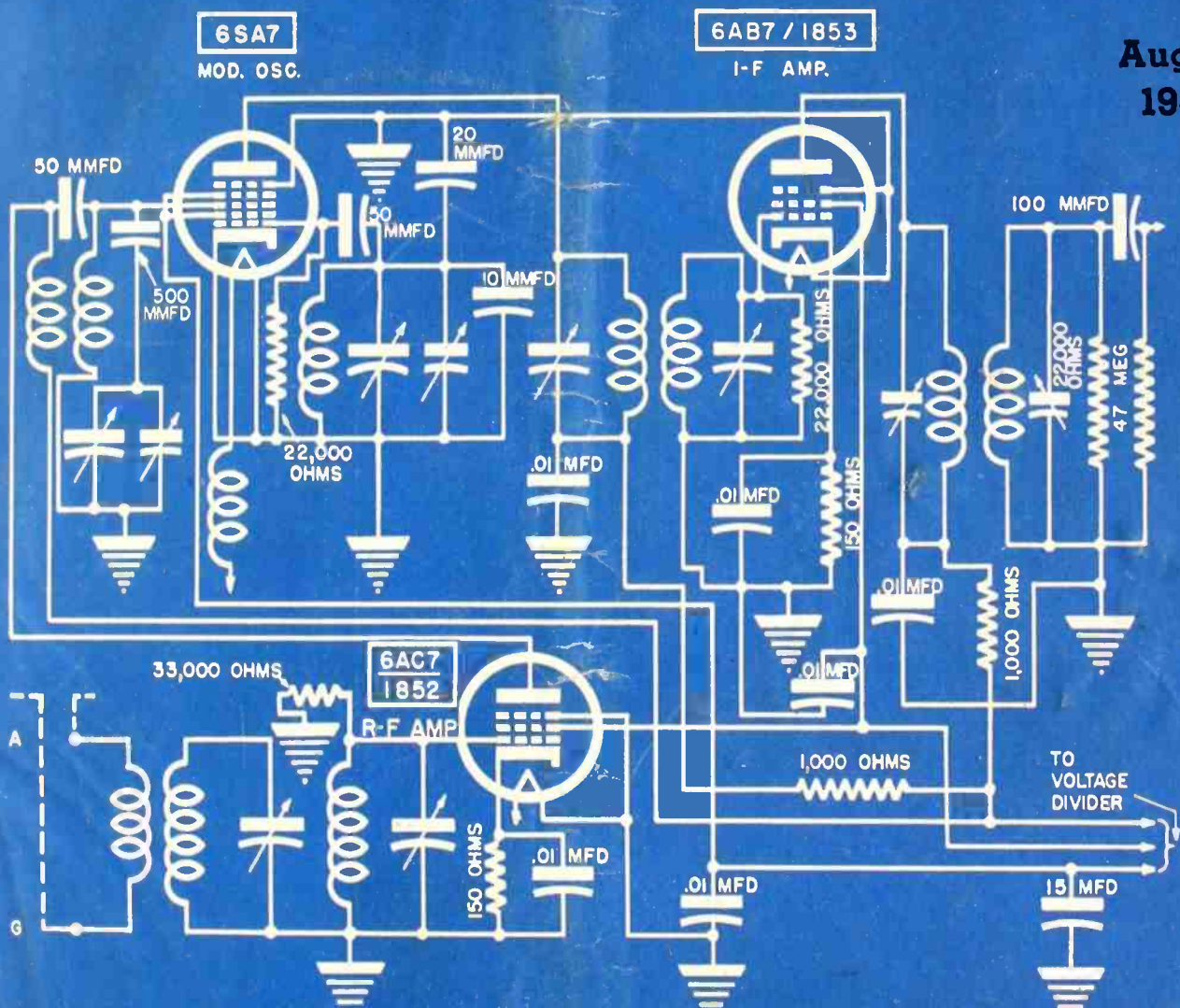


# SERVICE

August  
1945



Fixed tune r-f amplifier, modulator-oscillator and first i-f stage of a 7-tube i-m receiver. (See page 43.)





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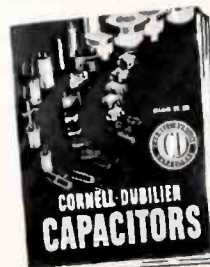
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# KEN-RAD

OWENSBORO, KENTUCKY



# EDITORIAL

WITH peacetime here at last and production of receivers, accessories and components in full swing, the Service Man faces a hectic series of months. According to plan, over 3,000,000 sets will be produced before Christmas. Most of these will be of the a-m and a-m/f-m type. Television and special f-m sets will also be made but not in any great quantities.

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A Monthly Digest of Radio  
and Allied Maintenance

Reg. U. S. Patent Office

Vol. 14, No. 8

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Editorial Director

ALFRED A. GHIRARDI

Advisory Editor

F. WALEN

Managing Editor

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Bryan S. Davis, President

Paul S. Weil, Vice Pres.-Gen. Mgr.

James C. Munn, 10515 Wilbur Avenue, Cleveland 6, Ohio: Telephone SWEETbriar 0052

Pacific Coast Representative: Brand & Brand, 816 W. Fifth St., Los Angeles 13, Calif.: Telephone MICHigan 1732

A. Goebel, Circulation Manager

F. Walen, Secretary

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# To Save Life

## RAYTHEON TUBES ARE USED IN NEW ELECTRONIC STETHOSCOPE

The conventional "acoustic stethoscope," used by doctors since the horse-and-buggy days, now gives way to a revolutionary electronic stethoscope called the "Stethetron."

Human lives are saved by making diagnosis easier and more accurate with the "Stethetron" made by The Maico Company, Inc. Of particular interest to you is that miniature Raytheon High Fidelity Tubes are used in this remarkable device because of their complete dependability and precision performance.

This is just one more example of the superiority of Raytheon Tubes—the line that you should feature to give your customers the best possible service.

Feature Raytheon Tubes now—for greater profits—and watch for the Raytheon merchandising program designed especially for established radio service dealers who want to lead the field in postwar volume in their communities.

*Increased turnover and profits, plus easier stock control, are benefits which you may enjoy as a result of the Raytheon standardized tube type program, which is part of our continued planning for the future.*

**Raytheon Manufacturing Company**

RADIO RECEIVING TUBE DIVISION

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# EDITORIAL

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Bryan S. Davis, President  
Paul S Weil, Vice Pres.-Gen. Mgr.



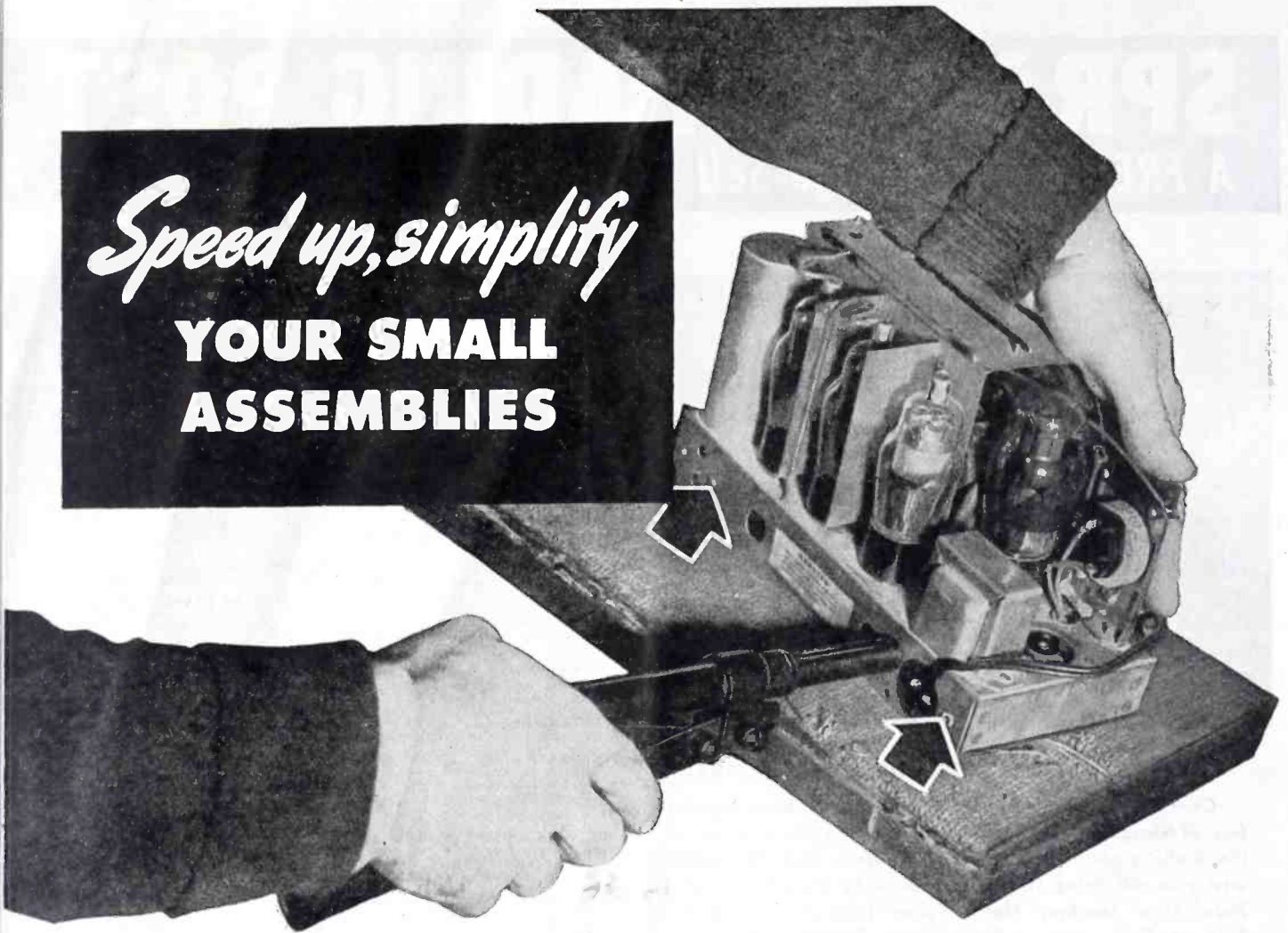
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*Speed up, simplify*

**YOUR SMALL ASSEMBLIES**

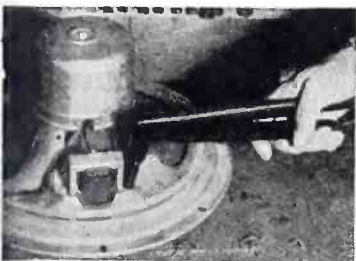


Your difficult small assembly jobs can be done quickly and easily. Use Cherry Blind Rivets—the new one-man, easy-to-handle blind fastener. Manufacturers and repairmen everywhere are switching to this improved fastening technique—are making Cherry Blind Rivets standard on their small assembly jobs.

These rivets are upset with a smooth, easy pulling action exerted by small, easy-to-handle Cherry Rivet guns. They can be used on fragile structures,

in soft or brittle materials, in all sheet metals, in crowded or cramped locations. Cherry Rivets are installed by one man from one side of any location, blind or not, without bucking. Though they form a strong, tight fastener, they can be easily and quickly removed with trimmers or a drill.

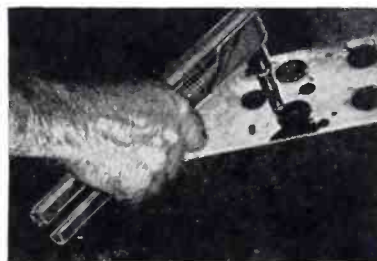
There are several types, sizes and alloys of Cherry Rivets. Installed rivets are strong and neat. The installed cost of Cherry Rivets is low.



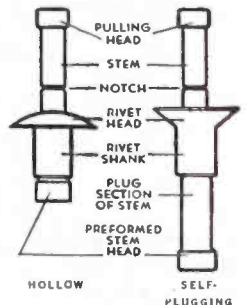
Cherry Riveting transformer to loudspeaker.



Time saved in fastening arm an record changer.



Tube sockets are easily installed; firmly held.



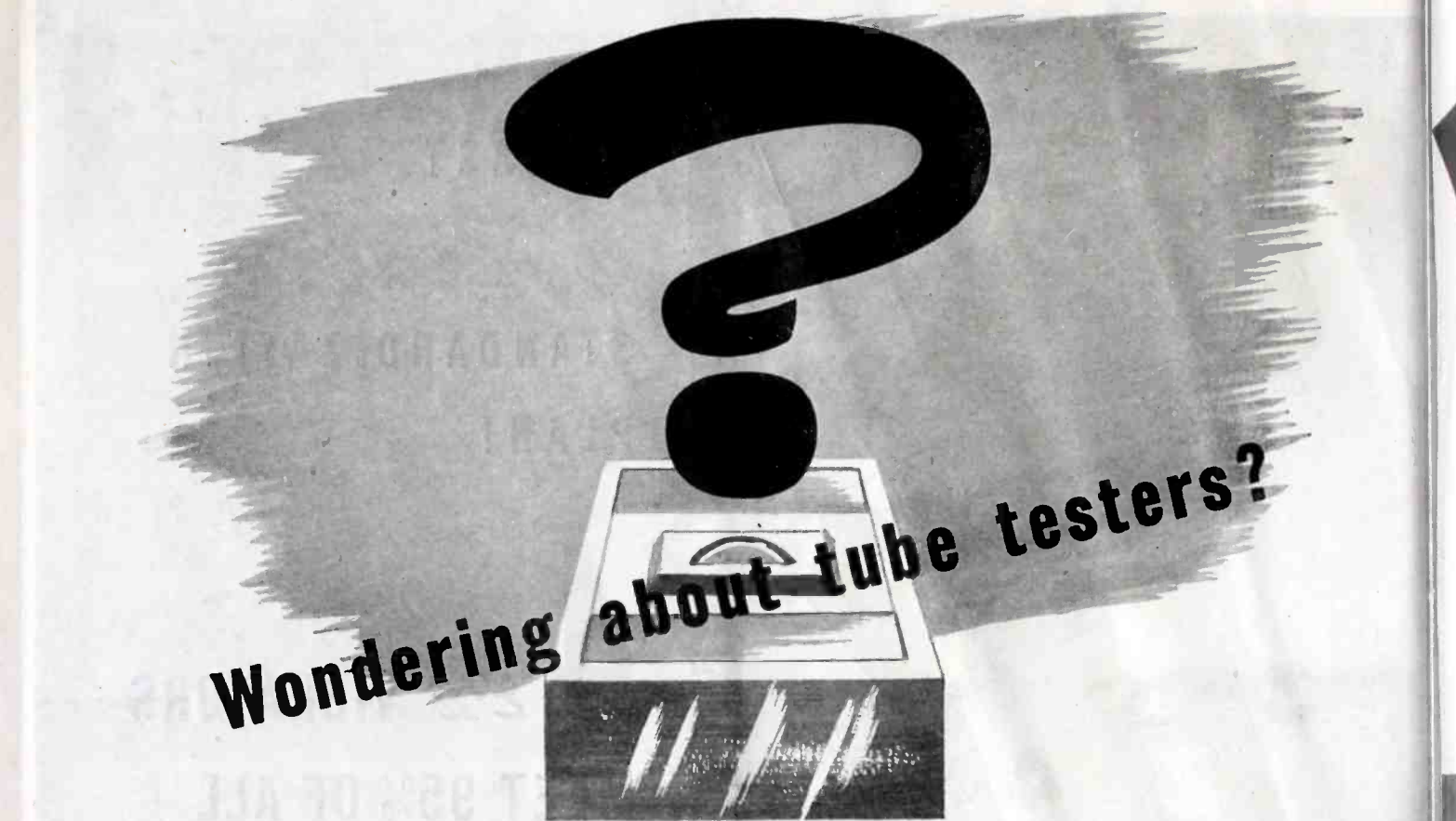
For a quick glance at the many types and uses of Cherry Rivets, write now for illustrated Manual D-45, Department A-268, Cherry Rivet Company, 231 Winston St., Los Angeles 13, California.



CHERRY RIVETS. THEIR MANUFACTURE & APPLICATION ARE COVERED BY U. S. PATENTS ISSUED & PENDING

**Cherry Rivet**  
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Wondering about tube testers?

*... Here's what Simpson has ready  
and waiting for your postwar needs*

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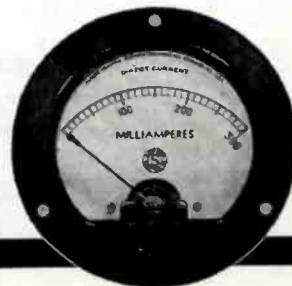
**Sensational? Yes . . .**

1. This new Simpson Mutual Conductance Tube Tester tests tubes with greater accuracy than any commercial tube tester ever designed.
2. Provides greater flexibility for future tubes than any other tester.
3. Tests tubes with voltage applied automatically over the entire operating range.
4. Simplifies as never before the interpretation of tube condition from mutual conductance readings.

SIMPSON ELECTRIC COMPANY  
5200-18 Kinzie Street, Chicago 44, Ill.

**Simpson**

INSTRUMENTS THAT STAY ACCURATE





# Centralab

## Medium Duty Power Switches

- 7½ amp. 115 V. 60 cycle A. C.
- Voltage breakdown 2500 V to ground D. C.
- Solid silver contacts
- 25,000 cycles of operation without contact failure
- Fixed stops to limit rotation
- 20° indexing

Centralab medium duty power switches are now available for transmitters (has been used up to 20 megacycles) power supply converters and for certain industrial and electronic uses.

It is indicated in applications where the average Selector Switch is not of sufficient accuracy or power rating. Its accuracy of contact is gained by a square shaft, sleeve fit rotor, and individually aligned and adjusted contacts. It is assembled in multiple gangs with shorting or non-shorting contacts. Torque can be adjusted to suit individual requirements. Furnished in 1 pole . . . 2 to 17 positions (with 18th position continuous rotation with 18th position as "off"); and 2 or 3 pole . . . 2 to 6 position including "off".



# Centralab

Division of GLOBE-UNION INC., Milwaukee

PRODUCERS OF Variable Resistors • Selector Switches • Ceramic Capacitors • Fixed and Variable • Steatite Insulators and Silver Mica Capacitors

# SYLVANIA NEWS

## RADIO SERVICE EDITION

AUGUST Published by SYLVANIA ELECTRIC PRODUCTS INC., Emporium, Pa. 1945



Radio servicemen looking for a simplified explanation of the science of electronics are urged to add to their reading list *A Primer of Electronics* by Don P. Caverly.

### Simplified Language

It gives you, without formulas or much mathematics, just what you want to know about electronic principles and how they are applied in working devices.

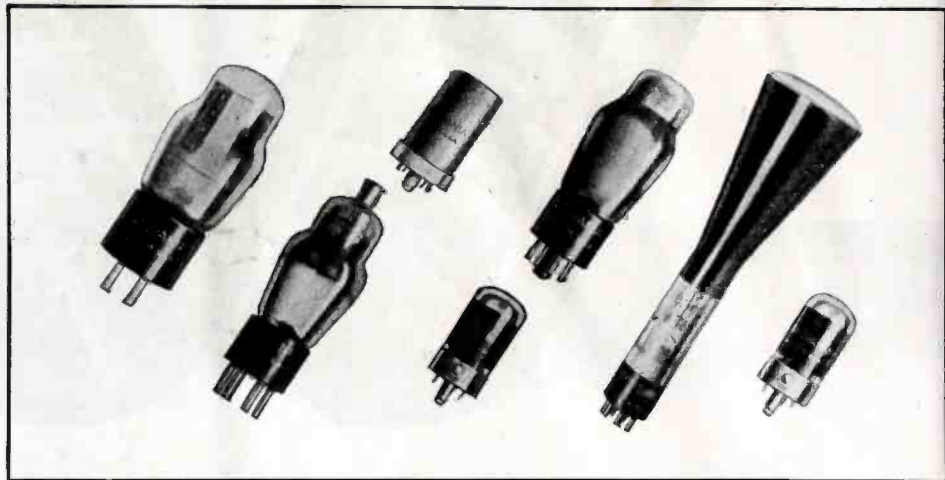
Here is an especially clear and simple explanation of electronics and electronic tubes and circuits, written by a Sylvania engineer for all concerned with the application, servicing, operation, or manufacture of industrial or household devices based on this science. Basic enough for beginners, yet technically authoritative and complete.

### Has Many Illustrations

Containing 235 pages of concise, easily understood language, the book is further clarified by having 125 specially prepared drawings and photographs. It is published by McGraw-Hill and is available for \$2.00 from your Sylvania distributor or, as a Sylvania service, directly from us.

## RADIO SERVICEMEN CAN NOW OBTAIN FORMER GOVERNMENT TUBES

*(Sylvania Tested and Guaranteed)*



Sylvania Electric announces the following tube types available to radio servicemen.

Several of the types released are of particular interest to amateurs and experimenters. With this market in mind, Sylvania has inserted similar announcements in representative "ham" publications.

The current list is as follows:

38—Well known standard output pentode.

39/44—Well known standard R.F. Amplifier.

2X2/879—The standard high voltage, low current rectifier for oscilloscope use.

7C4/1203A—A small lock-in diode rectifier suitable for use in vacuum tube voltmeter probes. 6/3 volt 150 ma. heater.

7E5/1201—A lock-in triode for use as a low power oscillator or amplifier up to 750 mc. 6.3 volt 150 ma. heater.

46—Standard power amplifier. Suitable for Class B or C amplifiers and used in many amateur transmitters.

OD3/VR150—Radio servicemen recognize this well known voltage regulator.

EF-50—A 9 pin completely shielded R.F. Amplifier somewhat similar to Type 7W7. Heater rating 6.3 volts at 300 ma.

1626—A transmitting triode requiring 12.6 volts, 250 ma. heater supply. Four watts output at 250 volts plate (max.).

1629—Same characteristics as Type 6E5 except for octal base and heater rating of 12.6 volts, 150 ma.

38142(VT-52)—Similar to Type 45 except for its filament rating of 7.0 volts, 1.18 amperes.

5BP1—Well known 5" cathode ray tube with the usual green trace. Makes a good scope with 1500 to 2000 volt anode supply.

5BP4—Same as 5BP1 except for the screen which gives a white trace.

VT-25A—This is the same as the regular Type 10 but has a low loss base. This item should be interesting to amateurs.

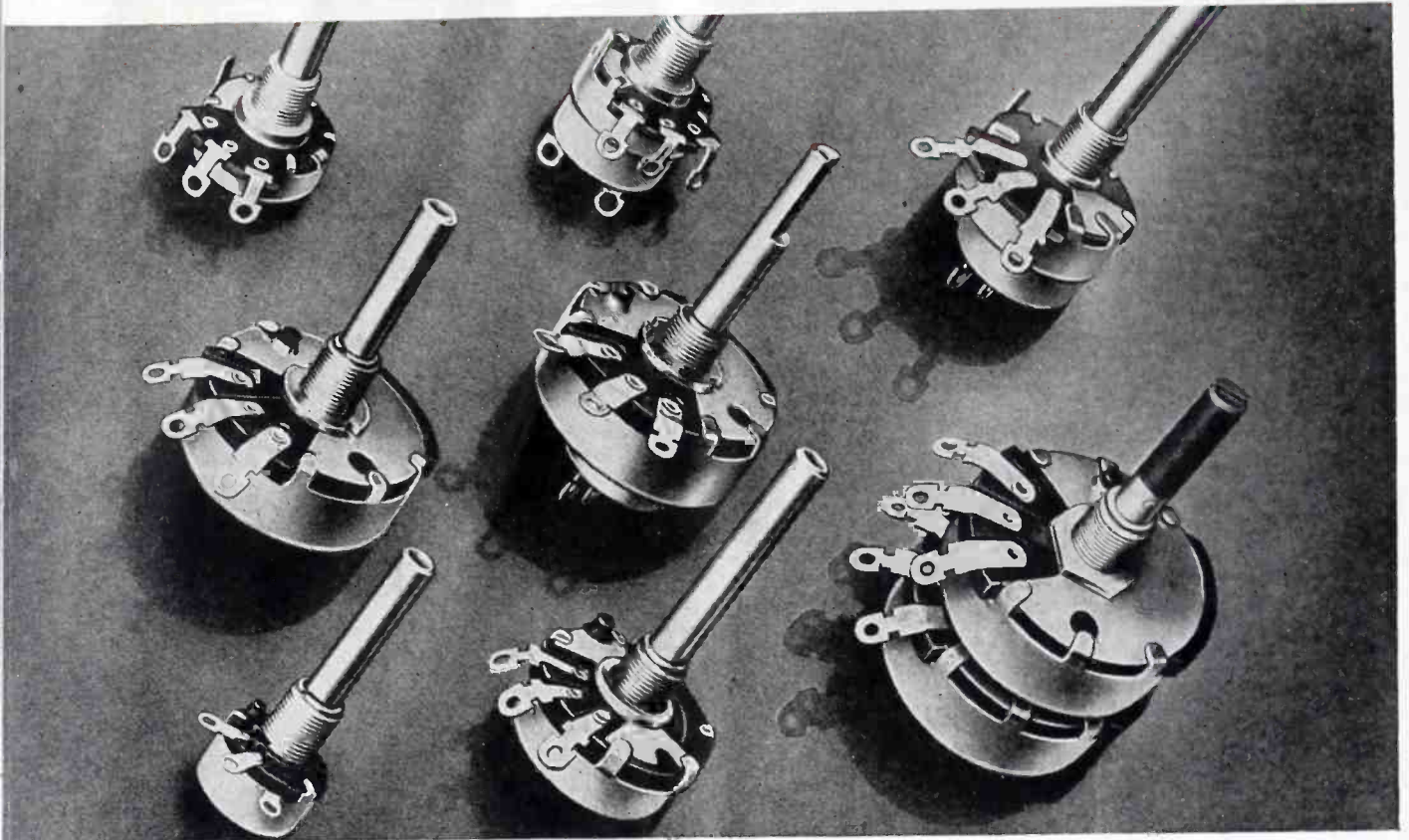
All tubes are available under the familiar L-265, or on rated orders, through Sylvania distributors.

# SYLVANIA ELECTRIC

Emporium, Pa.

MAKERS OF RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES; FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES; ELECTRIC LIGHT BULBS





## VOLUME AND TONE CONTROL RESISTORS

[Part Six of a Series]

by **ALFRED A. GHIRARDI**

Advisory Editor

This analysis and the analyses of Fixed Resistors which appeared in the March, April, May, June and July issues of SERVICE, have been especially prepared by Mr. Ghirardi in response to the numerous demands of newcomers to servicing for detailed construction, operating and servicing information on the various components that go to make up modern receivers.

This series constitutes a valuable reference which even experienced Service Men will find worthwhile as a refresher and for new servicing ideas. We would appreciate receiving suggestions for the subjects of future articles in the series.—Ed.

**T**ROUBLES experienced with the simple variable resistors employed as manual volume or tone controls in receivers are so frequent that they are responsible for a substantial percentage of the Service Man's repair and replacement work. These components are far more subject to trouble than are the various types of fixed resistors discussed in the previous articles of this series. This is so, because the vital parts of volume and tone control resistors are subjected to handling and mechanical motion almost every time the set owner turns the receiver on, or tunes to a new station. This eventually causes wear of the moving parts and of the resistance element; the latter, because of the nature of the resistance materials that must be employed, is not particularly rugged, even when new.

As a rule, faults that have developed

cause rotation of the control knob of the unit, while the set is in operation, results in annoying noise, intermittent operation, or unsatisfactory control of volume or tone. Such performance is extremely annoying to the set owner (especially in the case of a volume control) so he soon does something about having a repair effected.

### Wire-Wound and Composition Controls

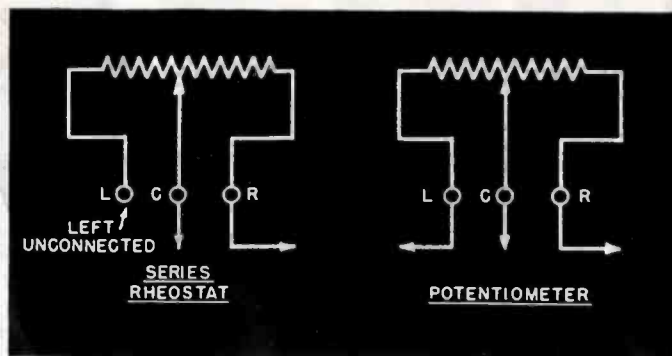
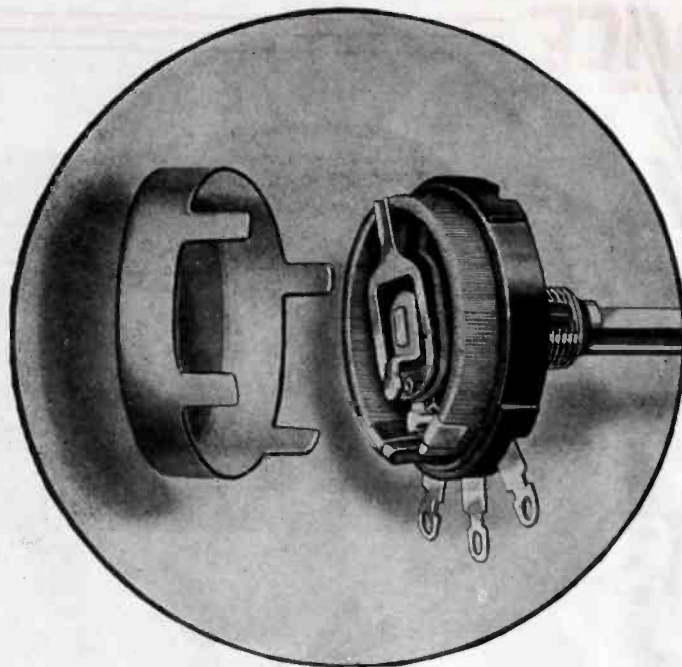
The construction employed in variable resistors is really an extension of the principles of construction used in the types of fixed resistors we have already studied. This is so because the choice of resistance material is limited to the same two groups of materials (metallic resistance alloys and carbon) as are used for fixed resistors. Accordingly, variable resistors are either of the wire-wound, or the carbon composition-element, type.

The wire-wound type was widely used for volume control purposes in the early receivers because the circuit

Above . . . Assortment of volume and tone controls.

(Courtesy Stackpole Carbon Company)

in volume and tone control resistors quickly make their presence known be-



Figs. 1 (left) and 2 (above). In Fig. 1 we have a fine-wire-wound variable resistor with dust cover.

(Courtesy IRC)

Fig. 2 . . . Three terminals are unusually provided so that the control can be used either as a simple variable series resistor (rheostat), or as a potential-divider resistor (potentiometer).

arrangements then employed for volume control required comparatively low resistances ranging between a few ohms (filament-control rheostats) and approximately 10,000 ohms (bias-control resistors). Since more recent volume- and tone-control circuit practice has dictated the use of signal-attenuator types in the audio grid circuits, or load resistances in diode-ave circuits, and these necessitate the use of much higher values of control resistances ranging from approximately 100,000 ohms to 3 megohms with but small current-carrying requirements, the composition-element type now is by far the most widely used in radio receivers. Its construction lends itself more readily to obtaining the higher values of resistance (and required tapers) than does the wire-wound type.

#### Wire-Wound Variable-Resistor Construction

The resistance element of a modern wire-wound type of volume or tone control, Fig. 1, usually consists of bare resistance wire of copper-nickel or nickel-chrome alloy (such as nichrome, etc.) having high specific resistance, precision space-wound on a specially treated thin strip of phenolic insulating material. This element is seated and cemented in an arc-shaped groove in a bakelite molded base. A special alloy spring contact arm, rotated by the control shaft, makes sliding contact with the resistance wire. This makes it possible to vary the resistance, included in the circuit, from zero to the maximum resistance of all the wire wound on the strip. The two ends of the resistance wire, and the movable contact arm are brought out to terminals for connection to the external circuits.

Two different types of contact arrangement are commonly employed in wire-wound controls. In the type illustrated in Fig. 1, the contact arm wipes against the outside edge of the resistance winding. In another type, the contact arm wipes against the inside (curved) surface of the winding. In each type, stops are provided to confine the rotation of the arm to the proper limits. Some controls employ a spiral spring for positive electrical connection between the rotor arm and its terminal. A dust-tight phenolic or metal cover usually is provided to protect the vital parts from dust, dirt and accidental mechanical injury. Some units are purposely made with the shaft insulated from the contact arm.

Modern good-quality wire-wound units for volume and tone control are

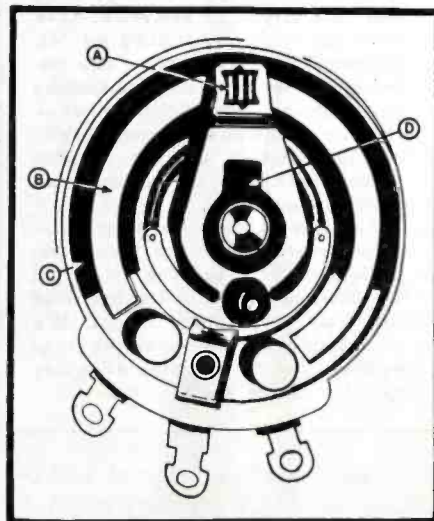
remarkably compact, smooth in mechanical operation, and free of noise. Humidity, temperature and age have little effect upon the resistance element. They are made to match similar standard or midget-size composition-element type controls in appearance, dimension, rotation, switch, etc., and are available in a series of values of maximum resistance ranging approximately from 1 to 20,000 ohms and in 2-watt and 4-watt ratings.<sup>1</sup>

The standard maximum-resistance tolerance of wire-wound controls is  $\pm 10\%$ .

#### Composition-Element Variable-Resistors

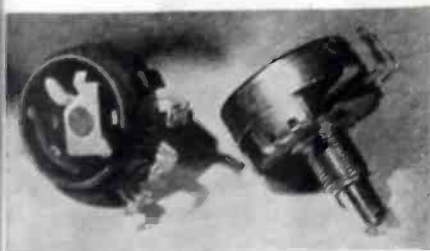
Two general types of construction are employed in the composition-element type variable resistor units now so widely used as volume and tone controls. Most manufacturers use a resistance element consisting of a circular supporting ring of moisture-proof, flat phenolic material (usually bakelite), or pressed paper, upon one surface of which a thin resistance-coating consisting of fine carbon particles suspended in a suitable binder is carefully applied through about 300° of its arc by spraying, painting or dipping. The coating is then carefully dried and baked. Each manufacturer has his own special methods of applying the carbon solution or paste and treating it to give the greatest dependability and long life during use. The element is assembled on a phenolic base and provided with a shaft, contact arrangement, terminals and dust cover. One such unit is illus-

Fig. 3 . . . Composition-element type of variable volume or tone control employing film of resistance material applied to a thin, moisture-proof base. At A, roller on contact arm presses against contact track; B, flexible metal contact-track contacts carbon-coated element underneath only at point where roller presses it; C, carbon-coated resistance element; D, shaft insulator piece. (Courtesy P. R. Mallory & Co.)



<sup>1</sup> These ratings apply to the maximum-resistance setting. Tapered units have a lower power rating than do linear units of the same physical dimension; the steeper the taper curve, the lower the rating.



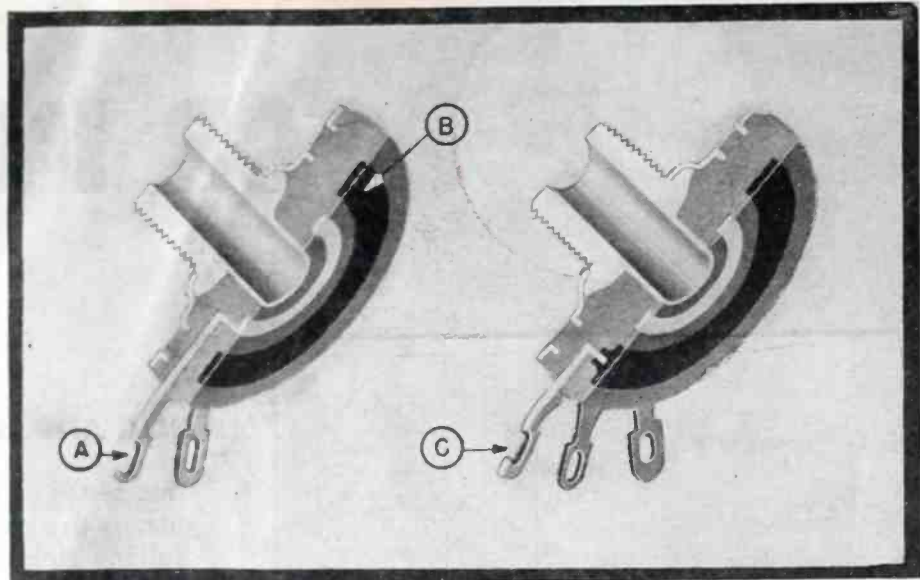


Figs. 4 (right) and 4a (above). Fig. 4 . . . two cross-sectional views of composition-element type of variable volume or tone control in which the resistance material (dark) is molded with the insulating base, terminals, bushing, etc., as one piece. At A, center terminal molded to resistance plate; B, thin layer of resistance material; C, end terminal molded to resistance material.

(Courtesy Allen-Bradley Company)

Fig. 4a . . . Midget (1 1/4" diameter) 1 1/2-watt wire-bound control with contact arm that wipes against under surface of resistor winding.

(Courtesy Clarostat Manufacturing Company)



rated in Fig. 3. In one modification of this construction, a wall-type resistor strip, which is mounted on the inner circumference of the bakelite shell of the control, is used.

In the other general type of construction (employed in the Bradley-meter) the carbon-composition resistance material has substantial thickness (about 1/32" thick) and is molded as a single unit with the insulating support, terminals, face plate and threaded bushing, Fig. 4.

Several ingenious arrangements have been devised for making electrical contact along the carbon-composition resistance material as the shaft is rotated. All are designed to minimize friction, and eliminate scraping and wearing away of the delicate high-resistance element so that the initial resistance value of the control will be preserved, noise reduced, and the useful life of the element extended. For example, in the unit illustrated in Fig. 3, the contact arm carries a small roller. This presses a thin, flexible, circular metal contact band or track into intimate contact with the high-resistance coating only at the point where the contact arm roller happens to be at the moment. Thus, there is no sliding or scraping action to wear away the resistance coating.

Since the molded resistance element in the unit illustrated in Fig. 4 is comparatively thick, a low-resistance carbon brush (not shown) can be used to make direct, smooth contact with its surface, thus assuring long life and quiet operation.

In the unit illustrated in Fig. 5, a springy multiple-finger brush contact wipes smoothly over the surface of the resistance element. Each finger acts independently, providing a sort of knee-action arrangement that makes positive contact with the resistance element at all settings, and minimizes noise and wear.

As a rule, the contact arm or wiper is insulated from the shaft and bushings, because the arm often is the terminating point of a sensitive volume or tone-control circuit that would be affected by body capacitance through the shaft and control knob. Various methods are employed to achieve this insulated construction. In one arrangement, a bakelite or fibre insulating strip that carries the contact wiper assembly at one end has its opposite end fastened to, and turned by, the shaft.

Composition-element variable resistors are made in a series of standard values of maximum resistance

ranging from approximately 500 ohms to 5 megohms, although units of lower and higher resistance are available. The resistance values most commonly used in volume- and tone-control circuits range from approximately 10,000 ohms to 2 megohms. In linear taper, the larger size units are designed to handle approximately 2 watts (at maximum resistance setting); the medium size handles approximately 1 watt, and the more compact midget sizes can handle only about 1/2 watt. Tapered units have a lower power rating than do linear units of the same physical dimensions, depending on the taper curve. In general, controls having the steeper curve have the lower rating.

The standard maximum-resistance tolerance of composition-element controls is  $\pm 20\%$ , although units of closer tolerance are obtainable at higher cost. Ordinarily, tolerance closer than  $\pm 20\%$  is not needed for volume or tone controls, as the total resistance value required is not critical.

#### Terminals and Terminal Arrangements

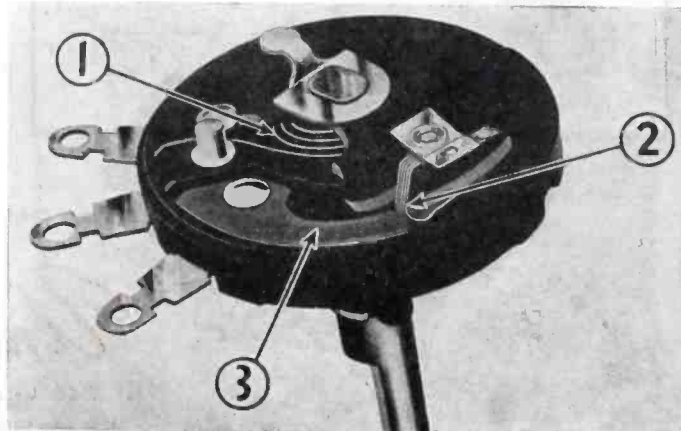
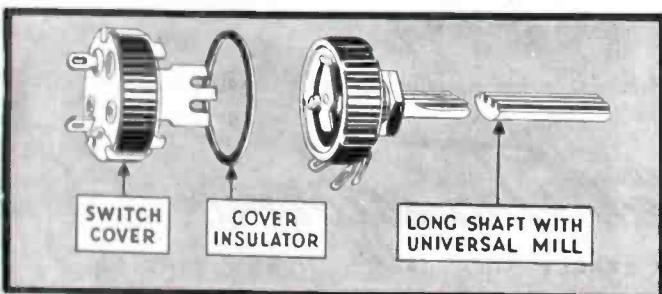
Most commercial wire-wound and composition-element volume- and tone-control resistors are furnished with  
(Continued on page 23)

Figs. 5 (right) and 6 (below). Fig. 5 . . . Composition-element unit that employs a 5-finger "knee-action" wiping contact to the resistance element. At 1, spiral spring connector; 2, "knee-action" contactor; 3, metallized resistance element.

(Courtesy IRC)

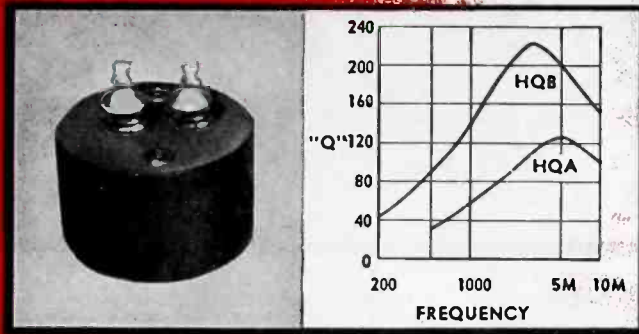
Fig. 6 . . . Midget variable control, using wall-type resistor strip, with and without switch covers.

(Courtesy Centralab)



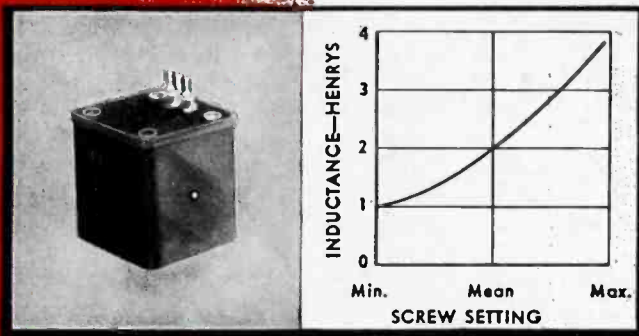


# FOR INDUCTORS



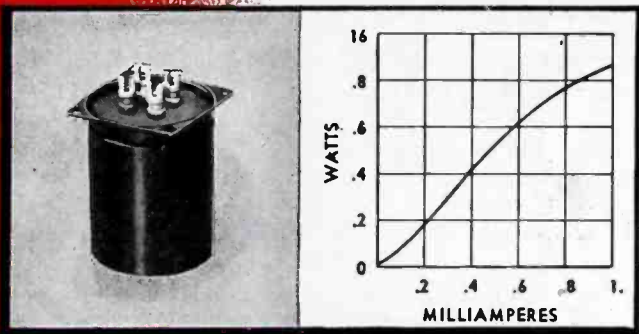
## HQA AND HQB HIGH Q INDUCTORS

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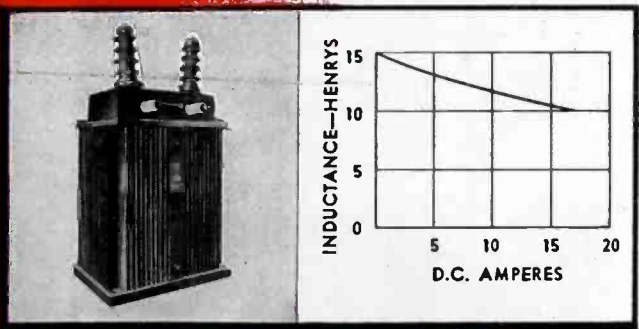
## TYPE VI-C VARIABLE INDUCTORS

These inductors are available in optimum values from 10 Mhy. to 10 Hys. They are tunable over a wide range by inserting an Allen Head wrench in the adjusting screw. Units measure 1 1/4" x 1-7/16" x 1-7/16".



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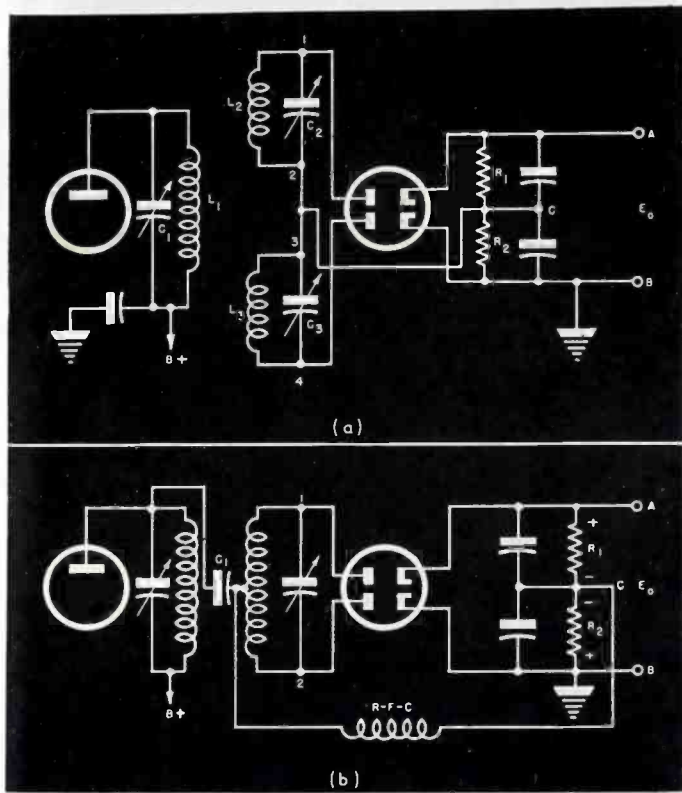
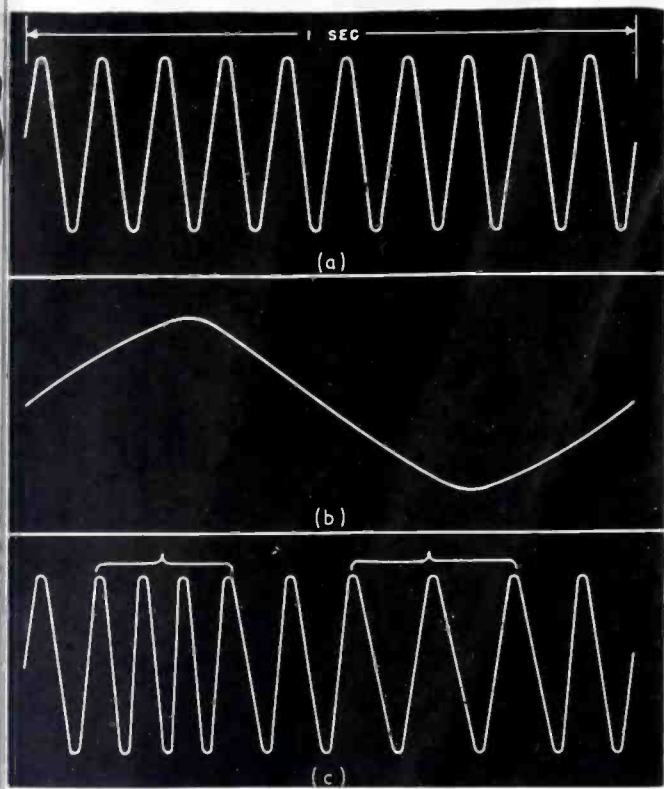
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# F-M DISCRIMINATORS

by J. GEORGE STEWART

THE discriminator stage of the f-m receiver serves the identical purpose of the detector in the a-m receiver. Both are used to recover the audio intelligence from the r-f carrier. However, the similarity ends there, the characteristics and operation of either detector being dependent on the wave shape of the transmitted signal.

To properly understand the operation, alignment, and servicing of discriminators, it is first necessary to understand the form of the transmitted carrier and its characteristics at the time of application to the discriminator.

Let us consider a sine wave of 10 cps, Fig. 1a. This sine wave is to be frequency modulated by a sine wave of 1 cps, Fig. 1b. The 10-cps carrier must respond to two characteristics of the modulating 1-cps wave, its frequency and its amplitude. Now let us assume that it is desired to change the frequency of the carrier 5 cycles, when the amplitude of the 1-cps wave is 10 volts. If the action of the circuit could be made linear, a 1-cps wave of 5 volts would then change the carrier frequency  $2\frac{1}{2}$  cycles, etc. We could then state that the frequency deviation of the carrier is a function of the amplitude of the modulating signal.

However, the frequency of the mod-

ulating wave must also be considered. In order to affect the carrier with the frequency of the modulating signal, we could take the change in carrier frequency and cause it to occur at a rate depending on the frequency of the modulating signal.

For example, suppose the 10-cps carrier is to be modulated by a 1-cps wave whose amplitude is 10 volts. By the standards set up in the previous paragraph, the carrier should vary from 10 cps to 5 cps to 10 cps to 15 cps and back to 10 cps in the space of one second. In this manner the carrier would then contain the two characteristics of the modulating signal, its frequency and its amplitude; resultant wave is shown in Fig. 1c.

The standard for f-m transmission is a 150-kc carrier swing ( $\pm 75$  kc). The full 75-kc swing represents the equivalent of 100% modulation. The frequency with which this swing, or degree of swing, occurs, is a function

of the modulation frequency. For this reason a 15-kc modulation wave is as easily transmitted as a 100-cycle wave.

In the f-m receiver, all stages ahead of the discriminator are used to amplify the received signal, in the same manner as the r-f section of an a-m receiver. There is an additional feature in the f-m receiver. This is the limiter. Since any variation in the amplitude of the received signal serves no useful purpose (in fact this variation is actually detrimental to the action of the discriminator), the limiter acts as a source of constant voltage to the discriminator, even though the input to the limiter itself varies. It is identical in action to a voltage regulator.

Two types of discriminators are in popular use; Fig. 2, a and b. Both circuits perform the same function, to demodulate the f-m signal in terms of audio frequency and amplitude.

In Fig. 2a,  $L_1 C_1$  is tuned to the i-f frequency, say 4,000 kc.  $L_2 C_2$  is tuned to 4,075 kc, and  $L_3 C_3$  to 3,925 kc. When a signal voltage of intermediate frequency appears across  $L_1 C_1$ , voltages will appear across both  $L_2 C_2$  and  $L_3 C_3$  even though they are not tuned to 4,000 kc. This occurs because of the proximity of their resonant frequencies to that of the i-f, or center frequency. Since the frequency devia-

Above, Figs. 1 a, b, c (left) and 2 a, b (right). Fig. 1a represents 10 cycles of a 10-cps wave; 1b shows a 1-cps modulation wave; 1c is the resultant wave form when the two are combined in f-m. Note variation in individual wave form. Fig. 2a and b . . . Here are two types of discriminator circuits. Circuit of Fig. 2b is used in most f-m receivers.

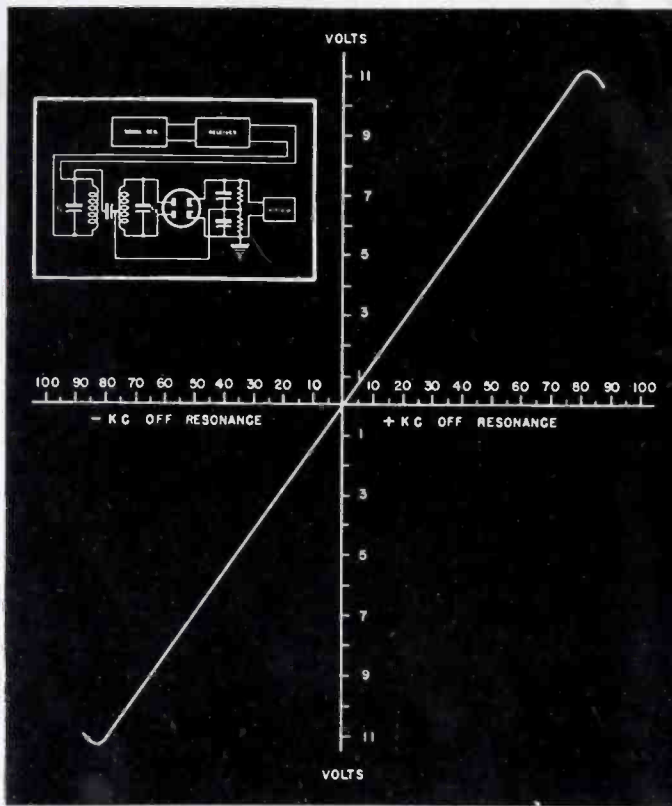


Fig. 3 . . . A typical response curve for the circuit shown in the insert. Developed voltage is a function of off-resonance frequency within the limits of broadcast f-m.

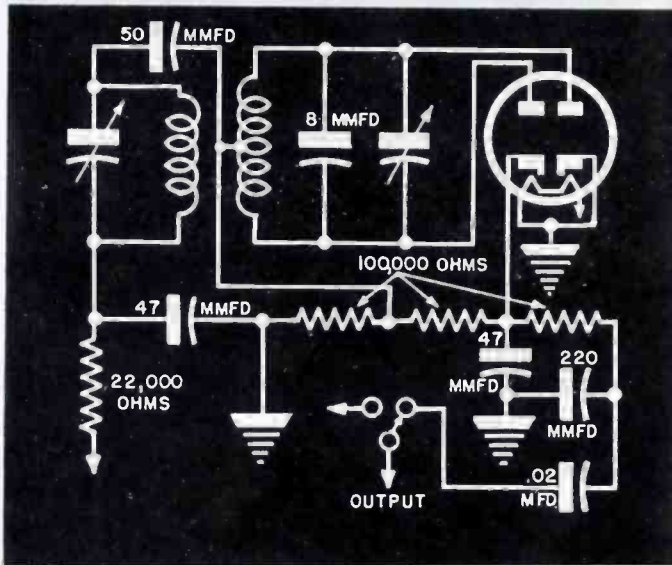


Fig. 4 . . . G.E. J FM 90 discriminator. A temperature-compensated condenser is used in parallel with the secondary trimmer for frequency stability.

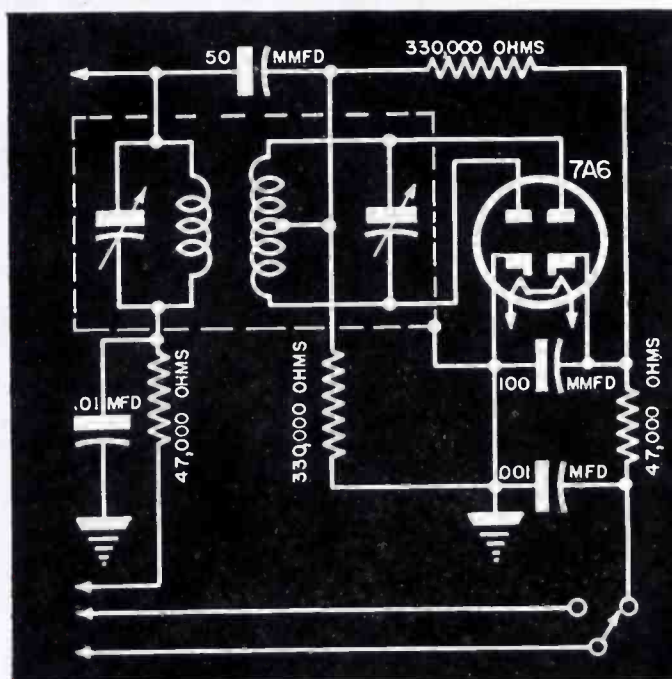


Fig. 5 . . . Pilot 300 discriminator. This circuit is similar to the G.E. circuit. The 47,000-ohm resistor and .001-mfd condenser are used to filter the r-f in the audio feed line.

tion is identical in both directions, the voltages across the two secondaries will be equal. In addition, the polarity of points 1 and 4 will be identical. When these voltages are positive the diodes will conduct, and direct voltage will appear across  $R_1$  and  $R_2$ . However, since both points  $A$  and  $B$  are positive with relation to point  $C$ , these voltages will cancel, and the net voltage between points  $A$  and  $B$  will be zero.

When the frequency in the primary of the transformer shifts to 4,075 kc, which is the resonant frequency of  $L_2 C_2$ , a higher voltage will be induced across points 1 and 2, and a lower voltage across 3 and 4 (since the deviation from the  $L_2 C_2$  resonant frequency is greater). When conduction takes place on the positive peaks, the voltage across  $R_1$  will be greater than that across  $R_2$ , which has dropped. The difference voltage will then appear across  $A$  and  $B$ . When the frequency shifts to 3,925 kc, we have the same condition, but in reverse. Therefore the amplitude of the voltage across  $A$  and  $B$  will be a function of the frequency swing of the intermediate frequency, and the audio frequency will depend on the frequency with which this swing occurs.

The system shown in Fig 2b is the more popular of the two. Here again, at center frequency, the voltages from points 1 and 2 to ground are equal and identical in polarity. When the frequency of the i-f signal is reduced, the voltage from point 2 to ground will rise and that from point 1 to ground will decrease. Since both voltages have the same polarity, only the difference voltage will appear across  $A$  and  $B$ . A similar condition occurs when the i-f signal swings upward in frequency, but now the polarity of the voltage across  $A$  and  $B$  is reversed.

Alignment of the discriminator is simple. In Fig. 3 (insert diagram), the i-f voltage is applied to the mixer grid, and  $C_2$  is adjusted for zero voltage across  $A$  and  $B$ , as measured on a vtm. The frequency of the signal generator is then varied  $\pm 75$  kc. The voltage as measured on the vtm should be equal and opposite in polarity for both conditions. If these voltages are not equal,  $C_1$  must be reset. A check should then be made again at center frequency to insure zero voltage. A typical graph for a discriminator, displaying ideal characteristics, also appears in Fig. 3.

Several additional precautions must be observed. A polystyrene adjustment screwdriver should be used for alignment, particularly for  $C_2$ , since

(Continued on page 26)



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# SECOND DETECTOR

## AND

# A V C SYSTEMS

by ROBERT L. MARTIN

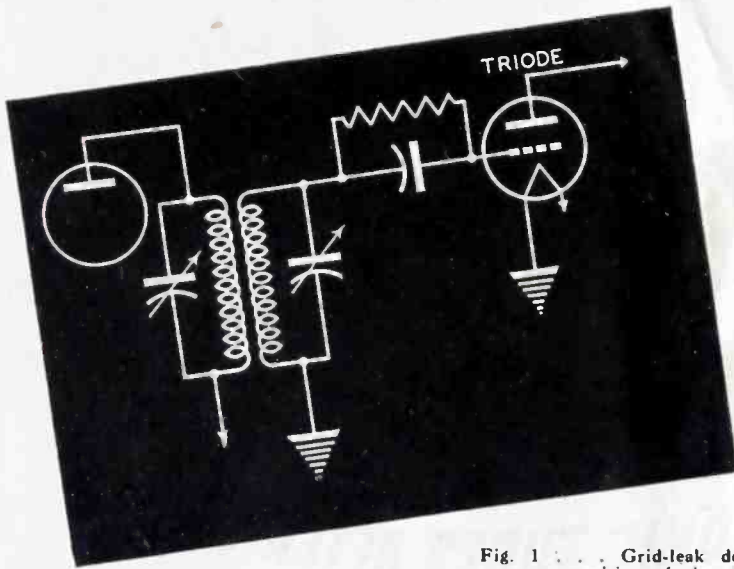


Fig. 1 . . . Grid-leak detector system—the most sensitive of the detection systems.

**I**N the modern receiver, the second detector and avc system play quite an important role. The second detector demodulates the incoming signals, reproducing the original program that modulated the transmitter. The avc (automatic volume control) system automatically biases an amplifier in proportion to the strength of the signal so as to keep a constant volume level at the loudspeaker; avc is sometimes referred to as agc, automatic gain control, the more precise term since the gain is being directly controlled, the volume indirectly.

Detection of amplitude-modulated waves may be brought about by operating the detector on a curved part of its current/voltage characteristic (the portions where Ohm's law is not obeyed) or by complete rectification at cut-off. Triode and pentode detectors may be operated as grid-leak detectors or as bias or plate detectors. The grid-leak detector, as shown in Fig. 1, is

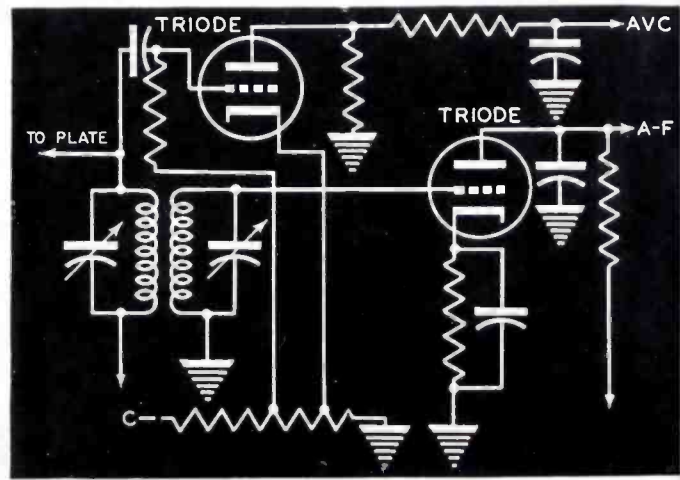
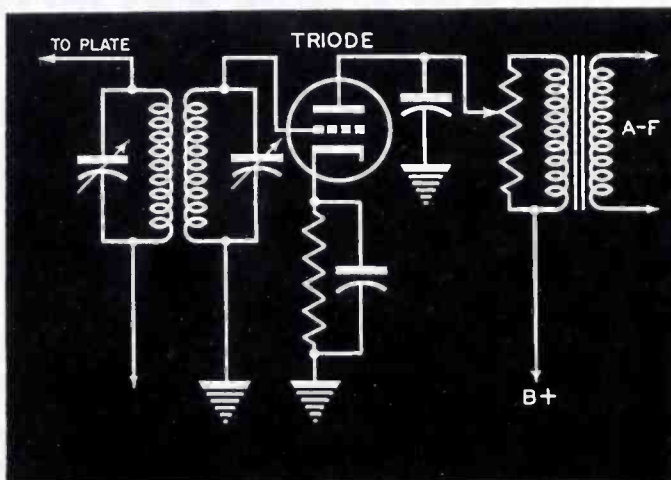
the most sensitive and economical type. Here, the grid acts like a diode plate and the grid leak as the diode load resistor of a modern, conventional diode detector. The demodulated signal appears across the grid leak and condenser. The tube also amplifies the signal, and thus the tube really acts as detector and amplifier. The carrier and sidebands are also amplified but they are eliminated by an r-f bypass condenser in the plate circuit which offers a low impedance to r-f but has a negligible effect on the a-f.

The disadvantages of the grid-leak detector are mainly its non-linearity and loading effects on the tuned circuit. The former is by far the more important. The detector operates ap-

proximately on a square-law curve where the output voltage is nearly proportional to the square of the input voltage. This leads to considerable second harmonic distortion which increases with the per cent modulation. Strong signals cause overloading of the tube as a class A amplifier which leads to worse distortion. Therefore an r-f volume control must be employed to limit the detector voltage.

Normal values of grid leak and condenser are 1 megohm and 250 mmfd. Higher leak values provide more sensitivity to low voltages (weak signals) but attenuate the high frequencies causing a loss of treble. These and other effects are further discussed under diode detectors in this article. The grid-leak detector, operating on zero bias, uses a low plate voltage. When triodes were used with audio transformers it was difficult to get a sizeable step-up ratio and a good match at the same time because the low plate

Figs. 2 (left, below) and 3 (right, below). Fig. 2 . . . Bias or plate detector with high-value self-bias resistor. Fig. 3 . . . Early method of obtaining avc by using triode and C bias divider.





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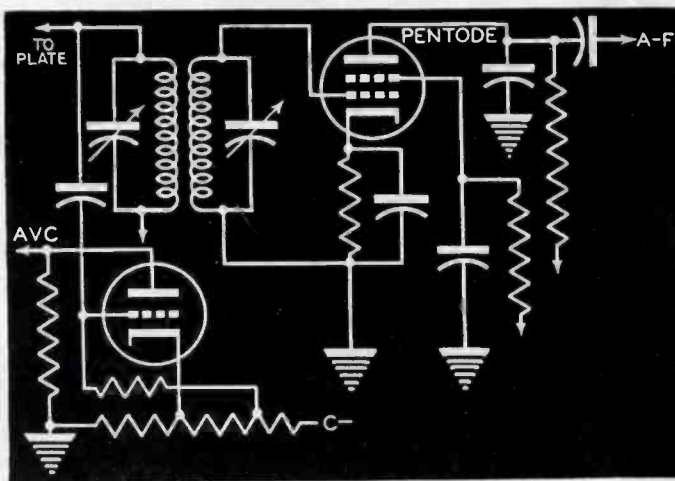


Fig. 4 . . . Tetrode or pentode-bias detector. This method offers a high-voltage output.

voltage gave a high plate resistance. With high gain pentodes and resistance coupling this is not a problem.

#### Bias Detectors

Fig. 2 shows a triode used as a bias detector, also called plate or power detector because detection takes place

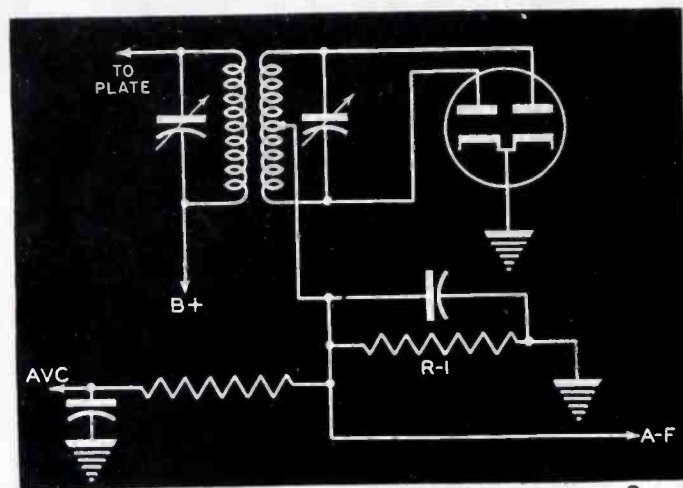


Fig. 5 . . . Full-wave diode detector delivering audio voltage plus avc.

in the plate circuit and more output power and voltage is available than in grid-leak detectors. The bias detector has a high value cathode-bias resistor which causes the tube to be operated near its cut-off point. Since this type detector carries both r-f and a-f, the resistor must have an a-f bypass, 1 mfd or more. A plate r-f bypass condenser of about 100 mmfd is used to

keep the unwanted r-f components out of the audio transformer. Fig. 2 also shows one method of audio volume control which was often used with plate detectors.

Because bias detectors operate at high values of bias, they are adapted to handling much larger signal volt-

ages than grid-leak detectors and are less subject to overload distortion. Another good feature resulting from the high bias is the high input impedance which imposes no loading on the tuned circuit feeding the detector. Still another feature, of particular interest to the Service Man, is the fact that due to the curvature of the tube's characteristic, the plate current increases as

the signal increases. This is useful in tuning or judging signal strength. It should be noted that, in grid-leak detectors, the signal causes a decrease in average plate current because the tube is working at zero bias and at the opposite end of its characteristic (with opposite curvature) from the bias detector. High-resistance tetrode or pentode tubes make very good bias detectors when used with resistance or impedance coupling to the audio amplifier. In Fig. 4 we have such a circuit using a pentode.

#### AVC Systems

Fig. 3 shows an early method of obtaining avc through the use of a triode coupled to the plate of the final i-f amplifier. The plate and grid voltage for the triode are derived from a bleeder resistor in the negative high-voltage lead, so that positive B is at ground potential. The tube is operated as a class B amplifier near cut-off so that when a signal is received, the average plate current increases (exactly like the bias detector) causing a voltage drop across the plate-load resistor. This drop, being more negative with respect to ground as the signal increases, may be utilized as avc bias to control the gain of one or more amplifiers to maintain a constant volume.

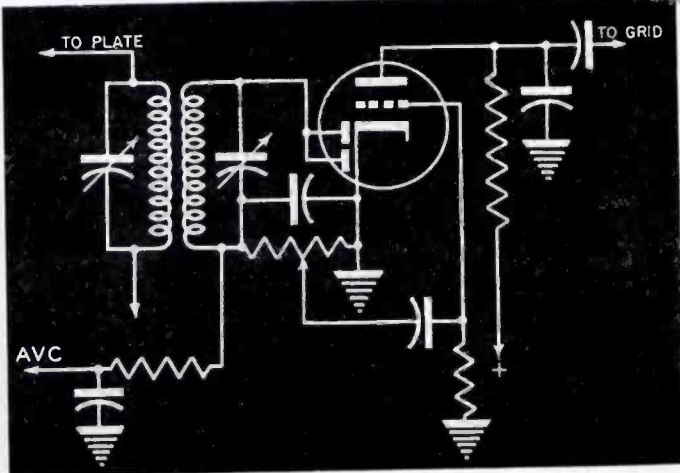
#### Detector-AVC Circuits

In Fig. 5 appears a combined detector and avc system using the first type tube developed for this purpose, the 6H6. This tube is a full-wave rectifier which supplies a full-wave audio signal across R<sub>1</sub>, the diode-load resistor. It has long been an obsession of the writer that this should represent the ideal detector, but somehow or other aural demonstrations fail to reveal the difference between full-wave and the conventional half-wave performance. It is hard to reconcile the extensive theory required for a thorough understanding of diode-detector operation and the simplicity of its circuit. In this article a brief analysis will be offered. The avc action is simpler, and therefore we'll approach that analysis first.

#### Diode-Load Resistor

In this system, the rectified r-f signal appears across the diode-load resistor which is shunted by a particular value of capacitor for proper detector action, as we will see later. This capacitor acts as an r-f filter so that, at the high side of the diode-load resistor, we have the demodulated, or

Fig. 6 . . . The most popular type of diode detector, with diodes in parallel.



(Continued on page 22)

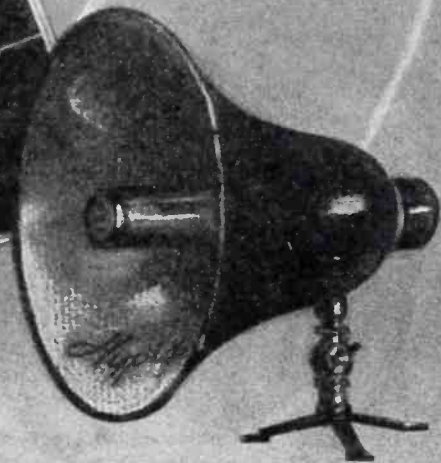


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## PHONE-VOLUME CONTROLS

(Continued from page 13)

three terminals, which permits them to be used either as simple series rheostats or as potential-dividers (potentiometers), as illustrated in Fig. 2. The designations employed for the three terminals are: left (L) terminal is that terminal which the movable contact approaches at the extreme counter-clockwise rotation position of the shaft; right (R) terminal is that terminal which the movable contact approaches at the extreme clockwise rotation position; (C) terminal is the center one connecting with the movable contact arm, all looking from the shaft end of the control.

When employed as a potentiometer or a potential-divider type of circuit, all three terminals, L-R-C, are used, as shown. When employed as a simple series-variable element (rheostat), only the C (center or contact arm terminal) and only the L (left) or R (right) terminal of the resistance element are used, the latter depending upon whether the resistance is to increase, or decrease, respectively, with clockwise rotation of the knob.

The standard practice in connecting volume controls is to connect them so

(Continued on page 38)

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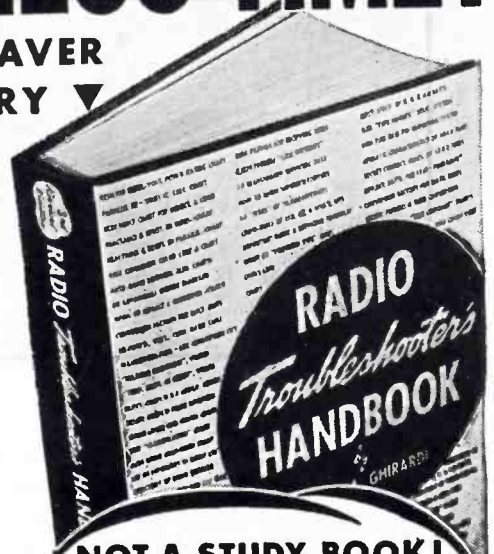
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# CATHODE-RAY TUBES

[Part Two of a Series]

by S. J. MURCEK

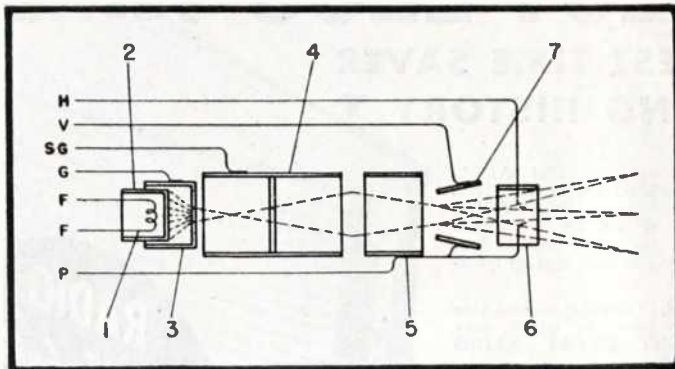


Fig. 1 . . . Operation of the electron gun. The tungsten heater, 1, causes cathode, 2, to emit electrons which are concentrated into a small volume by control grid, 3, always electrically negative with respect to cathode. Note the bending of the electron beam by the deflection plate system.

**R**EDUCTION in the grid-to-cathode negative control potential effects an increase in the number of electrons emitted by the cathode.<sup>7</sup> These electrons then are attracted through the beam-forming orifice in the grid electrode due to the attraction offered by the positively charged accelerating electrodes. The initial beam, on striking the target screen, produces a large, diffused fluorescent spot which may be indistinct or irregular because of beam dispersion.

Increase in the first anode voltage first decreases, then increases, the diameter of the fluorescent spot, this reaction occurring with an accompanying correction of the spot contour. Once the best possible focus adjustment has been found, indicated by the formation of a small, well-defined fluorescent spot of appreciable brilliance, decrease in the negative grid-to-cathode potential increases the spot luminous intensity. If the intensifier potential is applied under the condition that the spot is of the minimum possible area and of sufficient or satisfactory luminous intensity, the application of the former voltage results in a marked decrease of the spot area together with an appreciable increase in the spot brilliance.

When the fluorescent spot is stationary and of marked brilliance destruction of the fluorescing material results due to the high effective power which the material is required to dissipate. If, however, the spot is in motion, the average power dissipation required of the screen material is considerably less, and the brilliance of the luminous pattern may be increased proportionately. Hence, the candlepower or

luminous intensity of the wave pattern developed on the electron screen is limited by the power dissipation capacity of the electron screen material. To protect the fluorescent screen against damage through operation under conditions of excessive power dissipation, it is therefore necessary to maintain the latter within the limits prescribed by the tube manufacturer.

It will be recalled that the electron beam developed by the electron gun is essentially an electrical current in space. As such, this electron flow is subject to all the laws applying to electron currents in conductors. The electron beam may, therefore, be caused to *move* by either electrostatic or magnetic influence, thus varying the position of the fluorescent spot on the electron screen. Beam motion, in the conventional cathode-ray tube, is usually obtained by means of a suitable arrangement of deflecting electrodes or plates. The latter are so designated because of their inherent ability, when properly charged to the desired potentials, to *deflect* the position of the electron beam.

Beam deflecting plates or electrodes are shown in Fig. 1; *horizontal* plate pair, 6, and the *vertical* plate pair, 7, are shown to be so mounted to the electron gun structure that the plates of either pair are at a right angle with respect to the remaining pair. One plate of each pair is usually connected or is common with the tube final anode, thus placing a positive potential, which exerts attraction on the electron beam, on each of these plates. Each of the free deflection plates is operated with sufficient positive bias, so that the attraction exerted by the positive plates on the electron beam is completely neutralized. This positive plate biasing

potential is often variable so that the amount of neutralization thus obtained is controlled to permit the exact centering of the luminous spot in the center of the screen area.

If a variable a-c potential were superimposed on the free deflection plate potential, the electron beam would be attracted toward the free plate (the superimposed a-c potential increases the peak plate potential) and would be repelled away from this plate (superimposed a-c potential opposes and thus reduces the deflecting plate voltage). However, we note that the resultant decrease in free plate positive biasing potential permits the remaining plate of the pair to *attract* the beam away from the free plate.

During the period in which the horizontal deflection plate pair is subject to the a-c modulating potential, the electron beam bends flexibly just beyond the muzzle of the final anode, permitting the beam to swing horizontally across the electron screen in such a manner as to cause the fluorescent spot to write a solid line across the face of the electron screen. The length of the luminous line or trace, so written on the screen, varies in the approximate ratio of  $1\frac{1}{4}$ " for each 100-volt variation of the free plate biasing potential. This approximate sensitivity varies, however, with the voltage applied to the final anode of the tube. Thus, with an increase in the final anode potential, the deflection plate sensitivity decreases proportionately.

The luminous line written on the electron screen by the electrostatic influence of the horizontal deflection plates, where subject to an a-c modulation potential, is at an exact right angle to either of the plates. For the vertical plate pair, the luminous line written on the electron screen through the application of an a-c modulation potential to the free plate of this electrode pair is at an exact right angle to the line written by the horizontal deflection plate pair. Therefore the fluorescent spot may be caused to appear at any point on the electron

<sup>7</sup>H. J. van der Bijl, *Thermionic Vacuum Tube*, page 146, sect. 52, Edition 1.



# DESIGN . . . APPLICATIONS . . . SERVICING

When through suitable choice of the voltages applied to each of the free deflection plates. Under certain conditions, the electron beam is capable of writing on the electron screen any conceivable type of single line pattern, ranging from a simple straight line to the most complex type of harmonic pattern.

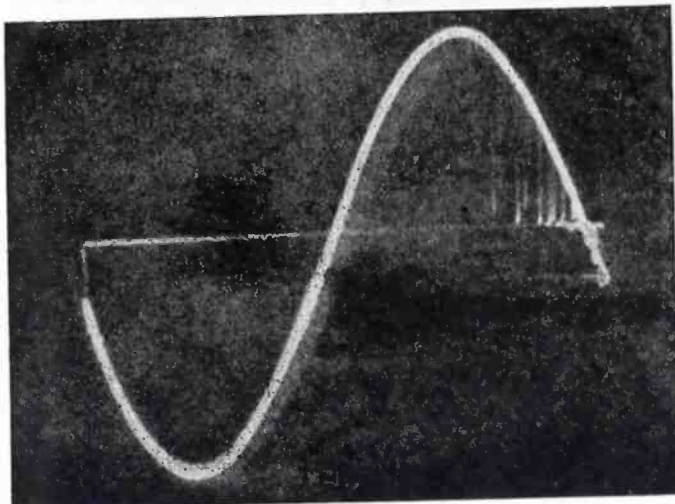
Inasmuch as the reactions which take place in electronic circuit potentials and currents produce patterns which are mathematical curves, the cathode-ray tube is most useful when one of the curve functions appearing is linear; one of the variable potentials which is utilized to move or sweep the electron beam increases or decreases in equal proportion per unit of elapsed time. In commercial instruments, it is conventional to apply such a linearly varying voltage to the deflection plate of the horizontal deflection plate pair. When the cathode-ray tube is operated in this manner, any voltage reaction which occurs in the modulating circuit of the vertical deflection plate pair appears as a recognizable voltage variation curve on the tube's electron screen.

In Fig. 2, the horizontal modulating voltage is obtained from a capacitor which is charged under a constant current rate, and the vertical modulation potential is obtained from a commercial power frequency a-c line. The horizontal linear voltage variation reaction to the non-linear vertical voltage variation is productive of the familiar sine-wave cycle pattern. From this photograph, therefore, it may be definitely concluded that the voltage applied to the free vertical deflection plate varies as the trigonometric sine of the horizontal voltage variation.

Since the cathode-ray tube is essentially an electron-optical form of the electron tube, the tube requires an appreciable amount of care in its application and use. In general, however, commercial cathode-ray tubes are more durably constructed than the conventional type of vacuum tube. Nevertheless, it is possible to prolong the useful life of this valuable tube through observation of a few simple rules in its usage.

Aside from consideration of the cathode-ray tube's fragile envelope, its most vulnerable component is the electron screen. The latter is permanently impaired if it is required to dissipate a greater amount of energy than is specified by the tube manufacturer. Hence, the electron screen must be subjected to an electron beam bombardment

Fig. 2 . . . How an a-c sine wave appears on the screen of a cathode-ray tube. It is apparent here that the electron beam is caused to move over the screen surface like an electrical pencil, in accordance with two functions: (1) horizontally, equal time units (microseconds), and (2) vertically, sine-proportional voltage increment and decrement.



intense enough to produce only the minimum level of observed pattern luminous intensity. Further, when the incident light level is higher than that experienced on a moderately cloudy day, the screen should be properly shaded from excessive light to permit reduction of the necessary electron beam current or intensity. If, however, it is necessary to photograph the pattern written on the electron screen, the luminous intensity of the pattern may be increased to a level which produces satisfactory reproductions, provided that the intensity level is reduced to the normal observation level at the earliest possible opportunity following the recording of the screen pattern.<sup>8</sup>

Since the useful life of the tube ends with the failure of the heater, great care must be taken to insure operation of the heater at the rated voltage and current. The voltage applied to the tube cathode heater is maintained at the proper voltage level in commercial c-r units through proper design of the power transformer. It should be observed, however, that the normal heater potential obtains only when the device is operated from a voltage source within the rating or range of input potential. It must be borne in mind that operation of the cathode heater at an excessive potential results in the destruction of the emissive oxide coating binding vehicle with the resultant flaking or loss of the emissive material from the cathode thimble.

Another precaution tending to preserve the life of the cathode-ray tube involves the protection of the latter from mechanical shock or vibration. Indirectly, the life of the cathode

heater is affected, whether this element is constructed of sag or non-sag wire, mechanical shock tending to break the heater wire in the former instance, and to cause its mechanical distortion in the latter. Shock and vibration may have more serious effects on the electron gun and deflection plate structure, however, since these electrodes may be caused to bend away from their proper respective positions by reason of the inherent inertia of the electrode mass. Once the deflection plate or electron gun structure is distorted from its original position in the tube envelope, an electronic aberration will be present in the curve pattern developed on the electron screen.

It has been observed, in the preceding discussion, that the electron beam

(Continued on page 38)

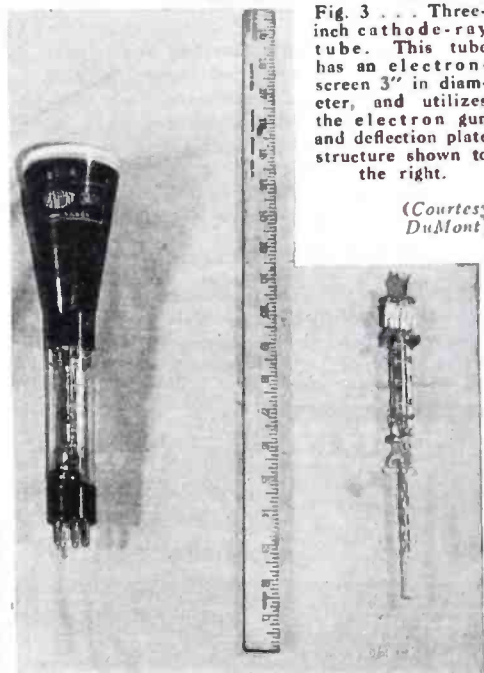


Fig. 3 . . . Three-inch cathode-ray tube. This tube has an electron-screen 3" in diameter, and utilizes the electron gun and deflection plate structure shown to the right.

(Courtesy DuMont)

<sup>8</sup>P. S. Christaldi, *Practical Guide for C. R. Design* (Special Considerations in Photographic Work), page 29.

# F - M DISCRIMINATORS

(Continued from page 16)

both sides of this condenser are at r-f potential.

The 6H6, 7A6, or whatever tube is used for the discriminator, should be checked for identical characteristics for both diodes, since any variation in

diode response will affect the linearity of the discriminator curve.

Sufficient signal must be fed from the signal generator to the mixer grid to insure proper limiter action. Too



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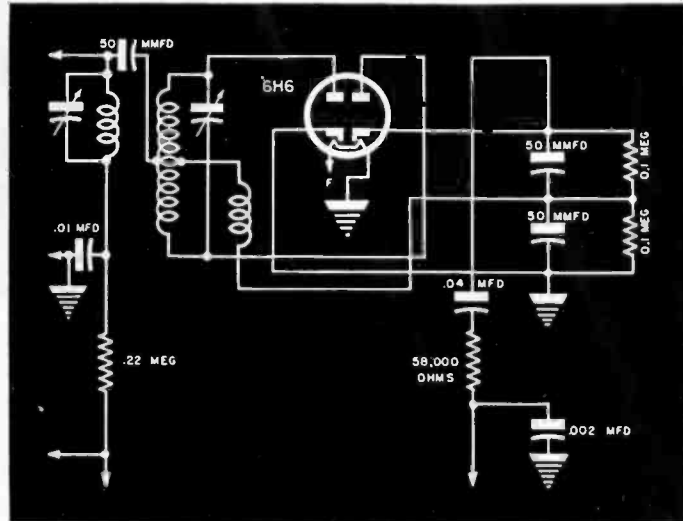


Fig. 6 . . . Stromberg-Carlson 25 discriminator. The choke in series with the secondary tap is used to reduce the loading effect of the two .1-megohm resistors on the transformer secondary.

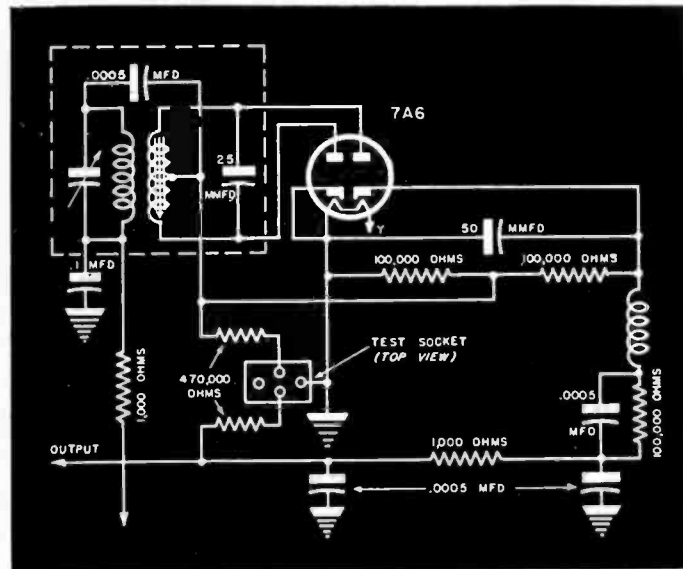


Fig. 7 . . . Zenith 12H678 discriminator. A socket is provided on the chassis to permit insertion of instruments for discriminator alignment.

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#### G.E. J FM90

Figs. 4 to 7 show some representative discriminator circuits as used in standard receivers. Fig. 4 is the discriminator used in the G. E. J FM90. Two points are worthy of note. A temperature-compensated capacitance, in parallel with the trimmer, serves to tune the secondary of the discriminator transformer. This is done to prevent frequency drift in the discriminator which may result in detector unbalance. A high-frequency line filter is used to remove any residual r-f and to deaccentuate the highs.

#### Pilot 300

In Fig. 5 appears the discriminator circuit used in the Pilot model 300. It is identical to the G. E. type except for the tube.

#### Stromberg-Carlson 925

The Stromberg-Carlson discriminator used in their model 925 is shown in Fig. 6. An r-f choke is used in the return of the secondary center tap to reduce the loading effect of the cathode resistors on the discriminator secondary, thereby improving its characteristics.

#### Zenith 12H678

The discriminator used in the Zenith 12H678 (chassis 12A6) is shown in Fig. 7. An iron core is used in the secondary of the discriminator for alignment. The RC network in the lower right-hand corner is an a-f compensation circuit for uniform frequency response. A special socket is included in the chassis to permit quick checking of the discriminator with a vtvm.

#### Usual Service Troubles

Service troubles in the discriminator are usually limited to poor audio response. This is caused by unbalance of the d-c voltages developed across the diode-cathode resistors. If the diode-cathode bypass capacitor is open, the d-c voltage across either cathode resistor will be found to be quite low.

In any event, realignment of the discriminator will usually result in improved performance.

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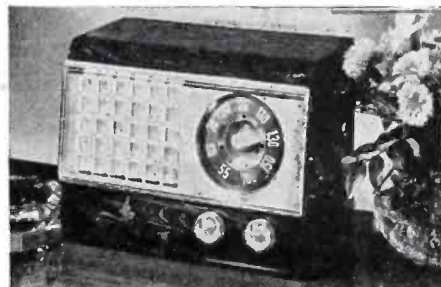
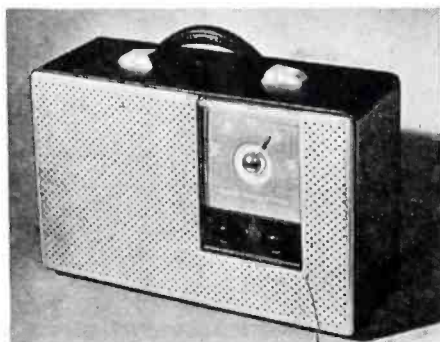
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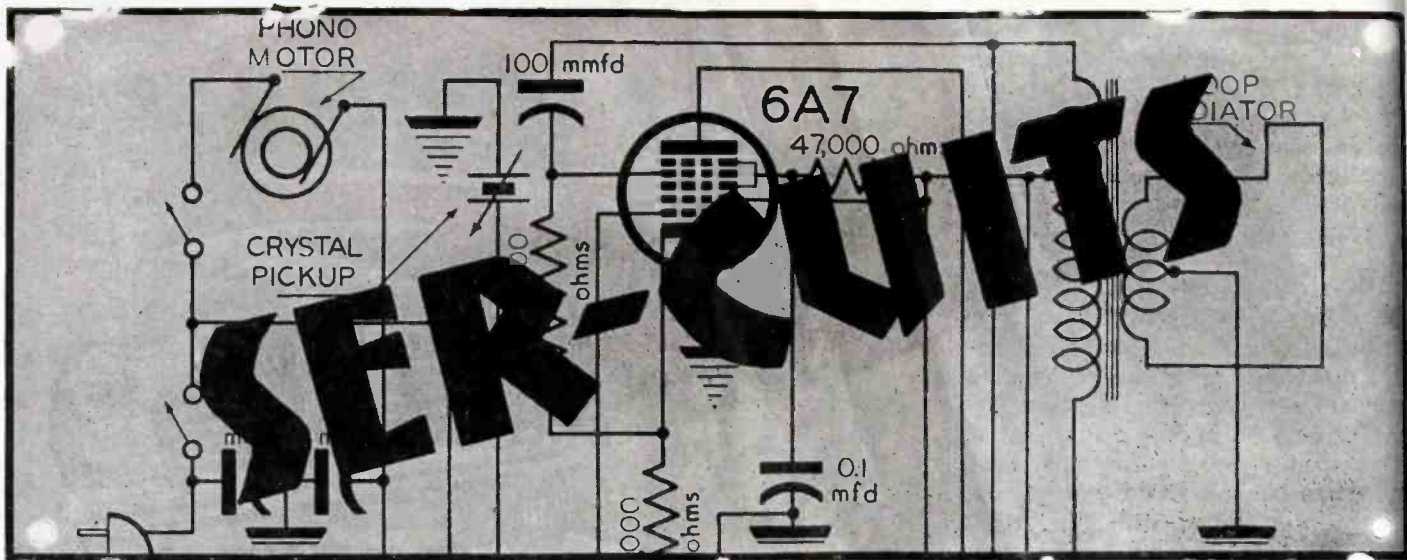
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#### POSTWAR PORTABLE AND TABLE MODELS



Emerson portable and table models displayed at a recent distributor postwar-receiver meeting.



by HENRY HOWARD

A 2-BAND receiver with simple band-switching, Fada 204, is shown in Fig. 1. An external antenna is connected to the primary of the short-wave transformer, to the primary of the loop antenna and to the chassis through a .01-mfd condenser. The signal grid of the 12SA7 converter is switched from loop to short-wave transformer by a single-pole double-throw switch. The oscillator switching is even simpler. Part of the grid coil in the oscillation transformer is shorted. The new potential end of the grid coil is connected directly to cathode instead of *B*—. Both the converter and i-f stages are supplied by *avc* as well as supplementary resistors. The converter

has a 99,000-ohm grid leak shunted by a .0035-mfd capacitor between the low side of the short-wave secondary and chassis. This is not in the circuit in broadcast position. The 12SK7 i-f has a 37-ohm cathode resistor without a bypass condenser.

**Silvertone 8935-8942**

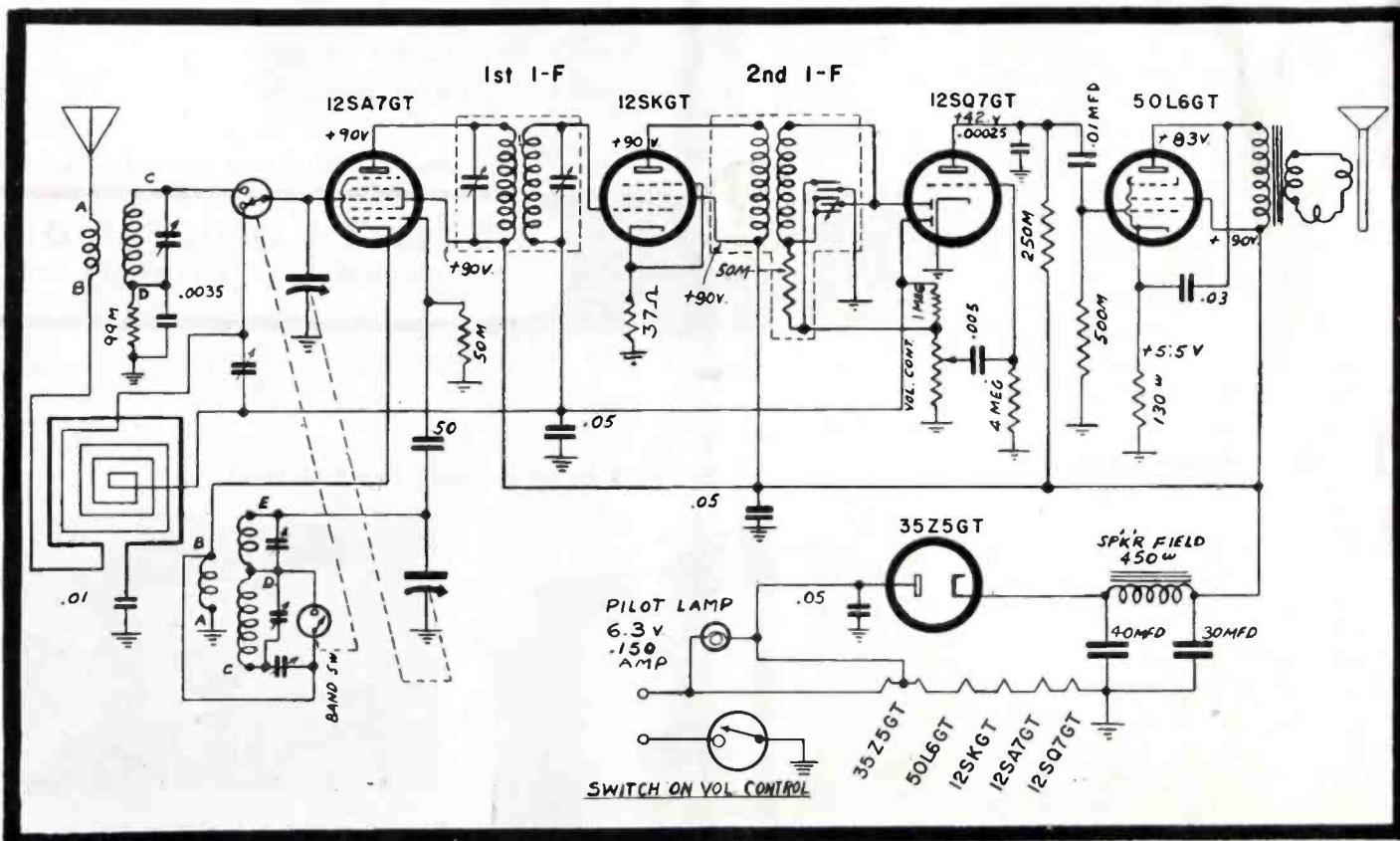
A 35-watt general-purpose amplifier, Silvertone 8935-8942, with 4 jacks for high-impedance inputs and a phono pickup plug appears in Fig. 2. Four

stages are used on the high-gain inputs and three on phono. Two separate channels are used for two stages after which the outputs are combined into a single channel. 6J7 pentodes with a 1-megohm grid input supplies substantial gain in the first stage. In the second stage are 6C5s with 1/2-megohm volume controls. A third 6C5 serves as the first stage of the phono amplifier. All three 6C5s have common plate connections which feed one of the 6N7 triodes as a third stage. The other triode acts as a phase inverter for driving a push-pull 6L6 output.

The gain of the 6J7 stage is controlled by dual screen-grid potenti-

(Continued on page 32)

Fig. 1 . . . Fada 204 two-band receiver. Signal grid of 12SA7 converter is switched from loop to s-w transformer by single-pole double-throw switch.







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## POWER TUBE SUBSTITUTIONS

by B. W. KAY

THE present tube situation has necessitated the use of many substitute types in replacement. Where power tubes are involved, the load impedance of the output transformer in the receiver may differ from the recommended load resistance for the substitute tube, so that considerable mismatch results, with consequent distortion and poor tone quality.

### Power Tube Data

Most tube manuals do not include data on power-tube characteristics at reduced plate voltages, where the tube has not been considered applicable to a-c/d-c operation. However, two simple formulas may be used to determine the proper load impedance for a tube operating at reduced plate voltage. These formulas apply only to tubes operating in class A1.

For pentodes and beam power tubes:

$$\text{Load Resistance} = \frac{\text{Plate Voltage}}{\text{Plate Current}}$$

For triodes

$$\text{Load Resistance} = \frac{\text{Plate Voltage}}{2 \times \text{Plate Current}}$$

These formulas are only approximations, but their use in the selection of a substitute power tube will insure fairly good results.

### C Bias

Some control of the impedance of a tube may be obtained by the proper use of C bias. Since the bias voltage establishes the plate current, the load impedance of the tube may be increased or decreased by varying the bias.

As an example, let us assume we are to replace a 43 type tube in an a-c/d-c receiver. This tube, with 95 volts on the plate, requires a load resistance of 4,500 ohms. Using the formula

$$\text{LR} = \frac{E_b}{I_b} \text{ or } I_b = \frac{E_b}{\text{LR}} = \frac{95}{4500} = .021 \text{ ampere}$$

Therefore any tube whose plate draws 21 ma at 95 volts is eligible. A 6V6 tube may be used, with 17 volts bias, which would limit its plate current to 21 ma.

### Using a 6V6

If it were necessary to replace a 25L6 with a 6V6, the same procedure

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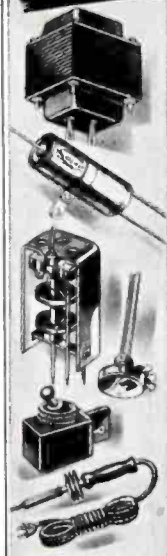
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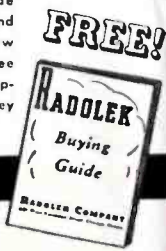
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...e of the 25L6, the plate current is  
...roximately 50 ma, equal to a load  
...istance of about 2,000 ohms. To  
...tain the same load impedance with  
...V6, a bias voltage of 10 volts should  
...ased.

### Matching

The simplest method for matching  
... substitute tube to the plate impe-  
... of the receiver's output trans-  
...ner, is to install the new tube, and  
... adjust the bias voltage so that the  
...e current is equal to that of the tube  
...stituted. This rule applies only  
...en pentodes are substituted for pen-  
...des, and triodes for triodes.

### Bias Control

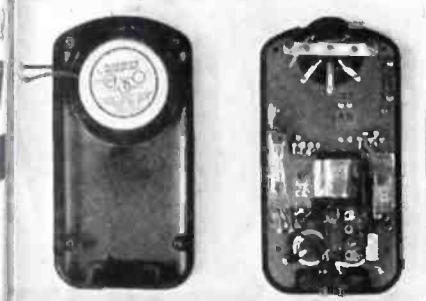
The limits for bias control of load  
... impedance are set by the driving volt-  
... delivered by the driver, or first  
...lio tube. If the bias necessary to  
... establish the proper load impedance is  
... low, the driving voltage may ex-  
...ceed the bias voltage, thereby creating  
... distortion. If this is the case, the gain  
... of the driver stage may be reduced by  
...unting the plate resistor of the driver  
...age with an equal resistor to reduce  
...e stage gain.

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...oped during the past few years. These tubes  
...vide unusually high gain and are finding ap-  
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...h miniature tubes. Exactng parts placement  
...essential in these small units to avoid feed-  
...back and thus afford maximum amplification  
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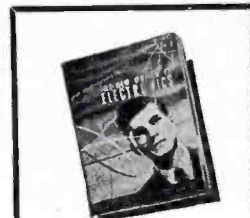
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# POWER AMPLIFIERS

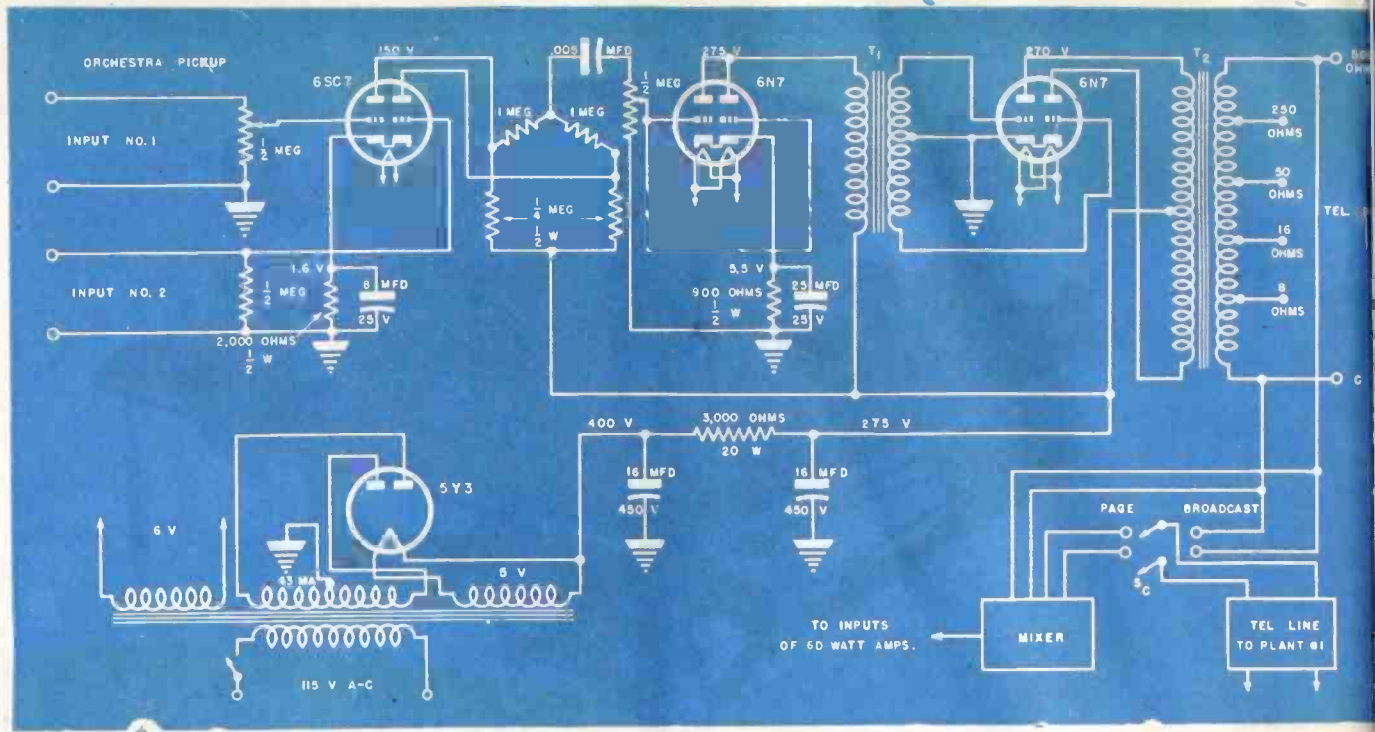
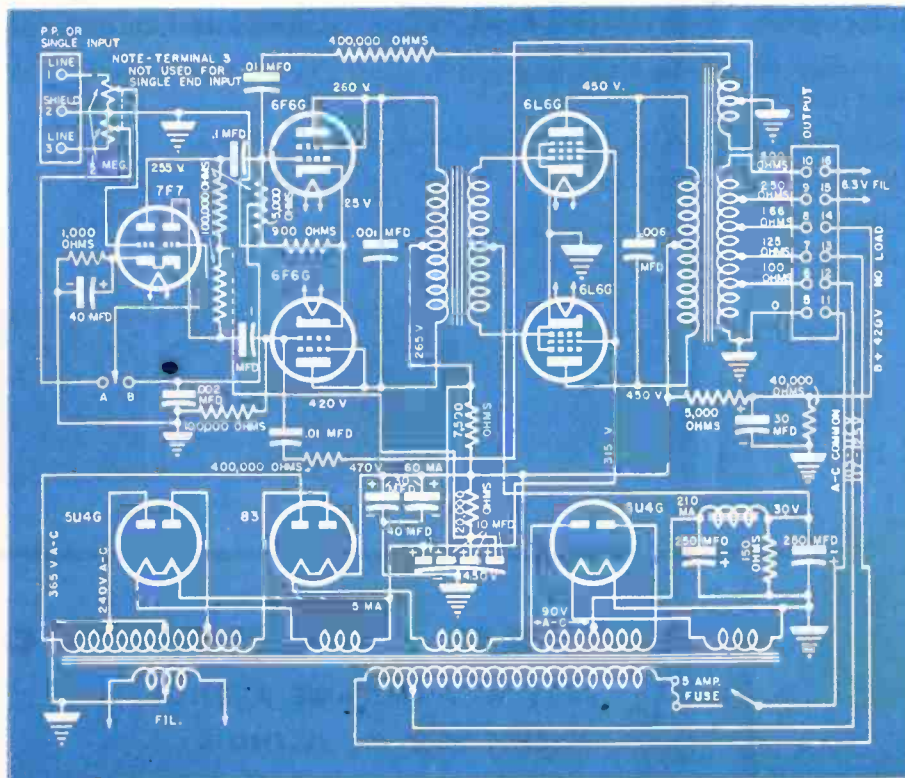


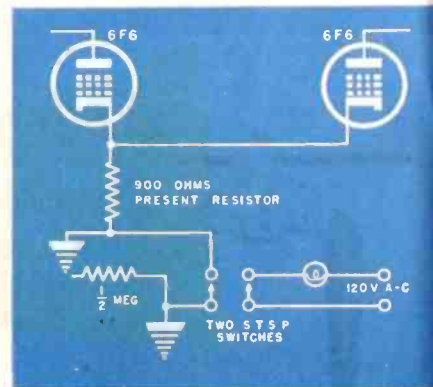
Fig. 1 (Above). . . . A mixer circuit for use with the 60-watt amplifier shown below. Two inputs are provided for microphone pickup. A switch permits paging over the same system as well as b-c rebroadcast. A mixer is also used for plant intercommunication.

Fig. 2 (Below). . . . A 60-watt audio amplifier developed by the Rauland Corporation for use in large plants. This unit is rack type and is complete with power supply.

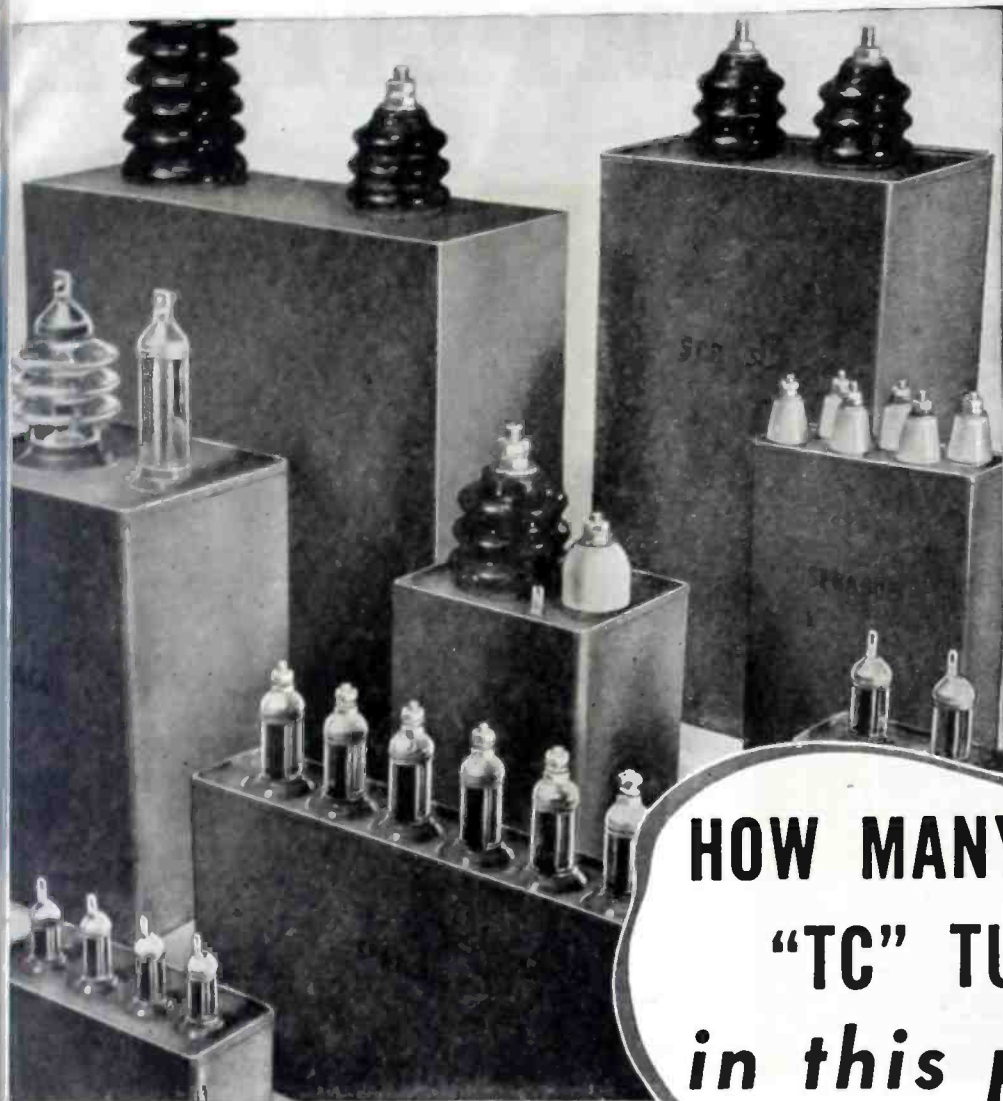


On this page and page 36 appear circuit diagrams of sound units used in a 6-plant installation. In the June issue appeared an analysis of the 800-cycle signal generator, nine-channel mixer, ten-watt booster amplifier and four-channel equalizer used in this installation. The article was written by Harold Lewis of the Sound Maintenance unit at the Pollak Manufacturing Company, where the installation was made.

Fig. 3 . . . A half-power circuit for use with power amplifiers. The use of this circuit permits a low musical background for voice announcements. Driver tubes are in 60-watt amplifier.







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*(Jobbing Sales Organization for Products of the Sprague Electric Co.)*

# SPRAGUE



**"NOT A FAILURE  
IN A MILLION!"**

# POWER AMPLIFIERS

(See page 34 for additional power-amplifier circuits)

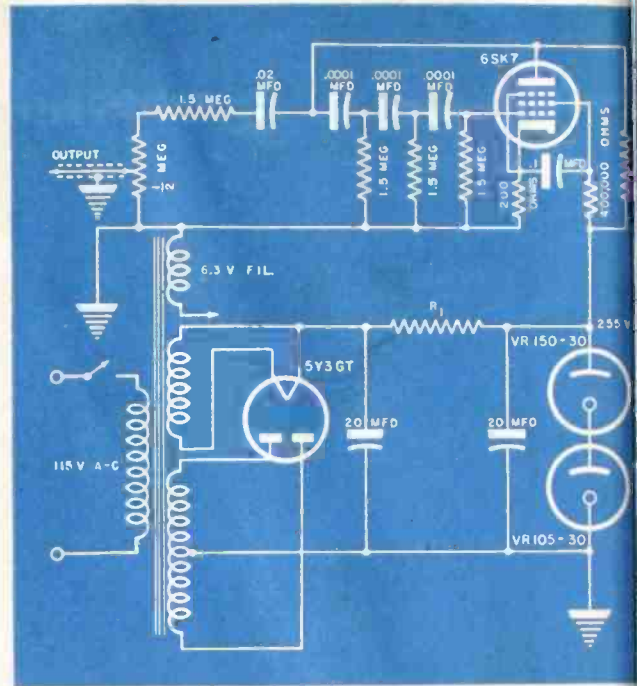
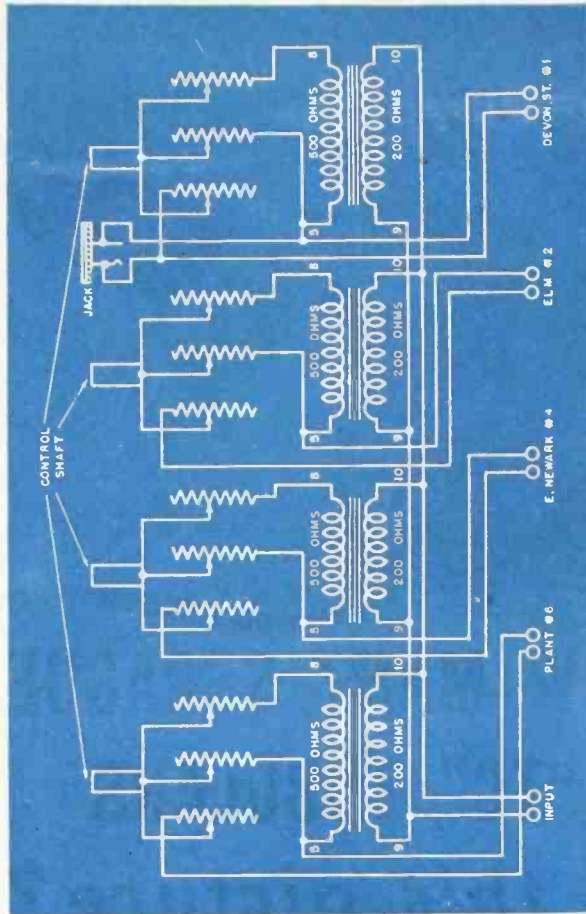


Fig. 4 (Left). . . . A four-plant transformer-type volume-level control unit. A single input may be used and redistributed to four plants, with the volume control monitored from one stud.

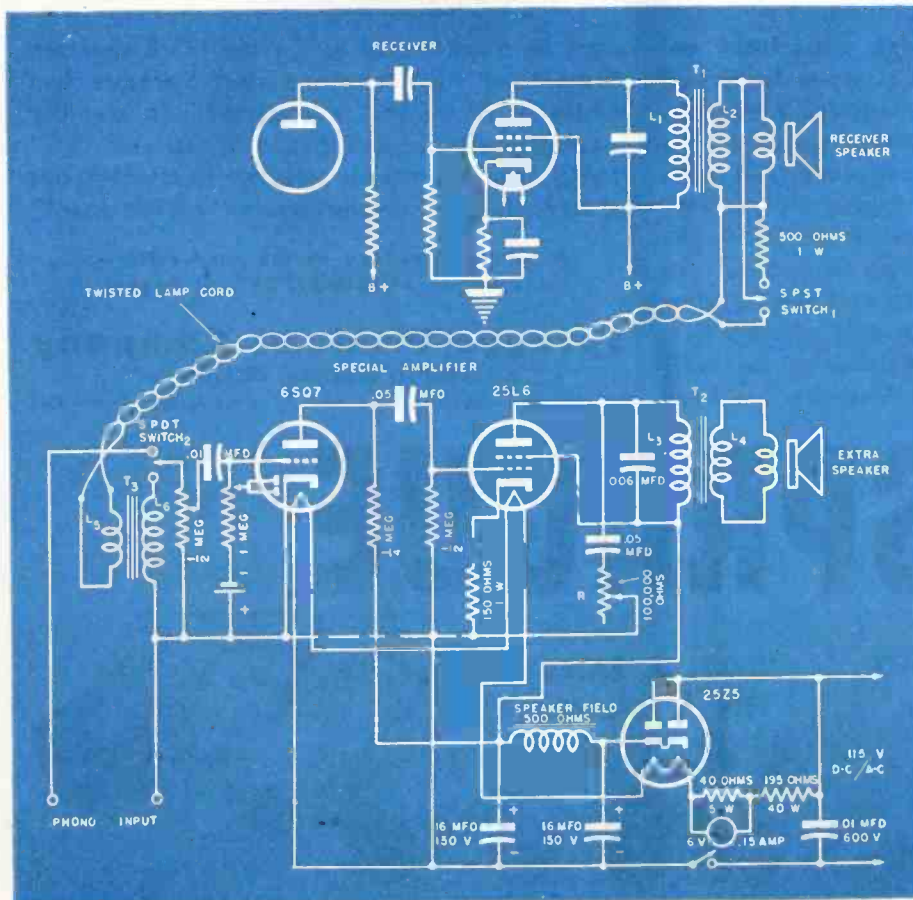


Fig. 5 (Above). . . . A 400-cycle phase shift oscillator for use in conjunction with plant-amplifier systems. Attention signals or fire alarms or any type of coded signal may be transmitted with this device.

Fig. 6 (Left). . . . A separate receiver amplifier for minimizing reaction back to the receiver circuit. This unit permits separate control of volume and tone. (See Willard Moody article, "Loudspeaker Conditions for Improved Tone Quality" SERVICE, June, page 16.)



## UTAH RADIO AND DETROLA TO MERGE

proposal to merge Utah Radio Production Company, Chicago, and International Detrola Corporation, Detroit, was made recently. Meetings of stockholders to vote on proposal will be held soon. International Detrola recently acquired controlling ownership of Rohr Aircraft Corporation, California.

## HENRY HUTCHINS BECOMES PRESIDENT OF JOHN MECK INDUSTRIES SALES CORP.

Henry Hutchins, formerly with National Union Radio Corp., as sales manager, has been elected president of John Meck Industries Sales Corporation. Offices are at 35 East Wacker Drive, Chicago, Illinois. The unit will handle national sales of Meck radios.



## DAVID J. FINN NOW RCA RENEWAL TUBE & PARTS SALES MANAGER

David J. Finn has been named manager of the renewal sales department of the RCA tube division. Mr. Finn will be in charge of the sale of tubes, component and replacement parts sold through distributors and retailers. Prior to his appointment, Mr. Finn was Chicago regional sales manager for RCA Victor.



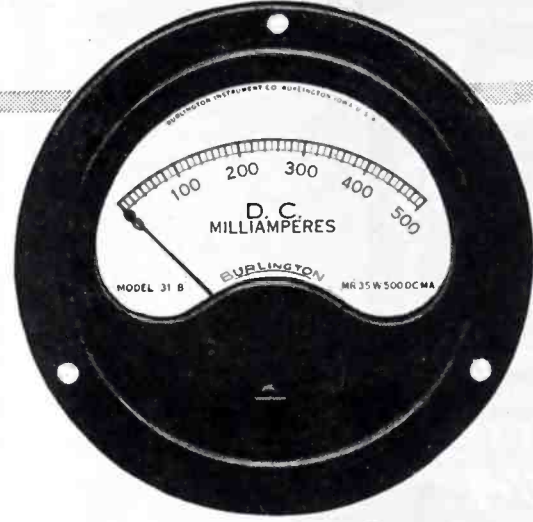
## NEWS OF THE REPRESENTATIVES

A. B. Patterson, 1124 Irwin-Keasler Bldg., Dallas, Texas; John M. Maynard, 1777 Shenandoah, Dallas, Texas; and F. Klicpura, P.O. Box 3113, Houston, Texas, have become members of the Northwestern chapter. Dale G. Weber of 126 S.W. Capitol Highway, Portland 1, Oregon, has been added to the roster of the Northwest chapter and Douglas H. Luksta of 408 York Road, Towson 4, Md., has become affiliated with the Mid-Atlantic chapter. The New York chapter has accepted associate membership application from Jack Fields, 27 Park Place, New York 7, N. Y. David Sonkin, national secretary has recently moved his office to 347 Fifth Ave.

(Continued on page 45)

# Burlington

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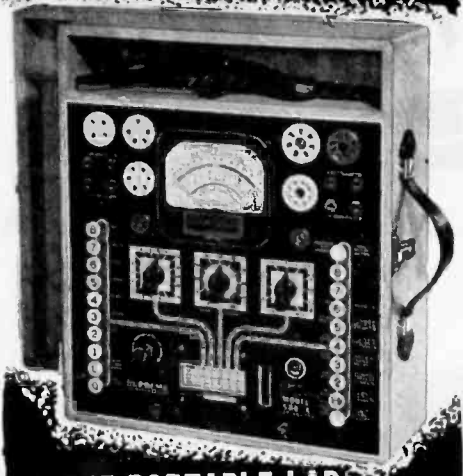
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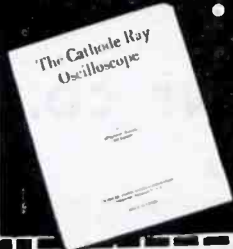


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DC AMPERES: 0-1-10  
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AC VOLTS: 0-5-10-50-250-1000  
OUTPUT VOLTS: 0-5-10-50-250-1000  
OHMMETER: 0-200-2000-20,000 OHMS  
0-2-20 MEGOHMS  
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## C-R TUBES

(Continued from page 25)

is responsive to the influence of a magnetic field by reason of its current or electron flow characteristics. Briefly, the electron beam is readily deflected by a magnetic field. If the cathode-ray tube is operated in a strong magnetic field, and this field may be of either constant or alternating nature, the pattern traced on the screen of the cathode-ray tube is distorted from the true or actual condition. Where this form of distortion is recognized, efforts are made to correct the distortion by increase of the cathode-beam intensity, thus subjecting the electron screen to the resultant irreparable damage. Again, where the magnetic field is of constant nature, the pattern may be deflected off the screen entirely, in which event correction of the deflection is attempted by application of excessively high potentials to the free deflection plate in the affected axis. Since the conductors which are connected to the beam deflection plates pass through the glass flare on which the electron gun structure is mounted, this glass insulator then is subjected to high dielectric strain; the glass may fracture and thus render the tube useless. In the instance of the commercial device which uses the cathode-ray tube, precautions are taken to prevent the application of excessive correction potential differences to the deflection plate pairs. Despite this precaution, it is advisable to correct spurious beam deflection by magnetic fields to conserve the life of the tube.

Protective measures against stray magnetic fields include shielding of the tube with a magnetically permeable or magneto-conductive metal shield, and the mounting of the entire cathode-ray apparatus in a similar shielded structure. Thus, the heater of the tube is shielded against magnetic fields in which it would tend to vibrate, this phenomenon occurring as the result of

(Continued on page 39)

## tone-VOLUME CONTROLS

(Continued from page 23)

as to provide *minimum* loudness at the extreme counter-clockwise setting of the knob (the movable contact arm of the unit being at the left-hand end of the resistance element, looking at the unit from the shaft end and with the terminals downward), with taper characteristics and connection into the circuit such as to give smooth, even increase of volume with clockwise rotation of the control knob.

[To be continued]

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a-c magnetic field reaction against stray field.<sup>9</sup>  
 Other protective measures designed to effect conservation of the cathode-ray tube life involve its proper operation after long periods of use. These particular precautions require that the tube be properly tested for its electrical condition periodically during such periods of protracted use.

**Tests**

Among the various electrical tests which indicate the electrical condition of the cathode-ray tube, the most important concern its cathode heater resistance and electrode current records which reveal the deterioration of cathode emission and tube vacuum. If such electrical tests are to indicate the condition of the tube under consideration, it is essential that a periodic record of tube function be properly established. The cathode-ray tubes of similar design do not usually exhibit similar electrical functional characteristics.

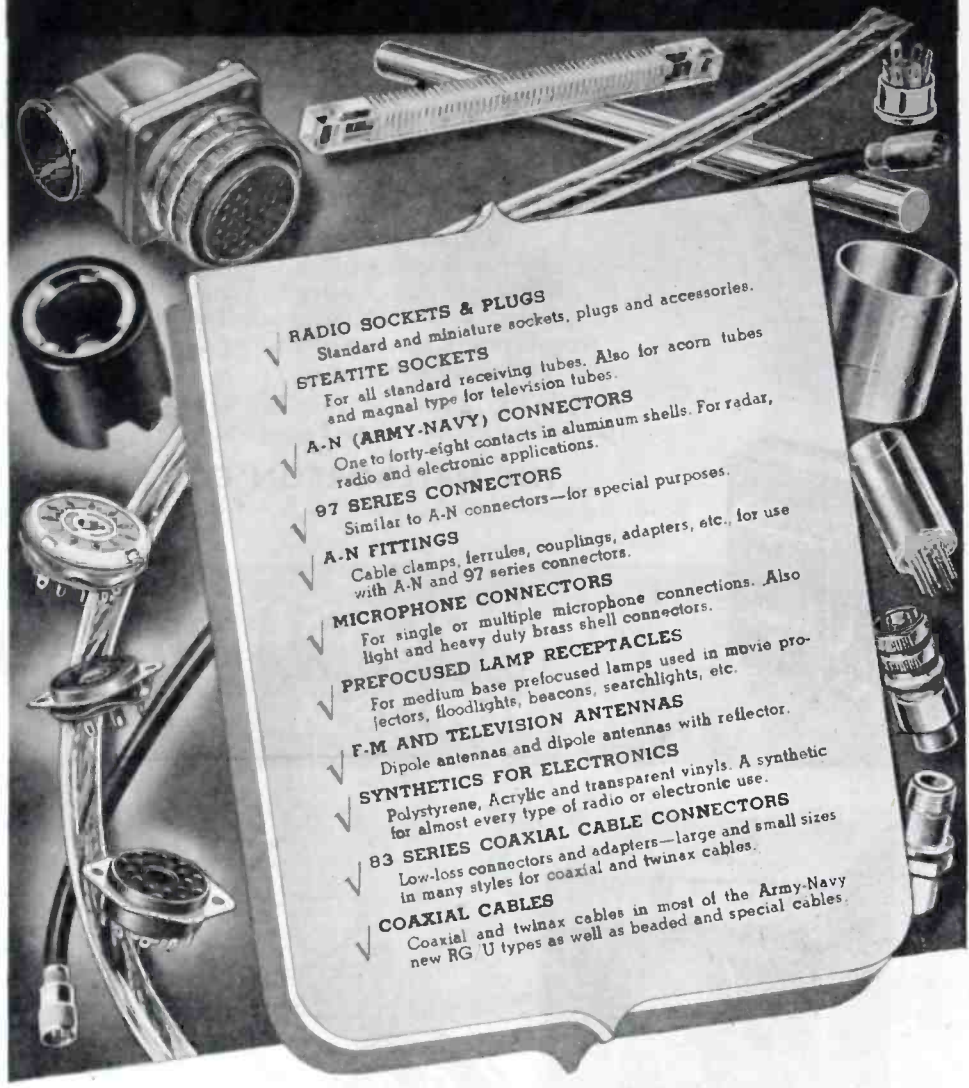
The cathode-heater resistance test provides a direct and reliable indication of the rate at which the mass of the cathode falls through slow loss by thermionic emission. A periodic record of the electrode resistance indicates a slow rise in the heater resistance as a result of constant operation over long periods of time. Since the emission from this electrode is feeble, and the temperature at which it operates is relatively low, the recorded rise in its resistance is correspondingly slow. However, any indicated rise in the resistance of this electrode is a direct warning that precautions must be taken to prevent shock or vibration.

Periodic records of the electron-gun electrode currents are effective in revealing the condition of cathode-oxide coating, as well as the envelope vacuum. Since the first and second anodes are the only electrodes of the electron gun which draw appreciable current, except in those cases where the tube is provided with an intensifier electrode, periodic records of these currents must always be taken under exactly the same operating conditions. Thus, the tube under test is placed into operating condition and is so adjusted that a single horizontal trace approximately 1/2 inch in length is written on the electron screen. Under these conditions, the stray electrons which reach the first and second anodes are those not having sufficient velocity to escape the attraction exerted by these positively

*(Continued on page 40)*

If the shield about the tube envelope exhibits signs of permanent or residual magnetism, that electron beam is permanently deflected by reason of the electro-magnetic influence resulting between the two.

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Coaxial and twinax cables in most of the Army-Navy new RG U types as well as beaded and special cables.

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## C-R TUBES

(Continued from page 39)

charged electrodes. Any condition affecting either the emission of beam electrons from the tube cathode or the velocity of the electrons in the beam, is reflected as a change in the currents drawn by the first and second plates or anodes.

Inasmuch as these plate currents are directly dependent on the emission provided by the tube cathode, a reduction in either of the electrode currents is a direct indication that the cathode emission has been somewhat reduced. Hence, the record of the first and second anode currents, where these are taken under identical conditions is a direct indication as to the probable life of the tube.

Material increases in the recorded first and second anode currents indicate that the electron beam velocity is reduced by the reduction of the envelope vacuum. This condition may be seriously complicated when the vacuum is contaminated with any of the noble gases, such as neon or argon. Either a decrease in the tube vacuum or the contamination of the tube atmosphere with any of the mentioned gases results in a partial dispersion of the electron beam. The electrons thus escaping the necessary acceleration are attracted to either the first or second anode causing an increase in their respective operating currents. Where the tube under test is provided with an intensifier electrode, the presence of gas in the tube atmosphere or the reduction of the vacuum results in a decrease in the intensifier electrode current.

The rise of gas contamination in a cathode-ray tube is the direct result of improper tube operation. If the beam current is permitted to attain an excessive value, or if the cathode of the tube operates at an excessive temperature, the metal electrodes of the tube tend to give off a portion of the occluded gases contained in their structures, although careful attention is given, during manufacture of the tube, to the degassing of these electrodes through electronic heating of these components to high temperatures.

Since the envelope of the tube is in close proximity to the metal shield which surrounds the tube, the application of excessive voltages to the deflection electrodes may result in the development of a brush discharge to the envelope wall with the attendant danger of either a fracture or puncture of the envelope glass. This condition often occurs when the high potentials are applied directly to the deflection electrodes. Since cathode-ray tubes having greater screen diameters re-

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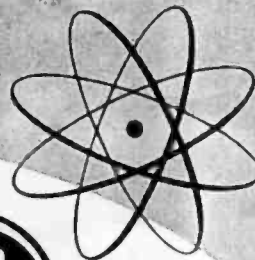
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Electronic Measuring Instruments

**GENERAL ELECTRIC**

177-D4



are higher deflection and operating potentials for development of a suitable written pattern on the electron screen, protective measures applied to the tube of the cathode-ray tube must be increased in proportion to the diameter of the tube electron screen.

Commercial cathode-ray tubes range, in electron screen diameter, from 1" to 12" in diameter. Where the tube is especially designed for application to television reception systems, it is technically designated as a *kinescope*.<sup>10</sup> In general, kinescopes vary little from the fundamental design characteristics of the cathode-ray tube proper except that, in some kinescopes, magnetic focusing and even deflection of the beam is resorted to provide the desired characteristics in the larger types. In addition the color of the screen luminescence may be other than the conventional green.

In conclusion, we find that the cathode-ray tube is a special form of the conventional vacuum tube, designed taking optical considerations. It is capable of producing visual written pages or graphical curves of highly accelerated voltage variations, thus providing a visual record of the nature and extent of the variations under consideration or observation.

PHB-3, RCA Vacuum Tube Handbook, C. R. ...

## VARIABLE CONDENSER SERVICING

by EDWARD ARTHUR

(PART II)

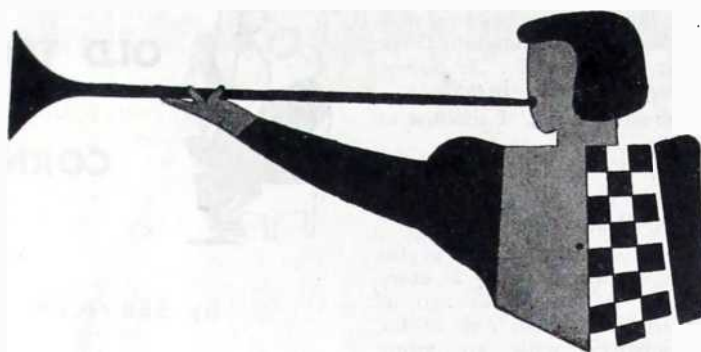
MICROPHONICS may arise in the tuning condenser due to vibration caused by the speaker. In superheterodyne receivers, the condition is created by the modulation of the local oscillator, caused by the vibration of that portion of the tuning condenser which tunes the oscillator. If grommets are used, they should be checked to insure their freshness and pliability. If the unit is mounted directly to the chassis, the entire chassis should be mounted on rubber or other shock insulating material. Sometimes the use of celotex, or other sound absorbing material, in the chassis compartment, effectively reduces vibration. If mechanically possible, the tuning condenser itself should be mounted on a thin sheet of rubber, with the holding screws insulated from the chassis with some more rubber. A ground pigtail should be connected from the unit to chassis.

Quite often the tuning condenser will be the cause of oscillation. The immediate

cause is interaction or feedback between two sections of the tuning unit. This condition is common in midrange receivers of the t-r-f type. A tin shield, which is easily worked or bent, inserted between the two sections of the tuning condenser, will help. The usual method is to bend the sheet at right angles around one of the sections, and solder in place. When the tuning condenser is mounted upright, so that the plates operate vertically, it may be necessary to shield the exposed rear of the unit. At other times a shield interposed between the tuning condenser and the nearby tubes helps. To

determine the location of the feedback point, a piece of heavy tinfoil, which is easily bent, may be used to find the most effective position for the shield.

Some band-switching circuits switch the coils used with the tuning condenser, instead of shorting out a portion of the coil for the higher frequencies. While the tuning condenser is not physically involved, trouble at the band-switch contacts may produce symptoms similar to those characteristic of the tuning unit. The band-switch contacts should be checked for improper contacts, and, where necessary, cleaned with carbon tetrachloride.



# An important announcement

WARD LEONARD next month will start the distribution of bulletins describing its greatly expanded line that is now being made available to the trade through Radio and Electronic Parts Distributors. The line will include a complete assortment of

## RESISTORS — RELAYS — RHEOSTATS

Each bulletin will be complete in itself and will be distributed as soon as it is printed. Write for your copies now.

## WARD LEONARD ELECTRIC CO.

Radio and Electronic Distributor Division  
82 West Jackson Blvd., Chicago, Ill.



**W**HILE walking down the street recently, I saw a friend, Johnny, putting the finishing touches to a new sign on the side of his combination truck and service car which read . . . *Sound Systems Repaired—Rebuilt—Installed.*

"Mighty interesting sign," I shouted to Johnny.

"Hello, there," he replied.

"Glad you like it. I'll be finished in a few moments. Wait around."

I waited, and soon we were in his shop, Johnny revealing quite a story about that sign. A few weeks ago he had had a hurry call from one of the local concessionaires with an ailing sound system. The repair man usually called, was ill, and so Johnny was asked to sub for him. Johnny had been *Johnny-on-the-spot!* And he had so impressed the sound-system user, that he had been told that all the repairs would be his from then on.

### Johnny's Program

That one job had led to others, till Johnny was quite a busy sound-system Service Man. I knew that audio maintenance required many hours of work. So I asked Johnny how he could afford to take on so many jobs, particularly since most of the repairs had to be done of the premises where the p-a systems were located. This meant that Johnny had to go into many a war plant in the vicinity, and work fast. Hardly a way to do thoughtful work.

Johnny told me that while the repairs to sound systems were slow and often took a long time to finish, he had outlined a program which clipped hours off. And since he was operating on a *flat-fee* basis plus the cost of the parts he replaced, the plan was working out very well.

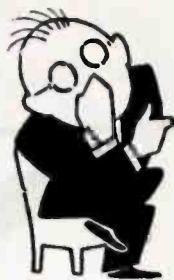
### Usual P-A Defects

While his method is not new, it warrants repeating and comment. In the first place, the p-a systems generally had only one of two defects which were not hard to find. Either they did not play at all, or there was so much distortion that the response was non-intelligible.

Broken mike cables, burnt-out transformers or filter condensers, even an occasional off-center speaker cone or a burnt-out voice coil, were easy to find and to repair. But it was when the unit failed completely that worry began.

### Initial Procedures

In Johnny's system he first inquires about the trouble. Let us assume that the proprietor says that the set will not play at all. Johnny checks the mike cable for a short (an open would generally cause an awful a-c hum). Then he checks the fuse and looks at the tubes to be sure that all filaments are lit. That usually takes a matter of minutes. If the set checked okay for all this, the loudspeakers are then disconnected from the set and a resistor of approximate value for the speaker load is then substituted. Since most of the lives being run from p-a systems are either 250 or 500 ohms, Johnny always has a supply of resistors of those values in his kit



## OLD TIMER'S

## CORNER

by **SERVICER**

bag with varying ratings from 5 through 250 watts.

Connecting a suitable resistor across the output, Johnny then shunts it with an output meter and turns the volume up full. Talking into the mike should have shown some indication if the set was functioning and the line to the speakers fouled or shorted. If this checked okay, the line is then checked.

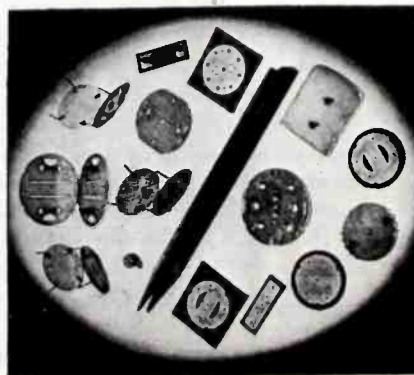
### Tracing

Checking the line is not often too easy to do. Disconnecting all the speakers from the line, an ohmsmeter is used to see if the line is shorted. If it was, it was merely a matter of tracing the short. If the line checks okay, Johnny then tests each speaker individually until the defective one is found. That one would either be replaced on the spot, or taken off the line and taken to the shop for extensive repair. If it is taken off the line, Johnny substitutes a resistor for it so that the impedance of the line is not upset.

### Home-Made Oscillator

In some instances Johnny has found that the trouble was actually with the amplifier. In that case, he uses our old friend, *signal tracing*. A home-made relaxation oscillator is used. It is hooked up to the mike input, having first disconnected the mike. Then with the output meter (and sometimes Johnny uses his 1" oscilloscope which is a very handy gadget for testing on outside of the shop premises) he checks for a signal first

### MODERN TUBE PARTS



Variety of small parts used in modern tube production. Note comparison of parts sizes with pencil.

(Courtesy Sylvania.)

at the plate of the first tube, and so on till the trouble is located.

If the first stage checks okay he probes at the grid of the second stage. If no signal came through, Johnny knew that the trouble lay between the plate of the first stage and the grid of the second stage. Again it was merely a matter of checking the coupling components, regardless of whether they were resistors and condensers or just a transformer.

### Distortion

By going from stage to stage, Johnny must finally isolate the trouble because where the signal disappears, there's trouble.

It sure sounded simple to me, and I could see from the amount of business which Johnny had collected, that he really had something there.

When it comes to distortion, the matter is not so easy. But Johnny followed the same system. Cutting down on the volume, he connects his home-made relaxation oscillator to the mike input and proceeds the same way (except he uses his oscilloscope) noting any increase in distortion over the original signal as he goes along.

### Use of Wave Form

I asked Johnny how could he expect to find distortion when the signal from his home-made oscillator was full of it in the first place. That was an easy one for Johnny to answer. He said that he first notes the wave form of the signal from the oscillator. And using that as a base, he can check for further distortion that would come from the amplifier. Finding where the p-a system introduces the most distortion, he experiments with different components.

### Sixth Sense

This seemed rather a hit-or-miss method to me, but Johnny told me that as you work at it, you get sort of a sixth sense which tells you which component is at fault. Most times, and especially when the set had been repaired several times, it was a matter of finding some condenser or resistor which was a bit out of tolerance in value. Johnny said he had even run across a resistor or condenser which while marked with one value, actually was another. As the amplifier had been used, the resistor or condenser had been subjected to heat destroying the value of the component so that it was nowhere near what it should be, and hence the distortion. These components he replaced.

### Charges

About the charges, Johnny had quite an idea. He charges a flat fee of \$5.00 to come to the plant. Then he charges a flat fee of \$3.00 to find the trouble if the set is dead, and \$5.00 if there is heavy distortion. He charges \$2.00 to replace the component, which is not functioning, if it is in the set, and \$2.00 per hour to fix the lines or speakers. And he adds to that the cost of the part he replaced. The average call nets him at least \$10.00 plus the profit from the part installed.

Fine business!



## Long Scale, Wide Range Volt-Ohm-Milliammeter



### DOUBLE SENSITIVITY D.C. VOLT RANGES

0-1, 25-5-25-125-500-2500 Volts, at 20,000 ohms per volt for greater accuracy on Television and other high resistance D.C. circuits.

0-2.5-10-50-250-1000-5000 Volts, at 10,000 ohms per volt.

### A.C. VOLT RANGES

0-2.5-10-50-250-1000-5000 Volts, at 10,000 ohms per volt.

### OHM—MEGOHMS

0-400 ohms (60 ohms center scale)  
0-50,000 ohms (300 ohms center scale)

### DIRECT READING OUTPUT LEVEL DECIBEL RANGES

—30 to +3, +15, +29, +43, +55, +69 DB

### TEMPERATURE COMPENSATED CIRCUIT FOR ALL CURRENT RANGES D.C. MICRO-AMPERES

0-50 Microamperes, at 250 M.V.

### D.C. MILLIAMPERES

0-1-10-100-1000 Milliampere, at 250 M.V.

### D.C. AMPERES

0-10 Amperes, at 250 M.V.

### OUTPUT READINGS

Condenser in series with A.C. Volts for output readings.

### ATTRACTIVE COMPACT CASE

Size: 2 1/2" x 5 1/2". A readily portable, completely insulated, black, molded case, with strap handle. A suitable black, leather carrying case (No. 629) also available, with strap handle.

### LONG 5" SCALE ARC

Far greater reading accuracy on the Triplet RED DOT Lifetime Guaranteed meter.

### SIMPLIFIED SWITCHING CIRCUIT

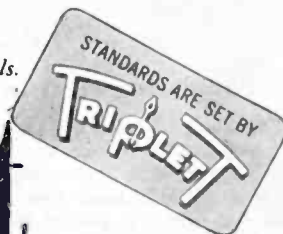
Greater Ease in changing ranges.

Write for descriptive folder giving full technical details.

HERE'S THAT NEW  
**TRIPLETT**  
**625-N**

# Triplet

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World's Largest Manufacturer of  
Wireless Telegraphic Apparatus

COMPLETE CENTRAL OFFICE EQUIPMENT

**McElroy Manufacturing Corp.**

32 Brookline Avenue • Boston, Massachusetts

## WARTIME RADIO SERVICE

1500 tested radio tube substitutions and other valuable information.

Keeps 'em Playing in spite of the tube shortage — only \$3 postpaid. Order now.

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Be sure to notify the Subscription Department of SERVICE at 52 Vanderbilt Ave., New York 17, N. Y., giving the old as well as the new address, and do this at least four weeks in advance. The Post Office Department does not forward magazines unless you pay additional postage, and we cannot duplicate copies mailed to the old address. We ask your cooperation.

## TUBES—PARTS

RADIO DEALERS—SERVICEMEN

Send for our list of available tubes and repair parts.  
Sylvania, Tung-Sol, Ken-Rad.

**M. V. MANSFIELD CO.**

937 LIBERTY AVE.

PITTSBURGH 22, PA.

## F—M RECEIVER

(See Front Cover)

THE fixed-tune r-f amplifier, modulator-oscillator and first i-f stage of a 7-tube f-m receiver, Stromberg-Carlson 515 FM, appear on the cover, this month. In the r-f amplifier, which uses a 6AC7, two tuned circuits are fed by a doublet antenna and a 33,000-ohm damping resistor from grid to ground to broaden the response. Thus, the amplifier being tuned

to about the center of the f-m band, will pass the entire band without excessive discrimination. Fixed bias is supplied by a 150-ohm cathode resistor bypassed by an .01-mfd capacitor. An unusual impedance coupling system is used on the first detector; plate choke and 50-mmf coupling capacitor.

A tuned-6SA7 converter uses a 550-mfd capacitor in series with a tuning

capacitor. A hot-cathode type Hartley oscillator contains temperature compensating shunt capacitors for greater oscillator stability. The heater is operated through the oscillator coil by tying it to the cathode. An r-f choke is then used in the heater circuit to isolate the 6SA7 from the other heaters. Such isolation accomplishes two purposes; it prevents undesirable coupling to other r-f or i-f stages through the heater circuit and it keeps various heaters from acting as a re-

(Continued on page 45)

● *Here, Mr. Radio Service Man Is a Natural for You*

Descriptive Literature Sent on Request



# SPEED IRON

PATENTS PENDING

THE SUCCESSOR TO THE ELECTRIC SOLDERING IRON

115 Volt, 60 Cycle, 100 Watt

**IT'S REALLY FAST!**

**Soldering Heat in 5 Seconds After Pressing the Trigger!**

You don't wait for the SPEED IRON to heat. It waits on your bench, cold, for you. When you pick it up and press the trigger it goes to work with a surge of power and speed that is amazing.

SPEED IRONS have been tested and used in hundreds of war plant applications over a four-year period and are now available to radio repairmen.

IF YOUR RADIO PARTS DISTRIBUTOR DOES NOT YET HAVE SPEED IRONS IN STOCK WRITE

**WELLER MANUFACTURING CO., DEPT. S, EASTON, PA.**

# SERVICING HELPS

## STEWART-WARNER R-137

*Changing volume level, cutting-off:* Remove i-f transformers, clean or replace mica insulators of trimmers and r-f trimmer condensers.

## PHILCO C-1450

*Set plays okeh in all but one position:* Try another vibrator, and if found okeh on opening original, wire will be found broken. The break is small, and just enough so that it makes contact in all but one position, when it is upside down.

## TRUETONE 13746

*Shorts and cuts off when turning volume control:* Replace rubbers of capacitor gang, as one lead rubs against the volume control shaft and shorts.

## MAGNOVOX C-178

*Intermittent operation:* Replace 200 volt .1-mfd screen bypass capacitors with one of 600-volt rating. Check green dropping resistor, about 10,000-ohms 5-watt wire-wound, for open or intermittent. Set sometime plays when upside down, probably due to weight of resistor. Replace to avoid come-backs.

## PHILCO 610

*Distortion, accompanied by low-plate voltage on 75 tube:* Plate bypass capacitors between two 99,000-ohm resistors partially shorted. Replacing clears up trouble, since shorted unit reduces voltage, choking tube activity.

*David B. Chambers*

## SER-CUITS

*(Continued from page 32)*

ing is completed by a loop plug. A 1A7 detector-oscillator is the only tube with avc. A filament r-f choke isolates the detector from the IT4 i-f amplifier. This tube uses a 5.6-megohm grid-leak bias. The first audio pentode section of the 1S5 uses a 10-megohm leak. The 3Q5 power tube is biased by the drop across three series-connected filaments.

A 117Z6 rectifier has a split A and B supply with separate resistance filters for line operation. The same resistance value is used in each filter, 2700 ohms. However, the A supply requires much higher capacities, 30 and 160-mfd, while the B uses only 10 and 20 mfd.

**AMCON**

*Capacitors*

**SHOCK-PROOF**  
**BATTLE-TESTED**  
**DURABLE**  
**DEPENDABLE**

American Capacitors meet the most exacting precision requirements because they are fabricated by experienced craftsmen. Electrolytic and Paper Capacitors, incorporating new plastic designs, cover all standard capacitance values and working voltages.

*"There is an Amcon for every size and purpose"*

**AMERICAN CONDENSER COMPANY**  
4410 RAVENSWOOD AVENUE • CHICAGO 40, ILLINOIS



## NEWS

(Continued from page 37)

New York 16, and William Gold, secretary of the New York chapter is now located at 304 East 23rd St., New York 10, N. Y.

### IRC DISPLAY MERCHANDISER

A counter display merchandiser displaying 16 of the most popular type DS volume controls has been released by the International Resistance Company, Philadelphia.

The DS controls are part of the new Century line just announced. This line is comprised of 100 controls which, IRC claims, solves over 90% of all service problems.



\*\*\*

### WARD LEONARD NAMES WRIGHT ENG. REP.

Wright Engineering Company, 5620 North Meridian Street, Indianapolis 8, Indiana, will represent Ward Leonard in southern Indiana, south-western Ohio and Kentucky.

\*\*\*

### RCA VICTOR APPOINTS J. B. ELLIOTT HOME INSTRUMENT DIVISION GENERAL MANAGER

Joseph B. Elliott has been named general manager of the RCA Victor home instruments division.

In this capacity, Mr. Elliott will direct all activities connected with the design, engineering, production, distribution, and sales of RCA Victor radios, television home receivers and Victrola phonographs.

Mr. Elliott returns to RCA Victor from Schick, Inc., where he was vice president in charge of sales and advertising. Prior to the war, he was sales manager of RCA Victor's radio, phonograph and television department.



\*\*\*

### MECK FORMS AUDAR, INC., TO MAKE AND SELL P-A AND A-F AMPLIFIERS

A separate corporation, Audar, Inc., to manufacture and sell public address systems and audio amplifiers, has been announced by John Meck Industries, Inc.

Corporation officers are: John S. Meck, president; E. W. Applebaum,



Model GI-R90 Dual speed home recording and phonograph assembly.

● Performance of General Industries phonograph mechanisms pleases every critic. Owners applaud the instant starting and quick pick-up, giving faithful reproduction of every note and syllable.

Manufacturers and dealers like the fine, trouble-free design and construction that reduce service to a minimum and keep every user content.

For postwar selling, put General Industries Smooth

Power motors, recorders and combination record-changers—recorders in the front row—center!

THE GENERAL INDUSTRIES CO.  
Dept. M • Elyria, Ohio



treasurer and general manager; and Russell G. Eggo, secretary.

\*\*\*

### SCOTT BARLOW JOINS SYLVANIA

Scott Barlow has been appointed editor of the Sylvania News and assistant to H. G. Kronenwetter, advertising production manager of the Sylvania radio tube division.

\*\*\*

### HOFFMAN RADIO OPENS SAN FRANCISCO BRANCH

Hoffman Radio Corp., Los Angeles, has opened a San Francisco branch in the Merchandise Mart with Walter Epstein in charge.

\*\*\*

### GENERAL CEMENT CATALOG

A catalog, 146, containing listings of radio cements, chemicals, hardware, cab-

(Continued on page 46)

### F-M RECEIVER

(Continued from page 43)

sistance load on the oscillator itself. The 6SA7 plate has a decoupling filter; 1,000 ohms and .01-mfd, to minimize feedback through the B circuit.

A 6AB7 is used as the first i-f amplifier with fixed cathode bias, a 22,000-ohm grid-load resistor, and a plate decoupling filter. A second i-f stage uses a 6AC7 with similar features, except that a .47-megohm grid leak contributes some bias. The grid leak is isolated from the loaded tuned-input circuit by means of a 100-mmfd blocking capacitor.

# Lifetime SAVES YOU MONEY ON RADIO PARTS and SUPPLIES



## BALLAST TUBES

J.F.D. Ballast Tubes —  
K49B, K49C, K55B, K55C  
L49B, L49C, L55B, L55C  
Each ..... 48¢  
100-77, 100-70 ..... 58¢  
NEW TYPE Aircooled  
Ballast Tubes ..... 88¢

## TUBES WITH ADAPTERS

Use these combinations to replace tubes that can't be bought now.

To Replace	Use Tube & Adapter	List Price	Your Cost Tube & Adapter
1A5	1T4 & Adapter.....	\$3.10	\$1.51
1N5	1T4 & Adapter.....	3.10	1.51
1H5	1S5 & Adapter.....	3.10	1.51
3Q5	3S4 & Adapter.....	3.10	1.51
1Q5	3S4 & Adapter.....	3.10	1.51
1T5	1T4 & Adapter.....	3.10	1.51
45	3A4 & Adapter.....	2.95	1.43
47	3A4 & Adapter.....	2.95	1.43

## RESISTORS—24¢

10 Watt Wire Wound Resistors, all values 24¢

## AC-DC RESISTANCE CORDS

135-160-180-220-250-290-300-330-350-390 OHM  
Each ..... 48¢ 10 for ..... \$4.50  
1CA Universal 22-330 ohm..... 73¢  
56Q ohm for 3-way portable..... 73¢

## SPEAKER BARGAINS

4" Electro Dynamic Speakers.  
450 ohm ..... \$1.68  
5" Electro Dynamic Speakers.  
450 ohm ..... 1.86  
6" Electro Dynamic Speakers.  
450 ohm ..... 2.58  
5" 6-Volt Auto Speakers..... 1.68  
7" 6-Volt Auto Speakers..... 1.59  
8" 6-Volt Auto Speakers..... 1.59  
6 x 9" 6-Volt Oval Auto  
Speakers ..... 1.59



## CONDENSERS 37¢ EACH

20-Mfd 150 V Tubular condensers..... 37¢  
20-20 Mfd 150 V Tubular condensers..... 60¢  
20-30 Mfd 150 V Tubular condensers..... 69¢



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Hookup Wire—short lengths..... lb. 69¢  
Hookup and Push-Back Wire—assorted colors—  
rubber, cotton and plastic cover—89¢ per 100'  
—10 assorted 100' rolls..... \$7.80  
Single conductor shielded rubber-covered micro-  
phone cable—6 to 40 ft. lengths..... per ft. 6¢  
Two conductor shielded rubber-covered micro-  
phone cable—short lengths—6 to 40 ft. per ft. 10¢  
WRITE for latest bulletin listing hundreds of  
items available for immediate shipment.

## NEWS

(Continued on page 45)

inet repair kits, repair parts, tools and other service accessories, has been published by General Cement Manufacturing Company, 919 Taylor Avenue, Rockford, Illinois.

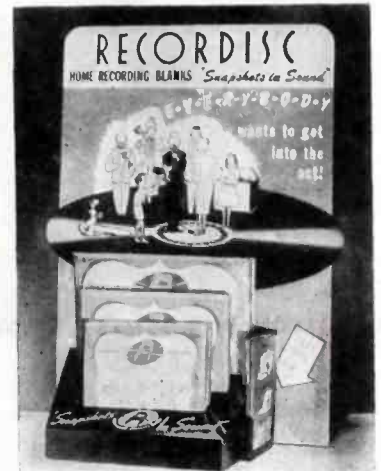
### ECA BOOKLET

The second in a series of consumer publications, *The Amazing Electron*, offering basic electronic data has been released by Electronic Corporation of America, 45 West 18th Street, New York 11, N. Y.

### RECORDISC DISPLAY

A combination display card and instantaneous home-recording blank container, for counter, shelf or table display, has been released by Recordisc Corporation, 395 Broadway, New York City.

Display can be obtained, free, from Recordisc jobbers.



### W. E. NAMES W. E. SNODGRASS HEARING-AID DIVISION HEAD

William E. Snodgrass, formerly executive vice president of the Dictograph Products Company, has joined Western Electric as general manager of the hearing-aid division.

### L. R. BROWNE JOINS CONCORD

L. R. Browne has been appointed manager of the industrial department of Concord Radio Corp., Chicago.

Mr. Browne was formerly civilian adviser to the examining board of the United States Signal Corps.

### SEGAR, ROCKE, McDONALD AND SCHOONMAKER NAMED ELECTRONIC LAB. REPS.

Harry B. Segar, Buffalo; Arthur Rocke, New York City; S. K. McDonald, Philadelphia and J. Y. Schoonmaker, Dallas, will represent Electronic Laboratories, Inc., Indianapolis.

### STACKPOLE CONTACT DATA

A 36-page electrical contact catalog and data book, 12, has been issued by the Stackpole Carbon Co., St. Marys, Pa. In addition to describing Stackpole contact materials with notes on the applications of each type, the catalog offers data on contact selection; choice of materials; contact types, shapes, and sizes; methods

**Lifetime Sound Equipment Co.**  
1101-1103 ADAMS STREET TOLEDO 2, OHIO Dept. 62

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**MANUFACTURERS:** - Be certain to send us all technical data on your peacetime products for publication editorially.

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## SPEED UP REPAIRS WITH THESE G-C AIDS!



FREE STEEL CABINET

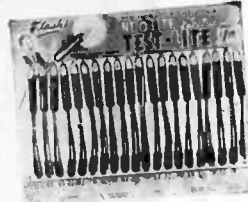
### G-C Dial Belt Kits

Exact replacement woven fabric belts. Easy to install — no stretching — no adjustments — a perfect fit every time. Kits come with 25, 50, 100, 200 or 300 belts.



### Automatic Wire Stripper

Strips insulation from all types of wire. Does the job instantly, easily, perfectly. An ideal tool for radio men, electricians and sound men.



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New improved design. Useful hundreds of ways. Tests AC and DC lines, DC polarity, fuses, etc. You can't afford to be without this handy all-purpose trouble shooter.

Immediate delivery on all G-C Products

Order From Your Radio Parts Jobber  
ALWAYS ASK FOR G-C PRODUCTS



**GENERAL CEMENT MFG. CO.**  
ROCKFORD, ILLINOIS



of taching contacts; contact metal components; welding and brazing tips, and various others.

### ARTER MOTOR SALES BULLETIN

4-page bulletin, 445, describing generators, magmotors and other rotary equipment, has been prepared by the Caer Motor Company, 1608 Milwaukee Avenue, Chicago, Illinois.

### OLSON FLUORESCENT LIGHTING CATALOG

catalog featuring fluorescent fixtures being offered by Olson Radio Warehouse, 73 E. Mill Street, Akron 8, Ohio. Described are industrial and commercial fixtures as well as kitchen units and bed lamps.

### DU MONT C-R PHOTOGRAPHY SCREEN DESIGNATION BULLETIN

bulletin, *New Designations of Screens for Cathode-Ray Photography*, has been published by Allen B. Du Mont Laboratories, Inc., Passaic, N. J.

Entered are data on screen materials. Hitherto two general types of blue screen materials have been used commercially for photographic work. Both have been designated as P5. It has now become apparent, however, that these materials, each offering distinct advantages in certain photographic applications, are sufficiently different to warrant different type designations. These two types of screen materials, sulphide and calcium tungstate, are discussed in the bulletin. RJA and the Armed Services have agreed to designate the screens having the characteristics of calcium tungstate as P5, and those of sulphide as P11. Du Mont tubes in the past have used the sulphide type screen. Therefore, the change to the P11 designation will not represent a change in screen material to those who have been getting P5 photographic screens from Du Mont.

The general characteristics of P5 and P11 screens compare as follows: Both are of the short persistence, blue fluorescent type, and of high photographic activity. The main difference is the considerably higher photographic and visual efficiency of the P11, and the shorter persistence of the P5. P11 is advantageous for all still photographic applications particularly high-speed phenomena, and for continuous moving picture recording up to the limit where persistence produces blurring of the picture (approximately 10,000 cps). The use of the P5 screen is for high-speed continuous motion-picture recording above the limit of the P11, or up to 60 kc without blurring.

### LUDWIG NOW PRODUCING AUTO ANTENNAS

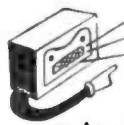
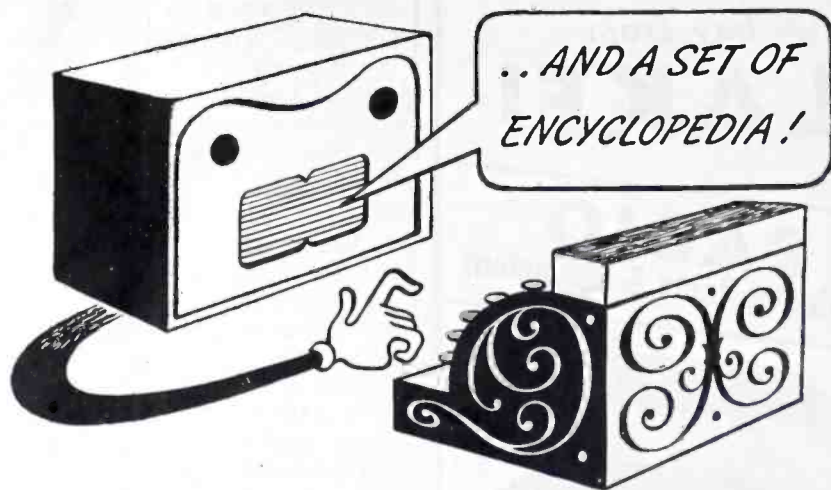
Ward Ludwig, formerly chief engineer of Ward Products, Cleveland, has become owner and general manager of a new company, The Radel Manufacturing Company, 6300 Euclid Avenue, Cleveland 3, Ohio.

A complete line of auto antennas, parts and inter-office communication equipment will be produced.

### WESTINGHOUSE AIRBORNE TELEVISION/F-M BROADCASTS

Plans to transmit television and f-m programs from stratosphere airplanes circling six miles in the air, as soon as permits and equipment can be obtained, were announced recently by Westinghouse.

## RIDER VOLUME XIV COVERS 1941-42 RECEIVERS



Even back in '41, when I was brand new, "Information Please" was giving sets of Encyclopedia Britannica to people who submitted questions that stumped the program's "experts."

If the "Information Please" people ever want to get hundreds of servicemen to stay up nights thinking of questions they can offer a "set of Rider Manuals," recognized as the most valuable piece of equipment in any shop.

That's why there's such a tremendous demand for Vol. XIV right now. It contains the vital servicing data needed to quickly diagnose and cure the ills of radios of my age; the last generation born before the stoppage of civilian set manufacture.

We have been worked hard because of the war. For the same reason paper is scarce and WPB limitations on paper may cause your jobber to be out of a Rider Manual. Thanks for being patient.

#### RIDER MANUALS (14 VOLUMES)

Volumes XIV to VII . . . 12.50 each volume  
Volume VI . . . . . 9.50  
Abridged Manuals I to V (1 vol.) 15.00  
Automatic Record Changers  
and Recorders . . . . . 7.50

#### OTHER RIDER BOOKS YOU NEED

The Cathode Ray Tube at Work  
Accepted authority on subject . . . . . 4.00  
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Servicing Superheterodynes . . . . . 2.00

The Meter at Work  
An elementary text on meters . . . . . 2.00

The Oscillator at Work  
How to use, test and repair . . . . . 2.50

Vacuum Tube Voltmeters  
Both theory and practice . . . . . 2.50

Automatic Frequency Control Systems  
—also automatic tuning systems . . . . . 1.75

A-C Calculation Charts  
Two to five times as fast as slide rule . . . . . 7.50

Hour-A-Day-with-Rider Series—  
On "Alternating Currents in Radio Receivers"—  
On "Resonance & Alignment"—  
On "Automatic Volume Control"—  
On "D-C Voltage Distribution" . . . . . 1.25 each

**JOHN F. RIDER PUBLISHER, INC. 404 FOURTH AVE., N.Y. 16, N.Y.**

Export Division: Rocke-International Corp. 13 E. 40th Street New York City Cable: ARLAB

## RIDER MANUALS *are complete* IN 14 VOLUMES

Initial flight tests of the system, known as Stratovision, are expected to be made this fall.

The system would employ a low-powered ground transmitter to send broadcasts to a specially-designed high-altitude plane circling slowly overhead. The plane would be equipped with receivers and transmitters for re-broadcasting these programs back to the earth.

Four television and five f-m transmitters are planned on each plane. According to Westinghouse engineers, a coast-to-coast network for relaying programs from plane to plane between New York and Hollywood would require stationing eight such stratosphere planes above strategic areas spanning the continent.

The eight planes in the Stratovision relay system would fly over New York, Pittsburgh, Chicago, Kansas City, Curtis, Neb., Leadville, Col., Salt Lake City and

Los Angeles, linking logical talent centers in New York and Hollywood.

The Stratovision system was originated by C. E. Nobles, 27-year-old Westinghouse engineer. The Glenn L. Martin Company cooperated in the development work.

#### LESTER KELSEY JOINS HALLICRAFTERS

Lester L. Kelsey has been appointed vice president of the Hallicrafters Company, Chicago, and general manager of the Echophone division of the company.

Mr. Kelsey was formerly assistant to the president of the Belmont Radio Corporation.

He was also general manager of the radio division of the Stewart-Warner Corporation for many years. From 1942 to 1944, he was a director of the Radio Manufacturers Association.

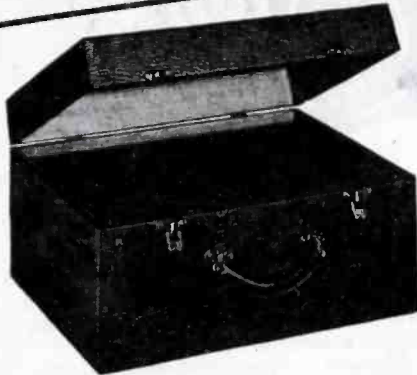
# SERVICEMEN

buy from

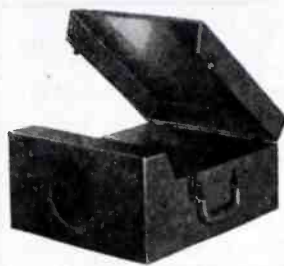
# LAKE!

## RADIO

Cabinets, Parts & Equipment



Portable Phonograph Case, of sturdy durable plywood, in handsome brown leatherette finish. Inside dimensions 16½" long, 14" wide, 9½" high. Has blank motor board. As illustrated above, specially priced at **\$6.95**



Portable Phonograph Case in brown leatherette covering. Inside dimensions 17" long, 14" wide, 8½" high. Has blank motor board and opening for speaker. As illustrated above, specially priced at

**\$8.95**

Also blank table cabinets of walnut veneer in the following sizes, with speaker opening on left front side:

(Note: \*7 has center speaker grill.)

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\*Speaker Opening in center of front side. Cabinets available in ivory color and Swedish Modern. Write for prices.

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## AVC-SECOND DETECTOR SYSTEMS

(Continued from page 22)

indicators. The input impedance of the first audio tube may also be a factor. Luckily, the effects of the amplifier are reduced when the volume control setting is reduced so that the loading is inconsequential on strong local stations. This is not so on weak stations.

In the detector action, the load resistor is shunted by an r-f bypass condenser large enough to filter out the i-f but not large enough to shunt the a-f. Without a condenser, the rectified voltage would follow at the i-f. The condenser charges to the peak value of the i-f voltage but can only begin to discharge through the resistor before the next i-f peak comes along; hence the voltage across the condenser (and resistor) is forced to follow the modulation envelope.

Fig. 7 shows an entire avc system with separate diodes for detection, and avc bias and individual filters for applying the bias to three amplifier tubes. Applying the voltage for avc use from the plate of the last i-f amplifier helps to reduce the a-c loading of the detector; hence, it improves the quality. Since a load on one winding of a transformer is reflected to all other windings, some loading does occur.

Fig. 8 illustrates a good method of adding avc to a receiver. An r-f voltage is picked off before the detector, amplified by a pentode and fed to a diode with a 1-megohm load resistance. The r-f voltage is then filtered by a ¼-megohm resistor and .05-mfd condenser for applying to the amplifier. Since the 1-megohm resistor is not shunted by a condenser, detection does not take place; therefore a-f is absent. Detection would not

**4 STANDARD TYPES**  
of Amperite Regulators replace over 400 types of AC-DC Ballast Tubes now in use.  
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add anything to the production of avc bias.

Second detectors for video reception differ only in the value of the load resistor and condenser, typical values being 2,000 ohms and 35 mmfd. The low resistance is necessary to prevent attenuation of the high frequencies in the 4-mc pass band.

A very good description of detector action appears in the RCA Receiving Tube Manual, series RC-14.

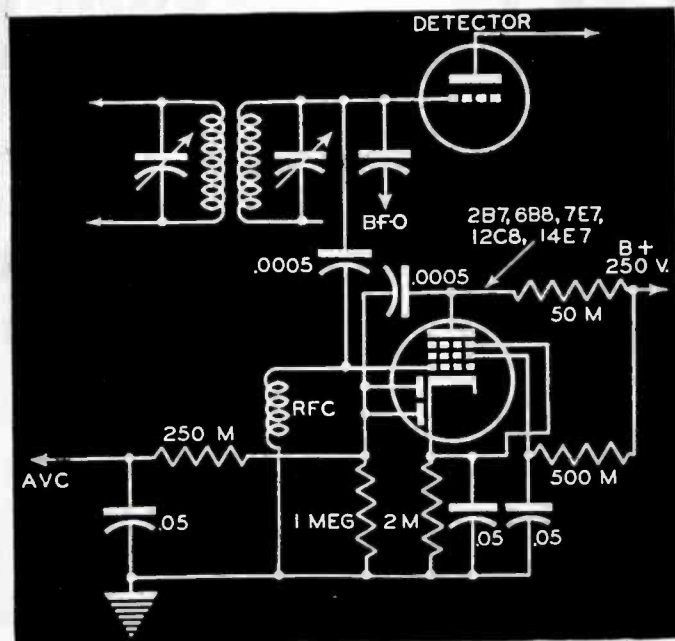


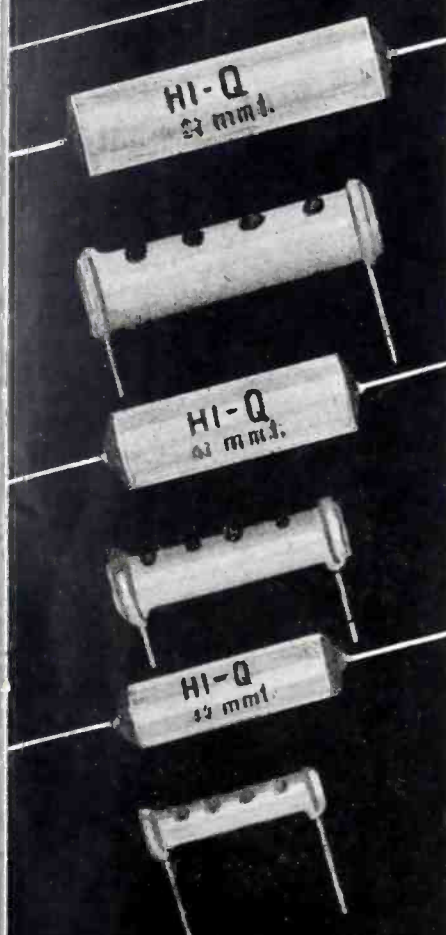
Fig. 8... An avc circuit for use with any receiver. In this system, an r-f voltage is picked off before the detectors, amplified by a pentode and fed to a diode with a 1-megohm load resistance.



# HI-Q

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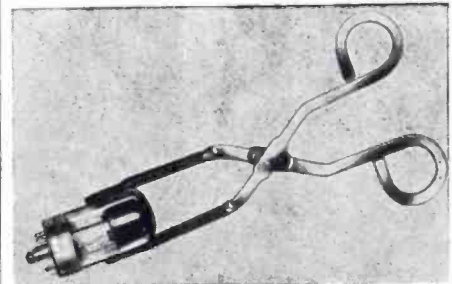
# NEW PRODUCTS

## BMP TUBE EXTRACTORS

A tube extractor for extracting and inserting miniature and straight-side glass (T5½, T7, T8 and T9) tubes has been announced by the BMP Company, Boonton, N. J.

Extractor applicable to 1A3, 6AG5, 9001, 1645 and 26 similar types (T5½ bulb size); OZ4G, 921, 922, 926, 936, etc. (T7 bulb size); 1P9, 917, 8012, 1640, 868, etc. (T8 bulb size); and 6E5, 7A4, 35A5, 1629, 50A5 and 140 similar types (T9 bulb size).

Gripping surface of tube extractor is rubber-covered.



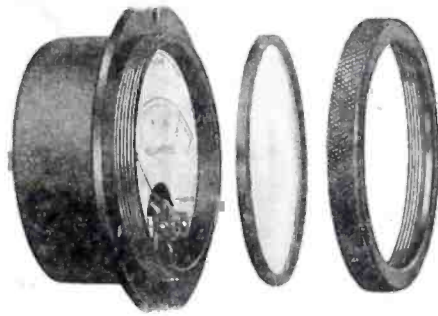
## TRIPLETT HERMETICALLY SEALED INSTRUMENTS

Round and square, panel-flush mounting, 1½", 2½" and 3½" meters have been announced by the Triplett Electrical Instrument Co., Bluffton, Ohio.

Mechanisms are D'Arsonval d-c type and repulsion moving iron a-c type, furnished in 2½" and 3½" seamless metal cases, 1½" in d-c only. Magnets in the steel case give maximum compensation.

Zero shift on the instrument does not exceed ±2%. Accuracy is said to be 2% of full scale.

Models 321-HS (3½") round, 221-HS (2½") round and 127-HS (1½") square made in d-c voltmeters, ammeters, milliammeters and microammeters. Models 331-HS (3½") round and 231-HS (2½") round made in a-c voltmeters, ammeters and milliammeters. Models 341-HS (3½") round and 241-HS (2½") round made in r-f ammeters and milliammeters (a-c thermocouple type).



## SUPREME V-T VOLTMETER

A vacuum-tube voltmeter, 565, has been announced by Supreme Instruments Corporation, Greenwood, Mississippi.

The r-f probe is said to be so small that it can be held in the hand as a test lead. Probe contains a h-f diode of the miniature type and can be used for the measurement, with negligible frequency

(Continued on page 50)

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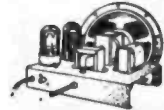
## Multitester

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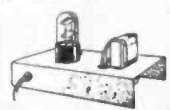
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NEW PRODUCTS

(Continued from page 49)

error, over a frequency range of 50 cycles to 100 mc.

Input impedance of 80 megohms on 1-volt range and 40 megohms on the 500-volt range. Balanced bridge type of circuit uses nearly 100% degenerative feedback; said to eliminate errors due to line voltage shift and due to grid current in the tube which operates the meter. Meter is completely isolated from the input circuit.

D-c voltage ranges of 0-1, 0-2.5, 0-10, 0-100, 0-250, and 0-500 and a-c voltage ranges of 0-1, 0-2.5, 0-10, 0-100, and 0-250 are provided by means of push-buttons.



RCA DRY BATTERIES

A complete line of dry batteries has been announced by the tube division of RCA Victor.

The new line will be placed with RCA tube and parts distributors.

The batteries will be packaged in red and black cartons.



JFD BATTERY ADAPTER HARNESSES AND PLUGS

Battery adapter harnesses for battery pack types are now being produced by JFD Manufacturing Co., 4117 Fort Hamilton Parkway, Brooklyn, New York.

Battery harnesses permit the substitution of individual A and B batteries.

Portable plugs of every type, including male and female snap fasteners, plugs with Fahnestock clips and plugs for A, B and C batteries have also been announced by JFD.

INDUSTRIAL INSTRUMENT RESISTANCE LIMIT BRIDGE

A resistance limit bridge, LB-3 working to  $\pm .1\%$  has been designed by Industrial Instruments, Inc., 17 Pollock Ave., Jersey City 5, N. J. Bridge (modified Wheatstone) has high and low-limit dials covering a range of  $\pm 11\%$  in .1% steps, and uses a sensitive built-in galvanometer to provide for the high and low indication, respectively. In normal operating position the zero on the galvanometer scale acts as a reference point.

Bridge may be used to check resistors between 1 ohm and 3 megohms. External resistance standards corresponding to the nominal values of the resistors under test, are required. For most measure-

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ments the galvanometer and internal volts d-c source will be found satisfactory. For measurement of resistors above several thousand ohms and particularly when the resistance range is increased above 1 megohm, an external battery is recommended. For low-resistance measurements particularly below 10 ohms, more sensitive external galvanometer may be desirable, although most measurement between 1 and 10 ohms may be satisfactorily made by using an external 1 1/2 volt battery.

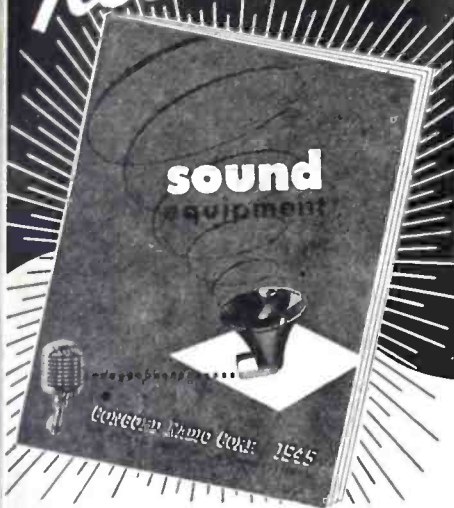


FAIRCHILD POTENTIOMETERS

A non-linear, wire-wound, potentiometer has been announced by the Fairchild



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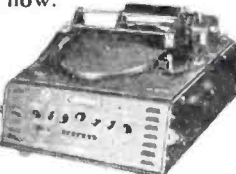
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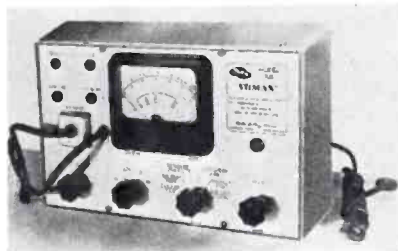
The potentiometer was developed for use in bridge T attenuators in an airborne electronic computing gunsight. At present, one standard size, with a 1 7/8" outside diameter is being made.

\* \* \*

### SILVER V-T METER

A vacuum-tube volt-db-ohm-milliammeter, Vomax, has been announced by the McMurdo Silver Company, 1240 Main Street, Hartford, Connecticut. Has 12 d-c voltage ranges (doubled by polarity reversing switch) for .05-3000 volts; input resistances of 50 and 125 megohms. Six a-c voltage ranges, .05-1200 volts; input loading 6.6 megohms and 8 mmfd. Three of these ranges are calibrated -10 through +50 db for power output measurements. Six d-c ranges for 50 microamperes through 12 amperes. Six zero-left resistance ranges cover 0.2 ohm through 2000 megohms.

A-c response is said to be flat to 5% over the range of 20 cycles to above 100 megacycles. One zero-set knob serves for all ranges. Five scales on 4 5/8" meter. Uses dual-tube circuits said to automatically balance against line voltage variation and tube aging. Removable diode r-f probe.



\* \* \*

### LANGEVIN AMPLIFIER MOUNTS

A type 201-A wall mounting cabinet which is said to permit universal installation on of the 101 series amplifiers to any flat surface, has been announced by the Langevin Company, Inc., 37 West 65th Street, New York.

Standard aluminum grey finish. Size: height 12", width 20", depth 12".

\* \* \*

### G-C INSTRUMENT KNOB

Molded 1 3/4" bakelite knobs have been announced by the General Cement Mfg. Co., Rockford, Illinois. Complete with 1/4" brass insert and set screw. Over-all height, 7/8".

\* \* \*

### U. M. C. DYNAMIC MICROPHONES

The type KD dynamic microphone for home recording and public address systems has been reissued by Universal Microphone Co., Inglewood, Cal.

Frequency response is 50-7500-cps; output level 63 db below one volt bar; impedance 40,000 ohms. Finished in deep bronze plating; includes 10' rubber covered cable; and standard coupling 5/8", 27 thread.

Weights under 2 pounds for shipping. Diameter, 3/4"; depth of 2 3/8".

\* \* \*

### ELECTRONIC MEASUREMENT POWER SUPPLIES

A power supply with continuously variable voltage, 0-325 volts d-c at 125 ma without switching, has been announced by Electronic Measurements Company, 10 West Front Street, Red Bank, N. J.



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★ And that means a lot. Those green colored inorganic-cement-coated Clarostat power resistors are now found in radio-electronic assemblies that are built to last! These resistors positively "stay put". They are brutes for punishment. Standard 10 and 20 watt fixed resistors in 1-50,000 and 1-100,000 ohms, respectively. Also standard adjustable resistors (as here shown) 25 to 200 watts, in 1-100,000 ohms, with brackets. Remember Greenohms—for better initial equipment or for better maintenance jobs.



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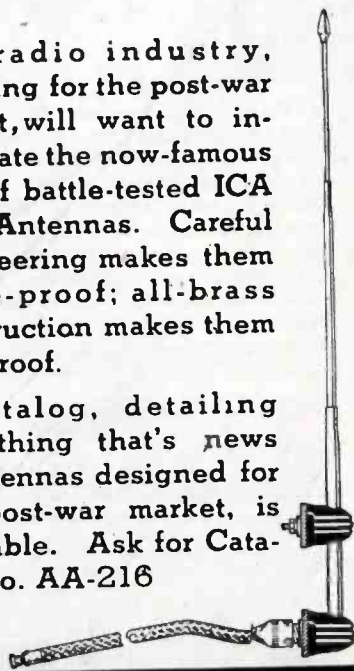


## BE WITH YOU IN A MINUTE—

The Insuline Corporation is still 80% in war production. In fact, it has received its third Army-Navy Award, and is out to earn a fourth. Still the ICA Plant is geared to swing into full peace-time production almost instantly.

The radio industry, planning for the post-war market, will want to investigate the now-famous line of battle-tested ICA Auto Antennas. Careful engineering makes them rattle-proof; all-brass construction makes them rust proof.

A catalog, detailing everything that's news in antennas designed for the post-war market, is available. Ask for Catalog No. AA-216



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## JOTS AND FLASHES

**F**UTURE trade shows for radio parts and equipment manufacturers will be conducted by the Radio Parts and Electronic Equipment Shows, Inc. Co-sponsors of the show unit are NEDA, RMA Association of Electronic Parts and Equipment Manufacturers and the Eastern Division of the Sales Managers Club. Herb Clough is president of the group; Charles Golenpaul, vice president; Sam Poncher, treasurer; and Jerry Kahn, secretary. First show may be held in October, 1946, in Chicago. . . . E. S. Goebel has been appointed acting director of sales of the communications and electronics division of Galvin. He succeeds Norm Wunderlich who resigned. . . . Norman R. Kevers has been elected chairman of board of Electronic Laboratories, Inc. . . . William W. Garstang has been named E-L president. . . . Jacqueline Silver has been appointed vice president of Magazines, Inc. Karl Kopetzky is president of the company. . . . The tenth "E" award was won recently by the Solar Manufacturing Corporation plants. . . . William H. Clingman will design cabinets for Lear Radio. . . . William's Wholesale Distributors of Newark, Ohio, will distribute Stewart-Warner receivers in 23 Central Ohio counties in the Newark and Columbus areas. William S. Moore is owner of Wholesale. . . . A Chicago office has been opened by James Knights, of Sandwich, Illinois. Location will be at 175 West Jackson Boulevard. . . . Ralph S. Merkel, former technical editor of Sylvania News, has been promoted to the rank of Major. . . . A second star has been added to the "E" flag of Aerovox. . . . A. V. Duke has been appointed assistant to H. C. Bonfig, vice-president in charge of home receivers for Zenith. . . . Garrard Mountjoy now heads the New York research and development laboratories of Lear Radio. . . . Ray T. Schottenberg, sales manager of the jobber division of Astatic Corporation, toured Baltimore and Philadelphia recently with Frank B. Russell, district rep. . . . RCA has released an illustrated brochure covering the use of sound in industry and educational institutions. It's called "RCA Sound Systems." . . . Thomas W. Ward is now with ECA as assistant sales manager. . . . Louis J. Chatten, former WPB radio and radar director, has been appointed vice president and general commercial manager of North American Philips Co. . . . If you have a service problem, send it in. . . . We'll be glad to help. . . . And don't forget to send in your Servicing Helps. . . . Service Men will be grateful for suggestions.

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Just try it. Take a genuine "Sealdtite" capacitor and try to *squeeze* it. No results. You'll find it has no soft spots, which in ordinary tubulars provide room for moisture, the capacitor's worst enemy, because the Solar capacitor has an internal winding of high-quality paper and foil, skillfully *molded* into *solid* plastic.

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EXCELLENCE AWARDS

SOLAR CAPACITOR SALES CORP.

285 MADISON AVENUE, NEW YORK CITY

**AFTER THE WAR—  
MORE THAN BEFORE**  
... FROM NATIONAL UNION TO YOU.



**MORE** instruments, meters and tools... an improved version of the famous N. U. Equipment Plan that was OK'd 60,000 times by service dealers before the war.

**MORE** dealer advertising... newspaper mats, telephone book advertising, mailing pieces, road signs, window displays to make your business prosper!

**MORE** technical data... in the form of Service Engineering Bulletins, manuals, charts and other up-to-date information prepared by N. U. scientists.

**MORE** sales appeal... through a striking new package design, styled to make National Union a recognized emblem for quality merchandise.

**MORE** tubes and parts... to capitalize on the increased use of radio, communications, television and electronic appliances and equipment in homes and industries.

**MORE** business helps... new and tested ideas for store layout, stock arrangements, workbenches, inventory record keeping, and business forms.

**YES**, a greater peacetime profit plan is coming... to build new business for radio service dealers and parts jobbers. This plan to build more business for you is backed by the resources of a great and growing company, with front rank engineering and production facilities. National Union can and does assure you... "After the War, More than Before!"

NATIONAL UNION RADIO CORPORATION  
NEWARK 2, NEW JERSEY



**NATIONAL UNION  
RADIO AND ELECTRON TUBES**

Transmitting, Cathode Ray, Receiving, Special Purpose Tubes • Condensers • Volume Controls • Photo Electric Cells • Panel Lamps • Flashlight B...