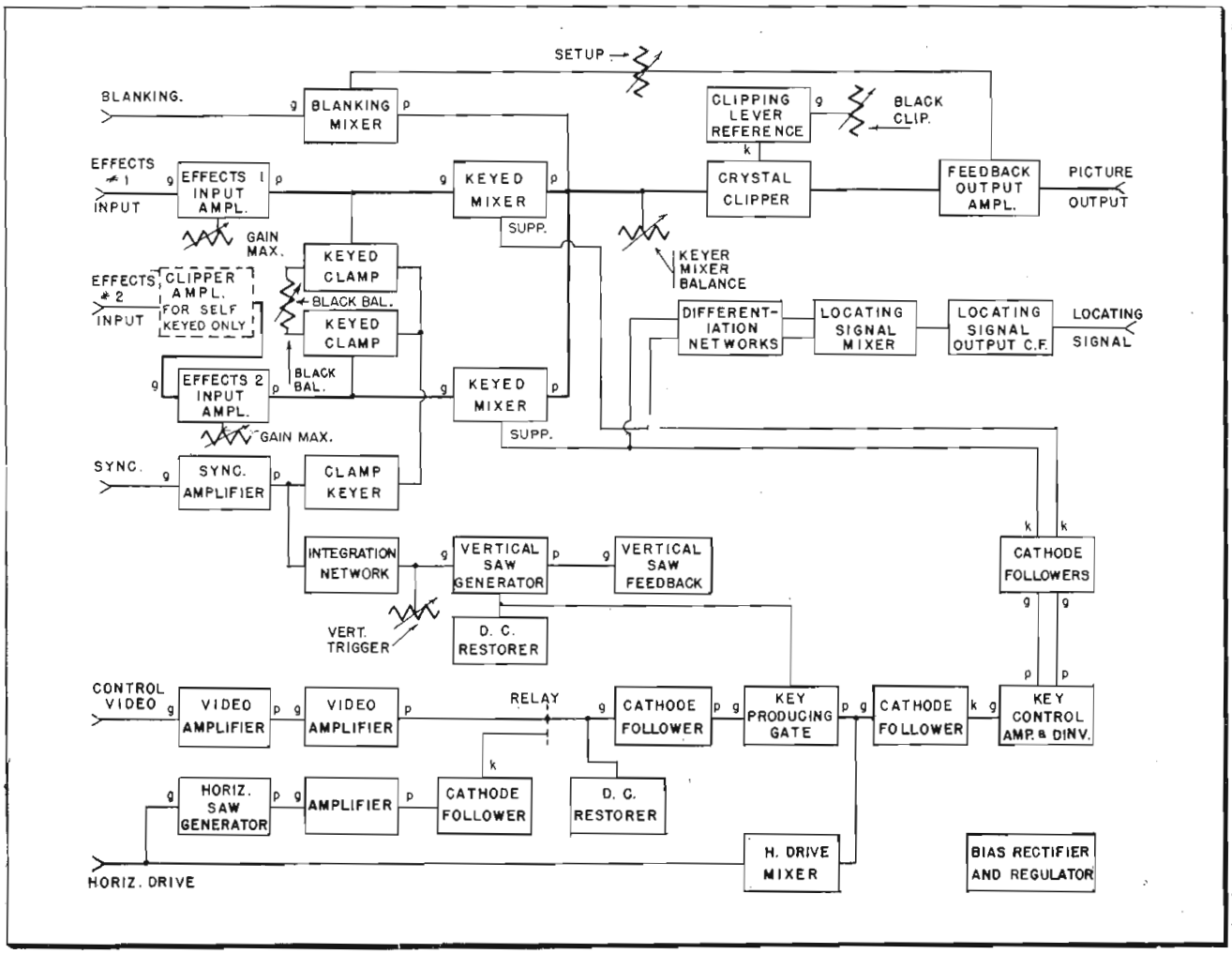
Keyed Insertions

In the case of keyed insertions several other stages are employed. The two input pictures are fed through the video amplifier keyed clamp stages to the keyed mixer stage as before. In this case, however, keyed mixer tubes will not conduct simultaneously but will be alternately conducting in response to the keying signals being applied to their suppressors. In order to avoid shifts in the clipping level which would result from the elimination of the static plate current of one of the amplifiers, a shunt resistance path to ground is provided and a potentiometer adjustment made to establish the clipping point at the same level as that existing for superpositions. Pedestal is mixed in the plate circuit of the keyed mixers to eliminate keying transients in the output pedestal after the signal has been passed through the crystal clipper. The output stage and the method of reintroducing set-up remain as before. To generate the keying control signal, a picture input is applied through the control video input and a relay to a video amplifier. This control picture input must necessarily be somewhat special in character if clean keying between the two main inputs is to be obtained.

A method which works very well is to blacken an area, on a blank slide, of the shape desired for the keyed insertion. This slide projected on an iconoscope film camera with video reversal may be properly shaded and have blanking level set so as to produce essentially a square wave on each line of the video signal output, producing an ideal keying signal for application to the montage amplifier. Somewhat less than the ideal signal may be used and still produce satisfactory results

(*Continued on page* 91)

Fig. 8: Block diagram of units of montage-wipe amplifier showing paths of control and signal voltages and lineup of switcher blocks



CUES for BROADCASTERS

Practical ways of improving station operation and efficiency

Edited by John H. Battison

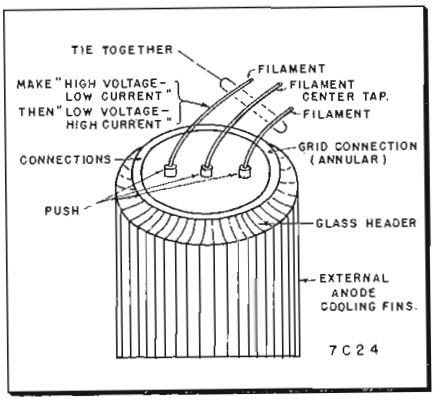
Clearing Internal Shorts in Power Tubes

WILLIAM MARON, Chief Engineer, WPOE, Elizabeth 4, N. J.

AN air failure protection device was described in the Cues for Broadcasters (TELE-TECH, July, 1951). The defective tube, which helped to bring that device into existence, lay on my desk for several weeks as a grim reminder of economic waste.

The 7C24 had an intermittent grid-filament short. By putting an ohmmeter from grid to filament and pushing on any filament post slightly the short manifested itself.

Several companies were approached with the idea of opening the tube



Shorts in power tubes burned out by r-f

and effecting a simple repair. However, all were very discouraging as to the outcome of such an operation. The biggest fear was that the elements would become contaminated by exposure to the air.

The defect was then carefully analyzed. As the short was intermittent when the tube was hot, it meant that the grid was making contact with the filament in one spot. If that portion of the grid could be burned away, the trouble might be cured.

An r-f high voltage (12 KV) power supply was borrowed. This was connected between grid and filament. Repeated applications of high voltage cleared the short somewhat, but not sufficiently to allow the tube to work in the transmitter.

The high voltage supply was disconnected. Then the filament leads were all tied together to prevent high current from going through too much of the grid and burning it up. The tube was put into its socket in the transmitter and one side of the filament supply was connected to the grid and the other side to the tied filament leads.

The filament supply was turned on and the filament post gently pushed with a test prod until it shorted to the grid. The high current burned off the portion of the grid wire touching the filament. This was done several times to assure full clearance.

Connecting the tube properly and turning on the transmitter showed normal operation. The tube has now been in operation over two months. Every day it performs is equivalent to found money.

The same method can be tried on other power tubes with internal shorts; there is no guarantee of success, but failure means only the loss of time in doing the experiment.

$$$ FOR YOUR IDEAS

Readers are invited to contribute their own suggestions which should be short and include photographs or rough sketches. Typewritten, double-spaced text is preferred. Our usual rates will be paid for material used.

Tape Storage

FRANK A. JENNE, Chief Engineer, WJMX, Florence, S. C.

AT WJMX, the need existed for a rack to hold and store rolls of recording tape. One was designed using 10" aluminum base discs after removing the "wax." The ends were made from a whole disc, allowing an extra ½" on the straight sides to support the back and make it more rigid on the bottom.

The back and bottom were made from a piece of ¾" plywood 12" x 19½" (or any length desired). Saw cuts ¼" deep 9/16" apart were made in the plywood for the divisions to fit in, then the back and bottom were separated and nailed together at a right angle.

It is possible to obtain four divisions from one 10" disc allowing an extra ¼" on the bottom bent double so that they fit the saw grooves tightly. The ends were attached with wood screws, and the divisions slipped in place in the grooves.

Echo Effects Produced By Splitting Tape

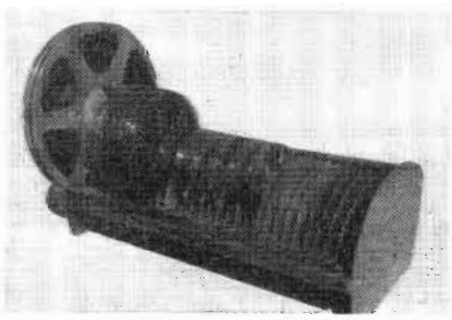
EDWARD J. BOH, Tech. Director KROX, Crookston, Minnesota

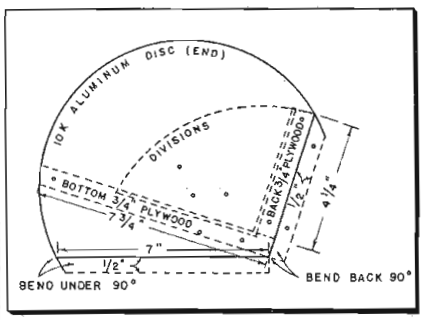
THERE has been a need, for the past few years, to give spot announcements a "shot in the arm". Because there was no space for building a chamber for echo effects, the only answer was electrical. This could be done with reverberation amplifiers, but we believed that there must be a simpler answer to the problem.

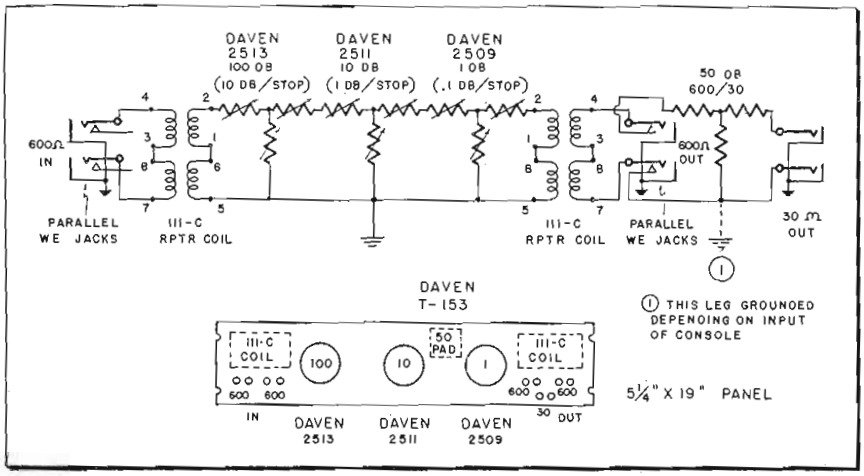
After much thought, we conceived the idea of *splitting the tape lengthwise,* then putting it back together with a slight off-set. The first punch line recorded was: "...firm name... Motors don't meet competition, they MAKE it.... !" This line filled about two feet of tape. The tape was split from end to end by holding the sharp tip of a razor blade against the edge of the "playback-record" head of the Magnecorder while it was running.

The next step was "patching" the tape together. In order to mark the two halves for perfect alignment, a small smear of fingernail polish was

Tape storage rack made from outworn discs can hold more than 20 reels







Attenuation panel with variable input and output pads and complete isolation

placed on the tape. After the polish had dried, the two strips were pulled apart several inches and glued together with splicing tape. The echo was perfect! Between an inch, to one and one-half inch of lead, produced the best echos. Then the split tape was re-recorded on a solid tape, using a second tape recorder.

Attenuation Panel

DON V. R. DRENNER, KGGF, Coffeyville, Kansas

AN attenuation panel has been devised by D. W. Gillette of the KGGF staff for use in making frequency response and distortion measurements.

The fixed output pad for insertion into the microphone input channel will depend on the impedance in use, i.e. whether 30 or 250 ohm microphone inputs are used, and the loss of the pad will depend upon the db down of the particular microphone normally in use. The pad shown is for 30 ohm input, 50 db loss, associated with the use of WE/Altec 633A type microphones.

The use of the two repeater coils gives complete isolation — a factor which we found to be essential in eliminating ground loops between the oscillator and the equipment under test.

Amplified Cue for Remotes

F. J. PINKERTON, Chief Engineer, WWOD, Lynchburg, Va.

MANY small and medium sized stations cannot install two telephone lines to every broadcast remote. Therefore, they depend upon the studio for the on-the-air cue. Most consoles are equipped to send this cue on the remote line, but the volume at the remote end is usually rather weak. This causes difficulty in hearing the cue especially in locations with noise, such as a baseball game.

Several schemes have been devised but most are involved and require extra tubes and parts. We use the Raytheon RR 30 remote unit which has on its panel a switch to change the output from line 1 to line 2. This was never used, so a few simple changes in wiring and the additional two half watt resistors resulted in a simple and effective cue amplifier.

On the normal (#1) side of the switch, the amplifier operates in the normal manner. On switching to side #2, the line is fed through bridging resistors into the fader input of channel number three, and by adjusting the position of fader 3, the volume of the cue can be set to the desired level. The other faders can be preset if desired and when the on-the-air cue is heard, the switch is thrown to #1 position and again the operation is normal. Since there is no additional load on fader 3 due to the bridging resistors and the normal open circuit, this channel can be used in the normal manner also, thus not limiting the number of channels available.

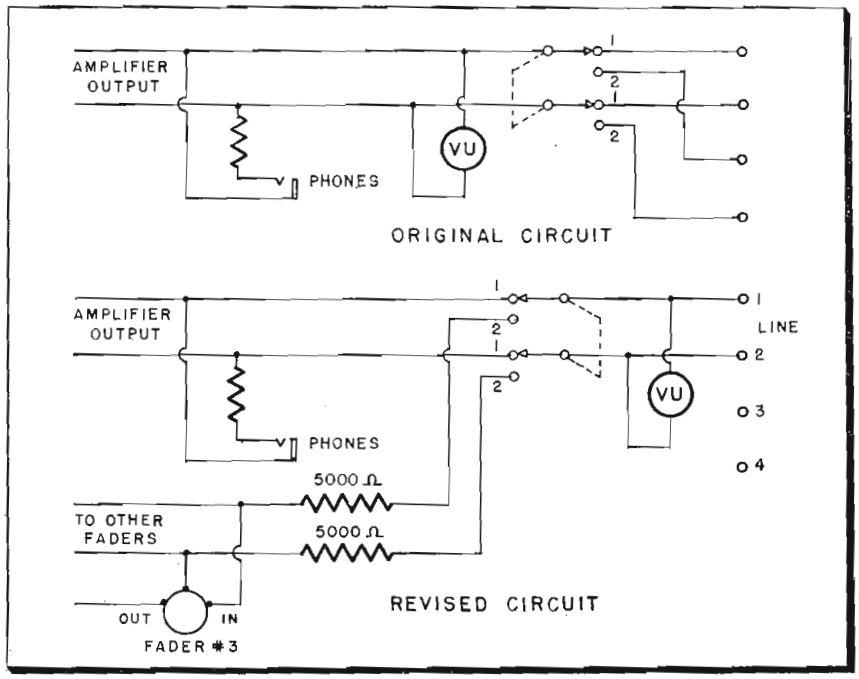
"Low-Level Input" for the High Level Input Magnecorder

FRANK F. BODINE, American Con. APO 206, Postmaster, N. Y., N. Y.

ONLY a jack (phone or mike type) and a foot of shielded wire are needed for a new and quick method of installing mike inputs on Magnecorders. Mount jack just to left of "bridging-in" jack on rear of chassis. The shielded wire can be grounded without disrupting the controlled ground system, as one end of the load resistor is grounded. This resistor is a 47,000 ohm, ½ watt type located under the middle of the ganged "function-selector" switch and connected from the switch to the main ground lug of the large chassis. Its normal use is as an inverse feedback load in the ground side of the input transformer and it still works as such with a high impedance mike connected across it.

Of course, the standard practice of using a "grid-line" transformer at the jack is even better. An RCA junior velocity mike showed normal recording level for close talking, with the Magnecorder gain control at middle position.

Amplified cue circuit for remotes using Raytheon RR 30 Remote Unit unused circuits



Ceramic Capacitors in

An analysis of the performance data on new miniature titania ceramic capacitors that are finding ever wider applications in

By J. M. BROWNLOW & G. N. HOWATT
Glenco Corp., Metuchen, N. J.

IN a miniature circuit application where relatively large changes in capacity with temperature and voltage can be tolerated, the miniature and subminiature high dielectric constant ceramic capacitors offer striking space saving possibilities. The high K ceramic dielectrics are derived from compositions containing barium titanate, $BaTiO_3$, and have, to a greater or lesser extent, the ferroelectric domain properties of this material.[2] In analogy to ferromagnetic materials, the ferroelectric high K ceramics exhibit hysteresis, field dependent properties, and have Curie points where the K displays a maximum with increasing temperature.

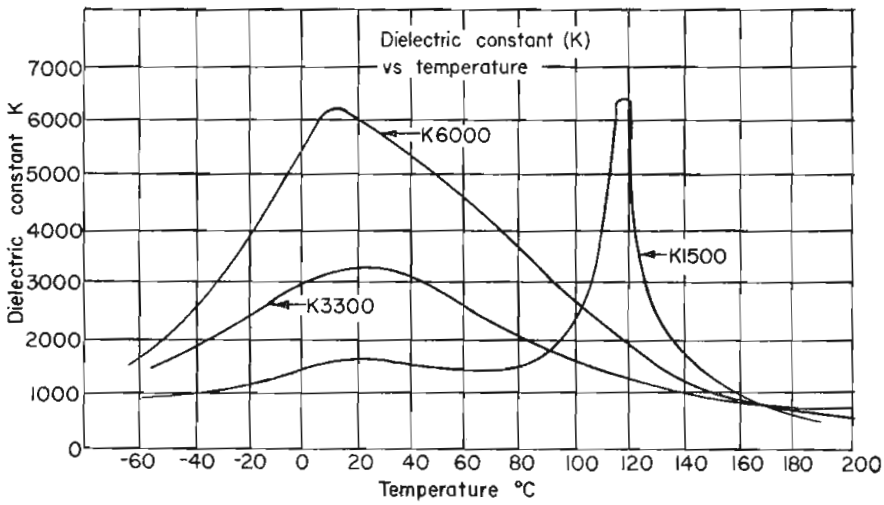


Fig. 5: Temperature characteristics of capacitor dielectrics K-1500, 3300 and 6000

Fig. 5 shows a temperature characteristic of three capacitor dielectrics, K-1500 resembling the behavior of pure $BaTiO_3$. The Curie points of K-6000 and K-3300 have been broadened and shifted to lower temperatures by the addition of zirconates of barium, strontium, magnesium and calcium to barium titanate. The range of operating temperatures will determine which of these three dielectrics should be chosen, the higher K values having the greater temperature dependence. For hearing aid applications, K's of 10,000 could be used. The higher power factors encountered below the Curie point are due to hysteresis losses Fig. 6.

Two other manifestations of the ferroelectric behavior are (1) the increase in K and power factor with the ac measuring field strength Fig. 7a and (2) the decrease in K with dc bias Fig. 8. The slope of the curve in Fig. 8 is a measure of the nonlinearity of these materials. The degree of nonlinearity is maximum at the Curie point and decreases to each side of the Curie point. The application of a fixed dc bias lowers and flattens the temperature characteristic. This effect is shown in Fig. 9 for K-6000 and in Fig. 10 for K-3300 for each of three field strengths corresponding to 150, 250 and 500 wvdc.

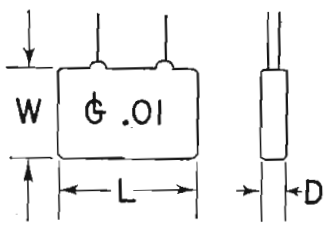
High K ceramic capacitors are usually marked with the guaranteed minimum value (GMV) of capacity measured with no applied dc bias at 1000 cycles at 5 volts rms and at 25°C. Besides the GMV tolerance, capacity tolerances of —0%, +100% and —0%, +60% are sometimes specified for K-6000 and K-3300. Closer tolerances are meaningless when one considers the temperature and voltage instability of these dielectrics. For K-1500, a capacity tolerance of —0%, +40% is the lowest that should be specified.

In a particular circuit application

TABLE II

HIGH K COUPLING AND BYPASS CAPACITORS

High K Ceramic Body No.	Capacity MF	No. of Layers	CBM miniature 500 WVDC Size in inches L	W	SMCB sub-miniature 250 WVDC Size in inches L	W	SSM sub-miniature 150 WVDC Size in inches L	W
K1500	.0003	1	.28	.25	.24	.20	.12	.12
	.001	1	.38	.35	.35	.30	.28	.25
	.005	1	.75	.58	.65	.55	.55	.48
	.01	1	1.00	.85	.88	.78	.73	.60
K3300	.0004	1	.2	.2	.18	.15	.12	.12
	.001	1	.25	.25	.200	.15	.15	.12
	.005	1	.50	.48	.48	.35	.35	.30
	.01	1	.75	.52	.55	.48	.48	.45
	.05	2	1.0	.88	.95	.80	.88	.65
K6000	.005	1	.45	.35	.30	.28	.26	.23
	.01	1	.55	.48	.45	.31	.35	.28
	.05	1			.88	.76	.73	.63
	.05	2	.95	.80	.68	.53	.61	.43
	.1	2			.88	.78	.75	.63
	.1	3	1.20	.85	.78	.55	.65	.53



500 WVDC
1 layer D = .15 in.
2 layer D = .18 in.
3 layer D = .24 in.

150 WVDC
1 layer D = .12 in.
2 layer D = .17 in.
3 layer D = .22 in.

250 WVDC
1 layer D = .12 in.
2 layer D = .17 in.
3 layer D = .22 in.

Dual Section and Triple Section Capacitors are available in Values of .01 mf. or less per section

Circuit Miniaturization

PART TWO
OF TWO PARTS

and titanate-based miniature circuits

where the capacity value must always exceed a certain minimum value, the appropriate GMV of capacity at 25°C. to be specified can be found by consulting Figs. 9 or 10. For example: if a minimum capacity value of .005 mf is required between the temperatures of —40° and +80°C at 150 wvdc it is seen that a K-3300 .01 mf GMV, which has 50% of its GMV capacity at these extremes, should be specified. If, in addition, there is also a maximum capacity value that cannot be exceeded, one has the choice of (1) specifying a capacity tolerance of —0%, +60% instead of GMV, or (2) specifying K-1500 or K-300, which have less temperature dependence than K-3300.

The change in megohm microfarads with temperature is shown in Fig. 3 for K-3300 and is representative also of K-6000 and K-1500. It has been found that the life test and high temperature performance of the high K titanates is very similar to that already outlined for the temperature compensating capacitors, the semiconduction processes initiated in titanium 3+ ions being possible in both high K titanates and titania ceramics.

Time Dependent Properties

There remain two time dependent properties peculiar to ferroelectric titanates to be considered. One is the decay of capacity observed when the capacity of a high K capacitor is measured as a function of time after quenching it from a temperature above 200° to 25°C. This exponential decay is shown in Fig. 11 and has a time constant that is small above the Curie point and large below the Curie point. In other words it takes longer to reach temperature equilibrium below the Curie point than above, the time constant depending on the distance from the Curie point.

This aging factor makes it necessary in production to age the capacitors several days before final capacity testing. The second time dependent phenomenon is the time required for a high K ceramic capacitor to attain a certain percentage of full charge

(*Continued on page* 120)

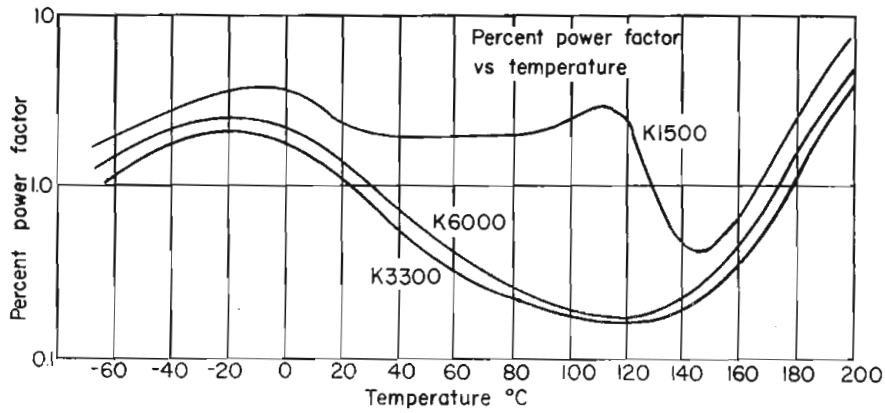


Fig. 6: Curves showing percent power factor vs temperature for dielectrics in Fig. 5

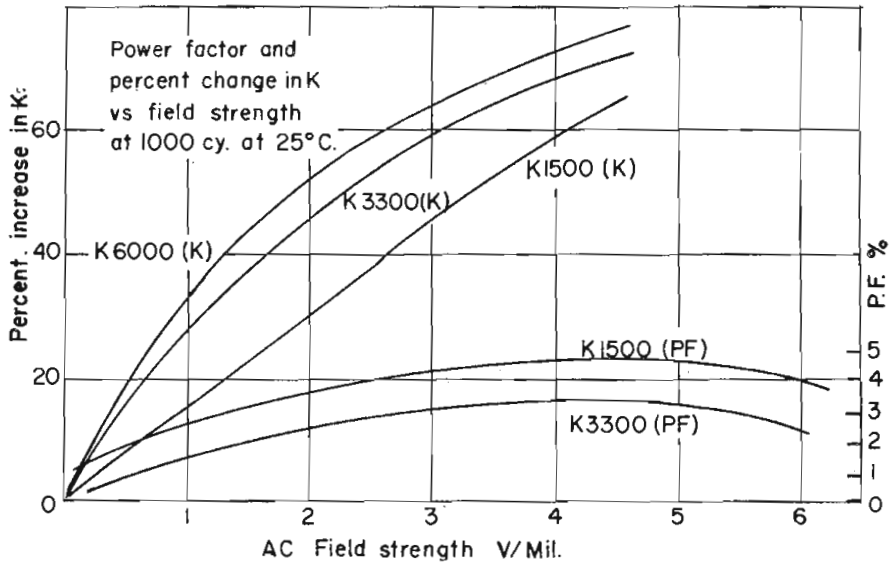
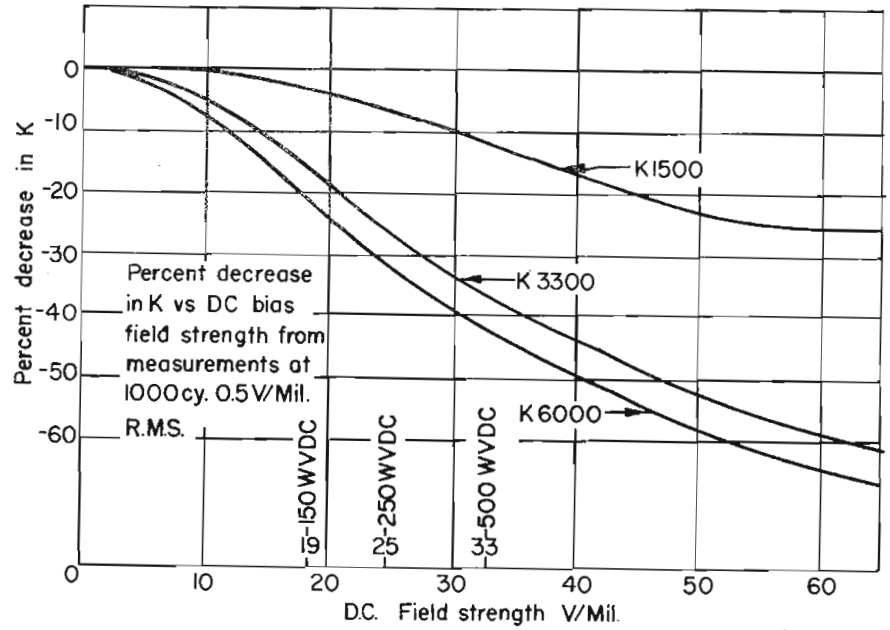


Fig. 7: Power factor and percent change in K vs. field strength at 1000 cps, 25°C.

Fig. 8: Decreasing K (%) vs bias field strength. 1000 cps, 0.5 v/mil RMS



Heater-Induced Hum

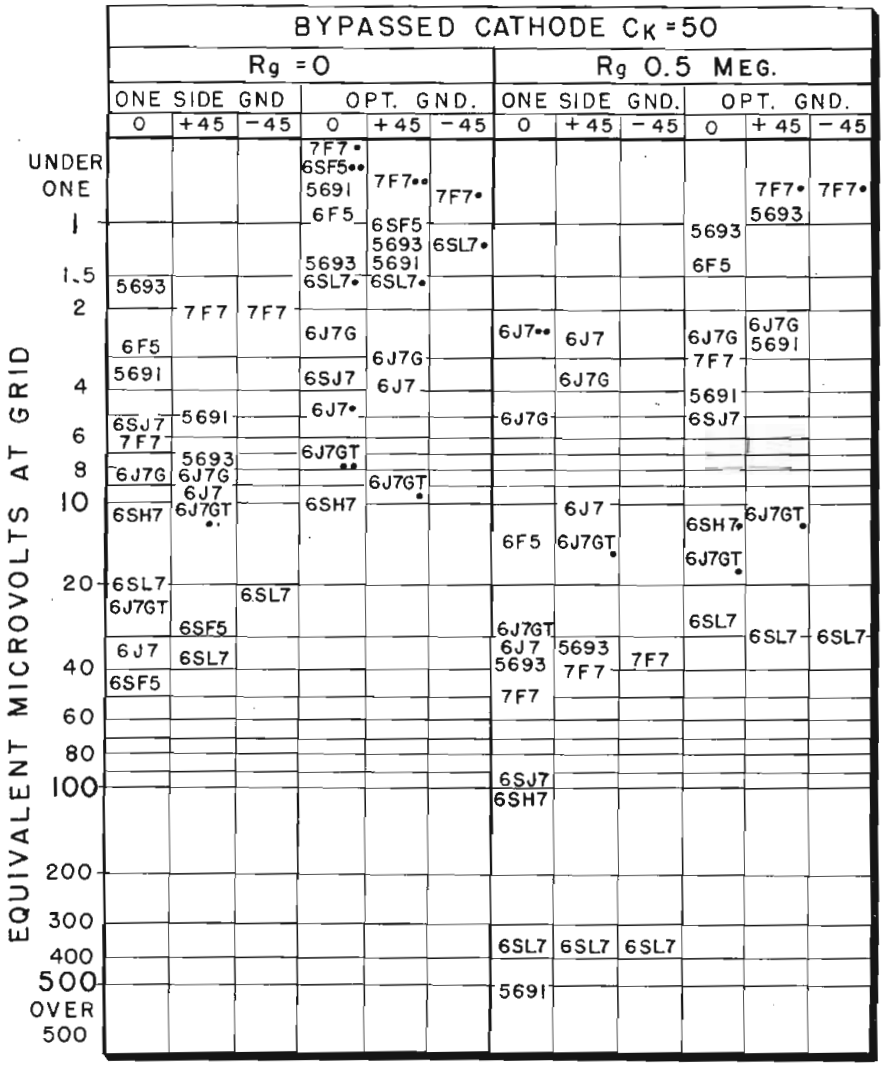
60-cycle hum in eleven different tube types are catalogued for bypassed and unbypassed cathode conditions

BY suitable choices of tubes and circuitry, heater induced 60-cycle hum in ac operated low-level amplifiers can be reduced to less than 1 microvolt. Less fortunate tube and circuit combinations may give heater-hum levels of more than 500 microvolts.

These are conclusions of a limited investigation of heater hum recently made at the National Bureau of Standards and the study has yielded useful practical data for designing such amplifiers. Emphasis was on cataloguing heater hum characteristics of various tubes and circuit arrangements, rather than on investigating the causes of the hum.

Eleven tube types, in various circuit arrangements, have been studied so far. Included were single triodes 6F5 and 6SF5; dual triodes 6SL7, 7F7, and 5691; and pentodes 6J7, 6J7G, 6J7GT, 6SJ7, 5693, and 6SH7. In general, only 4 to 6 tubes of each type were checked, although tubes of several manufacturers were included wherever possible. Data were discarded for occasional individual tubes which, in showing wide deviations from the mean, were not believed representative.

Fig. 1: Levels of heater-induced hum in eleven tube types with bypassed cathodes in various amplifier arrangements. Vertical position of the tube on the chart indicates 60 cycle hum in equivalent microvolts at grid for several circuit variations



Circuits were varied with respect to cathode bypass capacitance, heater return tie point, heater return potential, and grid circuit resistance. The cathode resistor was either bypassed with a 50 μf capacitor or left unbypassed. Input grid resistance was either zero or 0.5 megohm. The heater return was either to one side of the heater, or through the adjustable arm of a 100-ohm potentiometer placed across the heater supply and adjusted for minimum 60-cycle output. Heater return potential was either to ground, to 45 volts positive, or to 45 volts negative. Hum measurements were made with various combinations of these circuit variations.

In the test set-up, the 60-, 120-, and 180-cycle hum components of the output of the amplifier under study were measured on a vacuum-tube volt-meter, using appropriate amplification and filtering. At the same time, wave form was observed on a cathode-ray oscilloscope. Gain was measured by applying a known signal to the grid of the test amplifier; hum level could then be expressed in terms of equivalent microvolts at the grid. Provision was made for switching from ac to dc heater supply for calibration and comparison.

To obtain the desired measurements of heater-induced hum, external ac hum was reduced to a negligible value, using recognized shielding precautions; heater leads were twisted and shielded and kept away from the grid circuit, which was also shielded.

Circuit components were based on median values given in manufacturer's manuals. Preliminary checks indicated that hum is not significantly affected by the usual variations in components—plate, screen, and cathode resistors, and cathode and screen bypass capacitors—required to match different load impedances.

The most hum-free amplifiers investigated so far at NBS used either of several triodes (6F5, 6SF5, 7F7, or 5691) or a pentode (5693), in a circuit including bypassed cathode, heater grounded through an adjustable potentiometer, and low grid impedance. Wide hum differences were found for different tube types, as well as for different circuit arrange-

in Audio Amplifiers

ments. Apparently, however, the 60-cycle equivalent input hum of almost any tube type tested, whether triode or pentode, can be reduced to 10 microvolts by suitable circuitry; and all of the triodes tested could be brought below 2 microvolts.

The NBS figures are for the 60-cycle components alone and are therefore not fully comparable with figures given in the literature, which generally include harmonics. The 60-cycle components were measured because of their importance in low-level power-frequency amplifiers, often required in instrumentation applications. Some of the low 60-cycle values measured at NBS were accompanied by harmonics no greater or even substantially less than the 60-cycle figure; in other instances the harmonics were many times greater than the 60-cycle component.

The general effects of the circuit variations were not unexpected. Without the cathode bypass condenser, hum was of course much greater; a sufficiently large bypass capacitor is obviously desirable for all low-hum applications. Return of the heater circuit through an adjustable potentiometer connected across the heater supply, when adjustment was optimum, reduced the hum to as little as 1/20 or even 1/50 of the initial value. Returning the heater circuit through 45 volts, either positive or negative but preferably positive, reduced hum somewhat in most cases. Increased grid circuit resistance tended to give greater hum in triodes, while in pentodes hum in general either showed no change or else decreased with increased resistance.

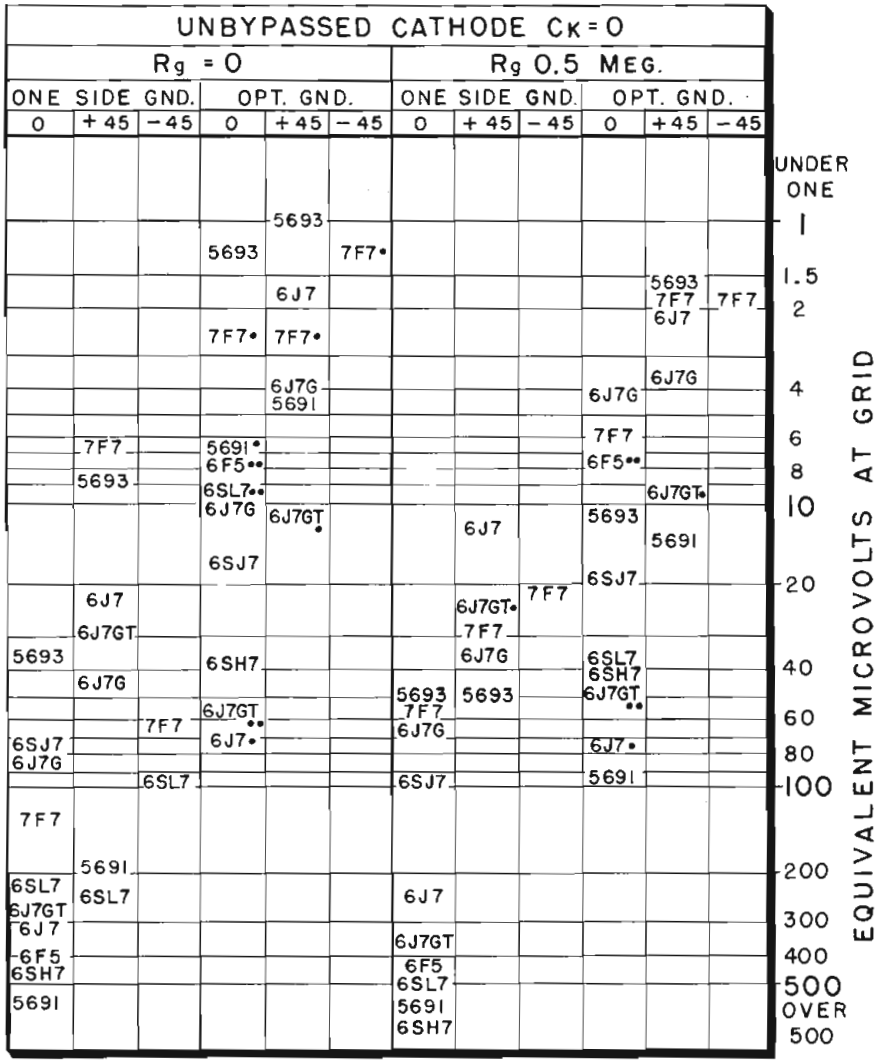
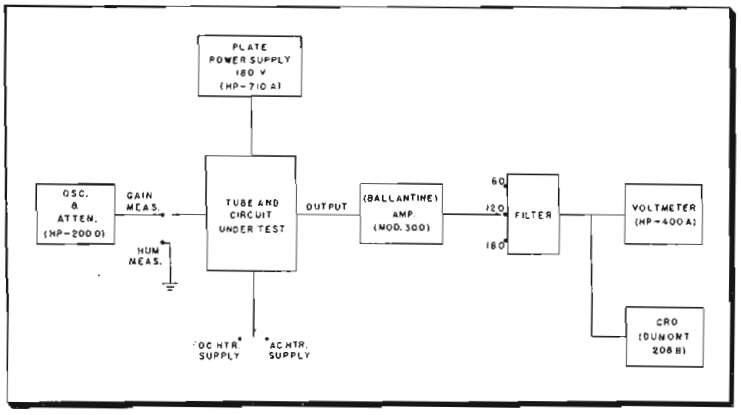
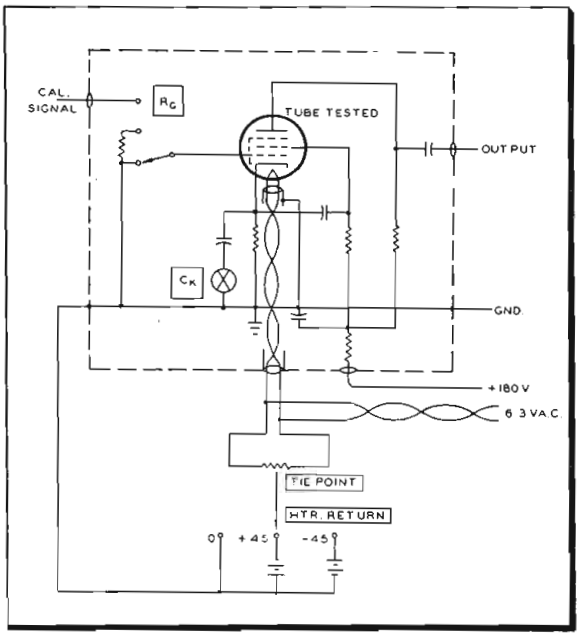


Fig. 2: (above) Chart similar to that shown in Fig. 1 except that cathode circuits are in unbypassed condition

Fig. 3: (lower left) Block diagram of complete arrangement for measuring hum level

Fig. 4: (right) Typical low-level amplifier circuit used in these measurements





1. "Low Noise Miniature Pentode for Audio Amplifier Service", D. P. Heacock and R. A. Wissolik, TELE-TECH, Vol. 10, No. 2, Feb. 1951.
2. "Controlling Hum in Audio Amplifiers", L. T. Fleming (NBS). Radio and Television News, Nov. 1950, p. 55.

Signal Corps' New

New tandem transmitting station. Lead vehicle houses complete camera pick-up and transmitting equipment and is interconnected to power supply coach by 4-wire cable

"Project Caravan" consists 31-ft. motor coaches. Micro-

PROJECT Caravan, the name applied to the new Signal Corps mobile television pick-up, transmission and display system was recently delivered to Ft. Monmouth by the Radio Corporation of America. This mobile system is the outgrowth of the Chief Signal Officer's recognition in 1949 of the potential value of television in training and instructing troops. In response to his desires, the Signal Corps Engineering Laboratories investigated the possibility of developing a mobile television system designed to demonstrate the potentialities of television as an instructional and training tool. Subsequently, Coles Signal Laboratory prepared specifications for the construction of the mobile system and the Radio Corporation of America built the equipment under this specification.

The caravan consists of four special ten-ton six-wheel coaches, each 31-ft long. The first vehicle in the television fleet contains the camera pick-up and transmitting unit. It is equipped with three complete TV field camera chains, a microwave transmitter for transmitting the video signals, and a 45-watt FM transmitter for the sound signals.

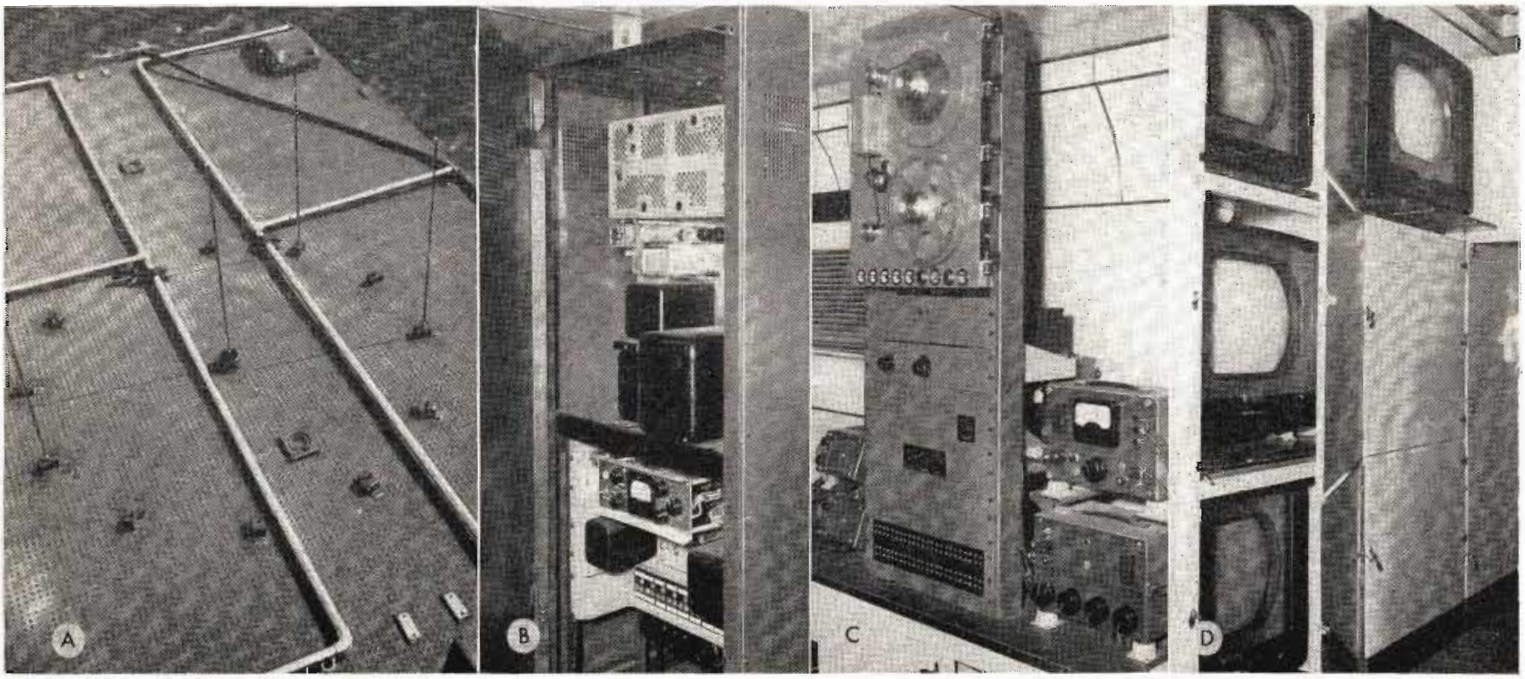
The cameras are RCA standard field types, each equipped with tripod dollies and electronic viewfinders. Prior to actual telecasting, these cameras are removed from shock-mounted storage lockers in the vehicle and attached to the tripod dollies. This makes them movable over the telecasting area. A multi-conductor cable is attached to each camera and to a distribution box inside the coach. Each camera utilizes a single cable which can be used in lengths up to about 1000 ft.

The field type camera controls are portable suitcase type units which are all shock-mounted to a convenient operating desk built into the rear of the coach. Suitcase type power supplies of about the same size are shockmounted below the desk. This operating position is surrounded by glass windows so that the operators can see the field of action and thus be aided in directing pick-up activities.

Control Facilities

The circuitry of the transmitting unit is shown in the accompanying block diagram. Video signals from the three cameras are fed through their respective camera control units to a field type video switching unit installed on the operating desk. From this control point, any of the three

(A) Reinforced roof of transmitting vehicle showing rod antennas for FM audio. Directional radiation is achieved by proper location of parasitic director whips with respect to center radiator. (B) Close-up view of modified mobile-type, 45-watt FM aural transmitter. Lower chasis is microwave transmitter control unit. (C) Audio facilities include four microphone inputs and tape and disc recording equipment together with latest type amplifiers. In photo (left) 2-way radio control units, high fidelity tape recorder and (right) OP-6 and OP-7 line and mixing amplifiers. (D) Ten TV picture monitors are stored in receiving coach



Mobile Television System

of complete television pickup, transmitting, and display facilities housed in four wave relay is used to transmit video between units while FM is used for audio

cameras can be monitored and switched to the microwave transmitter. The camera controls provide preview monitoring, enabling the operator to decide which camera should be switched to the transmitter.

Audio facilities consist of four microphone inputs, RCA OP-6 amplifier, OP-7 mixer, type RT-11A tape recorder and OR-1A disc recorder. There are facilities for patching the microphones through amplifiers into either recorder or directly to the FM audio transmitter, or for mixing microphone and recorder signals. The two-way radio system, an RCA 15-watt Carfone, provides order wire facilities between all four vehicles on 163 MC. A second such system on 173 MC provides an additional order wire channel between the transmitter and receiver coaches.

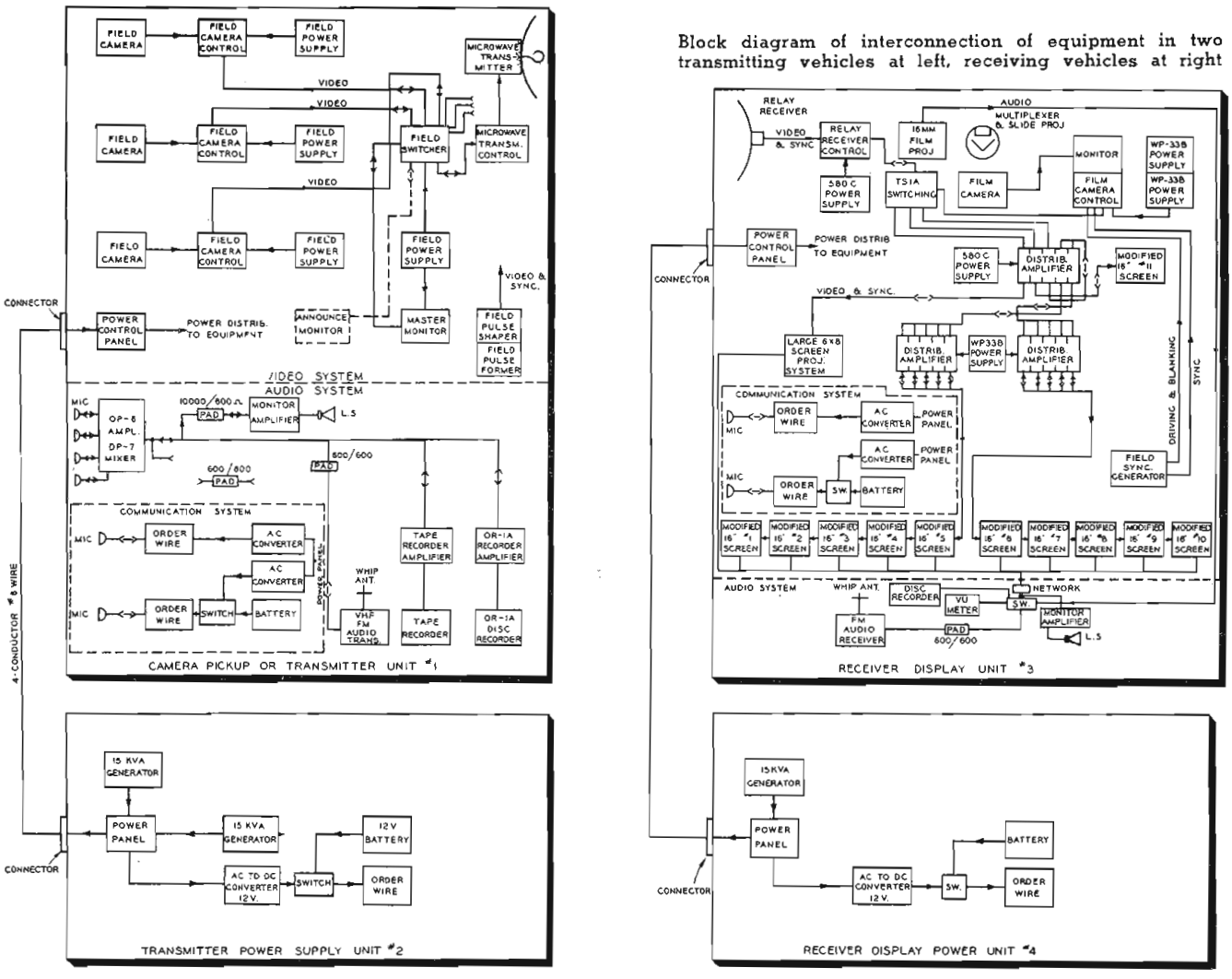
The second mobile unit contains the power supply for the transmitting equipment. This consists of two 15-KVA gas driven generating units, each of which supply 120/208, 3-phase, 4-wire, 60-cycle power. One of the generators is designated for standby use, or for supplying power to special lighting equipment for illuminating the scene to be televised. By means of a switching arrangement, the truck batteries are able to supply power to the two-way radio communication system when the caravan is in motion and the generators are not in use.

The receiver-display unit forms the third coach in the caravan. In addition to housing the FM and microwave receiving equipment, it contains ten 16-inch picture monitors, a 16mm TV projector and film camera, slide projector, and a large-screen television projector.

This equipment is interconnected so that TV picture and sound received by microwave can be switched to the ten monitors, or if desired, film can be used on the 16mm TV projector and the picture and sound fed to the monitors or to the large

(*Continued on page* 101)

Block diagram of interconnection of equipment in two transmitting vehicles at left, receiving vehicles at right



"Add-a-unit" Feature of New, Inexpensive,

Designed to reduce the complexity and costs of many be added together to form desired instrument thus enabling

By D. B. SINCLAIR

Chief Engineer, General Radio Co. Cambridge, Mass.

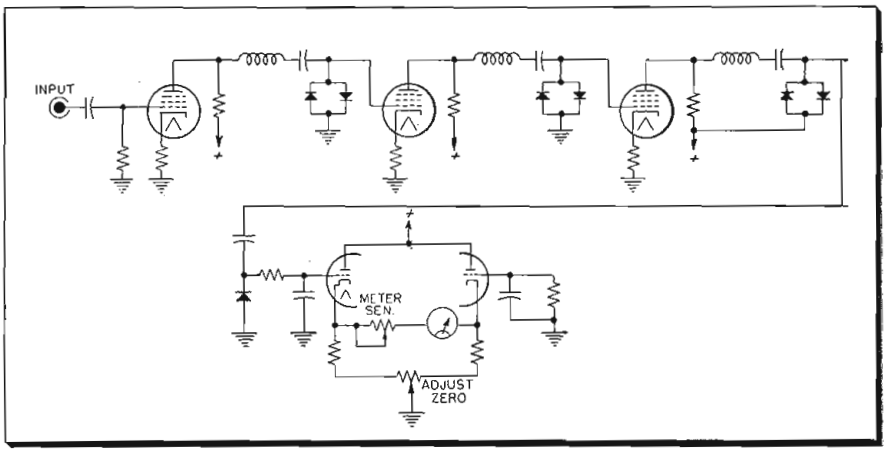


Fig. 16: Bridge-detector, 50 cps to 5MC, logarithmic amplifier circuit. Input-output curve shaping by germanium diode clipping eliminates time constant difficulties

FIG. 16 shows the circuit of a logarithmic amplifier specifically designed for use as a null detector with bridges over the frequency range from 50 cps to 5 MC. It is a three-stage wide-band amplifier using type 6AK5 pentodes, with a maximum gain of about 70 db. Its most novel features are the use of germanium diodes as limiters to shape the input-output curve to an approximately logarithmic law and the rectification of the heater voltage to the first tube to reduce hum. The meter will deflect one division for an input of approximately 25 microvolts, and full scale for an input of approximately 50 volts. Since this compression is obtained by a clipping process, no time constants are involved and the meter response is not impaired as it would be with an avc system adequate for use at 50 cps.

The panel view of the instrument shows the application of the same design features described for the other unit instruments the sheared name plate carrying all the instrument information, the standard two-piece cabinet, and the Jones plug to fit the small power supply.

The inside view shows construction similar to the R-C oscillator with one notable exception. The shelf is thoroughly shock mounted to minimize microphonics and cannot be used as a tie-bar to draw the two sides of the cabinet together. A separate tie-bar has therefore been provided for this function as in the two power supplies.

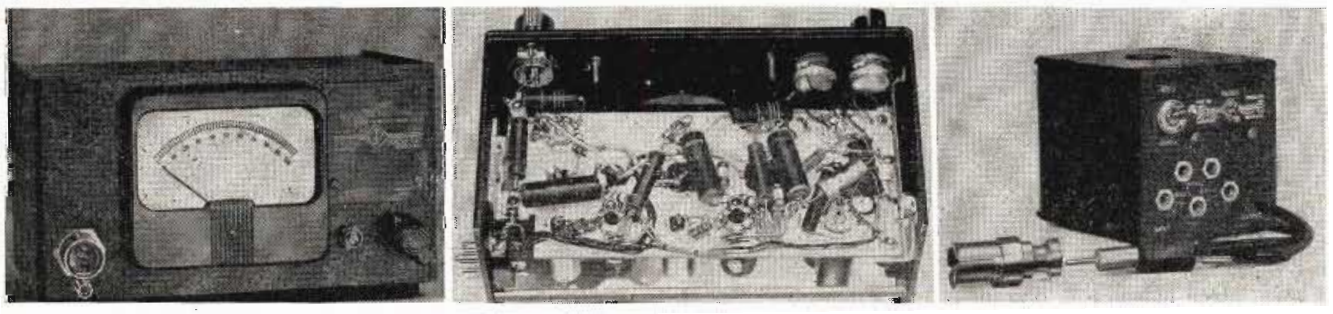
Filter

Fig. 17 shows a filter of somewhat novel construction that is used to adapt the null detector to use with the 400 and 1000-cycle fixed-frequency oscillator. Because of the germanium-crystal limiters in the interstage couplings of the null detector it becomes impractical to arrange for plugging in a filter at any point in the amplifier beyond the input. The filter shown has therefore been designed to work directly in the input, at levels of the order of a few microvolts, and to be adequately insensitive to stray pickup. This insensitivity to pickup has been achieved through the use of a toroidal coil, wound on a molybdenum-permalloy dust core, enclosed in a cylindrical mu-metal shield. A simple parallel tuned circuit is used, with taps for different source impedances obtained with a capacitive voltage divider used as tuning capacitance. At the two frequencies of 400 and 1000 cycles, which can be selected by a switch, variation between 37 db insertion gain and 18 db insertion loss occurs at source impedances varying from 1 ohm to 1 megohm. Rejection to the second harmonic exceeds 35 db in all cases.

Crystal Oscillator

The final instrument to be described is a crystal oscillator of moderate accuracy, which can supply harmonics of 1 MC, 100 KC and 10 KC over wide ranges of frequency. Fig. 24 shows the circuit. A twin-triode, whose cathodes are coupled

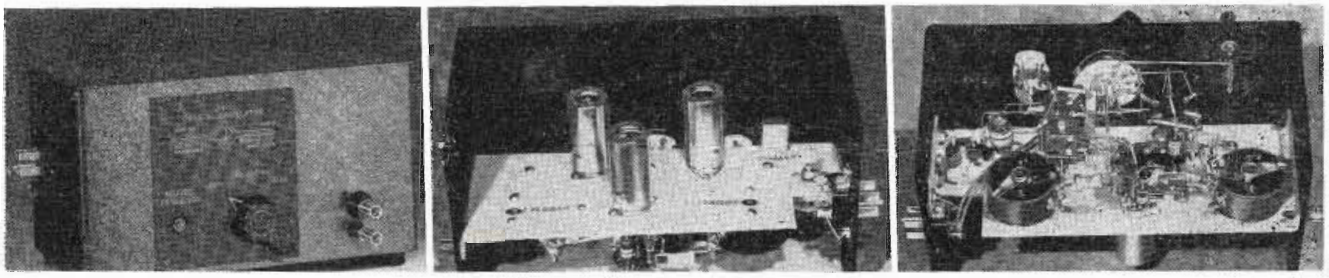
Fig. 17-18: (Left & Center) Panel and bottom views of logarithmic amplifier. Meter deflection is detectable for 25 microvolts input, full scale for 5-50 volts. Chassis is shock mounted to minimize microphonics. Fig. 19: (Right) 400 and 1000 cps filter for use in amplifier input. Inductance is wound on toroidal molybdenum-permalloy dust core and is shielded with can to minimize pickup



High-Quality Test Instruments

present day measuring equipments, small plug-in units may purchaser to buy only those elements actually needed

PART TWO
OF TWO PARTS



Figs. 20-22: (L. to R.) Panel, top and bottom views of crystal oscillator. Harmonic content is adequate to provide 1 MC harmonics to 1000 MC and 100 KC harmonics to 250 MC. Hermetically sealed A-T cut quartz plate located at right of chassis (center). Its frequency can be changed from the front of the panel with a screw-driver adjustment of a small series air condenser

through the quartz crystal, oscillates at 1 MC. In the plate of the first half, which operates as a cathode follower, is a type 1N34-A germanium diode, which serves as a harmonic generator. In the plate of the second half, which operates as a grounded-grid amplifier, is a parallel-tuned circuit, the voltage across which is fed back to the input grid to complete the oscillating circuit. A small capacitance, in series with the crystal, serves as frequency adjustment. Two multivibrators for 100 kc and 10 KC are driven in cascade from the oscillator.

This circuit has been found stable and reliable. It can be easily set against the WWV transmissions at 5 MC or 10 MC, and it is usually stable to better than 1 ppm over a few hours under normal room conditions.

Fig. 20 again illustrates the general application of the design principles adopted for the unit line, notably the sheared name plate carrying all the instrument information and the Jones plug for the power supply connections. The interior view shows the simple construction and the use of the hermetically sealed type JAN crystal, developed by the Bell Telephone Laboratories and now being widely manufactured under their license. This crystal has been found admirably stable and satisfactory for this type of application. As in the R-C oscillator, the shelf again does double duty as tie-bar to draw the cabinet sides together.

It is certainly true that the several instruments described here have been dismissed rather lightly, and it may well be that there will be questions on the details. What is intended, however, is to show an approach to the problem of designing low-cost equipment of good quality and wide applicability. This feature of wide applicability is significant, particularly for educational laboratories, because it removes the element of mystery from a complex,

(*Continued on page* 117)

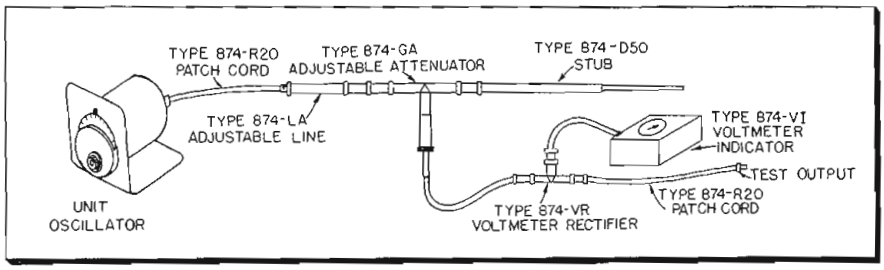
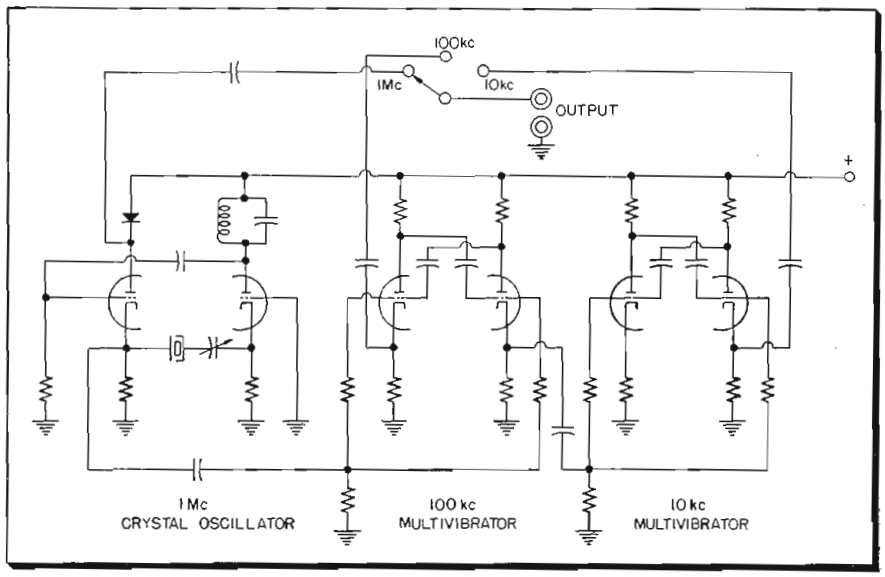


Fig. 23: Functional diagram of a unit oscillator and its associated accessories which have been connected together to operate as a standard-signal generator

Fig. 24: Circuit diagram of the crystal oscillator which provides distorted outputs at 1 MC, 100 KC and 10 KC. Three twin-triode tubes are employed as cathode coupled oscillators and as 10:1 multivibrator-type frequency dividers



For MANUFACTURERS

New Methods, New Materials and New Machines

Edited By Bernard F. Osbahr

Glass Printed Circuits

A NEW kind of glass which can be precision-machined through the use of ultraviolet light, heat and hydrofluoric acid to form intricately cut patterns of any desired shape and depth has been announced by the Corning Glass Works, Corning, N. Y. This new glass is a special kind of photosensitive opal glass. An equally new process of "chemical machining"

Section of a glassprinted circuit formed by ultra-violet photography and hydrofluoric acid etching

has been adopted which produces without the aid of mechanical tools, lace-like patterns hitherto considered impossible.

The first step in the process is printing the design in the glass, using an ordinary photographic negactive and ultraviolet light. Development is then accomplished by heating the glass to 1200° F. for the required length of time, usually about two hours. At this stage, a milk-white image appears in the otherwise transparent glass.

Next, the glass is immersed in a solution of hydrofluoric acid until the white areas are eaten through and removed, leaving the remaining unexposed glass in the exact form of the original pattern. By varying the length and intensity of light exposure through the photographic negative, the depth of acid penetration in the glass can be accurately controlled from shallow etching to complete erosion. In this way, sculptured figures or contoured shapes can be made by using a continuous tone negative with proper degrees of shading.

The versatility of the new process has been demonstrated in the manufacture of "printed" electronic circuits. By using a photographic negative, in a single operation, a sheet of glass is cut into multiple pieces, each of proper shape and size, and each having identically etched circuit patterns and holes for fastening to a chassis. The pattern thus photo-engraved in each piece of glass is filled with conducting metals to form an electrical circuit of high precision and durability.

$$$ FOR YOUR IDEAS

Readers are invited to contribute their own suggestions which should be short and include photographs or rough sketches. Typewritten, double-spaced text is preferred. Our usual rates will be paid for material used.

Wire Thread Inserts

AUTOMATIC Signal Division of Eastern Industries, Inc., Norwalk, Conn., achieves three major design advantages by inserting helical-wound wire thread-forms into the tapped holes of plastic terminal boards. The phosphor-bronze thread inserts (1) strengthen the plastic threads and protect them from wear, (2) provide electrical connections through the panel, and (3) furnish soldering lugs for connecting wires.

Heli-Coils, as they are termed, are installed in three steps. (1) A hole slightly smaller than the outside diameter of the insert is drilled in the panel. (2) The hole is tapped so the insert (of diamond-shaped cross section) can be screwed into it. (3) The wire thread insert is screwed into the tapped hole with an inserting tool.

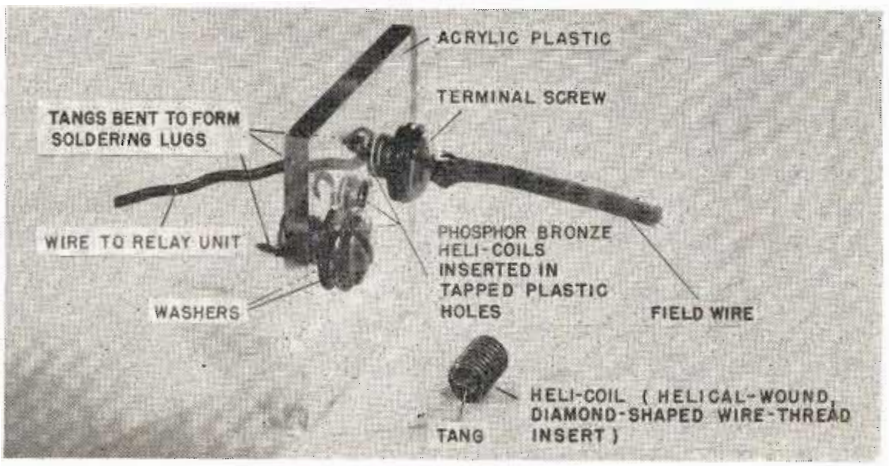
Wires leaving the rear of the panel are soldered to bent-up "tangs" of the inserts. (The "tang" is a quarter-length of the lead coil bent across the insert opening. It is engaged by the inserting tool when the insert is being installed.) The phosphor-bronze inserts themselves make the electrical connection through the panel. Heli-Coils can also be made from stainless steel for such applications as strengthening the threads in aluminum cases.

Permanent-Record Adhesive tapes

HELIPOT Corp. of S. Pasadena, Cal., manufacturers of precision potentiometers, starts each of their units through the production line with the application of a pre-printed pressure-sensitive "Kum-Kleen" label made by the Avery Adhesive

(*Continued on page* 96)

Sample plastic terminal board showing how wire-wound helices form desired terminals



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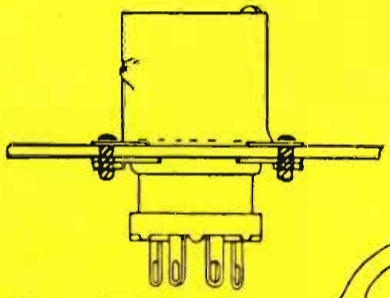
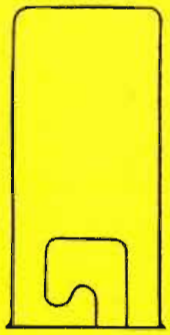


Bayonet shield base when shielding of tube is necessary.

Mounting Strap



Three lengths of shield cans are available: height: 1⅜, 1¾, and 2¼

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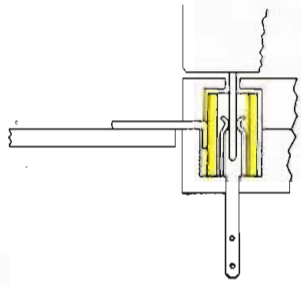
— with built-in Ceramic Condensers, Plexicon Tube Sockets, no larger than standard receiver socket, provide the most effective method of by-passing . . . with condenser close to tube element providing shortest path to the ground.

. . . capacity up to 1,000 MMF — tube element may be coupled or by-passed as desired.

Reduces set assembly costs — saves space; permits moving other components closer to tube socket. Where space and weight makes compactness mandatory, as in Airborne equipment, the Plexicon socket is the solution.

CONSULT CINCH!



The silvered ceramic condensers ore shown in yellow. Capacitors built into socket may be either by-passed to ground directly, or left open for coupling applications. On by-pass applicatians, graund strap contacting outer plote of capacitor is connected to metal chassis when tube socket is mounted.

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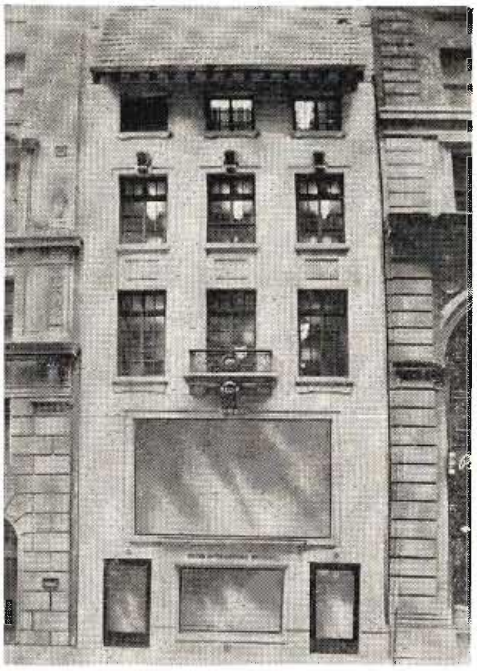

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Champion E 6459 N Sheridan Rd AM 2-3565
Cole Sales Co G McL 4753 N Broadway LO 1-7611
*Crossley & Assoc 4501 N Ravenswood UP 8-1141
*Cumming & Assoc B 228 N LaSalle St AN 3-5837
Cushing Co L G 605 N Michigan Ave DE 7-6456
Darmstader S. B. 520 N Michigan Ave SU 7-3925
*Diethert Co Russ 2323 W Devon Ave AM 2-4068
*Ellinger Sales Co 6663 N W Hwy RO 3-1570
Ellis Co Arthur J 1607 Howard St AM 2-2708
*Engle Co K D 4724 N Sheridan Rd UP 8-6363
Eschner Leroy 9 S Clinton St CE 6-1533
Everett Assoc 6744 N Calif Ave AM 2-3702
*Felleisen & Assoc 612 N Michgian WH 4-4822
Fistell H 1838 S Halsted SE 3-3285
*Gassner & Clark Co 6349 N Clark St RO 4-6121
*Gebhard H W 5129 W Devon Ave RO 3-3636
*Gianaras Sales Co 2345 W Devon Ave AM 2-2100
*Golten Co J 2750 W North Ave EV 4-5959
Granat Gary 330 S Franklin St WE 9-4595
*Green & Assoc L F 4949 W Diversey NA 2-2370
*Halinton Co H 6535 N Olmsted Ave RO 3-2132
Hathaway K A 53 W Jackson Blvd HA 7-6461
Hefter & Assoc E G 612 N Michigan Ave DE 7-1160
*Higgins Co R J 7345 Cottage Grove HU 3-7630
Hill J C 308 W Washington St AN 3-6420
*Hill RM & Bray GE 4524 W Madison ES 8-7050
Horlacher W A 7070 N Clark St RO 4-9487
Hower & Pretat 4 N Cicero Ave CO 1-3146
Instrument Sales Co 3947 Lawrence CO 7-4646
*JKM Inc 510 N Dearborn WH 4-6345
*Jones M M 2800 Milwaukee Ave EV 4-2646
*KaDell Sales Assoc 2406 W Bryn Mawr LO 1-3042
*Kahan I J 333 N Michigan Ave FR 2-1478
Kelburn Eng'g Co 600 W Jackson Blvd DE 2-2828
Langhaus Co M 333 S Clinton St WA 2-4595
*Lund-Hansen Co 1900 Montrose Ave LO 1-2551
McBride Sales Co JJ Merch Mart DE 7-3575
*McCarthy Co L C 9 S Clinton St AN 3-2104
*Magnuson R J 2323 W Devon Ave AM 2-3371

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*Memac Sales Co 9 S Clinton St AN 3-5728
Miles P H 333 N Michigan Ave FR 2-7100
Monson Corp 919 N Michigan Ave WH 4-0393
National Insulations Co 2808 W Lake VA 6-8060
Newman-Krause Co 3352 N Central Ave PE 6-6776
*Petitt Co G 549 N Washington St RA 6-0582
Plastic Tubing Sales 5215 N Ravenswood UP 8-6820
Quick H L 919 N Michigan Ave SU 7-9140
Quackenbush Al 2629 N 77th Ct FR 2-7100
*Ridley Assoc 1551 N Austin Blvd TU 9-2940
*Ritter Sales Co 612 N Michigan Ave SU 7-7759
*Rose & Co J K 2323 W Devon Ave AM 2-5584
Ryan Co G G 549 W Washington Blvd ST 2-7665
*Saffro Co Y L 800 N Clark St DE 7-5092
*Sarkis Co H 6560 Sheridan Rd HO 5-0883
Simpson Rodgers Smith Hunting 75 E Wacker CE 6-1715
*Smith Co O H 225 W Huron St SU 7-7919
*Stemm R A 21 E Van Buren St WE 9-4840
*Stemm R E 5707 W Lake St CO 1-1566
Stone C H 205 W Wacker Dr RA 6-7725
*Strauss Mae 425 Surf St
*Tatro F B 6022 N Rogers St
*Taylor Co R F 308 W Washington St AN 3-1808
Victoria Mfg & Sales Co 619 N Michigan DE 7-3800
Warner Co D L 7345 Cottage Grove Ave AB 4-0262
*West Jack 6747 N Octavia Ave RO 3-1393

Evanston

*Cozzens W B 720 Main St DA 8-4800

Glen Ellyn

*Kleker Co J H 177 Sunset Ave 2297

Harvey

Warner Co D L 15423 Honore Ave 6247

Oak Park

Haines E R 949 Lake St EU 6-4476

Springfield

Kloppenburg H M 1316 S College St 4323

Wheaton

Gaskins T 1005 S Aurora Ave

INDIANA

Angola

*Clancy & Co Joe Wilder Rd AN 863-X
Law Instrument Co P O Box 95 217

Ft. Wayne

*Bieberich Walter W 2817 Plaza Dr K 2928
*Central Sales Co 255 Central Bldg E-6251
*Fisch Bud 419 W Sherwood Terr HA 1089
*Hoemig Sales Co 1730 Clover Lane A-2083
*Macnabb Vernon C P O Box 326 EA 4945
*MacPherson Co B L 601 Ft Wayne Bank A-9460
*Southern Sales Co 1605 Lincoln Tower AN 5278
*Valentine Forrest C 912 Ft Wayne Bank AN 9122

Indianapolis

Alexander Co James E 5633 College Ave BR 6769
Chatfield C E 503 Illinois Bldg PL 1838
Crandall & Assoc R M E 56 St CH 8373
*Cunningham & Mitchell 6208 College Ave GL 3222
DeVoe Co Leslie M 4014 Washington Blvd HU 1395
*Macnabb Vernon C 909 Westfield Blvd BR 6770
*Nulsen Marvin E 5376 E Washington IR 7664
*Pheasant Charles E 18 N Bolton Ave BL 6176
*Reid Robert L 6325 Guilford St
Schenck & Assos Earl W 1616 Cord St BE 0191
*Schulz Co Edwin A 721 Sherwood Dr BR 1993
Whitesell & Assos R O 2208 E Washington MA 8517
*Wright Engineering Co 4241 Melbourne HU 8800

Marion

*Musser Victor E 2015 S Washington 835

IOWA

Cedar Rapids

Vrbik Jerry 309 Guaranty Bldg 4-0833

Des Moines

Silverman Jack 616 Locust St 4-9342

KANSAS

Merriam

*Koenig Sales 6359 Antioch Ave HE 3166

Wichita

Standard Products Co 650 E Gilbert 2-1431

KENTUCKY

Louisville

Cobb & Associates 1107 S Preston St JA 8144
*Wright Engineering Co 912 S 2 St JA 0295

LOUISIANA

New Orleans

Corrigan, Jr Charles E 504 Delta Bldg RA 8378
Southern Sellers 3507 Tchoupitoulas UP 8306
Redmann Stephen M P O Box 1325 UP 3767

MARYLAND

Baltimore

*Cerf & Co Art 3851 Boarman Ave LI 9644
Goodman Co S W 32 W Biddle St VE 2240
*Willou Sales Engineering Maxalea Dr TO 7800

Silver Spring

Gawler-Knopp Co 9204 2 Ave SL 7550
*Lienau & Co Chas W 10203 McKenney Ave JU 7-5888
*Taylor Co Morris F 8416 Georgia Ave SH 4002

Towson

*J-H Electronic Sales Box 6844 TO 3114

See also Neal Bear Advt. on Page 74

MASSACHUSETTS

Arlington
*Goss Co J 26 Gloucester St AR 5-0547

Beverly
Kelly & Co W T 90 Lothrop St 65

Boston
*Akeroyd A E J Hancock Bldg HA 6-2433
*Anderson Sales Co 172 State St CA 7-4832
*Burlingame Assoc 270 Commonwealth KE 6-8100
*Chamberlin H A 31 Milk St HU 2-7022
*Coakley Sales 11 Beacon St CA 7-0050
Costello Co J J 131 Clarendon St CO 6-3828
Elec App Co 1200 Soldiers Fld Rd ST 2-7440
Garner F W 110 Arlington St LI 2-7428
*Gerber Sales Co 739 Boylston St CO 7-0061
*Gibson Eng'g Co 1018 Commonwealth AS 7-5074
*Greene Dan John Hancock Bldg HA 6-1432
*Hannigan Co W T 43 Leon St GA 7-0238
Hatton & Co A T 11 Pemberton Sq CA 7-4704
How Inc J D 20 Providence St HU 2-4638
Nowlin W G 459 Statler Bldg LI 2-9690
Parker B H 610 Atlantic Ave LI 2-9214
*Perron & Co Ray 131 Clarendon St KE 6-1370
*Segel Co H P 143 Newbury St KE 6-3012
*Sturgeon P R 25 Huntington Ave KE 6-5580
Thacher Bros 458 Statler Bldg LI 2-3769

Brookline
*Harris Co S A 318 Harvard St LO 6-6400

Cambridge
*Holliday-Hathaway Co 238 Main St EL 4-1751

Lincoln
*Stevens & Co K C Box N LI 6-0408

Lynn
Hart Co F H 68 Market St NA 1-0381

Melrose
*MacInnis Co N R 53 Youle St ME 4-0879

Needham
*Lavin Assoc Henry 436 Dedham Ave NE 3-2671M

Needham Heights
*White Sales Co 111 Hoover Rd NE 3-2569

Newton
*Reynolds Co Harrison 313 Washington DE 2-4620

Norwood
*Cerf & Co Art 583 Neponset St NO 7-3164

Roxbury
Herman N 55 Lawrence Ave GA 7-2198

Scituate
Hendrickson & Sons W A Lawson Pk 652

Stow
Schall Jr Albert A MA 217-R

Waltham
*Waters Inc R A 4 Gordon St WA 5-0900

Wellesley Hills
*Pray Sales W B 18 Brewster Rd WE 5-3199M
Scott Co Michael 90 Edmunds Rd WE 5-0102

Weymouth
*Cerf & Co Art 51 Alden Rd ED 4-5495M

Winchester
*Hooker S C 397 Highland Ave WI 6-2745

Winthrop
Nickerson C S 200 Somerset Ave OC 3-3276

MICHIGAN

Detroit
Adams Co R A 14595 Abington Rd VE 8-1344
Carrier & Gable Inc 155 W Congress St WO 1-1786
Cawthorne Co T S 570 Maccabees Bldg TE 1-0402
Eynon-Dakin Co 1847 W Bethune TR 3-0110
*Fitzner Co B J 8803 Michigan Ave LU 4-0180
Hill Co B R 19481 Jas Couzens Hwy VE 8-3460
Koehler-Pasmore Co 11833 Hamilton St TO 8-332
*Lee W S 13715 Gratiot St
*Liddle E F 18925 Grand River Ave VE 7-5310
*Merchant R C 4829 Woodward Ave TE 1-1677
*Milsk Co Robt 522 Michigan Bldg WO 2-4969
*Nordstrom & Co R C 15840 2nd Blvd TO 9-8291
Satullo Co 7635 E Jefferson Ave LO 8-1508
*Scott T T 15709 Turner Ave UN 3-6867
*Shaffer Grant 16267 Jas Couzens Hwy UN 3-1227
Staff Co R A 5-158 Genl Motors Bldg TR 4-3970
Sterling Co S 13331 Linwood Ave TO 8-3130
*Stevens F J 15324 Mack Ave
*Thorpe J M 4390 Haverhill Ave TU 5-4438
Zaffina Co L F 14611 Alma Ave WA 1-4442

Ferndale
Haggerty Sales Co 1507 W Saratoga Ave LI 2-0811

Grand Rapids
Dewey Co E B 235 Federal Sq Bldg GL 4-1825

Grosse Point
*Walton Co H E 128 Kercheval

Highland Park
Armstrong Beitel Merkle 15850 Third TO 8-0044

Huntington Woods
McCaffry Co J A 13104 W Lincoln LI 4-1380

Jackson
*Brotherson R 325 Hibbard Ave 2-9654
Jordan E H 218 N Wisner St 2-0694
*Wilson Gerald 403 Second St 4-3692

Kalamazoo
Dewey Co E B 2519 Lake St 4-6163

Niles
Schenck & Assoc E W 1991 Baldwin Dr 3391-J

Royal Oak
*Hagerty Co J J 1223 Longfellow Ave LI 1-5572

MINNESOTA

Minneapolis
*Bartleson Bill 4605 Blaisdell Ave
Eiler Equipment Co 637 Sexton Bldg MA 8881
*Elliott Equipment Co 712 Portland Ave GE 1805
Fleming & Assoc 529 S 7th St BR 8895
*Foster Mel 1036 Lumber Exchange GE 5622
*Heimann Co 1215 Harmon MA 5457
*Hill F B 256 First Ave N MA 8353
*Kirkeby M H 437 Oliver Ave S GE 4945
Oszman E W 8 W 26th St PL 4415
Pinkney & Hine 552 Plymouth Bldg LI 0523
*Richardson & Co H M 2210 Fosbay Tower GE 4078
*Warner Co A J 5022 29th Ave S DR 1895

St. Paul
*Aaron & Assoc I I 1951 University Ave MI 0027
Benson Co E R 2651 University Ave MI 5197
*Laub-Dale Co 1951 University Ave NE 7911

MISSOURI

Clayton
*Maynard Co L W 139 N Central Ave DE 3723

Jefferson City
*Paden Co Ward Box 569 5-1023

Kansas City
*Bettis Co Maury E 406 W 34 St LO 0772
Clancey J A 15 W 10 St HA 7181
Everett Assoc 411 W 74 Terr DE 7996
*Farris Co R W 406 W 34 St LO 7495
*Fry & Co W E 406 W 34 St JE 5236
*Kay Sales Co 3760 Broadway LO 7640
*Larabee Co Fred H 6033 Main St DE 2804
*McGary Co Wm T 313 Reliance Bldg VI 5252
*McGrade Co E W Porter Bldg
Melton Co E L 2901 E Meyer Blvd JA 0467
Pommerenk Co H C 3835 Main St LO 2296
*Roes & Co H A 1805 Grand Ave HA 2036
*Schmitz Co J O 917 Porter Bldg LO 9824
*Scholz Co Paul G 210 W 8 St HA 7111
*Schryver Sales Co Clyde H 4550 Main St WE 4660
*Somers & Co F C Grand Ave Bank Bldg GR 1355
*Terwilliger Sales 636 E 96 St TR 3230
*Thibau Co A R 402 Mfgr's Exch Bldg VI 7057
*Young & Myers Co 4550 Main St JE 4343

Kirkwood
Winslow Edward A 20 Hillcrest Pl 1289

Normandy
*Lowell Assoc Theo B P O Box 21 MU 7803

Overland
*Scholz Co Paul G 2455 Ashland Ave WI 2773

St. Louis
Beneke Co Jules 575 Arcade Bldg CE 1677
*Borghoff Co Wm 4018 Greer Ave FR 0482
Bullivant F J 1913 Washington Ave CH 6510
Harris-Hanson Co 208 N 22 St MA 5464
*Kathrinus & Co Norman W 1218 Olive St CE 6300
Levin S M P O Box 405 WI 2869
Mayerson-Follman Co 2342 Olive St CH 1102
*McGary Co William T 6635 Delmar Blvd DE 6430
Rose Equip Co W L 317 N 11 St CH 7247
*Wellman W N 1171 Arcade Bldg CH 4652
Wells-White Co 6625 Delmar PA 7622

University City
*Jaques L E 8112 Tulane Ave CA 5349

NEBRASKA

Omaha
Bangh Conrad R 1104 WOW Bldg AT 4232

NEW JERSEY

Boonton
*Holliday-Hathaway Co 113 Cornelia St BO 8-3097

Camden
*Bittan-Boenecke Co 210 N 6 St WO 4-8650
Braddock Edward 726 Cooper St WO 3-3585
*Foley A A 640 Federal St WO 3-2693
*J-H Electronic Sales Co Box 205
*Keefe Electronic Sales 539 Market WO 4-2215

Elizabeth
*Shulan Co Wally 656 Salem Ave 5-9116

Haddonfield
*Schottenberg Ray T 152 Merlon Ave 9-6347

Hoboken
RSA Co 68 Hudson St 2-5281
*Simberkoff Sales Co 68 Hudson St 2-5211

Jersey City
*Schwartz Adolph 1 Exchange Pl DE 3-2424

Margate
Gatty Sidney H 11 N Clermont Ave 2-1361

Montclair
*Brennan F X 38 Lackawanna Plaza 3-2461

Netcong
Weir R Donald 18 Allen St 221

Newark
*Cerf & Co Art 744 Broad St MI 2-6734
Detwiler L K 443 Broad St HU 5-9000
Gawler-Knoop Co 1060 Broad St MI 2-4767
*Schenck LeRoy 31 Clinton St MI 2-7613
Smith Co 1180 Raymond Blvd MI 2-2812

Ridgewood
Engel G Curtis PO Box 569 6-7878
*Finlay Robert 104 Brookside Ave 6-8645

Rutherford
Sanford L C 202 Woodland Ave 2-0979

Tenafly
*Lawton Co 12 Foster Rd EN 3-3979

Union
Lerman Leonard S 1093 Salem Rd UN 2-9406

West Collingswood
*Muggleworth James C 432 Virginia Ave 5-3515

Westfield
Marron George 712 Norman Pl 2-3350

NEW MEXICO
*Neely Enterprises 107 S Washington St 5-7831

NEW YORK STATE

Albany
Carse Electric Corp 100 State St 3-3628

Bayside
Turney & Beale 40-08 Corp Kennedy St 4-4000

Binghamton
Kimstark 3 Mather St 4-9465

Brooklyn
*Jacobs Jack 1800 E 12 St
*Spellman F C 206 E 4th St SO 8-0180

Buffalo
*Farber Maury 157 Hartwell Rd
Fillmore & Fillmore 259 Delaware Ave MA 2795
Hansen Bert A 1124 Prudential Bldg MO 9222
*Jackson Robert Ellicott Sq Bldg MA 3306
Johnson Agencies HC 97 Fargo Ave SU 2684
Keller Industrial Prod 33 E Hazeltine RI 3938
Lamb Robert F 1807 Elmwood Ave BE 3757
Mitscher Co R W 487 Ellicott Sq Bldg WA 2517
Shea S E 735 Ellicott Sq Bldg WA 8240
Wink Willis 235 Hendricks Blvd AM 6426

Camillus
*Wolf O C Box 81

College Point
Block & Co W 116-15 Fifteenth Ave FL 3-7897

DeWitt
*Taylor Co F W PO Box 222 SY 72-5198

Far Rockaway
Howley Sales Co 318 Beach 31 St 7-7588

Fayetteville
*Andrews M P Mott Rd 65-8405

Forest Hills
Berger Geo E 109-01 72nd Rd
*Border Engineering 88-08 Selfridge St LI 4-1291
Mingins Sales Co 1 Continental Ave BO 3-1643

Hamburg
Cooper-Morgan Inc Box 152 EM 3405

Jackson Heights
*Landis Sales C 81-11 Roosevelt Ave IL 8-1344

Kenmore
Cerf & Co Art 116 Eiseman Ave RI 1009

Long Island City
*Hicks W M 29-27 Bridge Plaza N ST 4-3819

Manhasset
*Holliday-Hathaway Co 490 Plandome Rd 7-3424

Manlius
Cerf & Co Art 117 Fayette St MA 2-3301

Orchard Park
*Ball Assoc Inc 58 E Quaker St ID 4416

Rochester
Gislason Gilbert 617 Case Bldg LO 8323
Holliday-Hathaway Co 182 Mayflower Dr MO 3143

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Johnson Agencies H C 111 Mt Hope Ave HA 1090
Keller Industrial Prod 217 East Ave HA 3265
*Le Roy Gordon C 29 Bancroft Dr CH 3358J
Ossmann Edw A 295 Lake Ave GL 5624
*Richter William 3 Juniper St CU 7635
Schmitz A W 82 St Paul St HA 3090
Shea S E 520 Granite Bldg
*Wolfe-Marsey 74 Park Ave MO 6228

Syracuse

*Allen Leonard D 2401 S State St
*Andrews A R 521 Cumberland Ave
*Burlingame Assoc 712 State Tower Bldg 2-0194
*Chamberlin H A 106 Edtim Rd SY 73-4052
Hansen-Bert A PO Box 1224 BA 662
*Swank Wally B 2310 Bellevue Ave 8-1528
Wulfetange Jr J F 326 State Tower Bldg 3-8013
*Zimmerman W H 647 S Warren St 3-6405

Troy

Hinsdill Electric Co 225 River St AS 2-0700

New York City

*Aaron Paul D 120 Liberty St BE 3-6063
Adelman Co Leon L 25 Chittenden Ave TO 7-1145
Audio & Video Prod Corp 730 Fifth Ave PL 7-3091
Bialek Assoc Samuel 205 E 42 St MU 4-1655
*Biggs & Co J A 347 Madison Ave MU 5-2688
*Bittan Co D R 53 Park Pl BA 7-2789
*Bittan Assoc Harry 551 Fifth Ave MU 2-8945
*Blair-Steinberg Co 395 Broadway WO 4-7321
Bloom-Friedman Assoc 521 Fifth Ave MU 2-1930
*Bressler Jules J 1780 Broadway PL 7-2689
*Breuer Co R E 250 W 57 St CO 5-0440
Brown Jack 1631 Walton Ave LU 7-2031
*Burlingame Assoc 103 Lafayette St DI 9-1240
*Camber Marty 30 Dongan Pl LO 7-1420
*Carduner-Lichter Co 164 Duane BA 7-0210
Christie & Co R S 175 Fifth Ave GR 7-4226
*Cooper-DiBlasi 259 W 14 St WA 9-3920
Crofton Assoc T J 30 Rockefeller Pl CI 7-5782
*Diamond Simon 75 West St WH 4-2970
*Egert & Fields Co 11 Park Pl WO 4-0996
Ellis Harold R 366 Madison Ave VA 6-3417
*Erde S S 130 Lafayette St WO 2-6476
*Forrest Bernard J 71 Murray St DI 9-3481
*Forshay John M 27 Park Pl BA 7-4977
Frazar & Hansen Ltd 120 Broadway WO 4-3454
*Freed & Co Leo 420 Lexington Ave LE 2-4771
*Friedman Co Adolph 220 E 23 St LE 2-6677
*Furman Nat 395 Broadway WO 4-7321
Geist & Assoc Inc H J 60 E 42 St MU 7-1550
Ginsbury Sylvan 8 W 40 St PE 6-8239
*Hughes Co Kenneth E 17 W 60 St CI 5-8831

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*Hy-Art Co 136 Liberty St WO 4-5087
Kahgan Jack J 40 Exchange Pl BO 9-8350
*Kopple Associates John J 60 E 42 St MU 2-1118
*Land-C-Air Sales Co 1819 Broadway PL 7-7747
Lerman L S 11 Park Pl BA 7-8736
*Mack Kaelber & Mack 1270 Broadway PE 6-2203
Masin Co O F 17 E 42 St MU 2-4580
Miller Ben 401 Broadway WA 5-3964
*Minthorne Co Leonard L 15 Moore St BO 9-6272
Morse Sales Irv 150 Broadway CO 7-2913
Newhope Corp 6 E 39 St LE 2-7372
*Newman Charles 53 Park Pl CO 7-4129
*Pickett James M 12 E 78 St TR 9-9520
Progressive Marketers 41 Union Sq OR 5-0775
Rockbar Corp 13 E 40 St MU 3-3477
*Roye Sales Agency 11 Warren St CO 7-1143
Rutt William 401 Broadway CA 6-7545
Sachs M A 15 E 26 St MU 3-9356
*Saftler Perry 53 Park Pl RE 2-5334
*Schmitt Co F Edwin 136 Liberty St WO 2-6550
*Shaw Co S A 101 Park Ave OR 9-4994
*Shulan Co Wally 136 Liberty St WO 2-0365
Skidmore & Co W K 20 Vesey St RE 2-2883
Smith-Benny Sales Co 11 W 42 St CH 4-1642
*Smith Howard F 259 W 14 St CH 2-2398
Snyder Milton C 205 E 42 St MU 4-1314
*Sonkin David 1775 Broadway CI 7-6946
*Sprung Joseph 254 W 31 St LO 5-1820

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Stang Sales Co 509 Fifth Ave VA 6-0890
*Sussman & Co Jules 130 Lafayette St WO 2-7261
*Tobias & Co D F 30 Church St CO 7-4350
Weber Associates Jack 154 Nassau St WO 4-0152
*Willgold Electronic Empire State Bldg LO 4-2525
Woolf Assoc Irving W 135 Liberty St RE 2-9673

NORTH CAROLINA

Charlotte

Glenn & Larson 2109 Hutchison Ave 4-3994
Highsmith & Co James L PO Box 1011 5-6436
Ranson Wallace & Co 116½ E 4 St 4-4244

Greensboro

*Harrell Atcheson & Adams PO Box 2158 6838

Hendersonville

*Erickson Co Herb PO Box 179 5645

Wilmington

*Cole Harry A 4924 Oleander Dr
Manufacturers Sales 4924 Oleander Dr 5749

OHIO

Bedford

Daugherty Co F A 100 Woodrow Ave 2-2231

Canton

Henger-Fairfield Co 400 4 St N W 5-6833

Chagrin Falls

Hoskins Neil K 210 S Franklin St 7-6136

Cincinnati

Beedle Equipment Roselawn Center JE 2640
Henger-Fairfield Co 124 E 7 St MA 4749
Laing Co W C 3253 Lambert Pl EA 1435
*Olsen Co John O 1402 Carolina Ave ME 1361

Cleveland

Ambos-Jones Co 1085 The Arcade CH 1-7470
Baehr Albert M 11621 Detroit Ave LA 1-8468
*Baier & Co A H 1306 War-Center EV 1-7227
*Bell Fred 11621 Detroit Ave
Brandes C O 4900 Euclid Ave HE 1-0414
*Brauer Walter J 15631 Lakewood Hts LA 1-7268
Crain-Brennan Assoc 521 Citizens Bl CH 1-0779
Dannemiller Assoc J R 1791 Oakmount EV 1-5100
*Dietrich Co Earl S 320 Hanna Bldg CH 1-7770
*Dolfuss Jr Chas H 2108 Payne Ave PR 1-0719
*Edwards-Lohse & Co 2123 E 9 St TO 1-5753
Elliott Co Howard C 11808 Shadeland YE 2-8639
Harrington-Fishel Co Engineers Bldg MA 1-0031
Henger-Fairfield Co 1812 Columbus Rd CH 1-1018
Herrick Co G L 15326 Lorain WI 1-4406
Jay Engineering Co 5413 Pearl Rd SH 1-3300
Jubell Harry G 2036 E 22 St MA 1-0229
*Landfear Co J M 1306 Warrensville Rd EV 1-6077
*Lehner J C 4301 Daisy Ave
*Midwest Sales Co Hanna Bldg MA 1-9392
*Morrow Co Les A 3123 W 117 St CL 1-5700
Odell Co M P 2536 Euclid Ave PR 1-6171
*Olsen Co John O 1456 Waterbury Rd AC 1-4932
*Rauer Frank W 4144 Marvin Ave ME 1-8350
Satullo Co 1125 Fidelity Bldg PR 1552
*Scott Sales Ernest P 1836 Euclid MA 1-1286
Simpson Rodgers Smith Hunting 1900 Euclid CH 1501
Staff Co R A 1213 W 3 St MA 1-4063
*Valentine Forrest C 6408 Euclid Ave EN 1-4344
*Weller-Rahe Co 11816 McCracken Rd MI 1-4348
White & Co C E 637 Bulkley Bldg MA 1-8410

Columbus

Henger-Fairfield Co 302 Garden Rd JE 7472
*Lehner Co J W 367 Brynhild Rd LU 5260
*McFadden William E 150 E Broad St MA 3363
*Olsen Co John O 1086 Oakwood Ave GA 2425
*Pugh Co C L 4500 Dublin Rd KI 4855

Dayton

*Bear Corp Neal 4052 Riverside Dr TA 1545
*Boehme C D B-4 Talbott Bldg FU 8188
Crossley & Assoc Alfred 410 W 1 St MI 8721
Henger-Fairfield Co 1034 U B Bldg AD 6724
Jay Engineering Co 1517 E 3 St MI 9668
Magee Edward E 4905 Lindberg Rd WE 3-4270
Odell Co M P 2676 Salem Ave OR 4441

East Cleveland

*Moss Co Chas R 1817 Marloes Ave PO 1-2518

Greenhills

*Wahl Co A C 9448 Winton JA 3912

Lima

Hecht Fred J 1832 Wendell Ave 20133

Maumee

Henger-Fairfield Co 1130 Key St 3-3211

Marion

Oliphant & Co J E 505 Uhler Bldg 2-3512

Middletown

*Wright Engineering Co 1304 Elwood Ave 23834

West Richfield

*Bear Corp Neal WE 100

Worthington

*Weller-Rahe Co 361 E Kanawha Ave JE 9589

OKLAHOMA

Tulsa

Klicpera Co M F PO Box 1012

OREGON

Portland

*Burcham Co Don H 917 SW Oak St BR 3830
*Lee Co Dave M 2712 NW Raleigh St BE 2241
Merritt Co Ron 1515 SW 5 St BR 0045
*Minthorne Co Leonard L Weatherly Bl KE 0718
*Weber Co Dale G 234 Sherlock Bldg AT 5403

PENNSYLVANIA

Ardmore

*Brookfield R F 55 Cricket Ave TR 7-9090

Doylestown

*Biggs & Co J Alan PO Box 450 9476

Drexel Hill

Lawton Co 836 Mason Ave SU 9-2146

Erie

*Olsen Co John O N Ohio St AC 1-4932

Esterly

*Cerf & Co Art Jacksonwald Ave RE 5-6837

Havertown

*Cerf & Co Art 2605 Ashwood Dr Rl 6-3458
*Fairbanks Howard J 1733 Academy Lane GR 2-2467

Jenkintown

Hilliard D M Box 246 OG 3249

Narberth

*Jeffries Samuel A 105 Forrest Ave 8-8500

Philadelphia

*Biernbaum John W 835 W Sav Fund Bl PE 5-3738
Blumenstein Assoc 5040 W City Line TR 7-4116
*Burlingame Assoc 422 W Coulter St TE 9-2006
*Connor Co Dan J 1036 Broad St Sta Bl LO 4-2870
*Cordray W Henry 18 W Chelten Ave VI 8-0447
Densham Harry W 1414 S Penn Sq RI 6-7743
*Edmunds E J 5344 Irving St GR 2-7484

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*Estersohn Harry 395 E Cliveden St VI 8-2836
*Friedman Martin 1006 W Sav Fund Bl PE 5-4778
Hopkin Bros Inc 120 N 7 St LO 8-8367
*Jeffries Samuel A 1513 Packard Bldg RI 6-6408
*Leban Albert D 218 Lloyd Lane AR 5515J
Lewis Herman 1622 68 Ave LI 8-1281
*Lowery Inc L D 1343 Arch St LO 7-5135
*MacDonald Samuel K 1531 Spruce St KI 5-1205
*Maguire & Co James A 5 & Chestnut St MA 7-1670
Massey Assoc 1411 Walnut St LO 4-2650
*Naudain L Parker Broad St Sta Bldg RI 6-3185
Orsi John F 201 S 4 St MA 7-4857
*Paragon Sales Co 111 S 22 St RI 6-5609
*Quinlan D G 4700 Frankford Ave JE 3-0650
Randall Kenneth W 121 N Broad St LO 4-2151
*Relinger Albert R 3617 N 8 St
Slubin & Co Lewis 1067 Drexel Bldg WA 2-6740
*Stratton Co C H 2601 N Broad St RA 5-7912
*Technical Representation 506 Wyndmoor WH 8-3152
*Trinkle Wilmer S 2601 N Broad St RA 5-1001

Pittsburgh

Airgood Joseph M 742 Berwin Ave LE 1-3539
Burke Elec Equip 416 Maple Ave PE 1-5357
Clark Co Russell F 1404 Clark Bldg AT 1-8089
Groetzinger Co H W 224 Penn Ave AT 1-8387
Kaufman Sales Jerry 535 5 Ave AT 1-0206
Bloom-Friedman Assoc 11 Jonquil Pl LO 1-7027
Ludgate Assoc John P 345 4 Ave AT 1-1805
*MacDonald Inc Samuel K 335 5 Ave AT 1-2253
*Olsen Co John O 3239 Faronia St WA 1-2959
*Podolny James H 4716 Coleridge St HI 1-0800
Ransford Co H E 2601 Grant Bldg GR 1-1880
Shaw S J Avalon Bank Bldg LI 1-4727
*Southern Sales Co 418 Frick Bldg AT 5766
Stover & Co S H 5495 Penn Ave EM 1-7533
*Tanner & Covert First Federal Bldg CO 1-0131
Tydings Emmett J 903 Plaza Bldg CO 1-6821

Springfield

Hile Co Charles R 52 Lungview Dr SW 6-3538

Wyncote

Gawler-Knoop Co 407 Greenwood Ave OG 8805

TENNESSEE

Chattanooga

*Johnson Co Jesse P 3535 Dell Trail 4-4026

Knoxville

Hough C A R 304 Cherokee Bldg 2-1383

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*Cartwright & Sons J M 1336 Madison Ave 2-1914
Moody Co Joe 1215 Central Ave 2-1067

Nashville

Long J Ward 2114 Belmont Blvd 8-4346

TEXAS

Dallas

*Anderson Co Geo E 1901 Griffin St RI5931
*Aymond Co Edward F 4308 Maple Ave LO1970
*Berthold Sales Co 4411 Maple Ave LO8336
*Branum Co 309 Reserve Loan Life Bldg RI4995
*Campion Sales Co Jefferson Tower YU9902
*Corry Co Hal F 3522 Gillon Ave JU3949
*Crockett-Lund Reserve Loan Life Bldg RA5764
Eng'g Products Co 5005 W Lovers Lane EL1179
Folsom S W 1102 N Windemere St YU9560
Green Co John A 6815 Oriole Dr DI9918
*Guenther J B 7322 Marquette Ave
Lipscomb Assoc Earl 3561 Marquette St EM7989
*Maynard Co John M 4507 Shenandoah LA1537
*McKinney Sales 1330 N Industrial Blvd ST1997
Media Inc 4224 Normandy
*Schoonmaker Co J Y 2011 Cedar Springs ST3335
*Smith J Earl 505 N Ervay St RA2966
*Texport Co 5004 Ross Ave TE6735
*Wilks Co Ernest L 1212 Camp St RI4059
Wynes J A PO Box 5181 EV0780
*Yount Jack 1431 Pleasant Dr EX0988

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Calmes & Assoc D 4605 Locust St Mo 5-1704
*Klicpera Co M F PO Box 3113 JA8459
*Willison Co G G 2030 Harold St JU1634

Waco
Brockenbrough & Sanders 515 Prof Bldg 4-0441

UTAH

Salt Lake City
*Bowen Co Ronald G PO Box 2215 MU091-W
*Gates Co 200 S Main St 9-1101
*Nelson Co A J PO Box 471 7-5359

VIRGINIA

Alexandria
American Eng'g Box 186 TE1718
Brown & Assoc W A 3834 Mt Vernon Ave OV6100

Richmond
Simpson & Son Paul M 717 Byrd Park Ct 4-0287

Roanoke
Underwood D J 25 E Church Ave 4-0194

WASHINGTON

Seattle
*Backer Co Jas J 2321 2 Ave MA8811
*Burcham Co Don H 2530 Warren Ave GA7398
Carlson Fred W 2307 5 Ave EL6630
Foley-Williams Co 1173 Dexter Horton Bldg
Haight Co Fred H 2217 4 Ave MA3750
Jensen Co Verner O 2616 2 Ave EL6871
*Lee Co Dave M 819 Thomas St MA5512
*Marsh Agencies 2601 1 Ave MA8762
Merritt Co Ron 217 9 Ave SE4948
Norris Co George D 3010 1 Ave EL1344
*Northwestern Agencies 4130 1 Ave S EL8882
*Parsons & Co C B 119 Belmont Ave N MI3800
Porter Co Burt C 729 Securities Bldg MU0074
*Stroum Co Samuel N 610 19 Ave N FR7515
*Wedel Co Frank 3215 Western Ave GA0222
Widdekind M K 719 2 Ave W AL6740

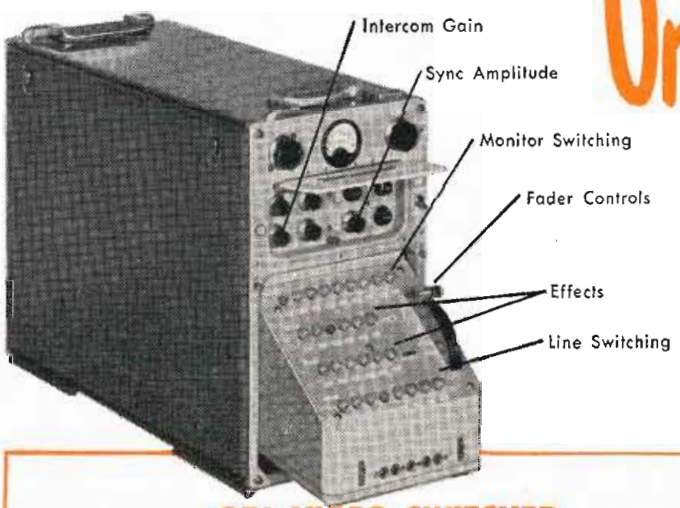
WISCONSIN

Milwaukee
*Aaron & Assoc Irvin 829 N Marshall BR6-8515
Dickinson Co E A 744 N 4 St BR2-0517
Knaak Co L B 704 E Pleasant St DA8-3434
Loeb Eugene R 5052 N Shoreland Ave WO4-2155
National Insulation Co 739 N Broadway DA8-6447

See also Neal Bear Advt. on Page 74

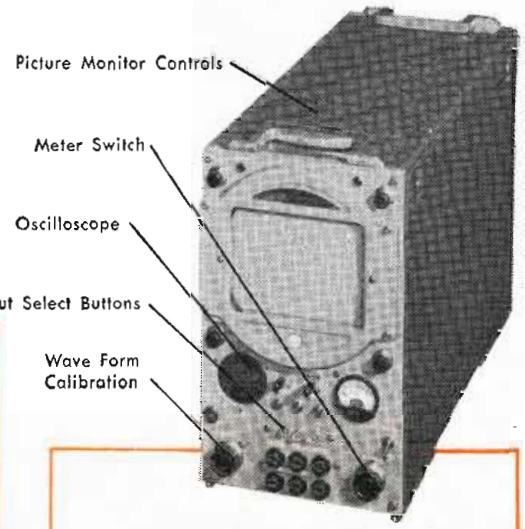
TWO CHAMPIONS

THAT MAKE AN Unbeatable Team!



GPL VIDEO SWITCHER

- Studio switching flexibility anywhere
- Panel and active buttons internally illuminated
- Portable, self-contained — Panel enclosed for transit
- Monitor views 5 camera inputs, 2 remotes, outgoing line
- Sound interlock switching for remotes and 2 cameras
- Two open panel positions, 90° and 120°
- Switch panel removable, operable to 5 feet
- Twin fading levers for fades, dissolves
- Two "effects" buses
- Styled to match all GPL TV equipment



GPL MASTER MONITOR

- Selection of 3 pre-set inputs
- 8½" Monitoring tube
- 3" Oscilloscope, also providing test facilities
- Meter readings of line voltage and power supply outputs
- Fast sweep for observing vertical sync block
- Quick-reference calibration voltage button
- Automatic sync of oscilloscope and kinescope sweeps at half-line or half-field frequency
- Regulated pulse high voltage supply isolated from sweep circuits
- High impedance bridging input
- Compact, portable
- Ready accessibility of all controls, tubes, circuits

For the new station, for the expanding station, GPL's champion team of Video Switcher and Master Monitor affords a new high in quality, in field flexibility, in rehearsal and programming control. Both units are packaged for easy portability, with self-contained power supplies. Either can be integrated into your present installation, can accommodate your particular operating conditions.

The Switcher and Monitor team is another example of GPL's unique achievement in the production of *high quality, high utility* equipment for TV stations — another reason why GPL *is* THE INDUSTRY'S LEADING LINE — IN QUALITY, IN DESIGN.

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TV Field and Studio Equipment
Theatre TV Equipment

WASHINGTON
News Letter

Latest Radio and Communications News Developments Summarized by TELE-TECH's Washington Bureau

USE MANUFACTURING CAPACITY—A move to utilize the mass production capacity of the electronics-radio manufacturing industry with the aim of remedying the current unemployment situation through the placing of additional defense orders from the armed services with the companies which have been concentrating on radio and television receiver production has been launched by the special Electronics Task Group of the Defense Production Administration.

DPA ELECTRONIC OFFICIALS—The DPA task group is headed by E. T. Morris, as Chairman of the DPA Electronic Production Board and Director of the National Production Authority's Electronics Division, who is an executive in the Westinghouse radio manufacturing organization "drafted" for government service. Representing the electronics-radio manufacturing industry on the task group are President William Balderston of the Philco Corp. and President Benjamin Abrams of Emerson Radio and Phonograph Co. Current employment in the plans of the home radio and TV receiver industry in the Chicago and New York-Philadelphia areas is only 50 percent of the level of employment in the first half of 1950.

CONSERVATION SUCCESSFUL — The Defense Production Administration and the military services are highly laudatory of the accomplishment of the electronics-radio manufacturing industry in its efforts to conserve critical metals and to utilize substitute materials through increased efficiency in design and production techniques without any deterioration of the equipment or components for civilian products and even in some instances apparatus for the armed services. Savings of 70,353 tons of critical metals were listed by the Radio-Television Manufacturers Association, including 9,687 tons of copper, or 24% less consumption than in 1950; 1,324 tons of aluminum, or 21%; 54,058 tons of iron and steel, or 24%; 4,117 tons of zinc, or 26%; cobalt, 229 tons saved, or 36%; nickel, 367 tons, or 28%; cadmium, 66 tons, or 23%; and tin, 266 tons, or 25%.

SAVINGS IN ALL BRANCHES—Survey of savings covered six typical radio broadcast and television home sets, fixed and mobile communication transmitters and receivers, AM-FM and TV transmitters and antennas, microwave systems, carrier and intercommunication equipments. Manufacturers have undertaken a concentrated drive on engineering changes, new circuit designs and new mechanical arrangements to achieve conservation.

PRACTICAL RULES—Further conferences with the radio and television industry on fair-trade-practice standards dealing with advertising and promotion of home receivers in November or December are planned by the Federal Trade Commission. After these conferences the Federal Trade Commission will engage in public hearings to formulate new rules. Glen McDaniel, President of the Radio-Television Manufacturers Association, strongly urged that the Federal Trade Commission evolve practical rules and standards. He emphasized that the public is fully competent to judge the sets and that the television industry is on the threshold of new developments in color television and ultra-high frequency television with receiving sets to be produced for those services.

AERONAUTICAL, MARINE PROGRESS—Foundation has been laid for important steps of progress in aeronautical electronic-radio communications and navigation and in marine radio communications and radar utilization at two recent conferences of their respective top technical organizations, the Radio Technical Commission for Aeronautics and the Radio Technical Commission for Marine Services. Dr. J. H. Dellinger, former Chief of the Bureau of Standards Radio Division and one of the nation's leaders in electronics-radio research planning, is chairman of both commissions. FCC Commissioners E. M. Webster and George E. Sterling, had leading roles in the conferences, while Civil Aeronautics Administrator Charles F. Horne is directing the transition of the aviation communications and electronic navigation system into the use of the most modern and efficient equipments.

FOREIGN VISITORS—Maj. Gen. Douglas A. L. Wade, the new British Telecommunications Attache to the United States, has arrived in Washington to begin his new duties at the British Embassy. General Wade has had an outstanding military career with the Royal Corps of Signals and in command and administrative assignments before his retirement from active military service. Several leading European communications officials were also to arrive in the U. S. during October for conferences with U. S. government and industry officials, including: John Innes, formerly managing director of Cable & Wireless, who now heads Submarine Cables, Ltd. Also General L. B. Nicholls, chairman of Cable & Wireless, will visit the U. S., along with Bent Suenson, vice chairman of Great Northern Cables of Denmark.

National Press Building
Washington, D. C.

ROLAND C. DAVIES
Washington, Editor

NEW EQUIPMENT for Designers and Engineers

Wide Band Video Amplifier

A new, improved wide band video amplifier (model V-2) has a flat amplitude response ±1.5 db from below 10 cps to

20 mcps. Designed for use as an oscilloscope deflection amplifier for the measurement and viewing of pulses of extremely short duration and rise time, it is also a tool to extend the amplitude range of vacuum tube voltmeters and signal generators. Its extended low frequency responses permit accurate analysis of television signals. Sixty cycle square waves are passed with less than 5% tilt.—**Polarad Electronics Corp., 100 Metropolitan Ave., Brooklyn 11, N. Y.**—TELE-TECH.

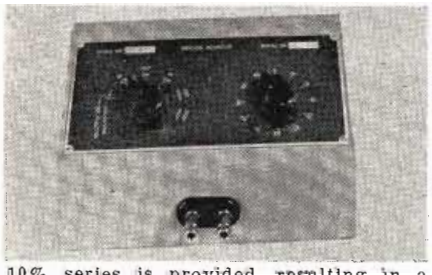
Resistors

Dalohm resistors are said to pack more resistance per watt per cubic inch than any other resistor on the market today.

Resistors are available in two, five, ten, 25 and 50-watt sizes. A special silicone material completely seals the resistance element making them completely impervious to moisture. Standard tolerance is 1%; however, if the occasion demands tolerances as high as 0.05% can be supplied. Temperature coefficient is substantially flat. Resistance shift is less than 0.00002% per C°.—**Dale Products Inc., Columbus, Neb.**—TELE-TECH.

Decade Resistor

Model 2B decade resistor is the first commercially available unit to incorporate the RTMA standard values. The



10% series is provided, resulting in a total of 72 discrete resistance values. It has a range from 10 ohms to 8.2 megohms and accuracy is rated ± 2.5% for any value.—**Rochester Electronics Company, Inc.**—TELE-TECH

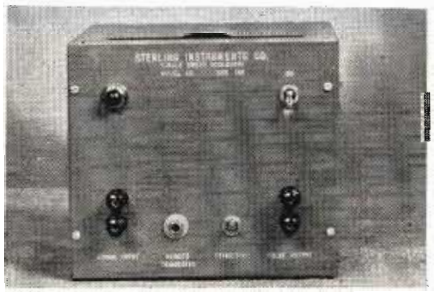
17-in. TV Tube

The 17TP4 is a 17-in. metal-shell picture tube utilizing low-voltage electrostatic focus which eliminates the need for a focusing coil or magnet and makes it possible to obtain the focusing-electrode voltage from the low-voltage dc supply of the receiver. The focusing electrode in the 17TP4 has its own base-pin terminal to permit choice of focusing voltage for best results. Because the focusing electrode operates at low voltage, the focusing voltage can conveniently be obtained from a fixed or adjustable tap on the low-voltage dc supply of the receiver. With either method, focus is maintained automatically with variation in line voltage and with adjustment of picture brightness. When fixed focus is used, the designer can set the focusing voltage at a value which will give good results for his particular operating volt-

ages. If somewhat better performance is desired, he can provide for adjustment of the focusing voltage.—**Tube Dept., Radio Corporation of America, Harrison, N. J.**—TELE-TECH.

Single Sweep Accessory

Type 121 single sweep accessory is designed to provide one, and only one, pulse to trigger the single sweep of a



CR Oscillograph at the start of any complex wave pattern, and at no time thereafter. This unit provides a single negative output pulse for triggering the single sweep from either a positive or negative input signal without the necessity of separate adjustments for positive and for negative signals. The signal input required is approximately 0.1 volts and may be obtained from the signal itself or from an external transducer such as the type 140 synchronization pickup, or a photo cell. The single sweep accessory finds its greatest application in the field of photography from CR oscillographs, where it is desired to record a single trace without interference from successive traces. It may also be used to trigger an oscillograph from a single, non-recurrent pulse when the time of its occurrence is not known. It may be reset with the panel switch or remotely by use of a cable. Entirely self contained, it operates from 110 volt 50 to 60 cycle input. — **Sterling Instrument Co., 13331 Linwood Ave., Detroit 6, Mich.**—TELE-TECH.

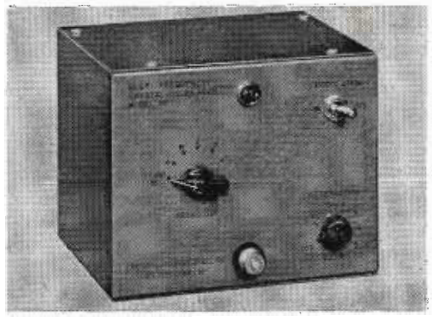
Potentiometer

A new high torque model I radiohm control, designed specifically for maintenance of circuit balance under condi-

tions of vibration has been developed. It is intended especially for equipment used in commercial or government installations where miniature size also is a prime requisite. Model I has a torque range from 2 to 4 oz.-in. It is available in plain type screwdriver slot on either end or with conventional knob adjustment. This unit also can be supplied with a dust cover or electro-static shield. —**Centralab Div., Globe-Union, Inc., 900 E. Keefe Avenue, Milwaukee 1, Wis.** —TELE-TECH.

Crystal Oscillator

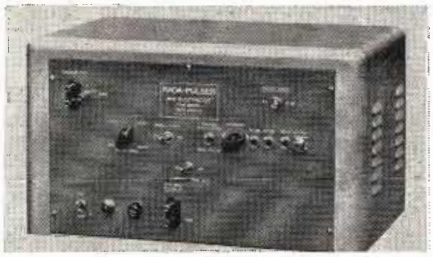
Model 50 oscillator is a multi-frequency high output signal generator. Compact in size, it provides a convenient



and inexpensive means of obtaining multiple outputs for spot frequency alignment of television and military receivers. It is available in a crystal controlled range of 4.5 to 50 MC.—**Crest Laboratories, Whitehall Bldg., Far Roekaway, N. Y.**—TELE-TECH

Pulse Carrier Generator

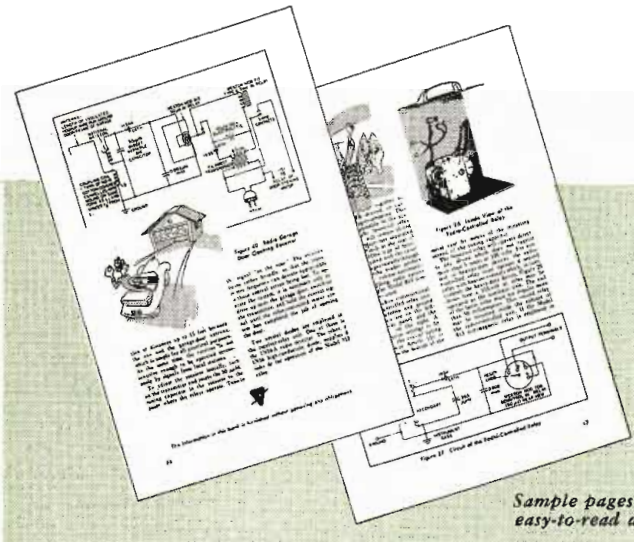
A new pulsed carrier generator known as the Rada-Pulser gives rapid and accurate transient response information in



laboratories, on production lines and in the field. The instrument is engineered for military as well as commercial usage. Rada-Pulse speeifications are as follows: carrier frequencies, 30 MC and 60 MC: pulse widths, 0.1 and 0.25 microseconds; pulse repetition rate, continuously variable from 500 to 2000 pps; maximum r-f output, approx. 1 volt at 70 ohms; attenuators, 20 db, 10 db switched, 10 db continuously variable. Pulse output is 50 volts at 70 ohms. Input terminals are provided to permit modulation by other pulse widths from external source. Positive and negative trigger pulses are furnished ahead of pulsed carrier to trigger oscilloscope sweep circuit. Regulated power supply is built in.—**Kay Electric Co., Pine Brook, N. J.**—TELE-TECH.

Put Electronics to work

IN YOUR HOME!



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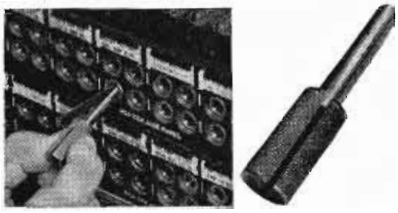
Rotary Relay

A series of light, compact, rotary switch actuating mechanisms provide intermittent pulsed reciprocating rotational motion up to 330°, with torques tailored to suit individual requirements. The drive consists of a miniature motor in a special circuit permitting rapid reciprocal switching up to 10 complete cycles per second. This device has applications in the field of microwave switches and phase shifters whose material elements require low torque rotary drive mechanisms, in high or low voltage switching, and in similar fields where a rapid rotary action with no lateral thrust is needed. The unit requires no holding current and can be operated from all commonly available power supplies with negligible power drain. — **General Precision Laboratory, Inc., Plensantville, New York** — TELE-TECH.

Jack Contact Cleaner

Jacklean is a handy new tool to aid in the cleaning and burnishing of contacts in jack panels and fields. It is made of cadmium plated spring steel and is especially designed for the cleaning of WE-218 type jacks. In operation, Jacklean is inserted into the jack just like a standard plug. A standard burnishing tool will then fit into the slot of Jacklean, and on removal of the latter the operator can proceed with burnishing. Price is $2.50 and a 5 in. burnish tool is supplied free. — **Commercial Radio Sound Corp., 231 East 47th Street, New York 17, N. Y.**—TELE-TECH.

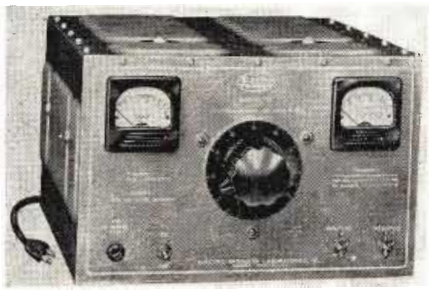


Transcription Player

A new 1952 line of transcription players has been developed ranging from the lightest portable transcription player to the most powerful single unit sound system. Fluid Sound, the new pickup system which gives improved fidelity of sound reproduction at the same time making possible perfect reproduction of both microgroove and standard recordings with a single stylus, is included. The line also features the patented Varipole speed control which permits a gradual adjustment of turntable speed from 25% below normal to 10% above normal. Varipole control provides a smooth, constant performance at whatever speed selected. The two-speaker models, capable of reaching audiences of 3,500 persons, weigh only 32 lbs.—**Califone Corp., Dept. JO, Hollywood 38, Calif.**—TELE-TECH.

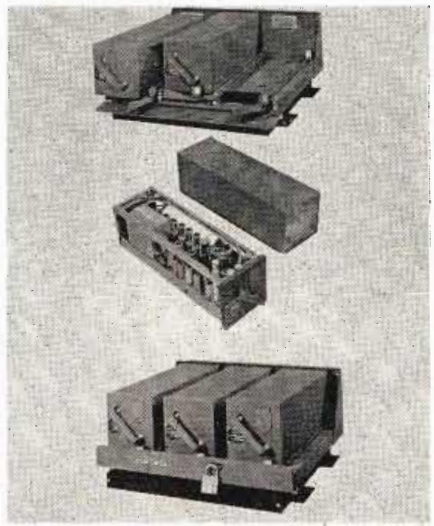
DC Power Supply

Model N dc power supply provides a continuously variable source of filtered power (0-28 volts). It supplies up to 36 volts at 6 amps. The ac power is approximately 730 watts with a 5 amp 28 dc volt load. D'Arsenval-type voltmeter and ammeter are accurate to 2%. Superior Powerstat provides incremental voltage adjustments. Bridge-type heavy duty selenium rectifiers permit continuous duty at 15 amperes. Operation is from 110-120 volt, 50/60 cycle ac power source. —**Electro Products Laborntories, Inc., 4501 North Ravenswood Ave., Chicago 40, Ill.**—TELE-TECH.



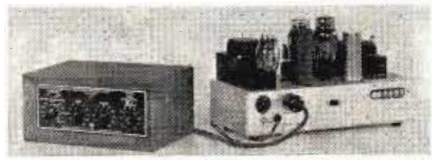
R. R. Radio Rack

A new horizontal-type rack for mounting Motorola Universal Railroad FM radio equipment has been developed. Designed to specifications of the Communications Section of the Association of American Railroads, it features an extremely rigid device for injecting and removing individual chassis to and from operating position in the rack. Also included are facilities for locking the housings in place with a single padlock, easy accessibility to a front terminal board by removing a protective panel, and a wiring system that is completely enclosed for protection. The new housings are designed so that metering is available from the fronts of the transmitter and receiver units to permit checking equipment without removing chassis from their housings or from the mounting rack when using the standard Motorola test set.—**Motorola, Inc., 4545 Augusta Blvd., Chicago 51, Ill.**—TELE-TECH.



Amplifier

On the type 214-A amplifier, control and compensating features improve music fidelity and simplify operation and installation. Remote control unit can be placed up to 25 ft. from power amplifier. An 8-position record-compensator adjusts for any recording characteristic. Selector switch changes from phono, tuner, TV, or other high-level inputs. Automatic loudness control boosts treble and bass at decreasing volume to compensate for human ear's insensitivity to high and low frequencies at low volumes. Individual 3-channel continuously-variable tone controls each have control range from 6 db octave boost, through flat response, to 6 db octave attenuation. Input-level adjustment matches almost any pickup. Frequency response is flat from 18 to 22 KC. Output is 20 watts. Harmonic distortion is less than 0.5% at full ouput. Low output impedances match speaker impedances from 1-24 ohms.—**Hermon Hosmer Scott, Inc., 385 Putnam Ave., Cambridge 39, Mass.**—TELE-TECH.

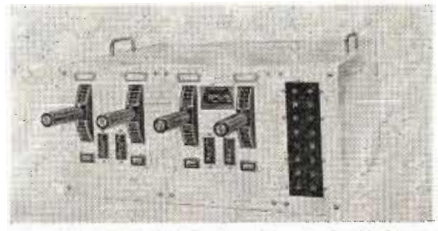


Audio Amplifier

The Craftsmen 500 ultra-fidelity audio amplifier is an all-triode unit which is based on the Williamson circuit. Incorporating one of the finest audio output transformers available along with 20 db of inverse feedback around the entire amplifier has made possible the following outstanding characteristics: total harmonic distortion less than 0.1% at 10 watts at mid-freqs; intermodulation distortion less than 0.5% at 10 watts; power response 12 watts, ± 1 db, 10 cps to 50,000 cps; frequency response ± 0.1 db 20 cps., to 20,000 cps., ± 2 db, 5 cps to 100 KC.—**The Radio Craftsmen, Inc., 4401 N. Ravenswood Avenue, Chicago 40, Ill.**—TELE-TECH.

Dimmers

Assemblies of the 2000 watt series of Powerstat dimmers are now available in packages of 3, 4, 5 and 6 unit dimmers. Each assembly is housed in an attractive smooth grey finished cabinet. Individual dimmers are operated by vertical hand levers with graduated drums. These levers can be interlocked for master control from one lever. Each dimmer has its own on-off switch and circuit-breaker, card holder for circuit identification and pilot light. Standard output connectors include a terminal board for solid connection; pin-jack receptacles for single prong or two prong plugs; parallel blade receptacles and twist-lock type receptacles. These dimmers' operation can be from two wire 1 phase, three wire 1 phase and four wire 3 phase ac power lines.—**Superior Electric Company, Bristol, Conn.**—TELE-TECH.



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History speaks... to commemorate the

A Caldwell-Clements message to give the engineering and manufacturing side of the industry complete information about the plans of the Caldwell-Clements distribution magazine, Radio & Television Retailing, to celebrate the industry's 30th anniversary in January 1952.

MAJOR FEATURES OF THE 30th ANNIVERSARY ISSUE

HOW TO TAKE ADVANTAGE OF THE INDUSTRY'S 30th ANNIVERSARY

You need not have been in business for 20 or 30 years. Even if your company is much younger but has a worthwhile record as to product or trade policies, you can easily capitalize the anniversary. Here are a few things you can do:

1—Tell your historical story in the January issue of RADIO & TELEVISION RETAILING, using enough space to do justice to your product and company.
2—Print the story, or reprint the advertisement, for mailing to the trade.
3—Furnish dealers with a consumer version for their own distribution, mailings, handouts, etc.
4—Arrange for dealer window displays.
5—Use the historical theme in radio, magazine and newspaper advertising.
6—Designate one or more models as Anniversary Models and organize a drive on those models.
7—Plan a celebration for company personnel.
8—Prime your own personnel for maximum participation.

RADIO & TELEVISION RETAILING

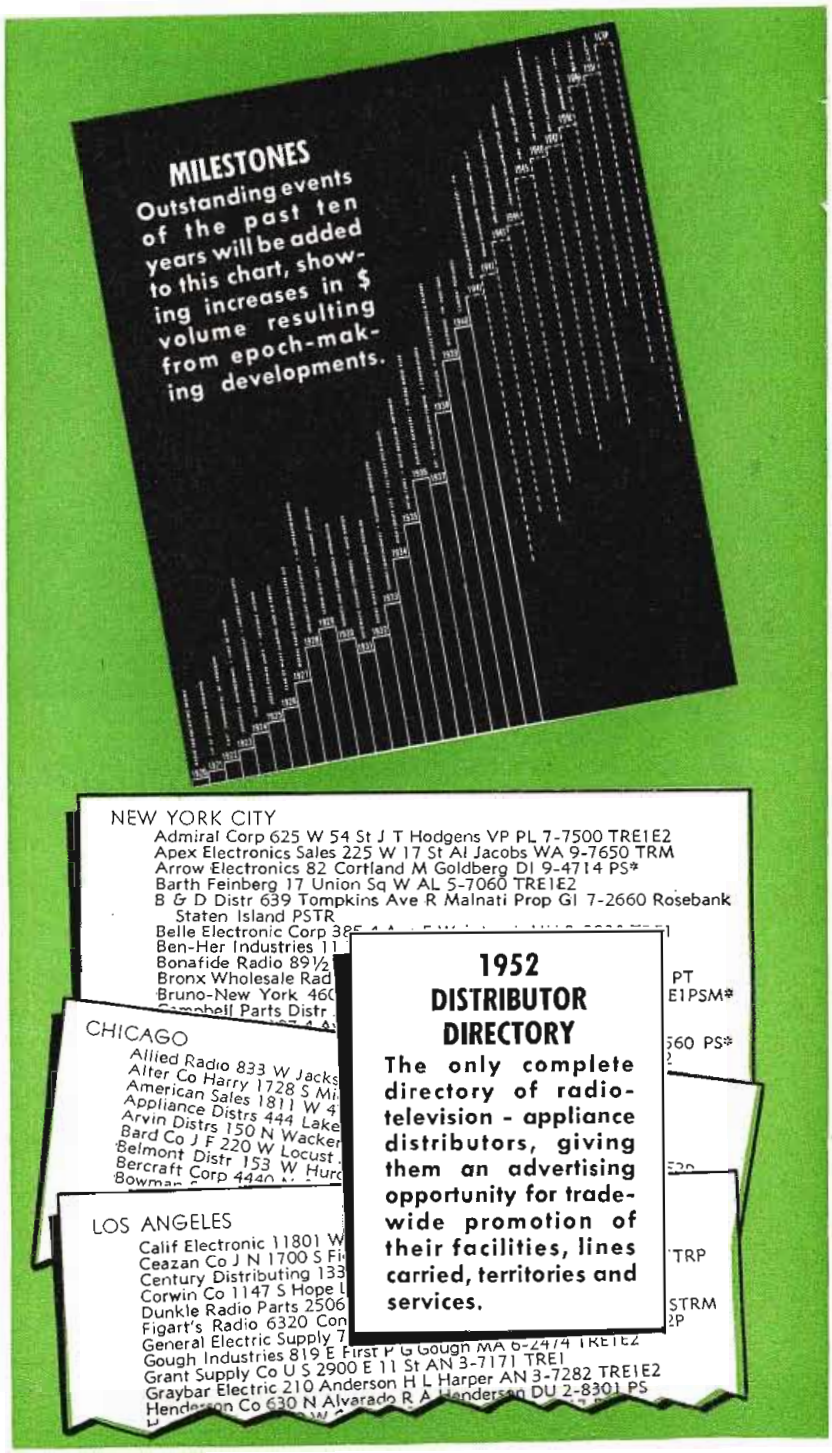
The overwhelming preference of the dealer in surveys year after year.

30,000 CIRCULATION (CCA)

including

27,000 dealers and distributors
10,000 largest dealers in U.S.A.
23,206 dealers and distributors with service departments.

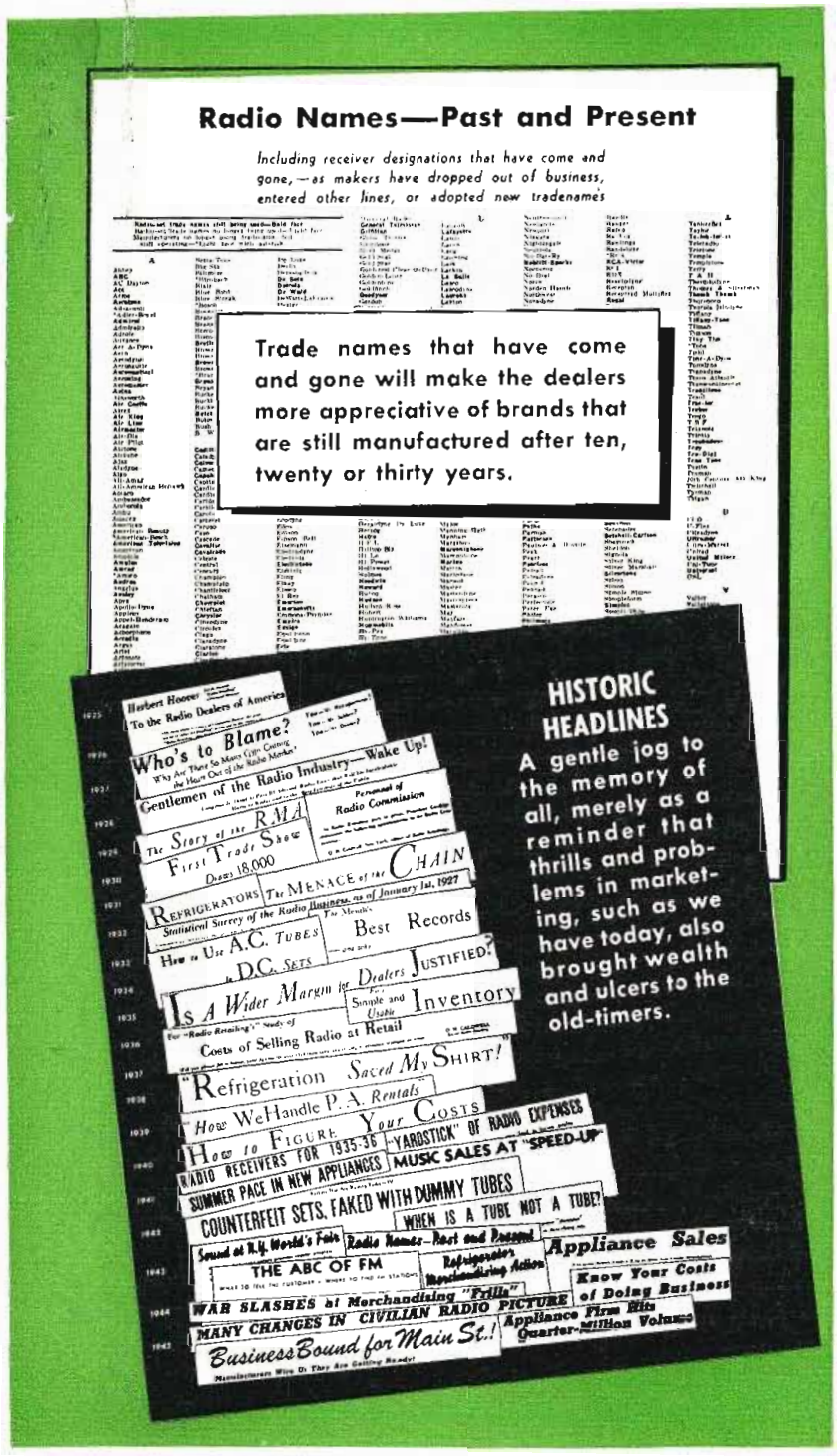
Average readers per copy..... **4**
Estimated total readership.....**120,000**



PUBLISHED BY *Caldwell-*

ADVERTISING OFFICES—480 Lexington Avenue,

30th ANNIVERSARY
of Manufacturing and Broadcasting



RADIO & TELEVISION RETAILING

January 1952 Issue

coincident with the 30th Anniversary of RADIO & TELEVISION RETAILING

Again, history will speak!

And again, the men who make and sell radio, television, appliances, phonograph records and kindred products — men famed for looking forward — will stop and look back on their common heritage.

All will be touched by that indefinable something that binds the most reticent men together when the topic of discussion is reminiscent of the early days.

In the furious pace of the past 30 years, radio and television have hardly had a chance to catch their breath but they have an amazing view in retrospect as in the days to come.

To RADIO & TELEVISION RETAILING, leading magazine in the field, falls the privilege of putting the story on paper in January.

NEW ELEMENTS IN THE TRADE

Bridging the last three decades, there have been several generations of dealers, most of whom never heard of Edison's "black box", Marconi's first wireless, Miessner's "catwhisker", DeForest's audion, Armstrong's regenerative set, the early TV work of Zworykin, Dumont and Farnsworth and other forerunners of radio today.

In the January issue, they will learn about these and other historic figures such as Alexanderson, Maxwell, Hertz, Fessenden, Conrad and many other radio immortals.

But what about the pioneering that led direct to today's living rooms? Or the historic reasons for today's successful products?

Since nearly every manufacturer has a history worth telling, why don't YOU seize the opportunity to increase the trade's confidence in your product? Remember one thing. Oldtimers in the trade may know your background but TV has brought a brand new crop of dealers, installers and servicers who are key men in today's market and may not know you too well.

Clements, Inc. **Publishers also of TELE-TECH**

New York 17, N. Y. • Telephone: PLaza 9-7880

Radiosonde Telemetering

(*Continued from page* 41)

in sequenced and columnized form and be capable of automatically synchronizing itself with the changing rate of radiosonde transmission.

Fig. 4 illustrates a recorded which was designed primarily for aircraft operation, containing the above-mentioned desirable features. It was developed through the combined efforts of the United States Signal Corps, at Evans Signal Laboratory, and the Times Facsimile Corporation, N. Y. C. The recorder, is a portable electro-mechanical apparatus used for recording the radiosonde data on a specially coated, pressure-sensitive type of chart paper. The telemetered pressure, temperature, and humidity signals are received in the form of international Morse code as illustrated in Fig. 5, and are recorded in three vertical columns on a continuously feeding chart.

The recording is accomplished by means of a scanning helix and a signal-energized hammer-print bar. Provisions have been made for visually and audibly monitoring the input signals for comparison with the recorded copy. Provisions have also been made to permit automatic synchronization of the scanning helix and radiosonde rate of transmission, since the latter is subject to change due to temperature effect on the motor and batteries. Fig. 5a illustrates the effect on the record by the slope of the recording when synchronization is lost. Fig. 5b illustrates the effect of the automatic synchronization control circuits on maintaining fairly uniform columns.

Part two will appear in December.

New Prices on Some Ampex Tape Recorders

Magnetic tape recording equipment for special applications is available through the Audio & Video Products Corp., 730 Fifth Avenue, New York 19, New York, at new low prices. Because of the increasing demand for the Ampex model 307 telemetering and data recording equipment, the production run has been enlarged, effecting decreases in unit costs. Effective immediately the new prices will be as follows:

Model 307	Ampex Stock #	Old List Prices	New List Price
Rack Mount	MP-1886-R	$2,475.	$2,250.
Console	MP-1886-C	2,560.	2,350.
Portable	MP-1886-S	2,575.	2,350.

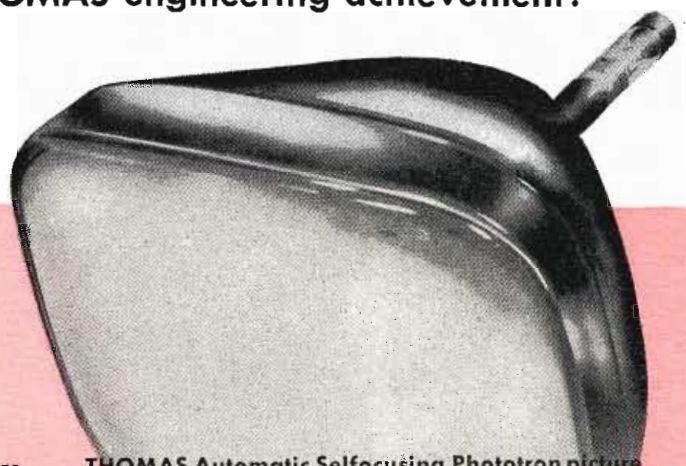
These prices are FOB, Redwood City, Calif. and apply to equipment on order as well as new orders. Billing for equipment already shipped or to be shipped in the near future will be adjusted accordingly.

This is it!

the NEW **Thomas**

Automatic Selfocusing Phototron picture tube . . .

available with sensational glare-reducing cylindrical surface face plate...the latest THOMAS engineering achievement!



THOMAS Automatic Selfocusing Phototron picture tube . . . replaces either electromagnetic—or electrostatic—focusing tubes. Gives sharp focus edge-to-edge for the entire tube life . . . without focus deterioration.

THOMAS Automatic Selfocusing Phototron picture tube . . . requires no focusing circuits or components. And is directly replaceable without circuit changes.

THOMAS Automatic Selfocusing Phototron picture tube . . . reduces service calls resulting from line voltage, or anode voltage fluctuation; plus call-backs due to faulty potentiometers and focusing devices.

Illustrated is the THOMAS 21 inch Automatic Selfocusing Phototron picture tube with glare-reducing cylindrical surface face plate. The selfocusing feature is available in other sizes and types.

Contact your jobber or distributor for the complete THOMAS Phototron line . . . or write THOMAS direct.

Thomas Phototrons are *Exact* original equipment with these 20 TV set makers and many others . . .

ADMIRAL • HOFFMAN • OLYMPIC • MECK • PILOT • STEWART-WARNER • KAY-HALBERT • MAGNAVOX • IMPERIAL • STARRETT
HALLICRAFTERS • WESTINGHOUSE • SCOTT • CALBEST • BENDIX TELEVISION • PACKARD BELL • CROSLEY • TELE-KING • MOTOROLA

Thomas ELECTRONICS Inc.

PASSAIC, NEW JERSEY

TEI TRADE MARK

CONTI ADVERTISING AGENCY

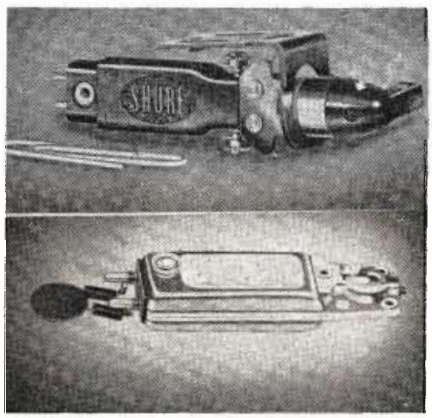
Oscillosynchroscopes

Models ON-5A and ON-5X Oscillosynchroscopes feature a sweep system which may be operated in either triggered or

recurrent fashion with direct reading panel calibrations of sweep speed. Sweep writing rates are continuously variable from 1.0 microseconds per in. to 25,000 microseconds per in. Vertical amplifiers are flat within ±3 db from 5 cps to 5 MC with a maximum sensitivity of .15 p. to p. volts per in. Horizontal bandwidth is from dc to 500 KC. A vertical deflection calibration source of 0-2, 0-20 and 0-200 volts provides a convenient means for determining amplitude of vertical input voltages. Model ON-5X is identical to model ON-5A except for a .45 microsecond signal delay line which permits the display of the leading edge of a pulse which is used to trigger the sweep.—**Browning Laboratories Inc., Winchester, Mass.**—TELE-TECH.

Phono Cartridges

Model W22AB-T turnover cartridge is a high-quality extended range vertical drive cartridge complete with positive turnover mechanism. This cartridge



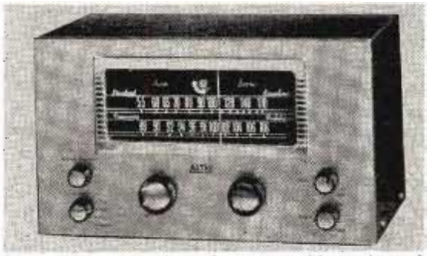
offers greatly improved performance when used as a replacement for single needle all-purpose cartridge, and it is also recommended for replacement of other types of turnover and dual needle cartridges. It replaces not only the cartridge but turnover mechanism as well. Model W42BH, dual-voltage cartridge is described as a low cost lever-type cartridge for 78 rpm records. Equipped with unique "slip-on" condenser-harness for dual-voltage output, 1.5 volts or 3.75 volts is obtainable in one cartridge. Special features of the model W22AN-T include extended frequency response to 10,000 cps; tracks at low needle point pressure—only 8 grams; sturdy construction guarantees long life of turnover mechanism, and standard ½ in. bracket mount has elongated holes for versatility and quick easy installation. In the model W42BH, level-type construction assures improved tracking; specially designed needle guard protects the crystal from breakage; it is equipped with pin jacks and pin terminals.—**Shure Brothers, Inc., 225 W. Huron St., Chicago 10, Ill.**—TELE-TECH.

Test Prods and Leads

New heavy duty self-holding test prods and leads have been designed for clipping to conductors up to #4 B & S gauge and are suitable for a wide range of applications in radio and electrical manufacturing and testing. The new "Klipzon" type H heavy-duty test prods and leads are provided with large self-holding points which are needle-sharp for piercing insulation, fungus and wrappings and will maintain good electrical contact until pulled off. Insulating sleeves on shank of test points prevent accidental shorting to nearby wires. The flexible leads are supplied with spade terminals for convenient connection to meters or other instruments. They are four ft. long and consist of 16 strands of #30 B & S gauge copper with lacquered polyethylene-rayon insulation. Prod test points may be removed easily by unscrewing from plastic handle—**United Technical Laboratories, Morristown, N. J.**—TELE-TECH.

FM-AM Tuner

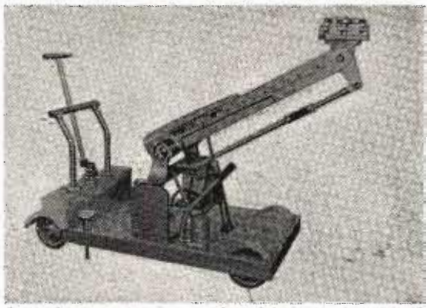
The 303A FM-AM tuner includes a built-in power supply and multistage audio circuit. The AM section is a super-



heterodyne, designed to provide a broad band flat top curve. The FM circuit employs two ground grid r-f stages, a separate oscillator and triode mixer stage, two stages of i-f amplification and a ratio detector. A built-in multistage amplifier which includes a preamplifier for variable reluctance pickup and contains the following controls: a four-channel selector switch for AM, FM, phonograph and spare; a three step selection of record crossover frequencies; equalization for variable reluctance pickup; filter for 33 1/3 recording characteristic use; variable control of rise and drop in both treble and bass, and a continuously variable volume control. The cathode follower output stage of this amplifier enables the tuner to be connected to any power amplifier with a high impedance input. The separation may be as great as 50 ft.—**Altec Lansing Corp., 9356 Santa Monica Blvd., Beverly Hills, Calif.**—TELE-TECH.

TV Dolly

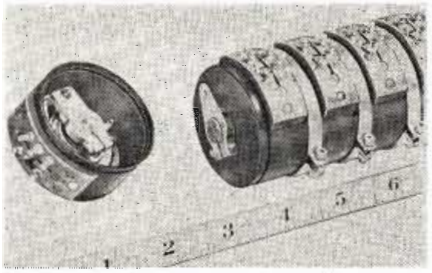
The Hydrolift Dolly permits fast changeovers from high to low camera positions, or vice versa. Time consumed



for change is 5 sec for high-to-low and 20 sec for low-to-high. The camera boom arm lift is operated by hydraulic cylinder and powered hy a manually operated pump. Downward movement is accomplished by gravity action on the oil cylinder. Rate of descent is controlled by a vernier screw arrangement, and the arm which can be stopped at any position is automatically locked by the hydraulic system. The dolly is designed to accommodate any 16mm or 35mm professional camera or blimp, as well as TV cameras, maximum load weight being 250 lbs. The dolly can be equipped with an electrical hydraulic pump system to eliminate the manual operation.—**National Cine Equipment, Inc., 20 West 22nd St., New York 10, N. Y.**—TELE-TECH.

Potentiometers

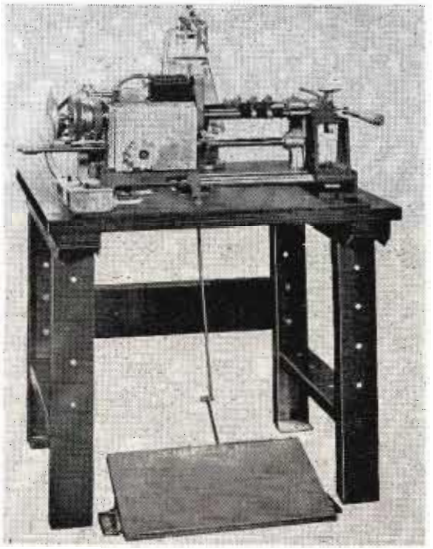
Potentiometers in the C-200 series are available singly or ganged and they maintain the same degree of mechanical and electrical accuracy in any combina-



tion of both linear and non-linear resistance windings. Clamping ring method of ganging permits accurate external phasing of individual units at any angle when circuit elements are changed. Individual sections are easily changed, if necessary. Taps can be furnished at any specified points on the winding within ± ½°. Mechanical rotation is 360° ± 1°. Resistance range is from 10 to 200,000 ohms, up to ± 1%. Contact materials are gold or platinum alloy. Shafts are stainless steel, and torque is 1 oz.-in. nominal per section. Operational life is 1 MC dependent on rating—**DeJur Amsco Corp., Industrial Division, Dept. T-C 45-01 Northern Blvd., Loug Island City, N. Y.**—TELE-TECH.

Transformer Winder

Model 117-A winds heavy wire bobbin and transformer coils accurately for regular production, laboratory or experimental use in military and other types of equipment where space is critical. Extremely high tension is applied through exceptionally high winding power and a heavy winding head to put wire exactly where desired. No loss of turns and accurate margins are assured by a screw feed and an electrically controlled clutch. Model 117-A is especially suited for winding heavy wire bobbin and trans-



former coils up to 6 in. long and up to 9 in. outside diameter, if round. Rectangular coils' clearance is 4½ in. Model 117-A can also be used for single layer close or space windings. At slight additional cost and on special order a winding traverse up to 8 in. or more can be supplied. Mandrels up to 4 in. long may be used. On model 92-6D, tension is furnished for wire gauges 18 to 24 and spools up to 6 in. diameter. Other tension available are model T-8 for wire gauges 16 to 24, 92-12 for wire gauges 14 to 24 or model 92-6 for wire gauges 24 to 44. Winding speeds up to 2000 rpm are possible with 32 pitch gears providing winding range from 10 to 500 turns per in. Length of winding is accurately determined by micro-precision reversing mechanism. Gears range in size from 30 to 100 teeth.—**Geo. Stevens Mfg. Co., Inc., Pulaski Road at Peterson, Chicago 30, Ill.**—TELE-TECH.

TV Special Effects

(*Continued from page 53*)

in this unit because of the high amplification and clipping actions which take place in the video amplifier for the control video input and which is, in any case, necessary for obtaining satisfactory montages. The output signal is fed through another relay and a cathode follower whose grid is dc restored to a variable control potential set by the montage level control on the control panel.

The output of the cathode follower is direct coupled to one of the control grids of the 6BN6 key producing gate. The width of this pulse will ordinarily vary from line to line and may vary in a random manner to produce areas of keyed insertion of an irregular shape. The output signal is fed through another cathode follower to the key control amplifier and phase inverter which produces keying pulses of two opposite polarities. These keying pulses are then fed through two cathode follower stages to the suppressors of the keyed mixers to determine the time sharing between the two main picture signal inputs.

On many lines no part would be blacked out and hence there may be long periods in which no keying signal is generated or applied to the control stages. To avoid making all the stages direct coupled, some keying signal should be provided in such a manner as not to cause any spurious or unwanted keying between the two main input pictures. This is accomplished by taking horizontal drive, amplifying and mixing it with the pulses generated by the key producing gate. This combined signal is the signal applied to the key control amplifier and phase inverter tube and the cathode followers and subsequently the suppressors of the balanced keyed mixers. Each stage is switched back and forth in response to the horizontal drive at a time which is completely covered by the pedestal period. In this way, every line has a signal and it is not necessary to dc couple or to make time constants extremely long.

One other function is also produced in this operation. The keying signals for the suppressors of the keyed mixers are differentiated and applied to the two control grids of another 6BN6, the locating signal mixer. This tube is so operated that it is normally conducting. Positive pulses applied to its grid have no effect in the plate circuit, but negative pulses serve to cut the tube off. The net result is that a positive pulse appears

at the plate for each negative pulse on the grids.

Since the differentiations are applied to identical pulses of opposite polarity, there is a negative pulse on at least one grid for each transition in keying level. The plate circuit will then have a positive pulse at the beginning and ending of the keying pulse of each line. These dots are used to intensity modulate a kinescope and outline the keyed-in area. These positive pulses are fed through a cathode follower output stage and mixed with blanking or driving signals to the studio cameras where they appear on the camera viewfinder, allowing the operator to position his camera accurately.

Combined Montage

Combined Montage is similar to keyed insertions except that the signal which provides the keying signal for the selection between channel 1 and channel 2 is the picture input to channel 2. This means that care must be taken in setting up the signal source so as to have a fairly large clean area separating random noise, spurious shading and other unwanted signals at black level from the picture content, which should be confined between white and a medium gray level. When this is done, V12 will conduct for all picture signal levels (white to medium gray) and key-off, at other times. In this way, a clean keying signal is obtained. Since it was necessary to confine the picture information to a lower contrast range than normal, the picture is fed to two additional video stages, shown in the dotted box in Fig. 8 where it is clipped and the gain adjusted so as to establish the medium gray level at transmitted black level and the white level at the white level of the main picture content.

Horizontal Wipes

In a horizontal wipe the signal controlling the operation of the key producing gate is generated internally. The signal is a horizontal rate sawtooth and the dc level to which the saw is restored is varied so that the instant when the grid of the key producing gate reaches the off to on transition may be made to vary in a linear manner from one side of the picture to the other. The horizontal drive is amplified and converted to a sawtooth. The sawtooth output is fed through cathode followers and amplifiers and a relay to the grid of a cathode follower. A dc restorer acts to restore the potential at the grid of the cathode follower to a variable dc determined by the posi-

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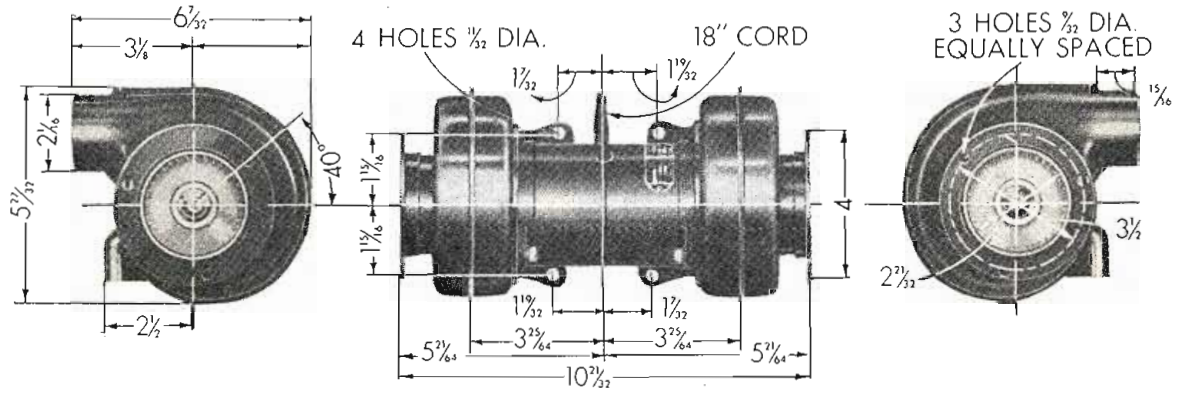

- AC Shaded Pole Motor!
- 2750 FPM Velocity!
- 2800 RPM Operation!
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- Quiet, Continuous Duty!

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A lucky special-purchase by Boston's famous RADIO SHACK, enables you to SAVE over half on these BRAND NEW (in original shipping carton) dual blowers made by the Delco division of GENERAL MOTORS! They have a multitude of uses wherever air is circulated in heating, cooling and ventilating services — with innumerable commercial, household and marine applications. Blowers are finished in durable, satin-black lacquer, have universal type mounting brackets (see sketch), and an 18" rubber cord with plug. Snail-type blower housings on each end of the double-shaft Delco Appliance motor employ multi-blade fans for quietness and maximum air volume. Motor will operate continuously with no attention except for lubrication. Convenient size for limited mounting spaces!

THE BLOWER BUY OF A LIFETIME AT ONLY....

$14.85

BLOWERS AVAILABLE IN QUANTITIES SUFFICIENT FOR PRODUCTION USE

MOTOR SPECIFICATIONS:
Die cast alloy case and housings. Stator: 2 field coils, machine wound enamel wire, taped, dipped and baked in insulating varnish for complete protection. Starting Coil: single-turn copper hairpin. Rotor: squirrel-cage type, skewed for quietness. High-grade silicon steel laminations. High-grade precision-ground steel armature shaft. Self-aligning bronze bearings. Universal-type mounting brackets. Lubrication: felt washers in large oil reservoir with sealed oil holes. Operates on 115 volt 60 cycle AC.

BLOWER SPECIFICATIONS:
Pressed steel housings, welded two piece, snail type. Two multi-blade squirrel-cage type fans.

CHARACTERISTICS:
2800 RPM operating speed. Rotation clockwise from right-hand end. 62 watts input 2750 feet per minute velocity. Air delivery 120 cu. ft. per min. free volume. ½" water static-pressure. Weight 11 lbs.

SENSATIONAL! CLOSE-OUT SALE OF SWITCH-TIMERS

FAR BELOW REGULAR COST!

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6 FOR $22.50
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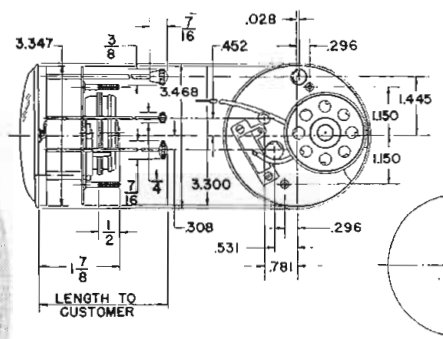
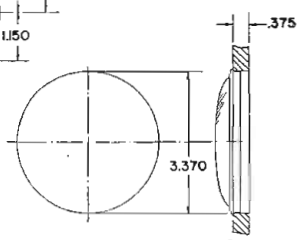


FAMOUS-MAKE ELECTRIC CLOCK



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CORPORATION
167 Washington St., Boston 8, Mass.

tion of the control lever on the control panel. Since the cathode of the cathode follower is direct coupled to the key producing gate, the sawtooth effectively is moved up and down along the grid base of the gate in such a way as to vary the length of time that V12 conducts and hence the width of keying pulse which is generated in the plate of the gate and fed to the suppressors of the keyed mixer to control the wipe position.

To produce a vertical wipe a sawtooth is used in much the same manner as was employed in the horizontal wipe. The manner of generation however is somewhat different. Amplified sync at the plate of the sync amplifier is passed through an integrating network and the resulting vertical rate pulse is used to trigger a gas discharge sawtooth generator. The waveform produced is linearized by means of a feedback amplifier. The ouput is applied to the 2nd control grid of the key producing gate. A is a dc restorer returned to a variable bias point and used to move the vertical sawtooth relative to the grid base of the key producing gate, varies the keying pulse width produced in the plate circuit in a manner analogous to that described for the horizontal wipe.

The wedge wipe is a combination of horizontal and vertical wipes in which the vertical rate sawtooth is applied to the second control grid and the horizontal rate sawtooth is applied to the first control grid. The characteristic of the 6BN6 is such that the plate will draw no current unless both grids are on. There are, then, four possible conditions. With the control characteristic of the 6BN6 normal, the plate will conduct, and a keying signal will be generated in one "quadrant". As the dc restorer control potentiometers are varied and the two sawteeth move along their respective grid bases the area in which both grids are "on" will become progressively larger or smaller depending on the direction of movement of the control handle. The resulting effect is a wedge progressing along a diagonal line from the upper left to the lower right of the picture or vice versa.

Radio Show at Bombay, India

The Radio and Electronic Society of India is organizing an international exhibition in Bombay from February 9th to 29th, 1952. This exhibition will afford manufacturers who specialize in radio equipment an opportunity to study the requirements of Indian buyers. Further information may be obtained from the Consulate General of India, 3 East 64th St., New York 21, N. Y.

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Sometimes a special fuse or fuse mounting is required. In such cases we welcome your requests either to quote — or to help in designing or selecting the special type of fuse or fuse mounting best suited to your particular conditions.

Submit description or sketch, showing type of fuse to be used, number of circuits, type of terminal, etc. If your protection problem is still in the engineering state, tell us current, voltage, load characteristics, etc.

At any time our staff of fuse engineers is at your service to help solve your problems in electrical protection.

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Please send me Bulletin SFB containing complete facts on BUSS Small Dimension Fuses and Fuse Holders.

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Company_____

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For Manufacturers

(*Continued from page 64*)

Manufacturing data concerning this precision potentiometer is permanently preserved on tape

Label Corp., Monravia, Cal. Each assembly operation is recorded in proper space on the label. Data such as resistance, stability, linearity and inspection remarks are completely listed on each unit. When required upon completion of final inspection, the informative label can be removed from each unit and placed in a master production record book for future reference of service and performance data. This method of production control greatly increases manufacturing speed and accuracy, and provides an immediate record on each unit for ready future reference.

Electronic Micrometer

RAPID and accurate measurements to a tolerance of .00002 in. are said to be possible with the new Carson-Dice electronic micrometer. An electronic circuit used in conjunction with an extremely accurate micrometer head permits "pressureless" measurement and eliminates "feel" as a source of error. The electronic circuit is sufficiently sensitive to give positive "on and off" indications with only five millionths of an inch displacement at the contact. Several models are available with different work capacities for measurement on compressible or non-compressible materials either conducting or non-conducting in nature. All models are portable, require no leveling and are unaffected by vibrations, variations in temperature, line voltage or aging of electronic tubes.

The Carson-Dice micrometer can

New portable radiotelephone, of less weight but longer range, designed and built by RCA engineers.

Longer range, but lighter weight for the "Take-along Radiophone"

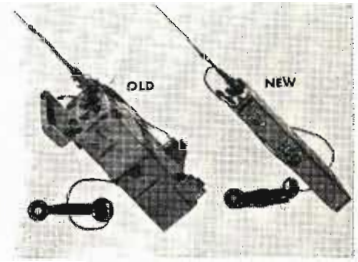
You've read how useful our Armed Forces found their portable radiotelephones. Now this indispensable instrument has become even more efficient.

At the Signal Corps' request, RCA engineers undertook to streamline the older, heavier model—which many a soldier of World War II called "the backie-breakie." Following principles of sub-miniaturization—pioneered at RCA Laboratories—every one of its hundreds of parts was redesigned. Models were built, tested, rebuilt, and finally RCA came up with an instrument weighing only 29 pounds. Its range is double that of the World War II model.

Even more important, under present conditions, RCA was able to beat the most optimistic estimate of the time needed to design such an instrument *by nearly three months.* Signal Corps engineers have called this "A major engineering and production achievement."

* * *

See the latest wonders of radio, television, and electronics at RCA Exhibition Hall, 36 West 49th St., New York. Admission is free. Radio Corporation of America, RCA Building, Radio City, New York 20, N. Y.



Comparison with the older model portable radiotelephone shows how RCA engineers have reduced its size with their new instrument.

RADIO CORPORATION of AMERICA

World Leader in Radio — First in Television


Equipment comprising electronic micrometer which measures to 0.00002-in.

be used for rapid measurement of machined parts, ball bearings, small assemblies, depths of counterbore. It can also be used to measure deflection in diaphragms, bi-metal elements, springs, bellows and similar applications requiring measurement without pressure. The micrometer also offers a precise means of measuring soft or compressible materials such as paper, foil, ribbon, rubber, felt, plastic sheets, linoleum, photographic film, and textiles with equal ease. Manufacturer is the J. W. Dice Co., Englewood, New Jersey.

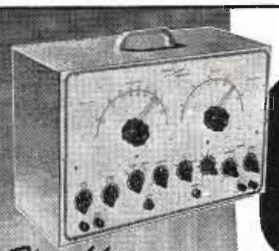
Chemical Rustproofing

MOVING parts made of iron and steel can get two-fold protection with a new chemical treatment announced by Octagon Process, Inc., 15 Bank Street, Staten Island 1, N. Y. Known as "Rustshield 2," it is a phosphatizing compound which changes steel and iron surfaces to rustproof, highly absorbent nonmetallic areas. Such a "Rustshielded" steel surface, with vastly increased surface area, is an ideal base for the retention of lubricating oils. This surface is a coating produced from chemical interaction of the phosphate solution and the metal surface; thus it has greater adherence than any physically-bonded coating could have. Metal parts so treated are said to remain properly lubricated for longer than smooth steel surfaces. This product meets the requirements for phosphate coating in the U. S. Army Ordnance Specification 57-O-2C, Type II, Class A.

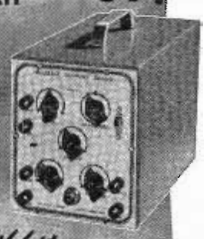
Rubber Drafting Stamps

ELIMINATION of the repetitious drawing of symbols that appear many times in schematic diagrams has been made possible by the use of rubber stamps made by the John Griffin Co., 2157 James Ave., St. Paul 5, Minn. Priced at $15.00 per set, each kit consists of 20 stamps enclosed in a styrene box with a bottle of opaque ink and two facing ink

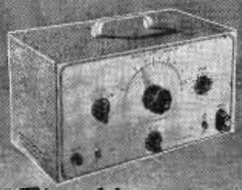
New 1952 HEATHKITS



Heathkit TELEVISION GEN. KIT $39.50



Heathkit ELECTRONIC SWITCH KIT $19.50



Heathkit AUDIO GEN. KIT $34.50

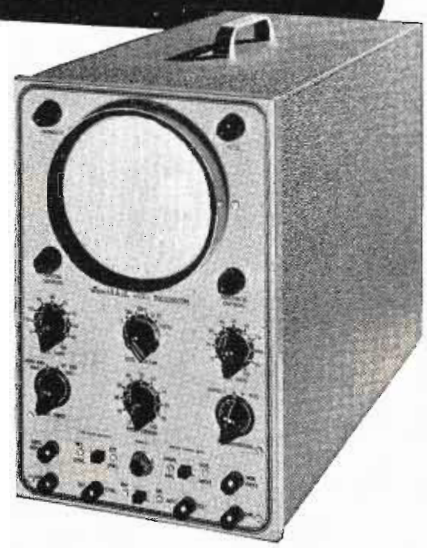
Heathkit CONDENSER CHECKER KIT $19.50

Heathkit R. F. SIGNAL GEN. KIT $19.50

Heathkit A.C. VOLTMETER KIT $29.50

Heathkit SQUARE WAVE GEN. KIT $29.50

Heathkit 5" OSCILLOSCOPE KIT



- New "spot shape" control for spot adjustment — to give really sharp focusing.
- A total of ten tubes including CR tube and five miniatures.
- Cascoded vertical amplifiers followed by phase splitter and balanced push-pull deflection amplifiers.
- Greatly reduced retrace time.
- Step attenuated — frequency compensated — cathode follower vertical input.
- Low impedance vertical gain control for minimum distortion.
- New mounting of phase splitter and deflection amplifier tubes near CR tube base.
- Greatly simplified wiring layout.
- Increased frequency response — useful to 5 MC.
- Tremendous sensitivity .03 RMS per inch Vertical .6V RMS per inch Hor.
- Dual control in vernier sweep frequency circuit — smoother acting.
- Positive or negative peak internal synchronization.
- Multivibrator type Wide Range Sweep Generator.

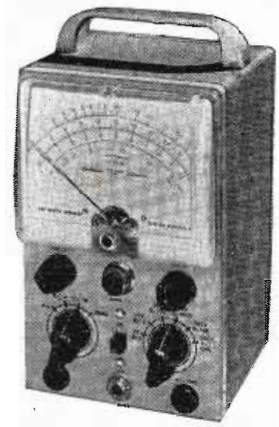
A brand new 1952 Heathkit Oscilloscope Kit with a multitude of outstanding features and really excellent performance. A scope you'll truly like and certainly want to own.

The kit is complete with all parts including all tubes, power transformer, punched and formed chassis, etc. Detailed instruction manual makes assembly simple and clear — contains step-by-step instructions, pictorials, diagrams, schematic, circuit description and uses of scope. A truly outstanding value.

MODEL 0-7
SHIPPING WT. 24 LBS.

$43.50

Heathkit VACUUM TUBE VOLTMETER KIT



- New styling — formd case for beauty.
- New truly compact size — Cabinet 4⅛" deep x 4-1/16" wide x 7⅜" high.
- Quality Simpson 200 microamp meter.
- New ohms battery holding clamp and spring clip — assurance of good electrical contact.
- Highest quality precision resistors in multiplier circuit.
- Calibrates on both AC and DC for maximum accuracy.
- Terrific coverage — Reads from ½V to 1000V AC, ½V to 1000V DC, and .1 to over 1 billion ohms resistance.
- Large, clearly marked meter scales indicate ohms, AC Volts, DC Volts, and DB — has zero set mark for FM alignment.
- New styling presents attractive and professional appearance.

The 1952 Model Heathkit Vacuum Tube Voltmeter! Newly designed cabinet combines style and beauty with compactness. Greatly reduced size to occupy a minimum of space on your work-bench. Covers a tremendous range of measurements and is easy to use. Uses only quality components including 1% precision resistors in multiplier circuit for greatest accuracy. Simpson 200 microamp meter with easy to read scales for fast and sure readings.

All parts come right with kit, and complete instruction manual makes assembly a cinch.

MODEL V-5
SHIPPING WT. 5 LBS.

$24.50

Heathkit INTERMODULATION ANALYZER $39.50

Heathkit AUDIO FREQ. METER KIT $34.50

YOU SAVE BY ORDERING DIRECT FROM MANUFACTURER

EXPORT AGENT
ROCKE INTERNATIONAL CORP.
13 E. 40th ST.
NEW YORK CITY (16)
CABLE: ARLAB-N.Y.

The HEATH COMPANY
. . . BENTON HARBOR 24, MICHIGAN

pads. The stamps comprise schematic representations of all major radio-electronic components. Each stamp is mounted on ¼ in. plexiglass and is centered on inscribed cross lines to assure accurate alignment to construction lines on the drawing. Special made-to-order stamps are also available at $2.00 each.

Universal Cabinets

A RADIO cabinet, whose style can be changed without extensive tooling, has been developed by General Electric's Chemical Division in Pittsfield, Mass. This radio housing design has as its basic module a simple rectangular case, with smoothly contoured edges for ease of molding. With a change of dial knobs, speaker panel, or other extraneous parts, the cabinet assumes the appearance of several diverse styles.

Designed by William B. Petzold, Head of Industrial Design, GE Plastics Department, this housing can

Sections comprising the modular cabinet design which permits six to eight models

be molded of styrene in combination with any other plastics compound or metal. The modular design can be used either horizontally or vertically, and six or eight different-looking cabinets can be designed around the one basic form. This factor cuts down retooling expenses, and makes maximum usage from the molds possible.

New TIC Plant

Technology Instrument Corp. has transferred all its production activities from 1058 Main St., Waltham, Mass., to a new plant in Acton, Mass. This move was necessitated because of the rapidly expanding activities of the company which could not be conducted adequately in its former location.

Army Mobile TV

(*Continued from page* 101)

screen projector, which can be set up in a nearby building or shelter. The monitors are 16-inch TV receivers modified to receive only the video signal. Individual cables 500 feet in length for the ten receivers are stored on reels installed inside the vehicle. During setup, these cables are pulled out through small doors in the side of the coach and connected between the receivers and a distribution box. Two cables are required for each receiver, one carries the audio and video, the other is an ac power cable. Special dollies stored in compartments can be quickly attached to the receivers for mobility over the viewing area.

The fourth coach contains a 15 KVA gas-engine generator of the same type used in the transmitting unit. This generator supplies ac power for the receiving equipment.

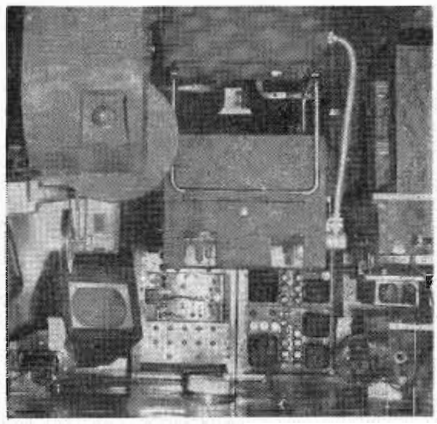
Custom-built Coaches

The entire caravan has been carefully built and styled to Signal Corps specifications. Driving power is applied to the front wheels of the coaches; the four rear wheels receive no drive power. It is interesting to note that the rear wheels are "tracking" wheels and not duals. This feature permits greater inside dimensions for the coach than would be possible with dual wheels, due to the space taken by the wheel housings. All vehicles are equipped with necessary test equipment and spare parts. Each of the coaches bears the Signal Corps insignia and is attractively finished in traditional Army OD with chromium trim.

The roofs of the transmitting and receiving vehicles are reinforced to support the weight of equipment and operators so that they can be used as a high vantage point for cameras and the microwave parabola. A ladder with hand railing is provided for access to the roof through a waterproof hatch. Whip antennas for the FM audio transmitter and two-way radio communication system are installed on the roof. All coaches are completely weather-proofed, while cooling and heating units further help to condition the interior for all-weather operation.

Power Control Panels

The transmitting and receiving coaches are each equipped with a power control panel. Instruments and controls on this panel include a voltmeter for reading voltages on



Interior view of receiving unit showing control position in rear, 16 mm film projection equipment, slide projection unit, and multiplexer in foreground

the three phases, one variac control of the voltage in each phase, and a frequency meter. The frequency meter of course enables the operator to keep the generators at 60 cycles for proper synchronization of the TV equipment. Frequency changes can be made manually on the governors of the gas-engine generators.

Microwave Visual System

The microwave transmitting and receiving system which handles the visual part of the TV signal is identical to that supplied TV broadcast stations for studio - to - transmitter link and relay purposes. The four-foot parabola provides a gain of 5000 which multiplied by the 100-milliwatt output of a klystron oscillator assembled to the parabola provides an equivalent power output of 500 watts. Since a 7000 MC frequency is used, transmission is limited to a line-of-sight path.

The parabolas at the transmit and receive positions are beamed toward each other providing a high intensity signal path. Transmitter and receiver units are mounted directly on the transmitting and receiving parabolas. In addition to these, there are control units for the transmitter and receiver rack-mounted in the coaches. The control unit for the transmitter contains a video amplifier and modulator which frequency modulates the klystron by varying the voltage on the repeller plate.

FM Aural System

The FM transmitting and receiving system which carries the sound portion of the TV signal—as well as the output of the tape recorder mounted in the transmitting unit—consists of a 45-watt 150 MC FM transmitter and superheterodyne receiver, modified to provide high fidelity response.

The design of the transmitting antenna for this system is such that a directional radiation pattern can be obtained when required. This is accomplished by inserting two parasitic whip elements in special connectors provided on the roof so that they operate as directors in conjunction with the whip radiator.

This system can be used to provide omnidirectional, bi-directional or unidirectional radiation. The radiator is permanently located in the center of a circle formed by closely-spaced connectors for the whip director elements. By placing these elements in front of the radiator, radiation is concentrated in the one direction; however one director can be placed in front of the radiator and one behind it for bidirectional radiation. For equal omnidirectional radiation, the director elements are not used.

Ultimately the Signal Corps mobile television system will be placed under the supervision, of the Army Pictorial Service, and will operate out of the Signal Corps Photographic Center in Astoria, Long Island.

Tarzian Tuner

(*Continued from page* 49)

tion tuning element. Two are used for band-pass input and one for oscillator tuning.

Bandwidth for the UHF r-f signal is 8 MC. A crystal mixer is employed, which is carefully matched for r-f and i-f impedances. The 9 db. insertion loss of the UHF tuner is substantially made up by the TT16 VHF tuner, so that a receiver using this combination will have comparable sensitivities in the UHF and VHF bands.

As there will be locations where only a single UHF station will be available, Sarkes Tarzian also showed a pre-tunable single-channel tuner which, when used in conjunction with the TT16, will bring in a single UHF station, with full performance. The cost of this single-channel tuner is very moderate and one or two can be installed on the back of a set or on the bracket above the UHF tuner.

Military Instructors Needed

The Signal School located at Fort Monmouth, N. J., has a number of attractive civilian openings for military training instructors in communications and electronics. Current vacancies are at all levels, ranging from trainee positions grade GS-5 to senior instructors grade GS-9. Attractive salaries are offered.

News of MANUFACTURERS' REPS

Magnetic Coil Corp., Ossining, N. Y., makers of powdered iron cores, toroids and ferrites, has appointed the **G. S. Marshall Co.**, Pasadena, Cal., to represent it in California, Arizona and New Mexico.

Neely Enterprises, Hollywood, Cal., has been appointed representatives for **Computer Research Corp.**, Hawthorne, Calif, in California, Arizona, New Mexico and Nevada.

Ron Merritt, Seattle, Wash., has been appointed northwest representative for **Gertsch Products, Inc.**, Los Angeles, makers of frequency meters.

Hamilton-Hall Manufacturing Co., 227 N. Water St., Milwaukee, Wis., makers of wire wound, cement coated resistors, has appointed the **J. T. Hill Sales Co.**, Los Angeles, as its Southern California and Arizona representatives.

R. F. Brookfield of Ardmore, Pa., has been named representative of the Mid-Lantic Territory for the **D. M. Steward Mfg. Co.**, manufacturers of technical ceramics.

Burlingame Associates has named Peter Lahana to their large staff of field engineers. He will provide valuable up-to-the minute production and technique information on the products manufactured by **John Fluke Engineering Co., Hewlett-Packard Co., Sorensen and Co., Inc., Sierra Electronics Corp., Technitrol Engineering Co., Tel Instrument Co., Inc., Varian Associates, Beta Electric Corp., and Labscope, Inc.**, in the territory including Western New England and that portion of New York north of Poughkeepsie and east of the Hudson River.

Leslie M. DeVoe of Indianapolis, Indiana, sales representative for Oxford Speakers in Indiana and Kentucky, has acquired Cecil Webb as his new associate. Oxford Speakers are manufactured by **Oxford Electric Corp.**, 3911 So. Michigan Avenue, Chicago 15, Ill.

George Davis, Los Angeles representative, will now represent the **Peerless Div. of Altec Lansing Corp.**, Beverly Hills, Cal., in the Southern California area.

C. R. Strassner Co., Los Angeles, will now represent **Electrical Communications, Inc.**, San Francisco, in California, Arizona, Nevada and New Mexico. The factory manufactures secode selectors and associated equipment.

"Reps" Officers for '51-'52

A complete roster of the officers and board of governors of "The Representatives" of Radio Parts Manufacturers, Inc., for the coming year has been released by Rep prexy W. S. Trinkle. New officers are listed below by name and title.

Wilmer S. Trinkle, President (Mid-Lantic)
Norman B. Neely, 1st Vice-Pres. (Los Angeles)
Russ Diethert, 2nd Vice-Pres. (Chicagoland)
Wally B. Swank, 3rd Vice-Pres. (Empire State)
Leroy W. Beier, Treasurer (Chicagoland)
Grant Shaffer, Secretary (Wolverine)
1951-52 Board of Governors
R. W. Farris (Mo. Vly.) (re-elected chairman)
Irvin Aaron (Chicagoland)
Robert Breuer (New York)
William E. McFadden (Buckeye)
S. K. Macdonald (Mid-Lantic)
David N. Marshank (Los Angeles)
Maitland K. Smith (Dixie)

President Trinkle has also announced 1951-52 standing committees:

(1) Industry Relations: Walter Hannigan (New England); John F. Thompson (Dixie); Jim Wright (Hoosier); Dave Ross (California); Gerald Wilson (Wolverine); John Kopple (New York); and oJseph Marsey (Empire State), subsequently elected chairman. (2) Nominating: H. Courtney Roes (Mo. Valley); Dan Bittan (New York), subsequently elected chairman; Dean Lewis (California); John Crockett (Southwestern); Charles Southern (Hoosier); and Paul Sturgeon (New England). (3) Membership: Ralph James (Pacific Northwest); Ward Pagen (Miss. Valley); Fred Hill (Gopher); Gordon Moss (Rocky Mountain), subsequently elected chairman; and Jules Bressler (New York).

Headquarters offices of "The Representatives" of Radio Parts Manufacturers, Inc., are at 600 South Michigan Ave., Chicago 5, Ill.

Coming Events

November 1-3—The Audio Fair, Sponsored by the Audio Engineering Society, Hotel New Yorker, New York City.

November 12-15—NEMA, Haddon Hall Hotel, Atlantic City, N. J.

November 15-16 — NARTB, District One Meeting, Somerset Hotel, Boston, Mass.

November 16-17—IRE Conference on Instrumentation, Kansas City Section, Hotel President, Kansas City, Mo.

November 29-December 1—Joint Electron Tube Engineering Council, First General Conference, Seaview Country Club, Absecon, N. J.

December 10-2 — JOINT IRE-AIEE Computer Conference, Benjamin Franklin Hotel, Philadelphia, Pa.

January 21-25—AIEE, Winter General Meeting, Hotel Statler, N. Y., N. Y.

March 3-6—1952 IRE Convention, Waldorf Astoria Hotel and Grand Central Palace, New York, N. Y.

March 10-13 — NEMA, Edgewater Beach Hotel, Chicago, Ill.

April 21-25—SMPTE, 71st Convention, Drake Hotel, Chicago, Ill.

April 24-26—Armed Forces Communications Association, National Convention, Philadelphia, Pa.

SPACE was at a premium

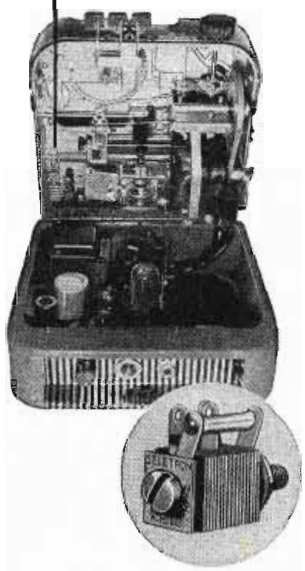
YET EFFICIENCY HAD TO BE HIGH

THAT'S WHY GRAY CHOSE

Seletron

T.M. REG. U.S. PAT. OFF.

SELENIUM RECTIFIERS



There's no room in The Gray Manufacturing Co. desk model Audograph Electronic Sound Writer for components without a big payload factor.

Gray engineers found SELETRON's tiny new selenium rectifier No. 16Y2 a powerhouse of efficiency for all its half-inch square cell size, and incorporated it into the Audograph's compact design . . . It functions direct at 120 volts to operate the back spacer. No. 16Y2 is rated at 130V input, 100V output, .050 output amps. Weighs less than half an ounce!

Millions of dependable SELETRON Selenium Rectifiers are in service. They are available for every purpose from the miniatures used in radio, TV and other electronic circuits, all the way up to the giant stack assemblies required for heavy industrial purposes.

SELETRON engineers are successful in solving rectification problems. Write us today without obligation . . . And have you our new 16 page rectifier guide for handy reference? Please request Bulletin 104-T-11.

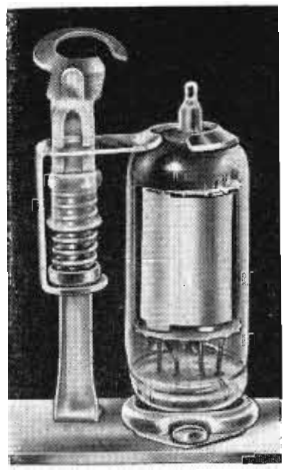
SELETRON DIVISION

RADIO RECEPTOR COMPANY, INC.

Since 1922 in Radio and Electronics

SALES DEPARTMENT: 251 WEST 19TH STREET • NEW YORK 11, N. Y.
FACTORY: 84 NORTH 9TH STREET • BROOKLYN 11, N. Y.

New BIRTCHER TUBE CLAMP FOR MINIATURE TUBES



POSITIVE PROTECTION AGAINST LATERAL AND VERTICAL SHOCK!

The New Birtcher Type 2 Tube Clamp holds miniature tubes in their sockets under the most demanding conditions of vibration, impact and climate. Made of stainless steel and weighing less than ½ ounce, this New clamp for miniature tubes is easy to apply, sure in effect. The base is keyed to the chassis by a single machine screw or rivet . . . saving time in assembly and preventing rotation. There are no separate parts to drop or lose during assembly or during use. Birtcher Tube Clamp Type 2 is all one piece and requires no welding, brazing or soldering at any point.

If you use miniature tubes, protect them against lateral and vertical shock with the Birtcher Tube Clamp (Type 2). Write for sample and literature!

Builder of millions of stainless steel locking Type Tube Clamps for hundreds of electronic manufacturers.

The BIRTCHER Corporation

5087 HUNTINGTON DRIVE • LOS ANGELES 32

One OF A LINE....

APPROVED BY THE AIR FORCE FOR *Dependable Control*

The Guardian Series 335 D. C. Relay, illustrated above, is but *one of a complete line* of Guardian Relays designed to permit more control in less space... more room for armament, power and personnel. Sensational Guardian developments include the famous "Guard-A-Seal" units specifically designed for aircraft and portable equipment, *sealed in aluminum.* They incorporate heavier frames, larger contacts, higher capacities, yet qualify under all AN weight requirements because the weight is in the relay—not the can!

GUARDIAN ELECTRIC

1607M W. WALNUT STREET CHICAGO 12, ILLINOIS

A COMPLETE LINE OF RELAYS SERVING AMERICAN INDUSTRY

Coaxial Cable

(*Continued from page 43*)

I) 200 meters for 3.2/10; 150 meters for 5.65/17; 100 meters for 8/24 and 35 meters for the 21/61 cable. The 32/95 size cable is not applicable for frequencies above 1000 MC.

Fig. 2 shows attenuation vs. frequency (db/100 ft) for the different sizes of cable up to 10,000 MC. The smallest cable is not primarily a power transmitting cable but, in any case, it does have a uniform transmission characteristic out to 3000 MC. Measurements above this figure are shown dotted since they are calculated figures. The situation in Germany in the past has been such that it has not been possible to make extensive measurements at frequencies above 3000 MC. Measurements at higher frequencies are currently being made in the United States by RCA but data from these tests are not yet available. Calculations based on cable structure indicate, however, that cut-off frequencies above 7000 MC are readily obtainable.

Propagation velocity of signals in this type cable is given as approximately 91% that of light. Recent measurements by International Standard Electric of Lorenz show that for the 8/24 cable at 2000 MC, the standing wave ratio is less than 1.01.

The type 5.65/17 cable is the smallest type transmitting cable manufactured for frequencies exceeding 100 MC and this cable can be used for frequencies up to 2300 MC. The 8/24 cable has a cut-off frequency exceeding 1760 MC, the 21/61 cable has a cut-off frequency of better than 960 MC, and the 32/95 cable exceeds a 750 MC cut-off frequency. Curves of allowable power transmission vs frequency, based on an operating temperature of 45° C, are also show in Fig. 2.

Costwise, it is expected that similar cables manufactured in the United States will be comparable in price to existing American types. However, because of the lower installation and maintenance costs involved, the overall investment in any specific case is estimated to be considerably lower.

Development of Styroflex

The polystyrene insulating tape helix is the outstanding unusual feature connected with the construction of these cables. Polystyrene is normally a stiff or brittle material which does not lend itself to being formed into the narrow thin tapes used here. Polyethelene, on the other hand, is

the solid dielectric type material used on most American coaxial cables, and while it is not as good as polystyrene electrically, its use is dictated by the fact that it is easily handled by extrusion processes. Table II lists the mechanical and electrical properties of polystyrene as an insulating material. German experiments indicated that the use of plasticizers in an attempt to soften polystyrene and hence render it flexible were generally unsuccessful. The addition of the plasticizer would either weaken the excellent electrical properties of polystyrene, or ultimately dry out and render the polystyrene brittle again.

A method was discovered for manufacturing a new material termed "Styroflex" from polystyrene. This material exhibits excellent flexibility characteristics while still retaining the desirable electrical features of polystyrene. It is formed by extruding polystyrene at temperatures ranging between 183-219° F, and then stretching the material longitudinally and transversely immediately after, as it cools. Normally this process yields sheets and strips of Styroflex that range in thickness from 0.02 to 0.015 mm. In special instances sheets of 0.01 mm can be manufactured.

The National Varnished Products Corp. of Woodbridge, N. J. is now setting up a plant to manufacture Styroflex in sheets and strips. Aside from its use in coaxial cables, a host of new applications are expected because of excellent electrical characteristics obtainable. New types of paper type capacitors become possible, and ultimately much of the paper-covered low-voltage communi-

Table 2: Mechanical and electrical characteristics of styroflex insulating material

Tensile Strength	— about 10,000 psi
Elongation	— about 3.0 to 4.0 per cent
Compressive Strength	— about 13,500 psi
Spec. Gravity	— 1.05
Heat Resistance	— 60 to 70 Centigrade
Water absorption after 7 days	— 0
Odorless and Tasteless	
Resistant to	— Acids, alkalies, alcohols, mineral oils, vegetable and animal oils.
Not resistant to	— Benzene, benzol, ether, methyl chloride, turpentine, ester and ketone.
Surface Resistance Direct	— $>$ 3 million megohms
After 4 days at 80% relative humidity	— $>$ 3 million megohms
After 24 hrs. in water	— $>$ 3 million megohms
Inner Resistance	— $>$ 3 million megohms
Loss tan delta up to 1000 kc	— $< 2.10^{-4}$
Dielectric Constant	— 2.5
Breakdown Strength	— about 2500 v/mil

Styroflex is manufactured in the following sizes:

Foil: Thickness: From 0.01 to 0.15 mm (0.00025 mils to 0.00375 mils).
Variation: Middle Values plus or minus 10%
Single Values plus or minus 15%
Width: From 1.0 up to 250 mm.

Easy way to make your product easier to use!

YOU can add a lot of extra convenience to your product by adding a few small General Electric lamps.

G-E miniature lamps can be used to show at a glance whether current is off or on. They can be used as dial lights—to make it easier for operators to read dials and gauges. They can add new safety to your product, too, by flashing warnings of high temperature or voltage.

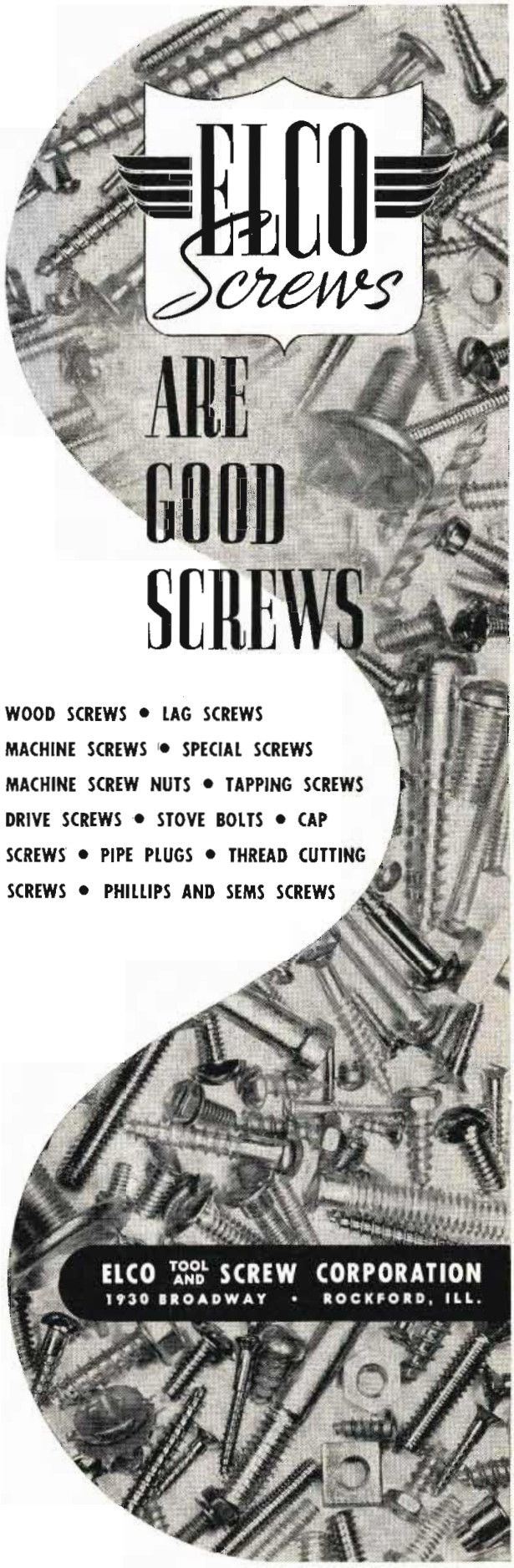
General Electric miniature lamps are available in both filament and neon glow, in a wide range of types and sizes. You're sure of top quality because every G-E lamp is backed by General Electric lamp research.

Plan now to design greater convenience and safety into your product with G-E miniature lamps. Call your G-E lamp supplier, or write Lamp Division, General Electric, Nela Park, Cleveland 12, Ohio.

LAMPS

You can put your confidence in—

GENERAL ELECTRIC



cation wire and cable may be changed, since Styroflex does not absorb moisture, and also since its dielectric constant is down to 2.5 compared to the 4 usually found in paper. In the case of coaxial cable insulation, the Styroflex helix shows an average loss angle less than 0.4 x 10^{-4} and an average dielectric constant of approximately 1.19.

Temperature Characteristics

The five cable types now manufactured have been designed to operate at a 50° C ambient temperature and 40° C is considered the maximum allowable temperature rise. With regard to thermal expansion, when the inner conductor is heated to 60° C above the sheath temperature, and the inner conductor and sheath are fixed at one end, the expansion of the inner conductor will be found to be only 0.25 mm. The calculated expansion for such a case is theoretically 7 mm, thus indicating the firm anchorage that the Styroflex helix has on the inner conductor.

The present limitation on power handling capacity of the cable comes about, not as the result of dielectric strength failure, but rather as the result of the thermal effects on the insulation. Investigations are now under way to increase the power handling capacity by such methods as cooling the cable with liquid coolant flowing through the hollow center conductor, blowing air through the helix, etc. The simplest and perhaps the best solution will be to use two or three layers of Teflon tape or similar material on the conductor. This would be done when the Styroflex helix was first applied, the initial layers having the Teflon strips substituted for the Styroflex. In this way the highest temperature gradient would appear across the Teflon tapes and the Styroflex would be in the relatively cooler section somewhat removed from the inner conductor.

Installation Characteristics

Today in Germany there are more than 150 UHF and VHF installations wherein Styroflex insulated coaxial cable is being used, and its use is continually on the increase. The tensile strength of all of the cables discussed is such that the breaking length is approximately 8000 ft. Installations have been made where the cables were hung from towers 450 ft. high with no point of anchorage other than the tower suspension point and no devices to limit the free

sway of the cable in the wind were employed.

In connection with the permissible bending radius of the cable in shipping or in a given installation, reels having a radius of 26 cables diameters or larger are employed although it is still possible and safe to bend the cable into a much smaller radius.

The method for cutting Styroflex insulated cable for splicing or connection to fitting may also be of interest. The outer sheath is first scored in two places about ½ in. apart. Then by carefully slitting or chipping out a small section sufficient to afford a grip on the aluminum, the section between the score marks can be stripped out. Care must be taken to remove all metal particles. The Styroflex helix is cut with a heated knife. This seals the tapes together to prevent unraveling. Now a putty-like plug is made of polyisobutylene to which some talc or mica dust is added. This material is forced into the opening in the cable until it completely fills all interstices. The inner conductor can then be sawed and filed smooth. All filings and metal particles are imbedded in the plug and are removed with it.

TELE-TECH will report further on manufacturing and application developments of this cable in the future as they occur.

Direct Commissions Available in U. S. Army Signal Corps

Under regulation 140-105-8, the Signal Corps is offering direct commission in the army to men in the 21 to 39 year age group who have college degrees and several years of experience in communications engineering. Applicants are advised to call at the Officer Procurement Branch of their local Department of the Army headquarters for personal interviews. Commissions ranging from second lieutenant to captain are conferred on the following basis:

Age Group	Rank	Years of experience
21-27	2nd lieutenant	3
28-33	1st lieutenant	6
34-39	Captain	10

Engineering Calculations

Mathematical Computing Service, consultants in applied mathematics, 105 Court St., Brooklyn 2, N. Y., specializes in performing services for industries and universities desiring engineering calculations of a high degree of complexity and the treatment of related mathematical problems in the field of electronics. An important function of the group is the mathematical formulation and complete solution of a problem from given physical data.

PERSONAL

Palmer M. Craig has been appointed vice president-engineering of Philco's television and radio division. He joined Philco in 1933 as a senior radio receiver engineer. After serving as chief engineer in charge of radar and military radio development during the early part of World War II, he was named chief engineer of the company's radio division in 1943. **Joseph H. Gillies** has been appointed vice president and general manager of the government and industrial division. At the same time, **William J. Peltz**, who has been manager of government and industrial operations, was appointed vice president-operations of the television and radio division.

Otto C. Bixler has been named director of engineering of Magnecord, Inc. Formerly he was associated with Airesearch Manufacturing Co., as an electrical development engineer on aircraft and guided missile applications of special electronic equipment. Prior to that he was affiliated with Western Electric in the electrical research products division, where he served as systems engineer on electronic equipment.

Trevor H. Clark, formerly with Federal Telecommunications Laboratories (IT&T), has been appointed director of the division of military research and development at Southwest Research Institute, San Antonio, Texas.

Frank A. D. Andrea, Jr., has been appointed to the engineering staff of the Andrea Radio Corp. Mr. Andrea, Jr., studied at the Pennsylvania Military College and received his degree of B.S. in electrical engineering. He also served in the U.S. Navy, during World War II, in the Pacific Theatre. His father, Frank A. D. Andrea, pioneered in the radio and television field more than 30 years ago.

Sigurd A. Sollie has been named product manager for the Daystrom Electric Corp., Poughkeepsie, N. Y., manufacturers of recording equipment. A pioneer specialist in sound recording and reproduction, he is the inventor of many basic developments, including early forms of the dynamic loud speaker, the electrical phonograph, many current recording and reproduction methods and a co-founder of the electrical transcription industry.

I. A. Martino, chief engineer of WDRC, Hartford, Conn., has just celebrated his 28th anniversary with the station. During this time he has taken part in many pioneer experiments and tests, as well as participating in the founding of the station in 1923.

D. Ward Pease, research engineer for the A. B. Dick Co. for 18 years, has been appointed assistant to the chairman of the electrical engineering department at Armour Research Foundation of Illinois Institute of Technology.

Harold C. Weingartner has been elected vice president and general manager of the equipment division of National Research Corp., Cambridge, Mass. He joined the Engineering Dept. of National Research Corp. in 1945, and he became chief engineer in 1946.

Ignatius Volpe has been named chief engineer of the Steelman Phonograph and Radio Co., Inc. He has been associated with the Air King Products Co., Minerva Radio Corp., and Jewel Radio.

Raymond S. Perry has been elected vice president and director of Federal Telephone and Radio Corp., Clifton, N. J., manufacturing associate of the International Telephone and Telegraph Corp.

Henry J. Arbeiter, chief engineer of Jerrold Electronics Corporation, Philadelphia, Pa., has been appointed also vice president of the company. He has been in charge of Jerrold engineering since the founding of the company, and has developed the Jerrold amplified television master-antenna systems for apartment houses, hotels, hospitals and stores, as well as entire communities.

Myer Fried, retired U.S. Army colonel with more than 20 years experience in military and aviation electronics, has been engaged by the RCA Service Co., Camden, N. J., as special advisor to P. B. Reed, vice president in charge of the government service division. He will assist in coordinating planning activities, field engineering, training of military personnel, technical publications, repair and modification of military electronics equipment, and other services to the military.

Robert Hertzberg, long active in the technical magazine field as writer, editor, and publisher, has established a consulting publications and public relations service for radio manufacturing and merchandising firms and their associated advertising agencies. Offices, photographic facilities, and experimental laboratory are at 2512 84th St., Jackson Heights 70, N. Y.

Dr. James F. Eversole has been appointed manager of research administration of Union Carbide and Carbon Corp. He will help co-ordinate the research activities of all of the corporation laboratories where basic research and development work is being done on alloys, chemicals, gases, carbons, and plastics.

TV Film Scanner

(*Continued from page* 45)

crease is less. This is because the low beam current does not produce sufficient redistribution by itself to allow an appreciable picture charge to develop, and the charge due to the intermittent irradiation with pulsed bias operation is much greater in relation to the beam redistribution. A correspondingly high efficiency could be obtained at high values of beam current if the pulsed irradiation was increased (so maintaining the same proportions of irradiation and beam current), but, as said before, it is not advisable to operate with very high bias values. In fact, low beam current operation is more important because of other advantages.

Fig. 4 expresses the relationship between signal output and scene brightness (measured by the average photocurrent) with various degrees of pulse technique for low beam current operation. It shows that the transfer-characteristic is very little changed if a medium degree of potential shift is applied. The excellent half tone rendition of the image iconoscope is preserved.

Memory Scanning

The necessary additions for a film scanner using "memory scanning" of an image iconoscope are indicated in Fig. 5, the main addition being the pulse generator driven by the master waveform generator. It produces suitable pulses of field frequency for the pulse light sources L_1 and L_2 and the collector, for which it is essential to ensure that the collector pulse is slightly longer than the duration of the pulse light flux, both periods, however, being sufficiently short to leave as long as possible for the picture projection within the field blanking interval. The design of the head amplifier requires some consideration as there are strong pulses during the charge and picture projection intervals (much greater in amplitude than the actual picture information), which have to be clipped to avoid overload. This can be carried out by diode arrangements, the residual level being cancelled by a suppression pulse in a mixer stage[5]. The main amplifier requires no comments; a simple line by line "clamp circuit" is sufficient to reinsert and hold the black level and to reproduce the average brightness of the picture faithfully.

The described investigations were carried out in the laboratories of Pye Ltd. and Cathodeon Ltd., both of Cambridge, England. The pulsed bias technique is incorporated in the

Photicon film scanning equipment as accepted by the British Broadcasting Corp.

1. R. L. Garman and R. W. Lee, "Image Tubes and Techniques in Television Film Camera Chains", Journal of the SMPTE, Vol. 56, January, 1951. The improved method is quoted on page 60.

2. R. Theile and F. H. Townsend, "Improvements in Image Iconoscopes by Pulsed Biasing the Storage Surface", Proc. I.R.E., to be published.

3. J. D. Mc Gee and H. G. Lubszynski, "EMI Cathode-ray Television Tubes", Journ. I.E.E. (London), Vol. 84, pp. 468-475, April, 1937.

4. H. Iams and G. A. Morton, V. K. Zworykin, "The Image Iconoscope", Proc. I.R.E., Vol. 27, pp. 541-547, September, 1939.

5. W. R. Cheetham, N. Q. Lawrence, R. Theile, "The Design of 16 mm Television Film Chain Employing Pulsed Bias Photicon Pick-up Technique", Journal of the SMPTE, to be published.

TV Color Tube

(*Continued from page* 39)

tory model, and probably would not have been presented at this time had not a leak of information to the press occurred. Due to the size of the electron gun assembly it was not possible to use a higher voltage on the tube and hence the brilliance was low. Also the linearity and resolution varied considerably, as different objects were shown.

The screen of the model shown was made by inscribing lines in the glass plate by hand and as a result they are not precisely straight. A photo-etching method offered by Eastman Kodak will enable the manufacturers to produce easier a screen with an infinitely finer resolution with perhaps as many as 100 groups of lines to the inch.

Readers who are familiar with the history and development of the tricolor tube may recall that the arrangement of verticle strips of phosphors is not unexplored.

A Signal Corps officer has a patent granted early in the war, Dr. Allen B. DuMont has patent Nos. 2,490,812 and 2,530,431 while L. C. Chesney has No. 44389 and Thornton Chase has 2529485 and 02307188 for similar methods. It is understood that the present tube differs in that all other multiple color tubes using a beam deflection system to provide color selection depend on switching the second anode supply. This introduces considerable problems in handling such voltages and deflection of a high velocity beam. By using a much lower voltage of around 350 volts on the control grid and swinging the two grid elements 350 v positive and negative with respect to ground, a relative voltage of 700 exists between the two elements. This method of color selection, plus the fact that pulse deflection is used in the tube proper gives rise to considerable optimism regarding the ultimate use of the tube.

MILITARY CONTRACT AWARDS

Manufacturers who have received contract awards for producing of radio-radar-electronic equipment for the Armed Services are listed below by name, city and equipment. Subcontractors interested in bidding on performance of any part of each contract should sell their services to these prime contractors. This list, which is current up to our press time, covers the period from Sept. 6 to Oct. 3.

Amplifiers

Gray Mfg. Co., Hartford, Conn.; Rauland-Borg Corp., Chicago, Ill.

Antennas

Heyer Products Co., Belleville, N. Y.; Modecraft Co., Brooklyn, N. Y.; Wind Turbine Co., West Chester, Pa.

Batteries

Burgess Battery Co., Freeport, Ill.; General Dry Batteries, Inc., Lakewood, Ohio; National Carbon Div., Union Carbide & Carbon Corp., N. Y. City; P. R. Mallory & Co., Battery Div., Tarrytown, N. Y.; Marathon Battery Co., Wausau, Wisc.; Manufacturers Battery Co., Madison, Wisc.; Nickel Cadmium Battery Corp., New York, N. Y.; Reading Batteries, Inc., Reading, Pa.; Specialty Battery Co., Madison, Wisc.; Union Carbide & Carbon Corp., N. Y. City; Willard Storage Battery Co., Cleveland, Ohio.

Cable Assemblies

The Daven Co., Newark, N. J.; General Electric Co., Bridgeport, Conn.; Graybar Electric Co., Philadelphia, Pa.; Kings Electronics Co., Tuckahoe, N. Y.; Mercury Engineering Corp., York, Pa.; Phelps Dodge Copper Products, New York City; Rockbestos Products Corp., New Haven, Conn.; Rome Cable Corp., Philadelphia, Pa.; Saratoga Plastics, Bellow Fall, Vermont; Simplex Wire & Cable Co., Cambridge, Mass.

Capacitors

Aerovox Corp., New Bedford, Mass.; Cornell-Dubilier Electric Co., S. Plainfield, N. J.; General Electric Co., Washington, D. C.

Coils and Transformers

Ashland Electric Co., Chicago, Ill.; Chicago Transformer, Chicago, Ill.

Connectors

Arey Machine Co., Hillside, N. J.; American Phenolic Corp., Chicago, Ill.

Converters

Varo Manufacturing Co., Garland, Texas; Wilcox-Gay Corp., Charlotte, Mich.

Crystals & Crystal Devices

L. L. Constantin & Co., Clifton, N. J.; Dallons Labs., Los Angeles, Calif.; Eugene Kral & Co., Jamaica, N. Y.; Standard Piezo Co., Carlisle, Pa.; Westline Electronics Co., Los Angeles, Calif.

Electron Tubes

Arcturus Electronics, Newark, N. J.; Bomac Laboratories, Inc., Beverly, Mass.; Central Sales & Mfg. Corp., Denville, N. J.; Robert Dollar Co., Redwood City, Calif.; Phelps Dodge Copper Products, British American Tube Div., N. Y. City; Radio Corporation of America, Harrison, N. J.; Raytheon Mfg. Co., Government Contracts Dept., Waltham, Mass.; Tung-Sol Lamp Works, Inc., Newark, N. J.; Victoreen Instrument Co., Cleveland, Ohio.

Indicators

Bendix Aviation Corp., Eclipse-Pioneer Div., Teterboro, N. J.; LaMar Aero Supply Corp., Clinton, Oklahoma; Robertshaw Fulton Controls Company, Greensburg, Pa.; Sperry Gyroscope Co., Long Island, N. Y.; U. S. Gauge Div., American Machine & Metals, Inc., Sellersville, Pa.; Ternstedt Div., General Motors Corp., Detroit, Michigan; Waltham Watch Co., Waltham, Mass.

Inverters

Jack & Heintz Precision Industries, Cleveland, Ohio; Leland Electric Co., Dayton, Ohio; Redmond Co., Inc., Owosso, Michigan.

Magnetrons
Raytheon Mfg. Co., Power Tube Div., Waltham, Mass.

Relays
Thomas Edison, Inc., West Orange, N. J.; Western Electric Co., New York, N. Y.

Resistors
Chicago Telephone Supply Co., Elkhart, Ind.; Hardwick, Hindle, Inc., Newark, N. J.; Herbach & Rademan, Inc., Philadelphia, Pa.; International Resistance Co., Philadelphia, Pa.; Ohmite Mfg. Co., Chicago, Ill.

Power Supplies
Alliance Mfg. Co., Alliance, Ohio; Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J.; Electro-Engineering Products Co., Chicago, Ill.; The Electric Products Co., Cleveland, Ohio; FADA Radio Corp., Bellsville, N. J.; John R. Hollingsworth Corp., Clifton Heights, Pa.; Jack & Heintz Precision Industries, Cleveland, Ohio; Jacobsen Mfg. Co., Racine, Wisconsin; Kohler Co., Kohler, Wisconsin; Motoresearch Co., Racine, Wisconsin; Penn Boiler & Burner Mfg. Corp., Lancaster, Pa.; R. H. Sheppard, Hanover, Pa.; United States Motors Corp., Oskosh, Wisconsin.

Radar & Radiosondes
Friez Instrument Div., Bendix Aviation Corp., Baltimore, Md.; Radio Corporation of America, RCA Victor Div., Camden, N. J.; Western Electric Co., N. Y. City.

Test Equipment
American Electroneering Corp., Los Angeles, Calif.; Munston Mfg. & Service, Inc., Long Island, N. Y.; Triumph Mfg. Co., Chicago, Ill.; Winslow Co., Newark, N. J.

Transmitters and Receivers
Admiral Corp., Chicago, Ill.; Barker & Williamson, Upper Darby, Pa.; Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J.; Emerson Radio & Phonograph Co., New York City; General Electric Co., Washington, D. C.; Mackay Radio & Telegraph Co., New York, N. Y.; Radiomarine Corp. of America, New York, N. Y.; Raytheon Mfg. Co., Waltham, Mass.; Utility Electronics Corp., East Newark, N. J.

Test Instruments

(*Continued from page* 63)

self-contained test instrument, and shows its operation as a system composed of fundamental building blocks.

Illustrations of this versatility can be drawn at length, and tend to become promotion, rather than description. An example, however, will serve to show typical possibilities. One of the high-frequency oscillators, plus a power supply, serves as an unmodulated general-purpose laboratory power source having reasonable power output and shielding. Add a fixed-frequency oscillator, and one has modulated power source. Add a mutual-inductance-type attenuator, a crystal rectifier, and a meter, and one has a standard-signal generator. Substitute a different oscillator, and one has a new frequency range. All these component items are available in forms which will inter-connect and plug together. The complete assembly will not, in many respects, do the job of a weldesigned singe-unit standard-signal generator. It will, however, make it possible to build up an instrument for rough work quickly and econonomically. It is hoped that the building-block concept will find a useful place in the modern laboratory.

W. R. G. Baker and N. Smith Receive IRE Awards

The IRE medal of honor will be conferred on Dr. W. R. G. Baker, GE vice president at the organization's annual convention in March, 1952.

In announcing the award, the IRE's board of directors cited Dr. Baker for his "early technical contributions to the radio transmitter art, his long sustained and effective leadership of institute and industry engineering groups and his outstanding service to the Institute."

Dr. Baker is treasurer of the Institute, chairman of its professional groups committee and a member of its board of directors. He also is chairman of the National Television Systems Committee of the RTMA.

Dr. Newbern Smith, Chief of the Central Radio Propagation Laboratory of the National Bureau of Standards in Washington, D. C., has been named the recipient of the 1952 Harry Diamond Memorial Award.

$21 Billion Awarded by U. S. to Prime Contractors

Over $21 billion in prime contracts were awarded by the Department of Defense during the ten-month period from July, 1950 to May, 1951. New York state manufacturers received 13.8% of the total with $3.8 billion worth of government business. Manufacturers of six other states received contracts which totalled a billion dollars or more: California, $2.8 billion; Michigan, $1.6 billion; Ohio, $1.4 billion; Indiana, $1.3 billion; Connecticut, $1.2 billion; and Illinois, $1.03 billion.

New York's share was almost evenly divided among the services: Army, $1.2 billion; Navy, $1.3 billion; Air Force, $1.2 billion. The value of Air Force contracts were higher than those of sister services in California and Indiana. Army led the field in Illinois and Michigan and the Navy spent 75% of the contract-dollar total in Connecticut.

Rome (N.Y.) Air-Radio Center

Development and testing of electronic air-ground systems for the Air Force is currently being conducted at the Rome Air Development Center, Griffiss AFB, Rome, N. Y., which is now carrying on all of the activities of Watson Laboratories, transferred to Rome early this year.

Ralph I. Cole is technical director of the Electronic Development Div. at Rome. The holder of several patents concerning improvements in radio direction-finding systems and special radio components, Cole was instrumental in the development of the first modern tank radio using such components as radio receiver BC312. The Rome Air Development Center (RADC) is one of the centers assigned to the new Air Research and Development Command whose headquarters are in Baltimore, Md.

Audio Fair Program, Nov. 1-3

The third annual Audio Fair is scheduled for Nov. 1-3 at the Hotel New Yorker in New York City, and some 15,000 audio engineers and enthusiasts are expected to attend. Approximately 100 manufacturers and exhibitors will display their latest products. The exhibits open at 9:30 AM each morning and close at 6 PM on Thursday, 9 PM on Friday, and 4 PM on Saturday. The annual banquet will start at 6:30 PM on Thursday; Nov. 2.

Technical sessions of the Audio Engineering Society will feature more than a dozen interesting and timely papers on various phases of the art.

Among the papers to be presented are:

"Problems of Ultra-Speed Recording Technique", C. J. LeBel, Audio Instrument Co.; "Magnetic Recording Equipment for Motion Picture Production", Bruce Denny & Wm. L. Thayer, Paramount Pictures, Inc.; "Modern Recording Installation That Emphasizes Tape", W. O. Summerlin, Audio-Video Recording Co., Inc.; "An Artificial Reverberation Generator", Lewis S. Goodfrieind, Audio Facilities Corp.; "Magnetic Tape Recording for Instrumentation and Data Storage", Kenneth B. Boothe, Audio & Video Products Corp.; "Loudspeaker Enclosures", Daniel J. Plach & Philip B. Williams, Jensen Manufacturing Co.; "Multiple-Speaker Systems", Harry F. Olson, RCA Laboratories, Inc.; "Design Principles, as applied to radio and loudspeaker cabinets", Jeff Markell, New Horizons Furniture,

Inc.; "New Amplifier Design", Herbert I. Keroes, Acro Products Co., Philadelphia; "Industrial Sound Systems", H. S. Morris, Altec Lansing Corp.; "Transistors in Audio Use", Bell Telephone Laboratories; "Magnetic Amplifiers for Audio Applications", Bu Ships, U.S. Navy.

On 45th Anniversary, Sarnoff's Three Challenges

Commemorating Gen'l David Sarnoff's 45 years in radio, RCA's Princeton Laboratories have been renamed the "David Sarnoff Research Center".

In accepting the honor, Gen'l Sarnoff told the laboratory scientists he would like to see them accomplish three more inventions before his 50th anniversary:

1. A true photo-amplifier that could produce bigger and brighter pictures in fine detail, as sound can be amplified.

2. A TV picture-recorder that will record video signals on an inexpensive tape, as sound is now recorded.

3. An electronic air-conditioner for the home, operating with tubes or the action of electrons in solids, and without moving parts.

"Electrons in solids offer tremendous possibilities," said Gen'l Sarnoff, "and I bid you to harness them to work in 'solid comfort,' instead of subjecting them to red-hot heat. Indeed, cold electrons are a great challenge, the promise of which is already manifested in tiny transistors, now being developed for use as detectors and amplifiers in radio, wire and cable communications. You have succeeded in throwing away the spinning wheels in television, and I am sure you will also succeed in discarding the wheels and noise in air-conditioners."

Members of "Eighth" TV Technical Training Program view 850 MC, audio and video, coaxial UHF-TV antenna feeders at Bridgeport, Conn. Program, sponsored by RCA Engineering Products Dept., was attended by more than 80 broadcasters plus Signal Corp and Air Force personnel. More than 40 RCA and other outstanding broadcast engineers served as instructors to acquaint students with the very latest in TV broadcast operation techiques. Persons attending course also received copy of new $8.00 TV training manual which has just become available. Authoritative 6th edition contains up-to-date theory and equipment data on transmitters, antennas, video, and audio.

Ceramic Capacitors

(*Continued from page 57*)

after the application of a fixed dc voltage. This effect is easily observed when testing for leakage resistance on a megohm meter where a high K capacitor will take longer to reach an equilibrium resistance reading than a capacitor containing a normal dielectric and having a capacitance equal to that of the high K capacitor. Here again the time to attain full charge is larger below than above the Curie point. The fact that ferroelectric domains exist below the Curie point allows these time effects to be attributable to ferroelectric domain activity, that is, time, field and temperature dependent.

The frequency spectrum inside of which the high K titanate capacitors will function extends from dc to an upper frequency limit of around 300 MC where the K begins to drop, reaching values of about 150 at 800 MC. The power factor increases rapidly in this region and the ferroelectric properties disappear.

Size data for high K ceramic coupling and bypass capacitors is given in Table II. The capacitors are in the form of rectangular plates with a length to width ratio of about 4 to 3. Tinned copper leads extend out from the longer edge. The configuration of the plate and position of the leads can be changed to suit special applications.

Specifications for High K Coupling and Bypass Ceramic Plate Capacitors

Capacitance: Capacity shall be within the specified tolerance when measured at 1 KC at 5 to 8 volts rms and at 25°C. After life and humidity test maximum capacity changes 20%.

Voltage: Flash tested at three

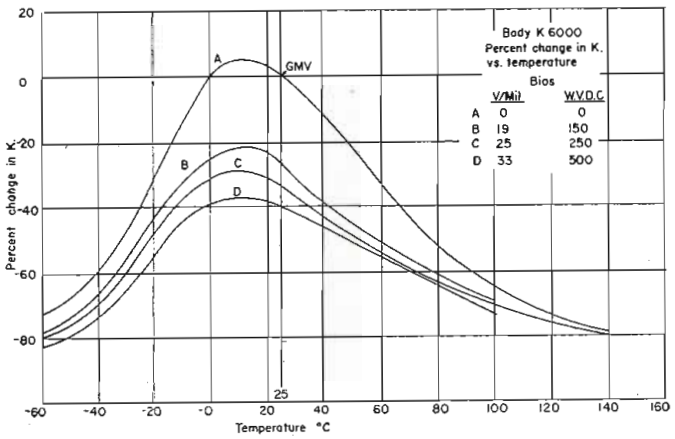


Fig. 9: (left) Body K 6000. Percent change in K vs temperature

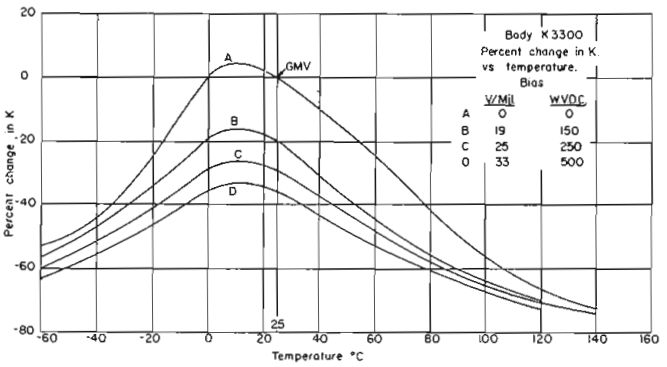


Fig. 10: (Right) Body K 3300. Change in K (%) vs temperature

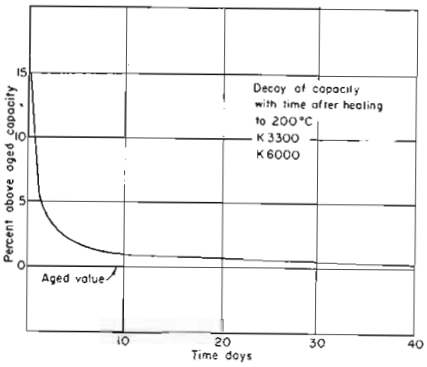


Fig. 11: Decay of capacity with time after heating to 200°C, K 3300 and K 6000

times rated dc voltage for one second through a resistor of not less than 30,000 ohms. Capacitor shall also pass this test after life and humidity tests.

Power Factor: The power factor shall not exceed 2.5% when measured at 1 Kc at 5 volts rms at 25°C. The power factor shall not exceed 5% after life and humidity tests.

Insulation Resistance: The insulation resistance shall exceed 10,000 megohms. After life and humidity tests the insulation resistance shall exceed 1,000 megohms.

Humidity Test: Capacitor shall be subjected to a temperature of 40°C and a relative humidity of between 90% and 95% for 100 hours.

Life Test: The capacitor shall be held at 85°C with 200% of rated dc voltage applied for 1000 hours.

Specifications for Temperature Compensating Ceramic Plate Capacitors

(Described in Part One)

Capacitance: Capacitor shall be within the specified tolerance. Nominal capacity of 1000 mmf or less measured at 1 Mc. Nominal capacity more than 1000 mmf measured at 1 Kc. After life and humidity tests maximum capacity change 2%.

Voltage: Flash tested at three times rated voltage for one second through a resistor of not less than 30,000 ohms. Capacitor shall pass this test after life and humidity test.

Q and Power Factor: The Q shall exceed 650 except for capacity values less than 30 mmf. The power factor shall be less than 0.14%. Q shall exceed 350 after life and humidity tests.

Insulation resistance, humidity test and life test same as above.

2. A. I. Dranetz, G. N. Howatt, J. W. Crownover, "Barium Titanates as Circuit Elements", Part I, TELE-TECH, April, 1949, p. 29
   A. I. Dranetz, G. N. Howatt, J. W. Crownover, "Barium Titanates as Circuit Elements", Part II, TELE-TECH, May, 1949, p. 28
   A. I. Dranetz, G. N. Howatt, J. W. Crownover, "Barium Titanates as Circuit Elements", Part III, TELE-TECH, June, 1941, p. 36

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THE WALL STREET JOURNAL
Friday, September 28, 1951

Westinghouse Air Brake Acquires Melpar Stock

Westinghouse Air Brake Co. has acquired all the stock of **Melpar, Inc.,** of ALEXANDRIA, VA., and CAMBRIDGE, MASS.

Melpar has prime contracts with the armed services covering the fields of sonar, radar, communications, guided missiles, computers and miniaturization. The new owners plan a "large expansion program" geared to meet increasing demands by the armed services, according to Edward O. Boshell, chairman and president of Westinghouse. He described the purchase as "an important step in our expansion program."

The Westinghouse expansion program is directed toward permanent peace time growth in industrial electronics.

OPPORTUNITIES FOR YOU

exist in the expansion program outlined above if you have experience in one or more of the following fields:

COMPUTERS
TELEMETERING
RADAR BEACONS
SUB-MINIATURIZATION
MICROWAVE RECEIVERS
MICROWAVE TRANSMITTERS
MILLIMICROSECOND PULSE CIRCUITS
RESEARCH IN UNDERWATER SOUND SYSTEMS

Send resume to
Personnel Director

MELPAR, INC.

452 Swann Ave., Alexandria, Va.

BENDIX RADIO DIVISION

Bendix AVIATION CORPORATION

TV RECEIVER DESIGN ENGINEERS —Progressive TV Design Section has excellent opportunity for highly experienced men with proven ability. Desirable openings also available for promising young engineers. We will be pleased to discuss salaries at all levels.

ELECTRONICS ENGINEERS — At all salary and experience levels.

RESEARCH ON: Antennae, Servomechanisms, Microwave ccts. and other phases of communications and navigation equipment.

PRODUCTION DESIGN OF: Military and commercial communications and navigation equipment.

FIELD ENGINEERS — Supervise installation and maintenance of radio and radar equipment. Factory training will be given. Base salaries from $4200 to $6900 per year. 25% bonus for time spent overseas. Traveling and living expenses paid by Bendix. Insurance plan.

TEST AND INSPECTION ENGINEERS — Practical knowledge of radio, radar, or TV manufacturing processes. Good knowledge of radio fundamentals essential. Base salaries from $3900 to $5880.

TECHNICAL WRITERS — Knowledge of radar fundamentals or radio required. Work closely with engineers to gather material for instruction and maintenance manuals. Base salaries from $3400 to $4300.

LABORATORY TECHNICIANS — Require knowledge of radio fundamentals and skill in use of measuring instruments and laboratory equipment. Previous industrial experience essential. Salaries from $262 to $321 per month.

BASE SALARIES FOR ALL POSITIONS LISTED ABOVE ARE SUPPLEMENTED BY UP TO 30% FOR REGULARLY SCHEDULED 48-HOUR WEEK.

Housing is no problem in Baltimore.

Excellent group insurance and family hospitalization plan.

Attractive retirement plan for professional personnel.

Write for application:

Engineering Personnel Supervisor
Department T
BENDIX RADIO DIVISION of
Bendix Aviation Corporation
Baltimore 4, Maryland
TOwson 2200

BULLETINS

Microwave Test Equipment

A new line of microwave test equipment covering the 2.6 to 90 KMc/sec range in 12 waveguide sizes has been developed by the De Mornay-Bonardi Corp. and manufactured by the Microwave Div. of the Calnevar Co., 1732 W. Washington Blvd., Los Angeles 7, Calif. Every item operates over the entire band of frequencies allocated to the corresponding waveguide size without critical adjustments. All instruments meet the applicable JAN specifications.

Magnetic Recording

Reeves Soundcraft Corp., 10 E. 52nd Street, New York, N. Y., has issued a new bulletin describing "Magnastripe", a newly developed coating of magnetic oxide bonded in a narrow stripe on motion picture film. This stripe permits magnetic recording and reproducing on all types of safety film ranging from 8 mm to 35 mm in size. It is chemically inert and film processing has no effect on the magnetic stripe. Recordings may be made either before or after the film is exposed.

Recording Oscillograph

The 5-114 recording oscillograph, a multichannel, precision instrument for the analysis and measurement of strain, vibration, pressure, acceleration and other phenomena, is the subject of a fully illustrated technical bulletin just published by Consolidated Engineering Corp., 300 N. Sierra Madre Villa, Pasadena, Calif.

Screen-Booth Filters

Tobe Deutschmann, 921 Providence Highway, Norwood, Mass., has just issued the first section of its proposed new complete catalogue. Identified as Catalogue No. 201, it covers the Tobe Screen-Booth line.

Terminal Blocks

Kulka Electric Mfg. Co., 633 S. Fulton Ave., Mount Vernon, N. Y. has just published a new bulletin describing the company's line of molded barrier type terminal blocks. They are made in four sizes and several styles.

Potentiometers

Helipot Corp., South Pasadena, Cal., has issued an attractive three-color catalog which shows the facilities of the two Helipot factories given over to potentiometer manufacture. Twenty product pictures and more than that number of charts, diagrams and drawings amply illustrate the potentiometer catalog. Data tables, a comprehensive index, general specifications and other information make it considerably more than "just a catalog".

Parts Catalog

Radio Shack Corp., 167 Washington St., Boston S. Mass., 29-year-old parts distributor, has just issued the largest industrial mail-order catalog of its entire history.

Tantalytic Capacitors

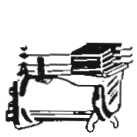
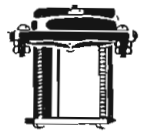
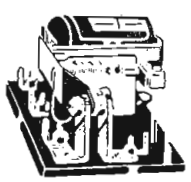
A G-E booklet on Tantalytic capacitors has been announced as available from the General Electric Company, Schnectady 5, N.Y. Designated as Bulletin GEC-808, it describes the features of the equipment, its application and operation. Tantalytic capacitors are designed for low-voltage, dc applications where very small size, light weight, long operating- and shelf-life are major considerations. They are rated 0.1 to 50 muf, 150 volts dc, and have an operating temperature range of —55 to +85 C, with a maximum loss of only 35 per cent capacitance at —55 C.

Tele-Tech

Advertisers - November 1951

While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.

RELAYS FOR EVERY PURPOSE

Over a Million in Stock!

Each relay is brand new, standard make, inspected, individually boxed and fully guaranteed.

The following list represents only a portion of our relay stock. Write or wire us for information on types not shown.

STANDARD DC TELEPHONE RELAYS

Stock No.	D.C. Voltage	Ohmage	Contacts	Unit Price
R-806	115*	900	1A	$2.05
R-161	6	10	2B & 1A	1.10
R-100	24	600	2A & 1C	2.45
R-518	85/125	6500	1C	3.60
R-633	180/350	10,000	1C & 5 Amps. Oct. Skt.	2.90
R-667	6	.75	1B/10 Amps. 1A/3 Amps.	2.45
R-632	6	12	5A & 1C	1.45
R-154	6/12	200	1A	1.25
R-517	12	250	2A	1.50
R-116	85	3000	1B	1.50
R-631	100/125	3300	2A	3.05
R-545	110/250	7000	1C	1.90
R-124	300	12,000	1A	2.45
R-160	6	12	3C & 3A	1.55
R-591	6	40	1B & 1C	1.30
R-155	12	100	4A & 4B	1.35
R-520	200/300	14,000	2C	1.45
R-159	6	50	2A	3.45
R-158	6	50	4A	1.35
R-576	12	200	2A	1.35
R-153	12	200	1C & 1A	1.55

SHORT TELEPHONE RELAYS

R-635	12	100	1C & 1A	$1.35
R-648	12	170	1E	1.35
R-826	12	150	2C, 1B	1.55
R-770	24	150	1A/10 Amps.	1.45
R-771	24	200	1A/10 Amps.	1.45
R-603	18/24	400	2A	1.55
R-575	24	500	2C	2.40
R-764	48	1000	2C & 2A	2.00
R-563	60/120	7500	1A	1.70
R-801	115*	——	None	1.45
R-213	5/8*	——	2A	3.10
R-589	12	125	2A	1.30
R-113	12	150	4A	1.55
R-689	12/24	255	1C	1.55
R-799	24	500	None	1.00
R-115	24	500	1C	1.70
R-110	24/32	3500	1C	1.70
R-121	150	5000	2A & 1C	2.05
R-634	150/250	6000	1A & 1B	2.45
R-800	12	150	2C & 1A	1.55
R-537	12/24	150	2C & 1B	2.00
R-750	24	400	1A	1.60

CONTACTORS

R-188	24	200	1A/75 Amps.	$3.70
R-183	24	60	1A/50 Amps.	3.45
R-187	24	100	1A/50 Amps.	3.70
R-554	24	85	2A/100 Amps.	5.90
R-788	100*	——	3B & 2A	5.45
R-682	115*	35	5A/10 Amps.	6.10
R-767	24*	20	2A/10 Amps.	4.95
R-180	12	25	1A/50 Amps.	4.05
R-657	24	50	4A/100 Amps.	6.95
R-265	24	60	1A/100 Amps.	3.45
R-535	24	70	1A/100 Amps.	4.80
R-556	24	70	1A/100 Amps.	4.80
R-557	24	100	1A/50 Amps.	3.85
R-178	24	100	1A/100 Amps.	4.80
R-727	10	20	1A/20 Amps.	2.00
R-608	24	125	1A/200 Amps.	2.80
R-184	28	50	1A/100 Amps.	4.90
R-719	24	10	1A/200 Amps.	4.95
R-182	28	80	1A/25 Amps.	2.40
R-244	75*	265	1A/20 Amps.	2.20
R-659	12	7.2	2A/20 Amps.	1.70
R-552	24	70	4A/50 Amps.	5.35
R-185	24	100	1A/50 Amps.	3.45
R-186	24	132	1A/50 Amps.	4.35
R-817	24	150	1A/50 Amps.	3.45
R-534	14	45	1A/30 Amps.	2.05
R-223	28	150	1A/40 Amps./48 VDC.	1.70
R-680	6	3	1A/50 Amps.	3.90
R-677	6	3.5	1A/50 Amps.	3.90
R-532	6	15	1A/50 Amps.	3.90
R-676	12	16	1A/50 Amps. 1AUX/25A	3.90

ROTARY RELAYS

R-709	6/8	1	12 Pos. 3 Wafer	$3.90
R-197	9/16	70	2C	2.05
R-713	9/14	125	1C & 1A	2.05
R-616	28	7	5B & 1A	2.40
R-712	24	200	2B	2.05
R-711	24	200	2C & 1B	2.05
R-573	28	200	1C & 1B	2.05
R-766	24	230	12 Pos. 8 Deck	4.90
R-809	28	7	1B & 12 Pos.W/ 7" Shaft for Wafers.	2.45

DIFFERENTIAL RELAYS

R-208	120	2000	2C/3 Amps.	$2.45
R-209	220/250	8000	1C/3 Amps.	3.10

SEALED RELAYS

R-658	6	35	2C/Octal Plug	$3.45
R-125	24	300	2C/Octal Plug	3.45
R-261	12/24	1900	1C/5 Pin Plug	3.75
R-673	48/150	7500	1C/5 Amps.	2.80

VOLTAGE REGULATORS

R-745	6	2	1A/10 Amps.	$1.05
R-780	24	350	1C/6 Amps.	1.05
R-509	6/12	35	1B/2 Amps.	1.05

SPECIAL RELAYS

R-503	12/32	100	3A, 2C	$13.50
R-749	600	——	Max. 28 Amps.	7.45
R-804	550*	——	1B/38 Amps.	4.35
R-250	115*	——	Adj. Cir. Bk.-.04-.16A	17.50
R-579	220*	——	1B	8.70
R-294	27.5	200	1B	5.35
R-686	115*	——	2C	6.10
R-246	115*	——	1B	11.20
R-246A	115*	——	1A	11.20
R-611	24*	——	1A/30 Amps.	5.35
R-283	12	125	1C/10 Amps.	4.35
R-614	18/24	60	1A/15 Amps.	4.35
R-245	12	25	4" Micalex Lever	3.20
R-527	6/12	50/50	In Series	1.20
R-544	12/24	60/60	1C	2.05
R-255	——	——	1A	3.50
R-669	75*	400 Cy.	1B, 1A	1.20

KEYING RELAYS

R-714	9/14	65	2C/5 Amps.	$1.55
R-850	12	450	1A/1.5 Amps.	1.50
R-721	18/21	290	2C/5 Amps.	1.55
R-694	24	300	1A/5 Amps.	1.50
R-935	28	1000	1C/1.5 Amps	1.65
R-949	2.4*	60 Cy.	1A/5 Amps.	1.95
R-704	2/6	.25	2B/5 Amps.	1.35
R-173	2/6	2	1A	3.00
R-280	6/8	77	1A Dble. Brk.	2.45
R-647	6/12	15	1B/20 Amps.	1.45
R-273	20	160	2A/15A Dble. Brk.	3.55
R-100	24	200	1A	2.45
R-570	24	230	1B Dble. Brk.	2.70
R-960	24	230	3C/15 Amps.	2.95
R-529	24/48	1020	2C	3.10
R-715	24	——	2C Ceramic	3.70
R-584	6	20	1A Dble. Brk.	1.30
R-192	12	44	3C/10 Amps.	1.70
R-204	12	66	2A	1.45
R-224	12	85	1A	1.45
R-221	18/24	5000	1A	2.00
R-205	24	260	2C	1.55
R-891	24	475	1C/5 Amps.	1.45
R-536	27	230	2C	1.55
R-488	27.5	250	1A Dble. Brk.	1.45
R-433	6.5	1300	2C	3.05
R-220	75	5000	1C	1.50
R-528	6/8	42	1A	1.50
R-627	115*	——	1B Dble. Brk.	3.10
R-754	24	150	3C/10 Amps.	1.30
R-598	28	185	2C	1.30
R-622	20/30	200	3A & 2C/10 Amps.	1.45
R-274	24*	——	2A	1.55
R-855	110*	60Cy	160 1A Dble. Brk/15A	3.25
R-277	12	30	2C-D Break Cera	2.20

MIDGET RELAYS

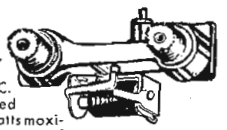
R-572	24	256	1C	$1.25
R-857	24	260	1 Make Before Make	1.75
R-912	4/5	20	3A-1C Ceramic	2.50
R-291	6	5	1A	1.25
R-921	6.7	18	1A Dbl.Brk.@10 Amp.	1.45
R-738	12	60	3A	1.20
R-922	12	75	1A Dbl.Brk.@10 Amp.	1.45
R-144	12	228	1A	1.45
R-145	18/24	250	2A Ceramic	1.45
R-298	21	300	1A	1.25
R-296	21	300	1A	1.25
R-586	21	300	1A & 1C	1.25
R-137	24	300	1C	1.45
R-142	24	400	2C	1.50
R-785	24	200	2C/10 Amps.	2.00
R-607	24*	——	1A	1.20
R-606	24*	——	1A & 1B	1.20
R-605	24*	——	3A	1.20
R-728	6	30	1A	1.25
R-149	6/8	45	1B	1.50
R-732	12	120	1A	1.45
R-281	12	126	2A	1.25
R-818	18/24	300	1B	1.30
R-135	24	250	1B	1.45
R-133	24	300	None	.75
R-138	24	300	4A	1.45
R-132	24	300	2C	1.50
R-731	24	300	2C	1.55
R-292	24	350	1C	1.25
R-626	24	400	1A/5 Amps.	1.55
R-786	60	1300	2C	2.00
R-588	90/125	6500	4C	2.70
R-755	24	300	1A	1.45
R-150	6	30	1A	1.50
R-893	14	150	1A, 1C	2.50
R-895	14	150	2A, 1B, 1C	2.50

SPECIAL RELAYS—Cont'd

R-660	6	——	3/8" Stroke	$1.20
R-651	24	100	Solenoid Valve	3.10
R-295	12	275	Annunciator Drop	2.70
R-230	5/8	2	2A, 1C	2.70
R-813	12	12	Wafer	5.35
R-275	12	750	1A, 1B, 1C	3.45
R-716	24	70	2A/5 Amps.	1.80
R-620	6/12	35	2C, 1A	1.30
R-629	9/14	40	1C/10 Amps.	1.55
R-720	24	50	2C Ceramic	1.70
R-500	12	10/10	2C/6 Amps.	3.55
R-816	12	10/15	2C/6 Amps.	3.55
R-524	24**	——	——	1.20
R-566	115* Coil Only			1.00
R-710	—— 150 Coil Only			.75

*AC. **AC/DC.

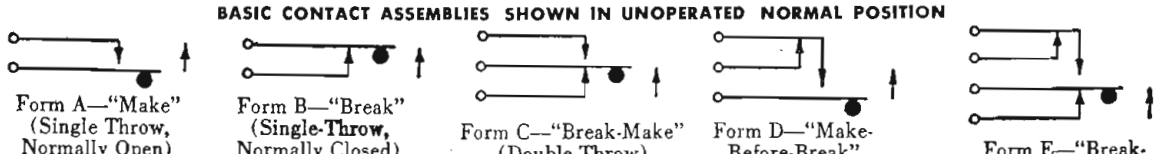
SPECIAL!



CO-AXIAL RELAY

D153766 SPDT, 6 VDC. 19 Ohm coil. Designed to accommodate 75 watts maximum. Perfect for all types of antenna switching. Designed for using standard 83-1SP coaxial fittings. Part of RAX-1 equipment. No. R-846—**$6.95** Ea.

BASIC CONTACT ASSEMBLIES SHOWN IN UNOPERATED NORMAL POSITION



Form A—"Make" (Single Throw, Normally Open)

Form B—"Break" (Single-Throw, Normally Closed)

Form C—"Break-Make" (Double-Throw)

Form D—"Make-Before-Break"

Form E—"Break-Make-Before-Break"

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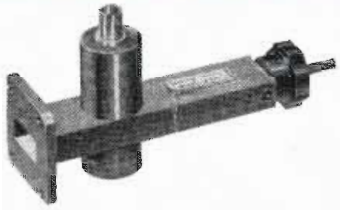
MICROWAVE POWER MEASUREMENTS

COMPLETE COVERAGE! 10 to 12,400 mc!

Instantaneous, direct readings! No adjustment during operation! No tedious computations! Complete new instrumentation for fundamental measurements of CW or pulsed power!

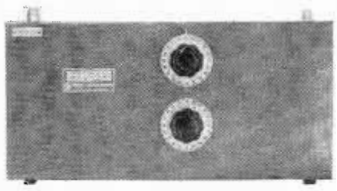
Instrument	Frequencies—Coaxial	Frequencies—Waveguide	Price (f. o. b. Factory)
475B Tunable Bolometer Mount	1,000 to 4,000 mc		$200.00
476A Untuned Bolometer Mount	10 to 1,000 mc		$125.00
S485A Detector Mount*		2,600 to 3,950 mc	$125.00
G485B Detector Mount †		3,950 to 5,850 mc	$95.00
J485B Detector Mount †		5,850 to 8,200 mc	$90.00
H485B Detector Mount †		7,050 to 10,000 mc	$85.00
X485B Detector Mount †		8,200 to 12,400 mc	$75.00
430B Microwave Power Meter	For use at any microwave frequency. Operates with mounts listed above.		$250.00

*For use with bolometer only. †For use with bolometer or crystal.



-hp- 485 Detector Mounts

For rf power measurements in wave guide systems, 2,600 to 12,400 mc (see table) in conjunction with -hp- 430A or 430B Power Meter and Sperry 821 barretter. Also may be used to measure relative level, or detect rf energy using a type 1N21 crystal. Semi-tuned by means of a built-in movable short.



-hp- 475B Bolometer Mount

Tunable from 1,000 to 4,000 mc for universal application, greatest convenience in making microwave power measurements. Double-stub design, coupling energy from 50 ohm coaxial systems into 100 or 200 ohm bolometers. Uses Sperry 821 barretter, thermistor or 1/100 ampere instrument fuse.

New! -hp- 430B Microwave Power Meter—measures pulsed or CW power—.02 to 10 mw

Model 430B gives you *instantaneous* rf power readings *direct* in db or mw at any frequency. (Operates with bolometer mount. Table at left shows -hp- mounts now available.) Measures CW power with instrument fuse or barretter as bolometer element; also measures CW or pulsed power using negative temperature coefficient thermistor at 100 or 200 ohm levels. Reads power direct .02 to 10 mw or in dbm from −20 to +10. 5 ranges selected on front panel switch. Accuracy ±5% of full scale. Higher powers may be measured by adding attenuators (-hp- Models 370, 380) to rf system. Directional couplers may be used to sample rf energy.

New! -hp- 476A Universal Bolometer Mount

Requires no tuning, no adjustment; measures rf power at any frequency 10 to 1,000 mc. Extremely low VSWR: Less than 1.15, 20 to 500 mc; less than 1.25, 10 to 1,000 mc. Reflected power less than 0.1 db under normal conditions. In combination with -hp- 430A or 430B Power Meter gives automatic, instantaneous readings from 0.02 to 10 milliwatts. Measures higher power with addition of attenuators and directional couplers. 50 ohms impedance. Has Type N connector and terminates flexible cables RG8/U, RG10/U, etc.

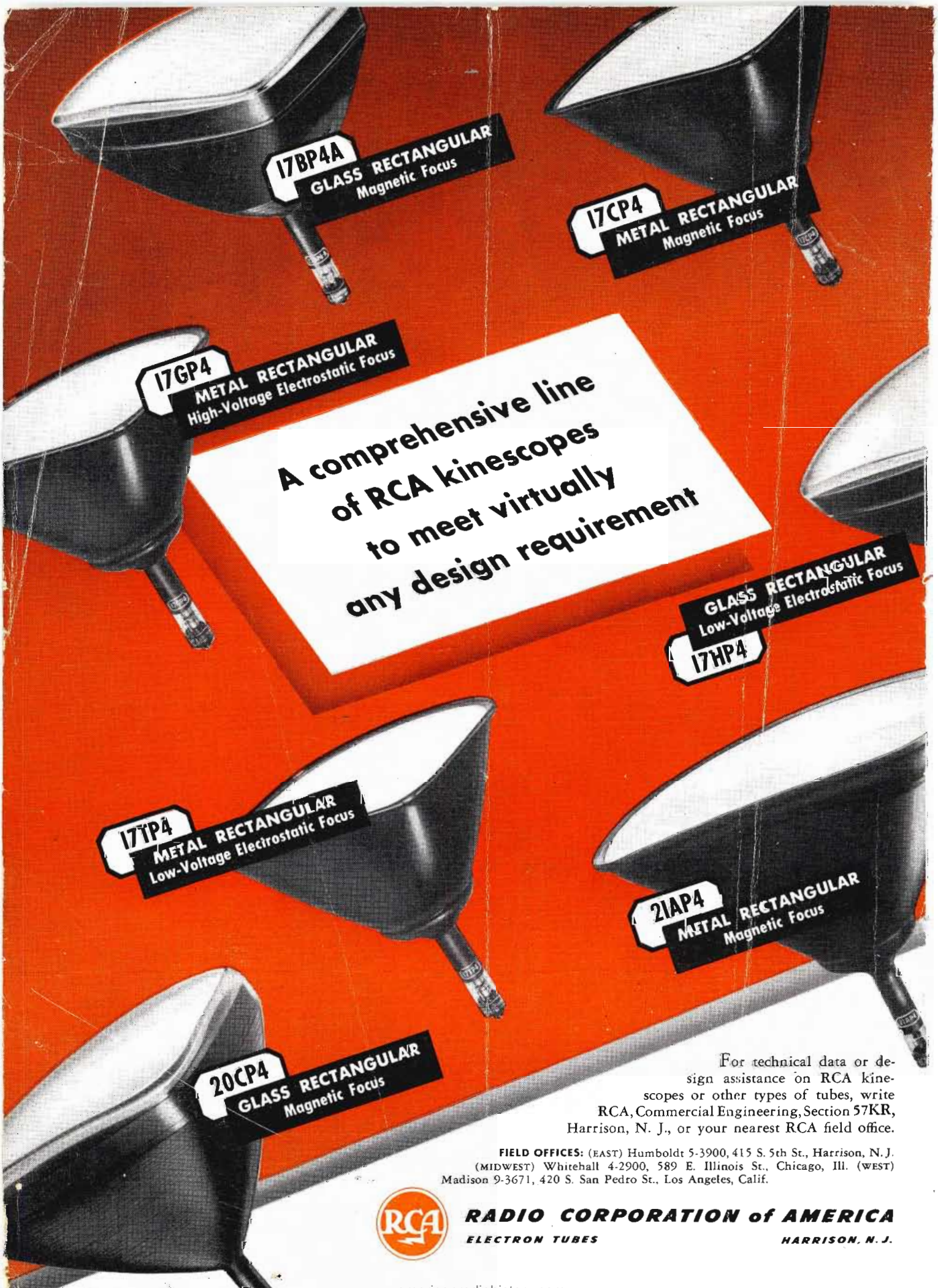
Get complete information! See your local -hp- representative or write to factory.

HEWLETT-PACKARD COMPANY

2161-T PAGE MILL ROAD • PALO ALTO, CALIFORNIA, U.S.A.

Export: Frazar & Hansen, Ltd., San Francisco, New York, Los Angeles

HEWLETT-PACKARD hp INSTRUMENTS



For technical data or design assistance on RCA kinescopes or other types of tubes, write RCA, Commercial Engineering, Section 57KR, Harrison, N. J., or your nearest RCA field office.

FIELD OFFICES: (EAST) Humboldt 5-3900, 415 S. 5th St., Harrison, N.J. (MIDWEST) Whitehall 4-2900, 589 E. Illinois St., Chicago, Ill. (WEST) Madison 9-3671, 420 S. San Pedro St., Los Angeles, Calif.

RADIO CORPORATION of AMERICA
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