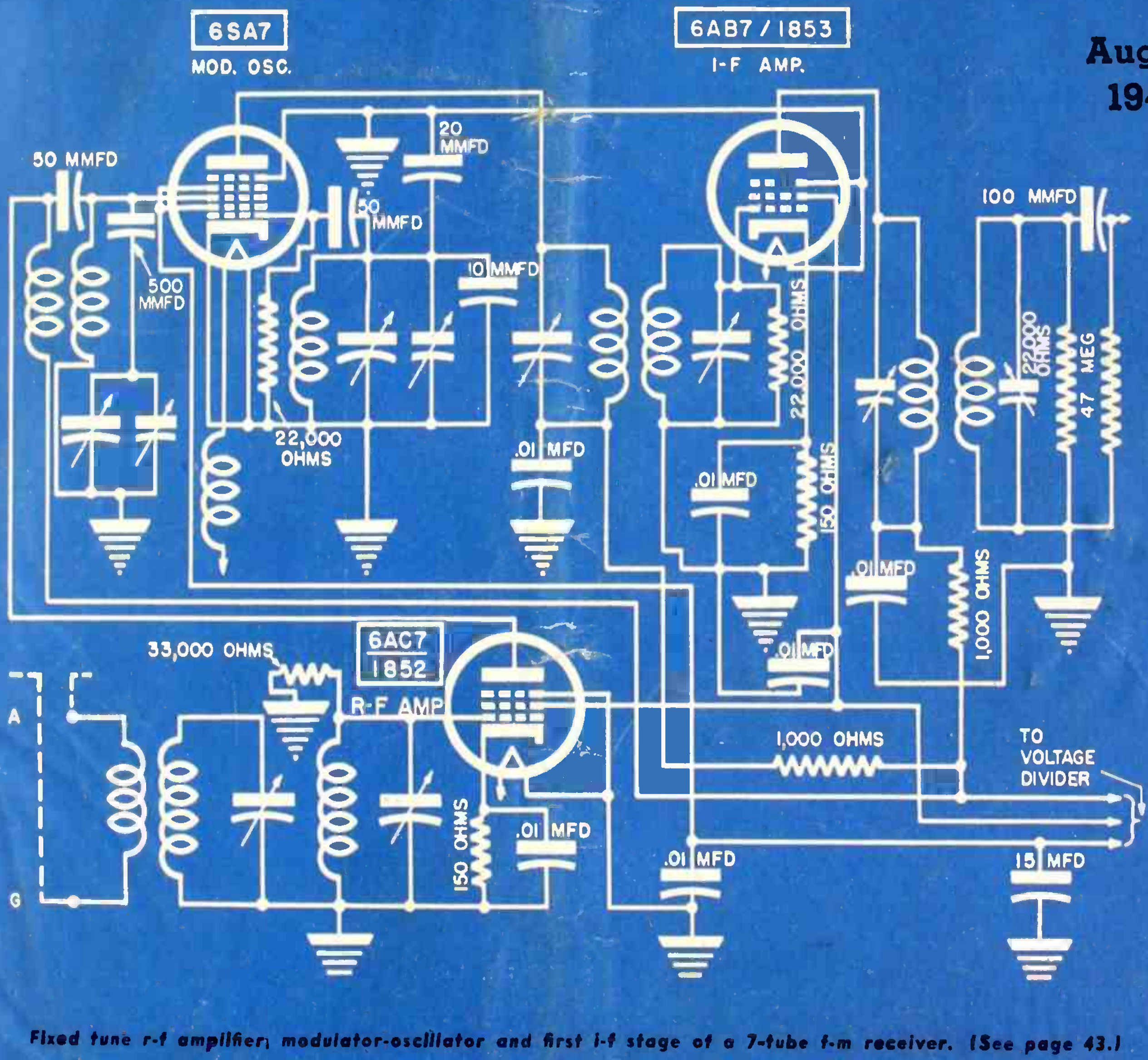
RADIO · TELEVISION · ELECTRONIC

SERVICE

August
1945



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

A MONTHLY DIGEST OF RADIO AND ALLIED MAINTENANCE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EDITORIAL

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SERVICE

A Monthly Digest of Radio and Allied Maintenance

Reg. U. S. Patent Office

Vol. 14, No. 8 August, 1945

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ALFRED A. GHIRARDI
Advisory Editor

F. WALEN
Managing Editor

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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.

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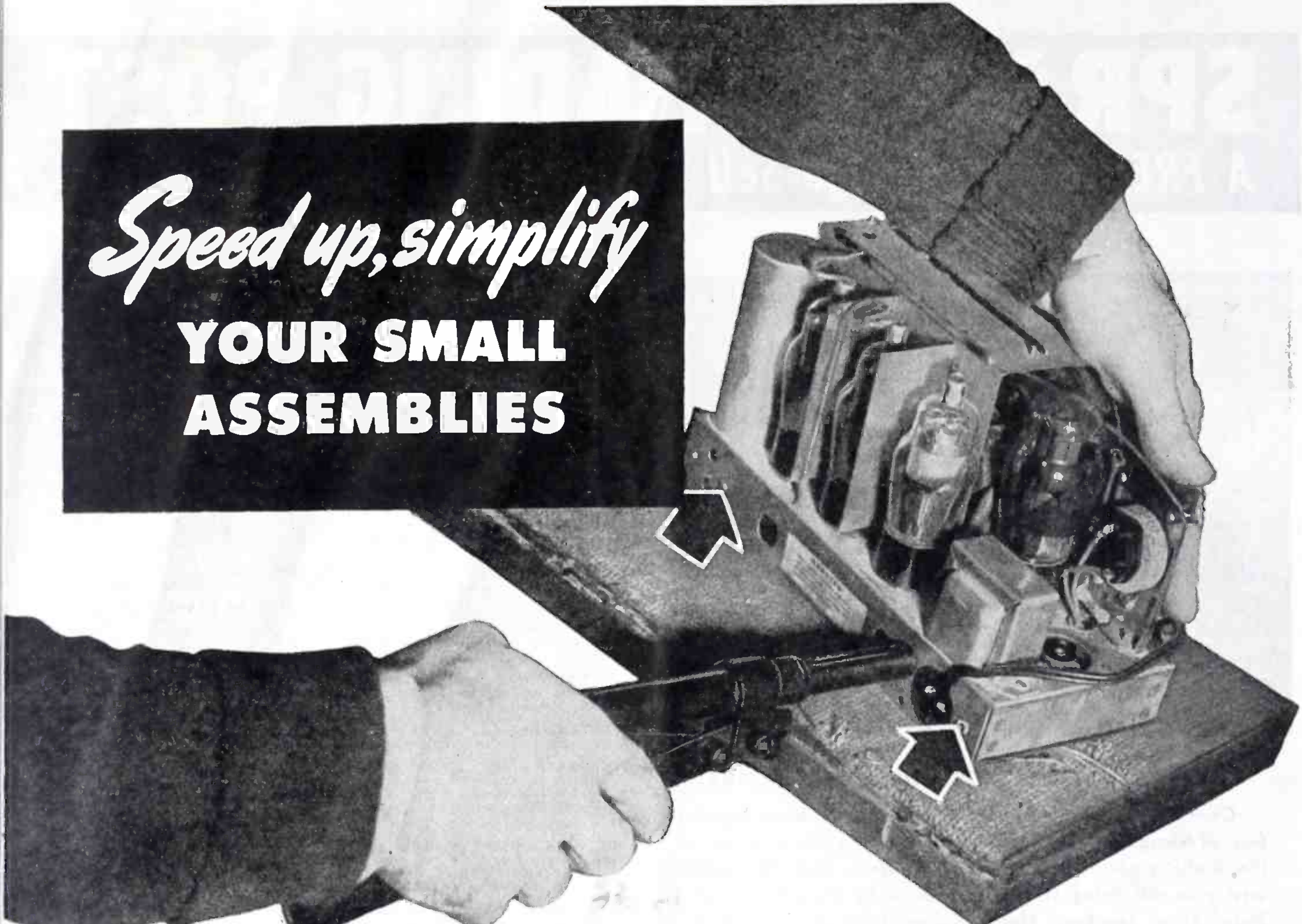
Speed up, simplify YOUR SMALL ASSEMBLIES



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.

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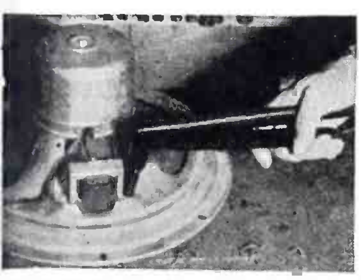
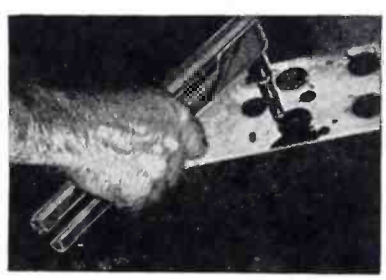
There are several types, sizes and alloys of Cherry Rivets. Installed rivets are strong and neat. The installed cost of Cherry Rivets is low.

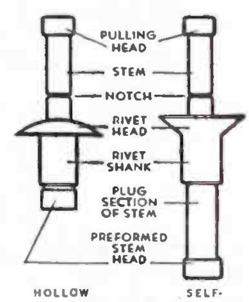


Cherry Riveting transformer to loudspeaker.

Time saved in fastening arm on record changer.



Tube sockets are easily installed; firmly held.



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

or a quick glance at the many types and ses of Cherry Rivets, write now for illus-ated Manual D-45, Department A-268, herry Rivet Company, 231 Winston St., os Angeles 13, California.

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Centralab

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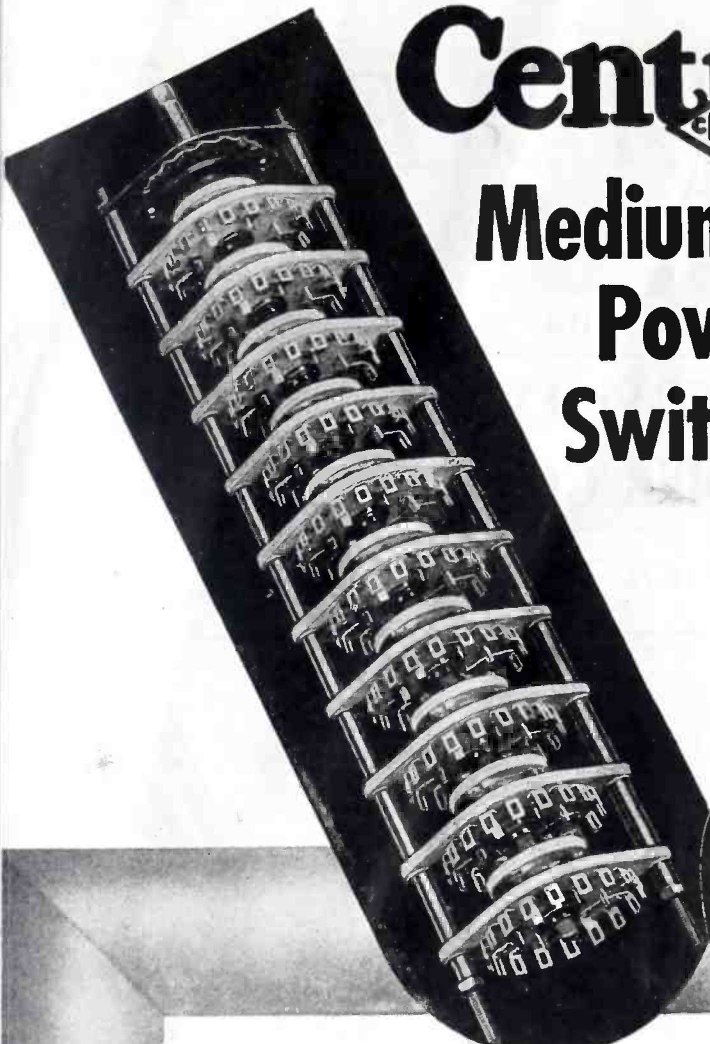

- 7½ amp. 115 V. 60 cycle A. C.
- Voltage breakdown 2500 V to ground D. C.
- Solid silver contacts
- 25,000 cycles of operation without contact failure
- Fixed stops to limit rotation
- 20° indexing

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

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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

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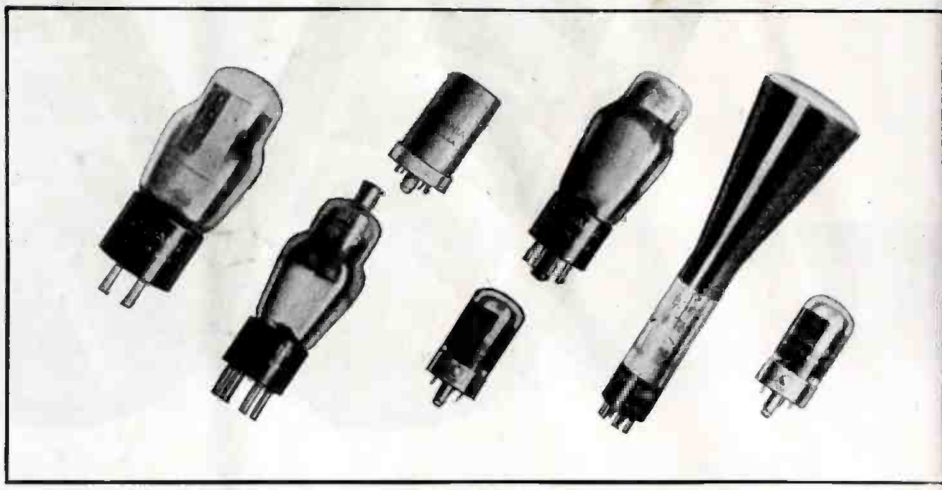

Sylvania Electric announces the following tube types available to radio servicemen.

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.

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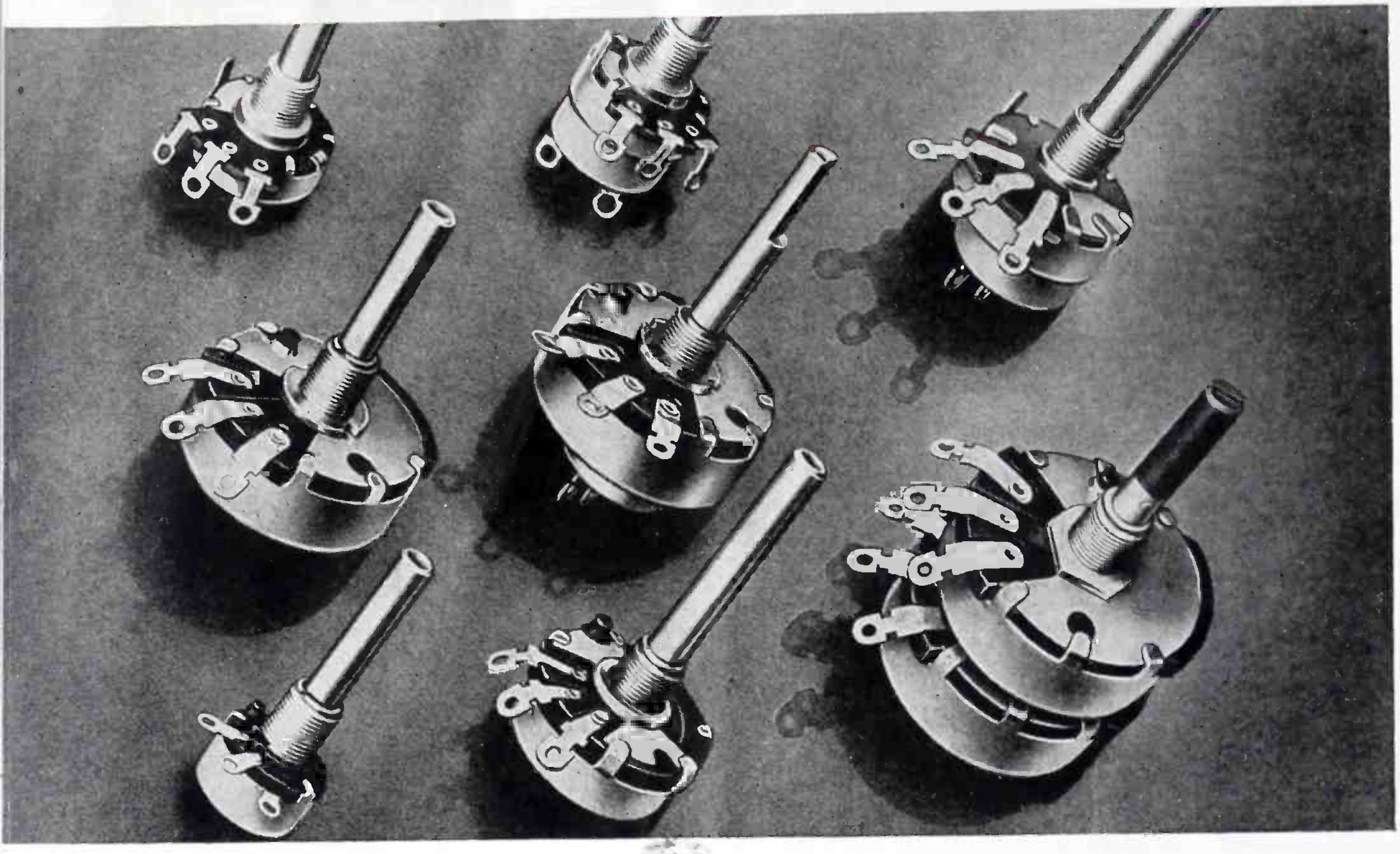


VOLUME AND TONE CONTROL RESISTORS

[*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.

TROUBLES 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.

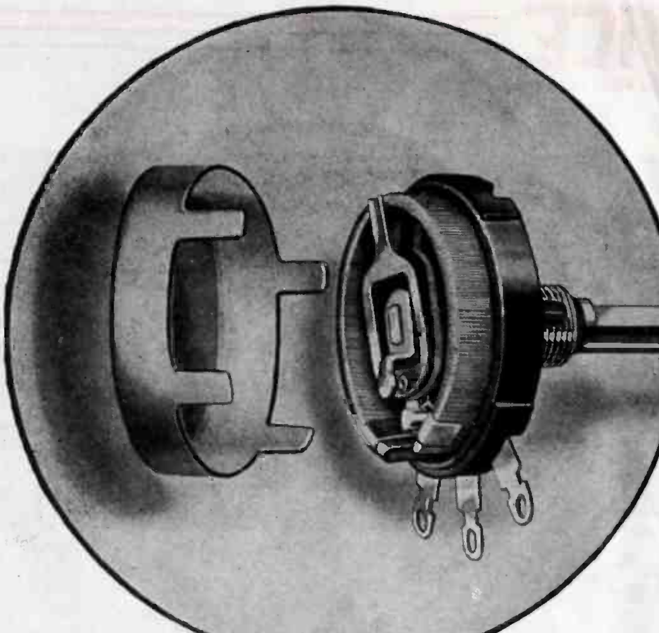
As a rule, faults that have developed in volume and tone control resistors quickly make their presence known because rotation of the control knob of the unit, while the set is in operation, results in annoying noise, intermittent operation, or unsatisfactory control of volume or tone. Such performance 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.

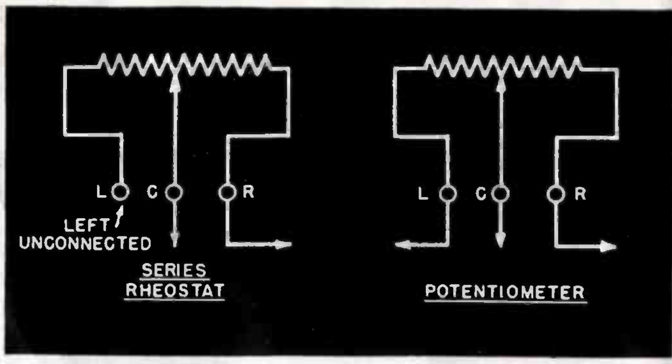
Above . . . Assortment of volume and tone controls.
(*Courtesy Stackpole Carbon Company*)

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





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-avc 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.

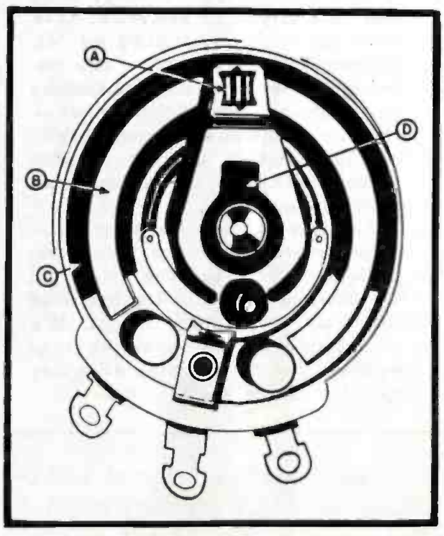
Wire-Wound Variable-Resistor Construction

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 nichrohme, 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.[1]

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.)



The standard maximum-resistance tolerance of wire-wound controls is ±10%.

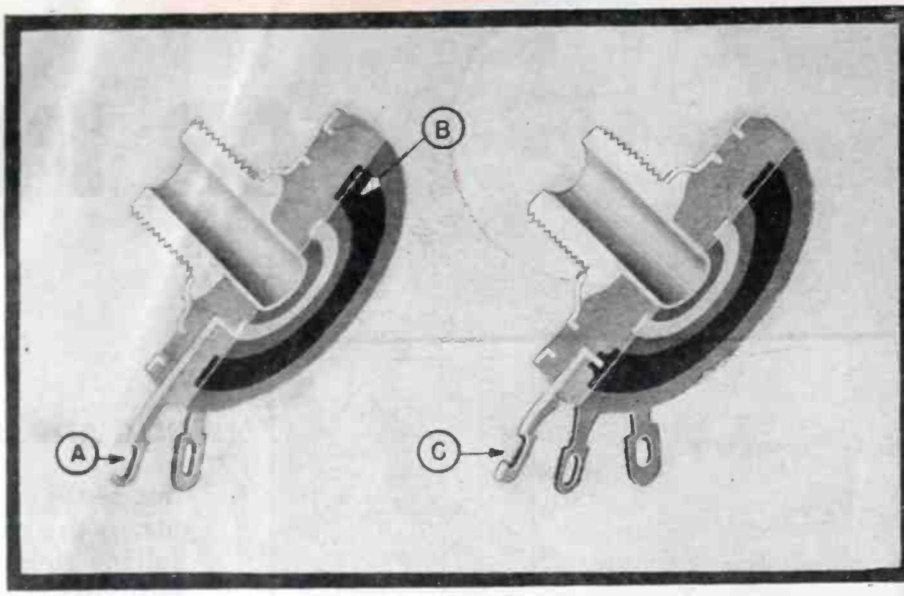
Composition-Element Variable-Resistors

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-

[1] 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.

'igs. 4 (right) and 4a (above). Fig. 4 . . . 'wo cross-sectional views of composition-element ype of variable volume or tone control in rhich the resistance material (dark) is molded rith the insulating base, terminals, bushing, etc., a one piece. At A, center terminal molded to ace plate; B, thin layer of resistance material; '. end terminal molded to resistance material.
(Courtesy Allen-Bradley Company)

'ig. 4a . . . Midget (1⅛" diameter) 1½-watt vire-bound control with contact arm that wipes against under surface of resistnr 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 Bradleyometer) 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 ½ 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 ±20%, although units of closer tolerance are obtainable at higher cost. Ordinarily, tolerance closer than ±20% is not needed for volume or tone controls, as the total resistance value required is not critical.

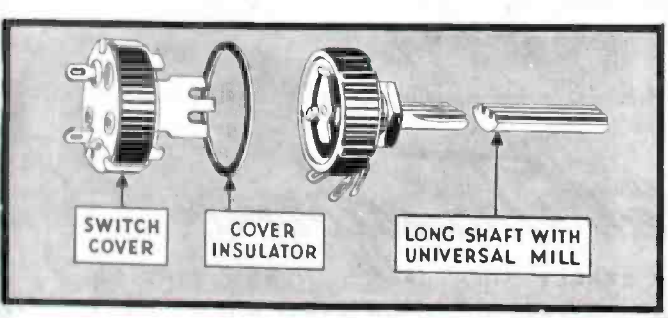
Terminals and Terminal Arrangements

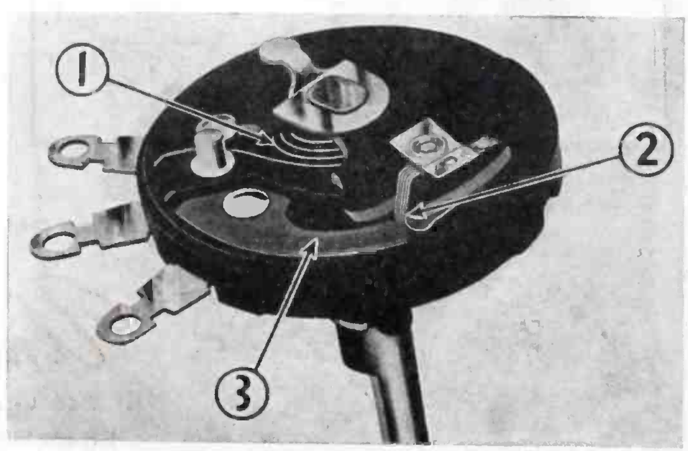
Most commercial wire-wound and composition-element volume- and tone-control resistors are furnished with

(Continued on page 23)

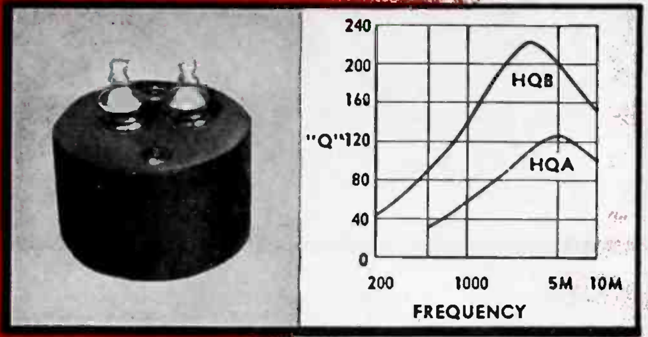
Figs. 5 (right) and 6 (below). Fig. 5 . . . Composition-element unit that employs a 5-finger "knee-action" wiping contact to the resistance element. At *1*, spiral spring connector; *2*, "knee-action" contactor; *3*, metallized resistance element.
(Courtesy IRC)

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





FOR INDUCTORS



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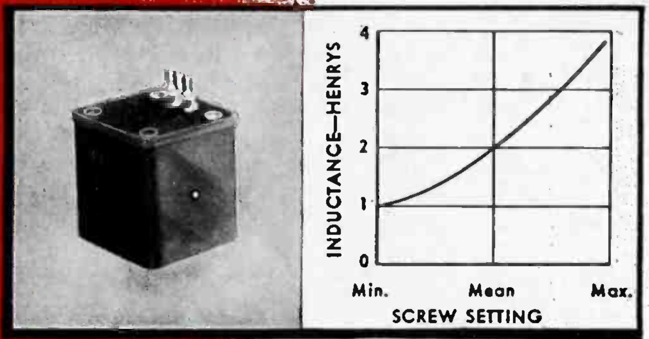

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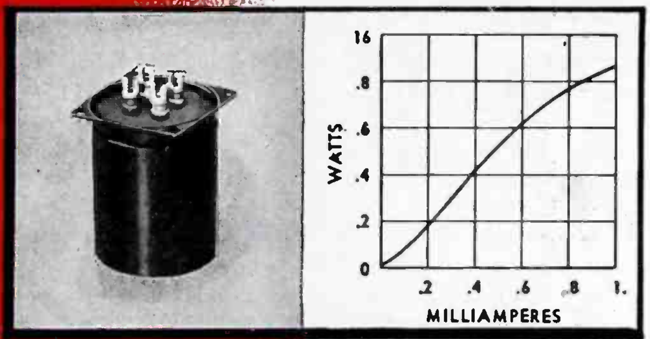

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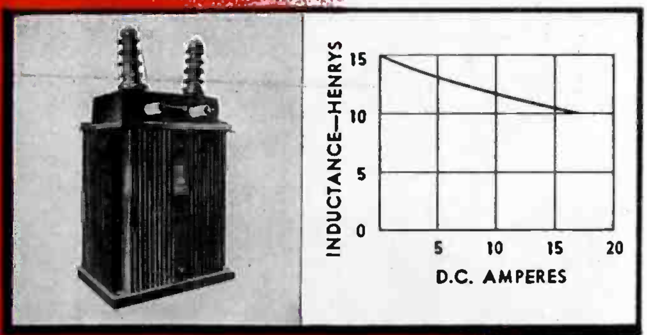

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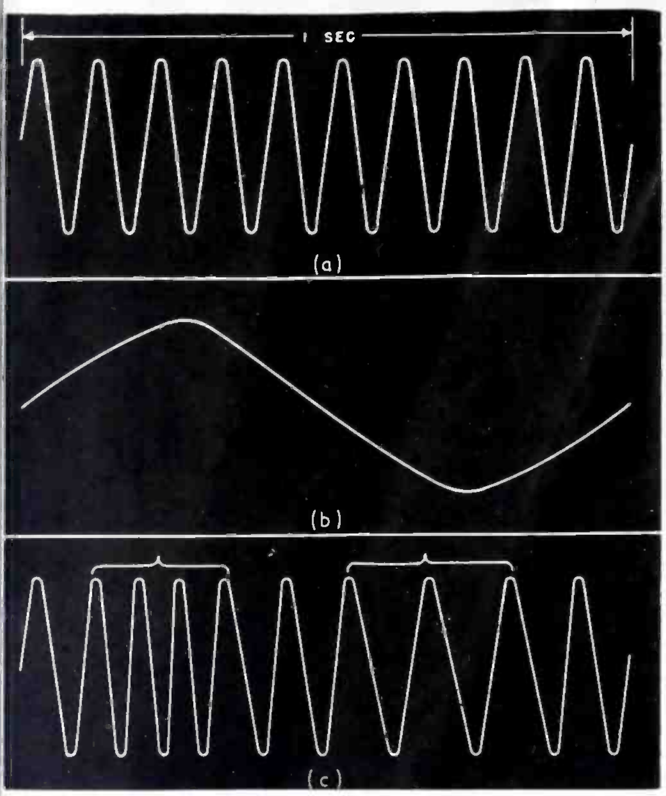

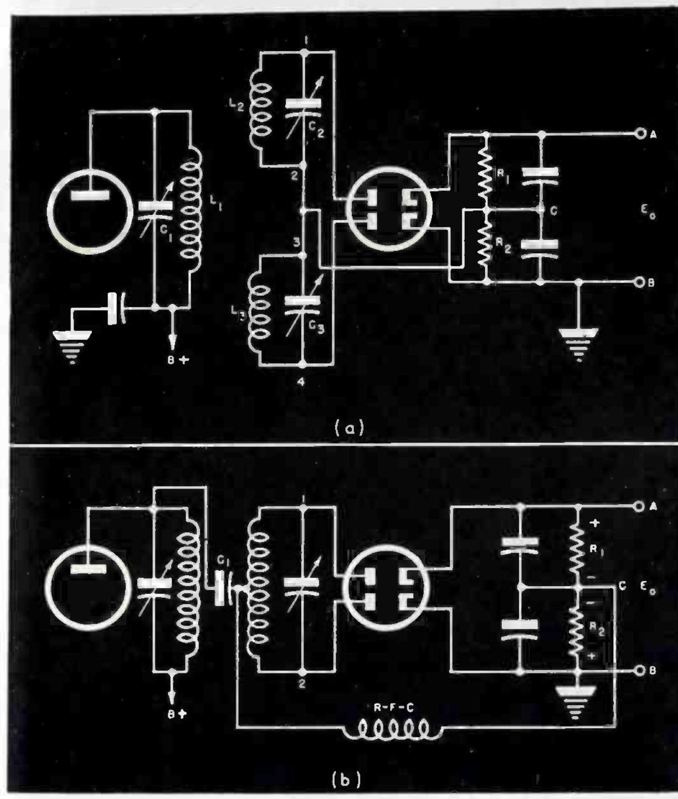

F-M DISCRIMINATORS

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. 1*a*. This sine wave is to be frequency modulated by a sine wave of 1 cps, Fig. 1*b*. 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 2½ 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 modulating 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. 1*c*.

The standard for f-m transmission is a 150-kc carrier swing (± 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. 2*a*, 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. 1*a* represents 10 cycles of a 10-cps wave; 1*b* shows a 1-cps modulation wave; 1*c* is the resultant wave form when the two are combined in f-m. Note variation in individual wave form. Fig. 2*a* and *b* . . . Here are two types of discriminator circuits. Circuit of Fig. 2*b* is used in most f-m receivers.

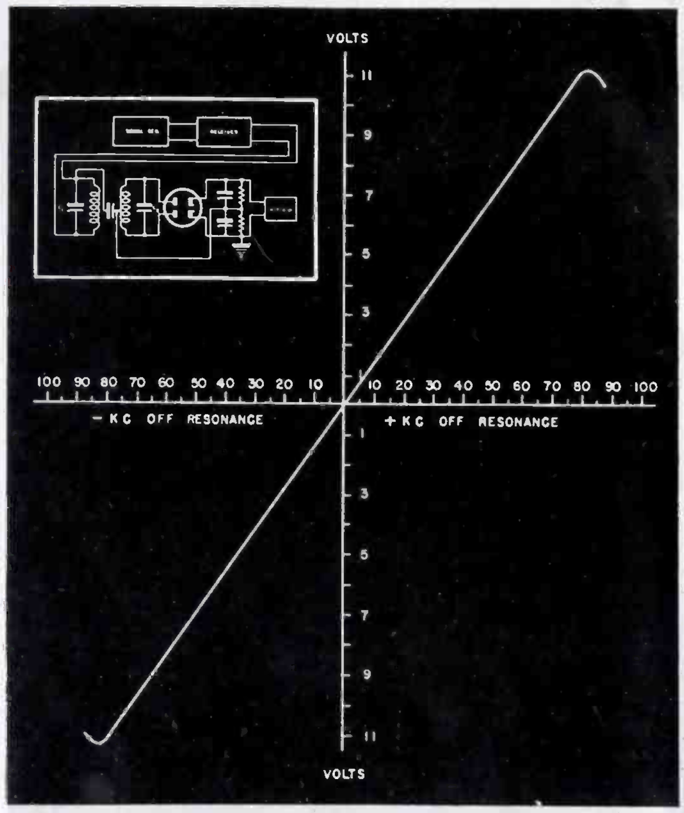

Fig. 3 . . . A typical response curve for the circuit shown in the insert. Developed voltage is a function of off-resonance frequency within the limits of broadcast f-m.

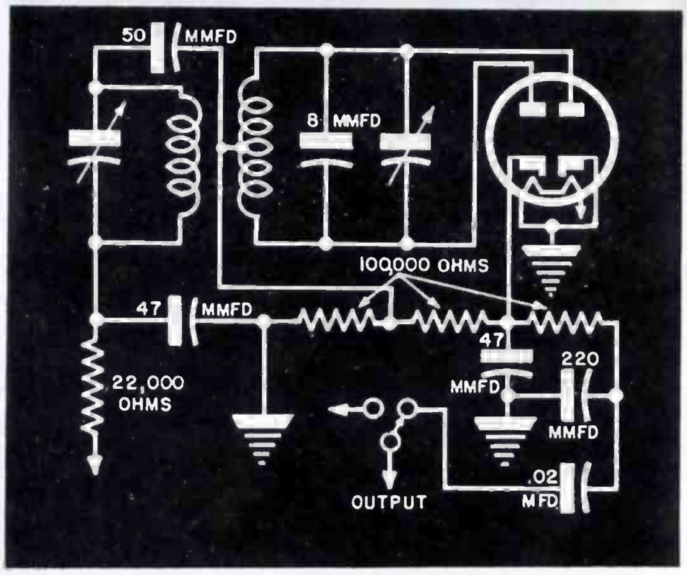

Fig. 4 . . . G.E. J FM 90 discriminator. A temperature - compensated condenser is used in parallel with the secondary trimmer for frequency stability.

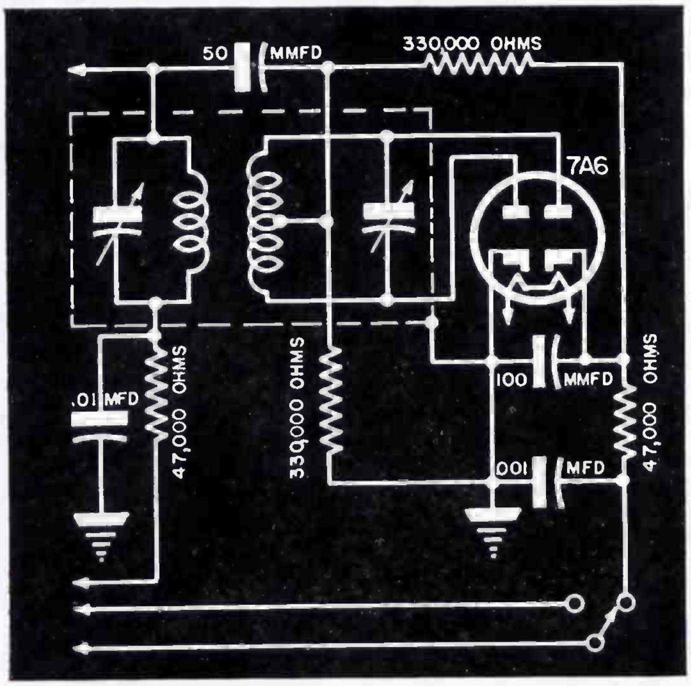

Fig. 5 . . . Pilot 300 discriminator. This circuit is similar to the G.E. circuit. The 47,-000-ohm resistor and .001-mfd condenser are used to filter the r-f in the audio feed line.

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_3 C_3 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 2*b* 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 vtvm. The frequency of the signal generator is then varied ± 75 kc. The voltage as measured on the vtvm 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

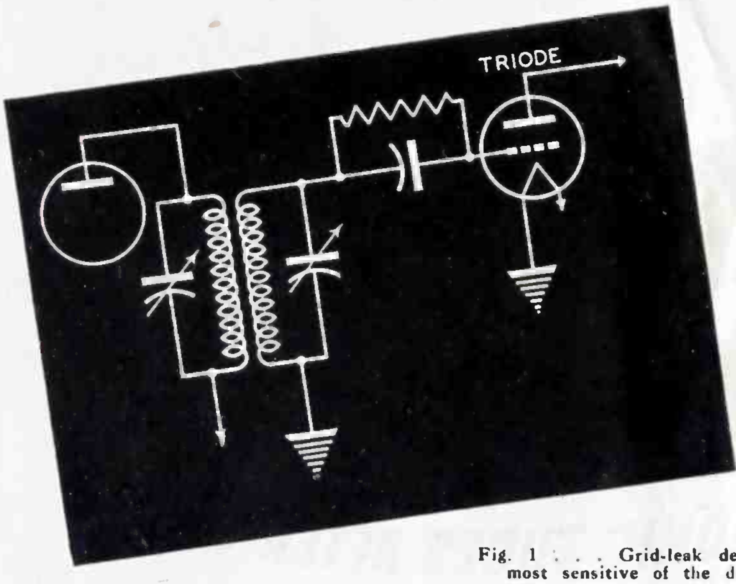


Fig. 1 . . . Grid-leak detector system — the most sensitive of the detection systems.

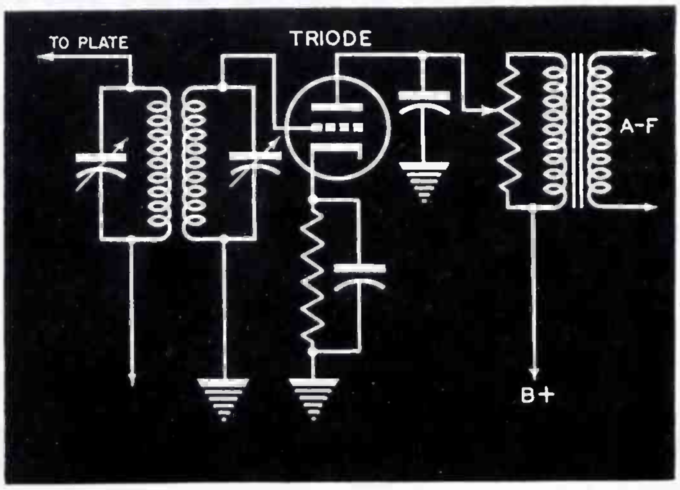
IN the modern receiver, the second detector and avc system play quite an important role. The second detector demodulates the incoming signals, reproducing the original program that modulated the transmitter. The avc (automatic volume control) system automatically biases an amplifier in proportion to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

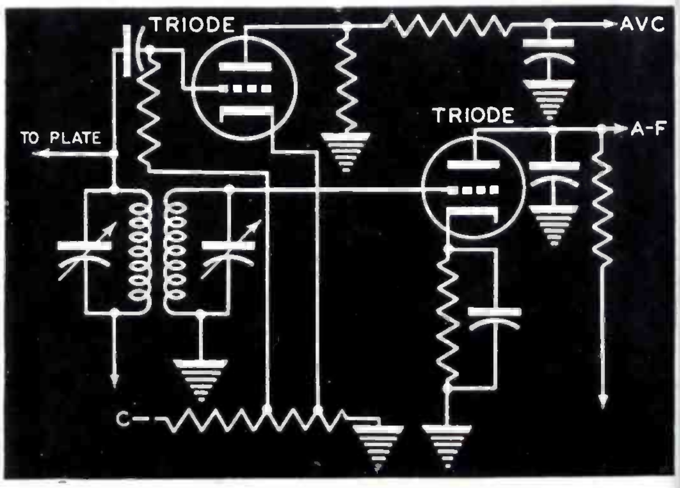
Detection of amplitude-modulated waves may be brought about by operating the detector on a curved part of its current/voltage characteristic (the portions where Ohm's law is not obeyed) or by complete rectification at cut-off. Triode and pentode detectors may be operated as grid-leak detectors or as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

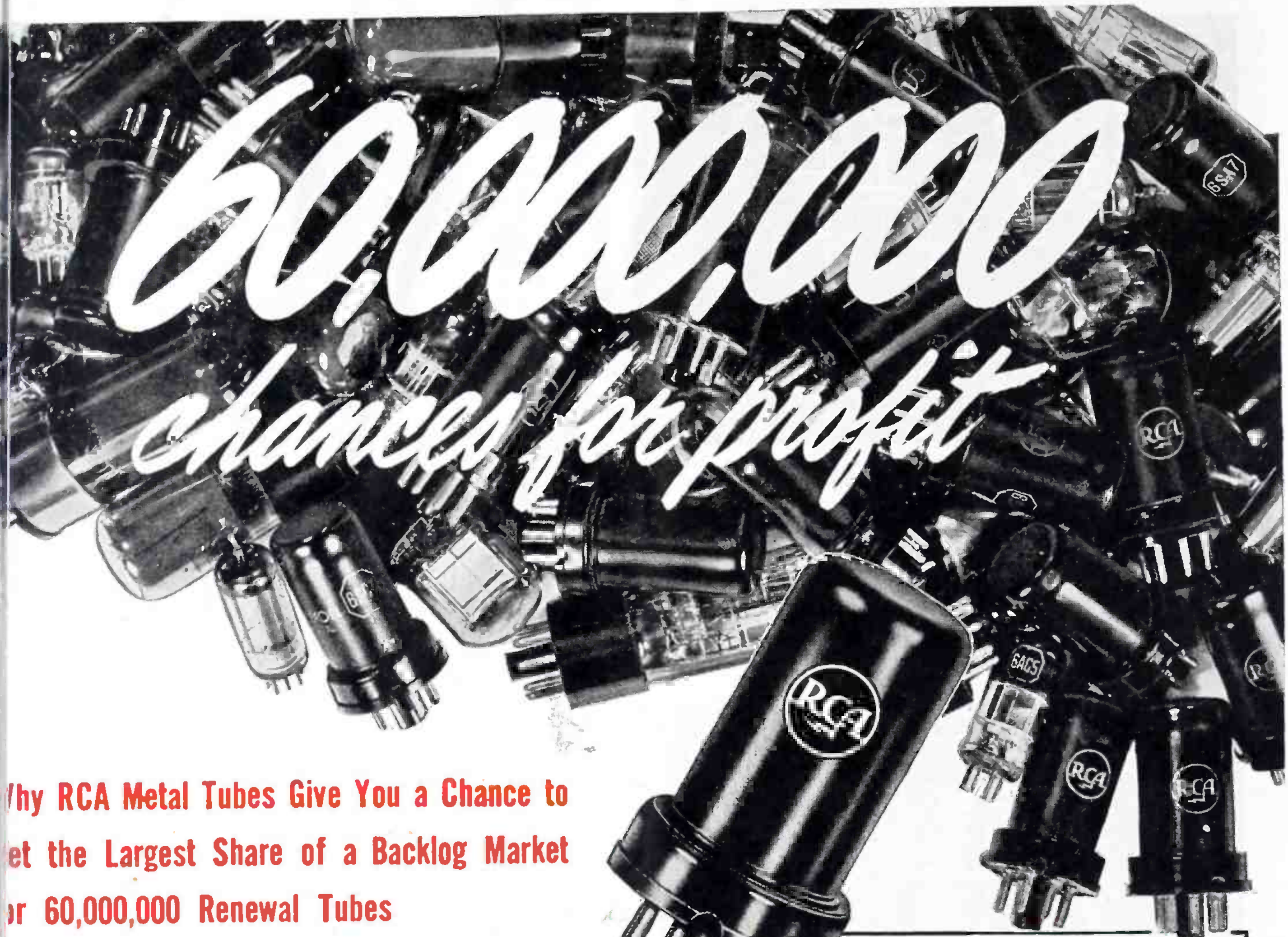
The disadvantages of the grid-leak detector are mainly its non-linearity and loading effects on the tuned circuit. The former is by far the more important. The detector operates approximately on a square-law curve where the output voltage is nearly proportional to the square of the input voltage. This 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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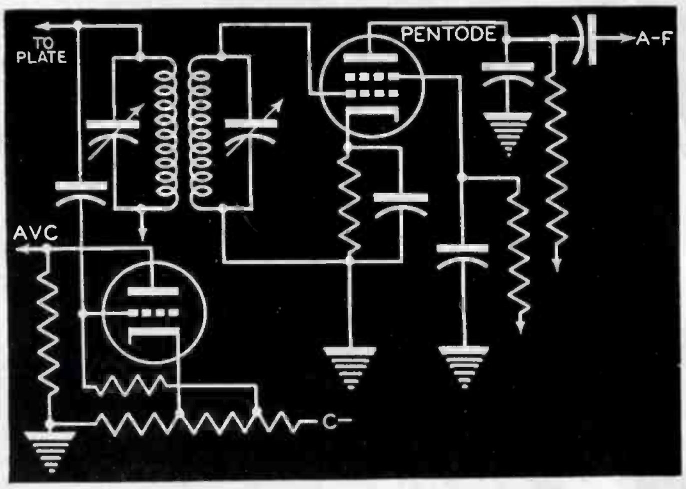

Fig. 4 . . . Tetrode or pentode-bias detector. This method offers a high-voltage output.

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 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-

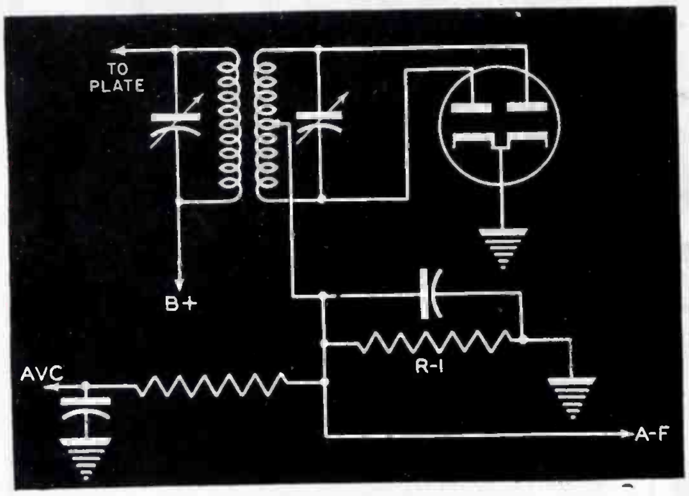

Fig. 5 . . . Full-wave diode detector delivering audio voltage plus avc.

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 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_1, 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.

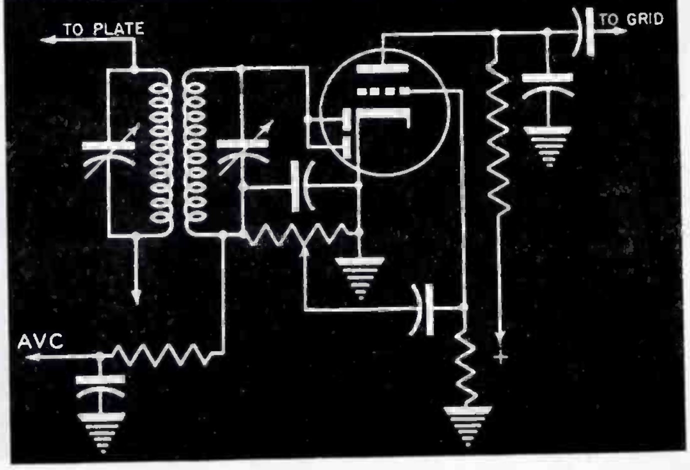

Fig. 6 . . . The most popular type of diode detector, with diodes in parallel.

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

(*Continued on page 22*)

AVC-SECOND DETECTOR SYSTEMS

(*Continued from page* 20)

detected audio signal. In Fig. 5, it is a full-wave signal; in Fig. 6, half-wave. But, in both cases, the high side of the resistor has a negative d-c polarity compared to the low side, which is grounded. Any voltage to be used for avc must be pure d-c, or direct voltage without any pulsations; hence the series resistor and shunt capacitor which comprise the necessary filter. There is another consideration besides filtering in connection with these two components. There must be a sufficient delay in avc action to prevent the action from following the program modulation. Also, the delay must not be excessive or the avc action will be too sluggish.

Fig. 6 shows one of the most popular combinations, a duplex-diode-triode type of tube designed primarily for use as a second detector, avc and first audio stage. Three or four methods of connecting the diodes are found in modern receivers, but the parallel connection of Fig. 6 is most popular. This halves the diode resistance, increasing the linearity of the detector because the load resistance then becomes a greater part of the total circuit resistance. The diode resistance varies with the signal voltage; the load resistance is unaffected. For minimum distortion, then, the diode resistance should be a small fraction of the total. But there are two more important requirements for low distortion; first, the input voltage must be high enough to minimize square-law detection and, second, the shunting of the diode-load resistor, from an a-c viewpoint, must be avoided as far as possible.

Square-law detection takes place when dealing with signal voltages of the order of a fraction of a volt, as previously noted in grid-leak detectors. It is reasonable then, that strong signals which produce 10 or 15 volts across the diode load should be comparatively unaffected by square-law action. This is one of the reasons that local stations are received with greater fidelity than more distant, weaker stations.

Shunting of the load resistor causes a serious type of distortion due to clipping negative modulation peaks. Several components contribute to this shunting: the avc system, the grid leak of the first audio tube and tuning-eye

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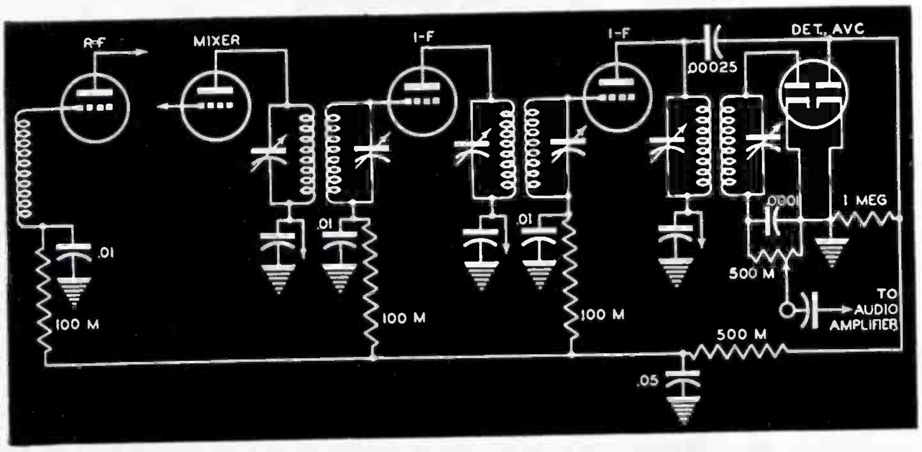


Fig. 7 . . . Entire avc system with separate diodes for detection, and avc bias and individual filters for bias to three amplifier tubes.

TONE-VOLUME CONTROLS

(*Continued from page* 13)

‹ee terminals, which permits them to used either as simple series rheo- ‹its or as potential-dividers (potenti- ‹neters), as illustrated in Fig. 2. The ‹signations employed for the three ‹rminals are: left (*L*) terminal is ‹at terminal which the movable con- ‹ct approaches at the extreme ***coun-*** ***‹-clockwise*** rotation position of the ‹aft; right (*R*) terminal is that ter- ‹nal which the movable contact ap- ‹oaches at the extreme *clockwise* ro- ‹tion position; (*C*) terminal is the ‹nter one connecting with the mov- ‹le contact arm, all looking from the ‹aft end of the control.

When employed as a potentiometer a potential-divider type of circuit, three terminals, *L-R-C*, are used, shown. When employed as a sim- ‹e series-variable element (rheostat), ‹e *C* (center or contact arm termi- ‹l) and only the *L* (left) or *R* ‹ight) terminal of the resistance ele- ‹ent are used, the latter depending ‹pon whether the resistance is to *in-* ‹*ease*, or *decrease*, respectively, with ‹ockwise rotation of the knob.

The standard practice in connecting ‹lume controls is to connect them so

(*Continued on page* 38)

CATHODE-RAY TUBES

[*Part Two of a Series*]

by S. J. MURCEK

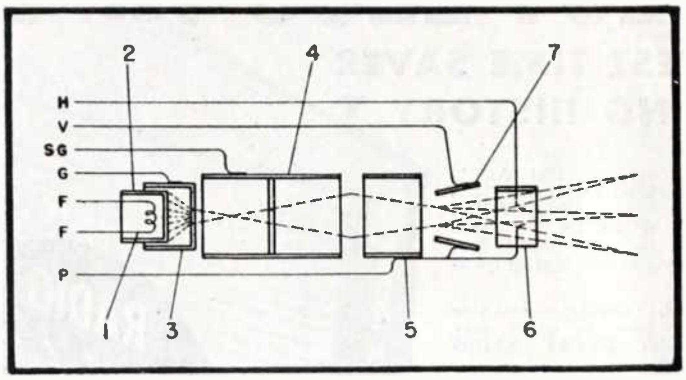


Fig. 1 . . . Operation of the electron gun. The tungsten heater, *1*, causes cathode, *2*, to emit electrons which are concentrated into a small volume by control grid, *3*, always electrically negative with respect to cathode. Note the bending of the electron beam by the deflection plate system.

REDUCTION in the grid-to-cathode negative control potential effects an increase in the number of electrons emitted by the cathode.[7] 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 1¼" 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

[7] H. J. van der Bijl, *Thermionic Vacuum Tube*, page 146, sect. 52, Edition 1.

en through suitable choice of the ages applied to each of the free ection plates. Under certain con-ions, the electron beam is capable writing on the electron screen any ceivable type of single line pattern, ging from a simple straight line to most complex type of harmonic ern.

nasmuch as the reactions which e place in electronic circuit poten-'s and currents produce patterns ich are mathematical curves, the hode-ray tube is most useful when of the curve functions appearing linear; one of the variable poten-s which is utilized to move or *eep* the electron beam increases or reases in equal proportion per unit elapsed time. In commercial c-r truments, it is conventional to apply h a linearly varying voltage to the e deflection plate of the horizontal lection plate pair. When the hode-ray tube is operated in this nner, any voltage reaction which urs in the modulating circuit of the rtical deflection plate pair appears a recognizable voltage variation rve on the tube's electron screen.

In Fig. 2, the horizontal modulating ltage is obtained from a capacitor ich is charged under a constant rrent rate, and the vertical modula-n potential is obtained from a com-ercial power frequency a-c line. The rizontal linear voltage variation re-ion to the non-linear vertical voltage riation is productive of the familiar ne-wave cycle pattern. From this otograph, therefore, it may be defi-tely concluded that the voltage ap-ied to the free vertical deflection ate varies as the trigonometric sine the horizontal voltage variation.

Since the cathode-ray tube is essen-ally an electron-optical form of the ectron tube, the tube requires an ap-reciable amount of care in its applica-on and use. In general, however, ommercial cathode-ray tubes are more urdily constructed than the conven-onal type of vacuum tube. Neverthe-ss, it is possible to prolong the useful fe of this valuable tube through ob-rvation of a few simple rules in its sage.

Aside from consideration of the athode-ray tube's fragile envelope, its ost vulnerable component is the elec-on screen. The latter is permanently npaired if it is required to dissipate a reater amount of energy than is speci-ed by the tube manufacturer. Hence, e electron screen must be subjected an electron beam bombardment 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.[8]

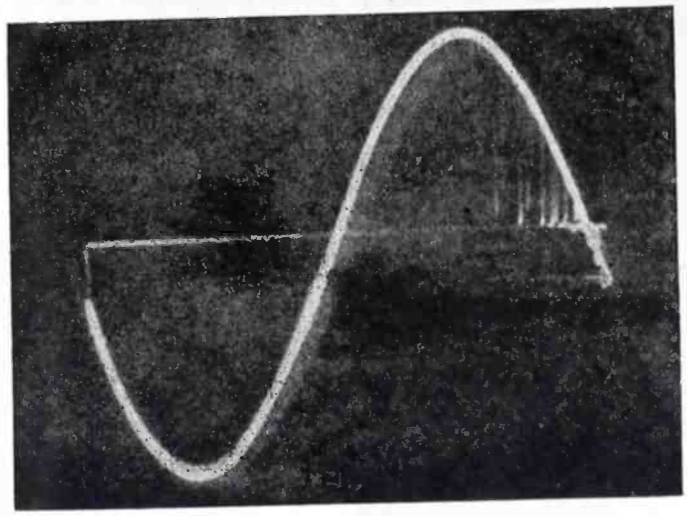


Fig. 2 . . . How an a-c sine wave appears on the screen of a cathode-ray tube. It is apparent here that the electron beam is caused to move over the screen surface like an electrical pencil, in accordance with two functions: (*1*) horizontally, equal time units (*microseconds*), and (*2*) vertically,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

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)

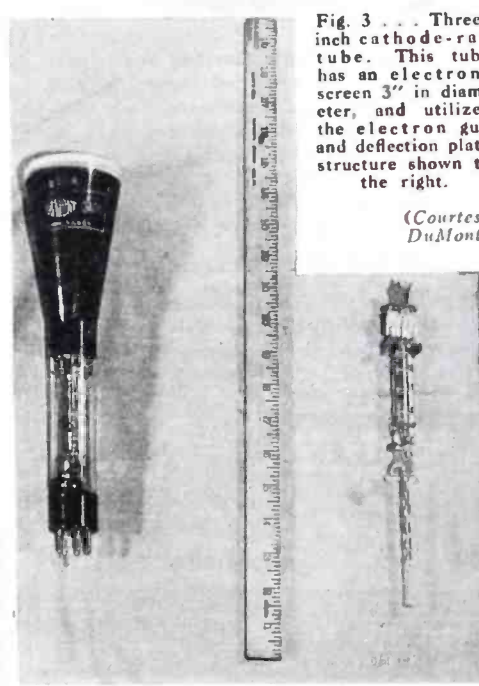


Fig. 3 . . . Three-inch cathode-ray tube. This tube has an electron-screen 3" in diameter, and utilizes the electron gun and deflection plate structure shown to the right.

(Courtesy DuMont)

[8]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

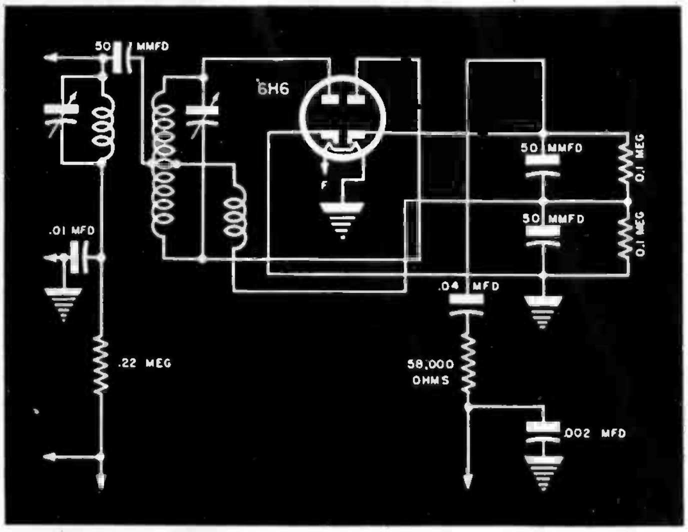


Fig. 6 . . . Stromberg-Carlson 25 discriminator. The choke in series with the secondary tap is used to reduce the loading effect of the two .1-megohm resistors on the transformer secondary.

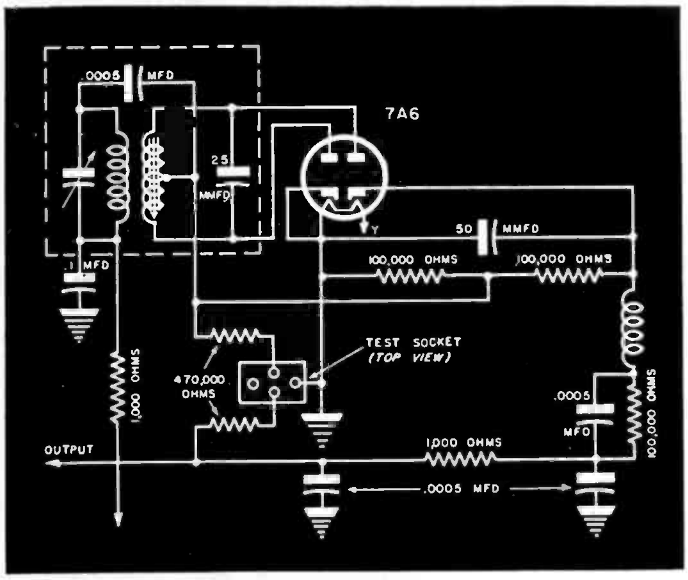


Fig. 7 . . . Zenith 12H678 discriminator. A socket is provided on the chassis to permit insertion of instruments for discriminator alignment.

w a signal will result in improper gnment.

The adjustment of C_2 is critical and e series of steps previously outlined · alignment may have to be repeated veral times before proper alignment achieved.

G.E. J FM90

Figs. 4 to 7 show some representa- ve discriminator circuits as used in andard receivers. Fig. 4 is the dis- iminator used in the G. E. J FM90. wo points are worthy of note. temperature - compensated capaci- nce, in parallel with the trim- er, serves to tune the secondary of e discriminator transformer. This done to prevent frequency drift in e discriminator which may result in etector unbalance. A high-frequency ne filter is used to remove any resid- al r-f and to deaccentuate the highs.

Pilot 300

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

Stromberg-Carlson 925

The Stromberg-Carlson discrimin- tor used in their model 925 is shown a Fig. 6. An r-f choke is used in the eturn of the secondary center tap to educe the loading effect of the cathode esistors on the discriminator secon- ary, thereby improving its character- stics.

Zenith 12H678

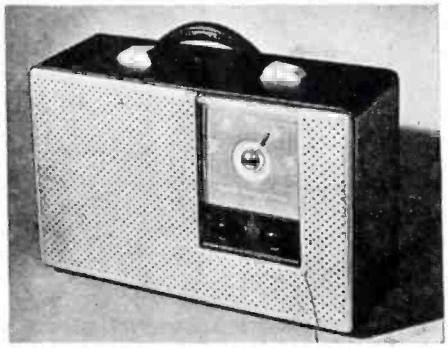
The discriminator used in the Zenith 2H678 (chassis 12A6) is shown in Fig. 7. An iron core is used in the econdary of the discriminator for lignment. The *RC* network in the ower right-hand corner is an a-f com- ensation circuit for uniform frequency esponse. A special socket is included n the chassis to permit quick checking f the discriminator with a vtvm.

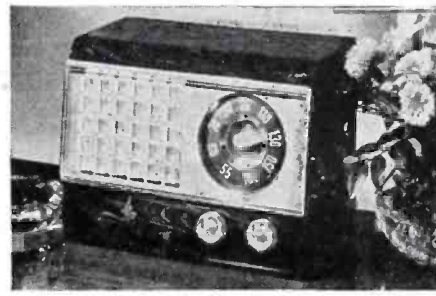
Usual Service Troubles

Service troubles in the discriminator re usually limited to poor audio re- ponse. This is caused by unbalance f the d-c voltages developed across he diode-cathode resistors. If the liode-cathode bypass capacitor is open, he d-c voltage across either cathode esistor will be found to be quite ow.

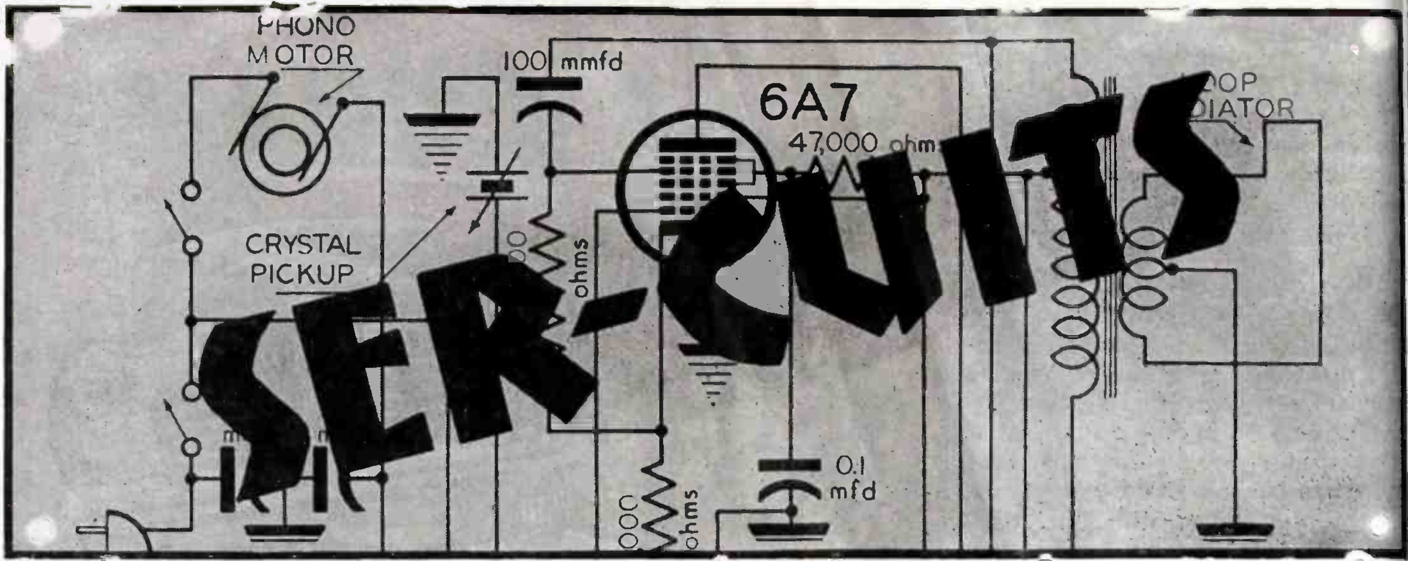
In any event, realignment of the dis- criminator will usually result in im- proved performance.

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 ½-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 potentio-

(*Continued on page 32*)

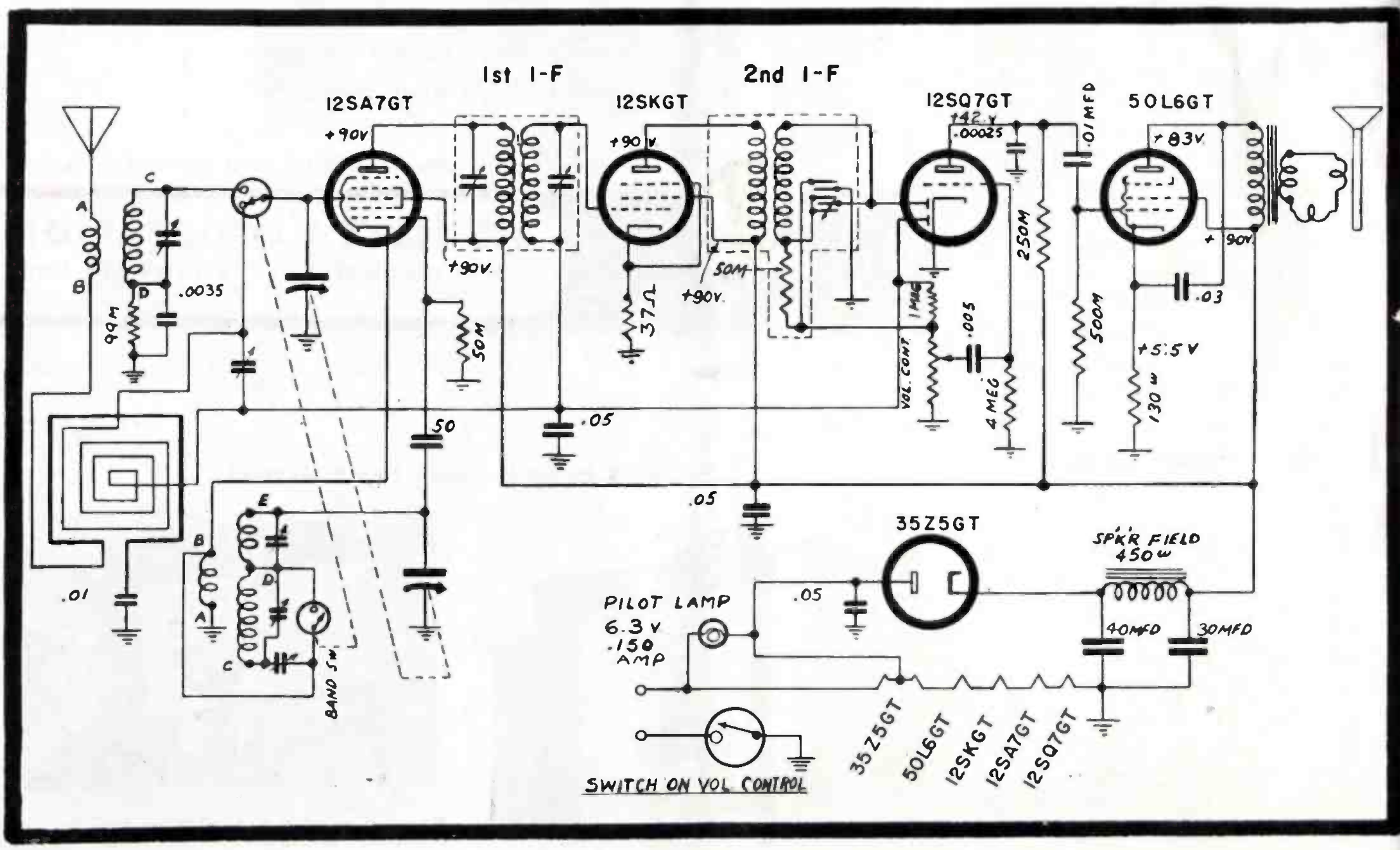
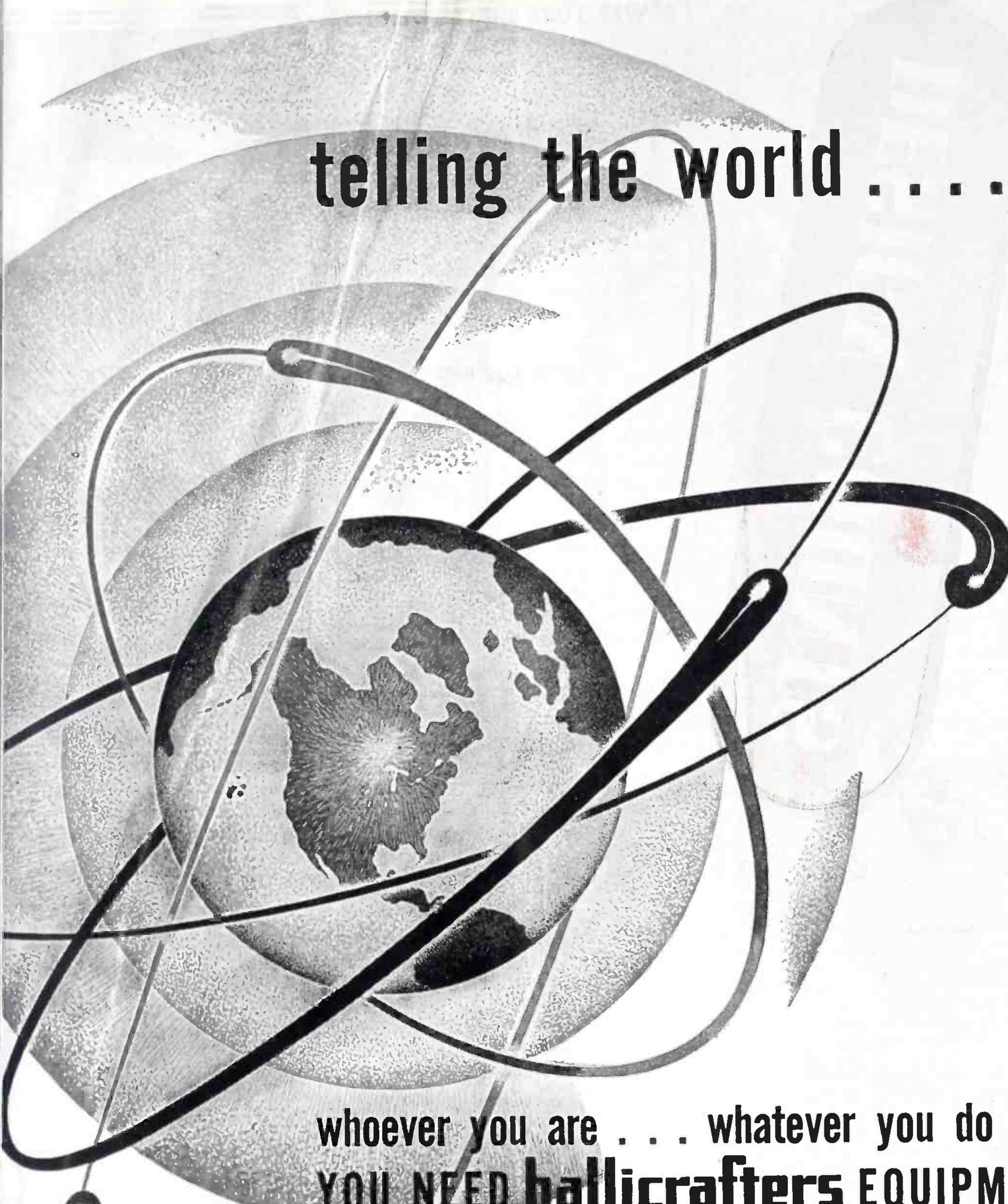


Fig. 1 . . . Fada 204 two-band receiver. Signal grid of 12SA7 converter is switched from loop to s-w transformer by single-pole double-throw switch.



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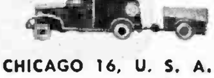

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POWER TUBE SUBSTITUTIONS

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

$$LR = \frac{E_b}{I_b} \text{ or, } I_b = \frac{E_b}{LR} = \frac{95}{4500}$$

$$= .021 \text{ ampere}$$

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 ıld apply. With 110 volts on the e of the 25L6, the plate current is roximately 50 ma, equal to a load stance of about 2,000 ohms. To ain the same load impedance with V6, a bias voltage of 10 volts should used.

Matching

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

Bias Control

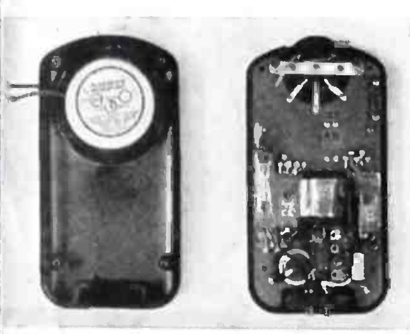
The limits for bias control of load pedance are set by the driving volt- a: delivered by the driver, or first lio tube. If the bias necessary to ablish the proper load impedance is t low, the driving voltage may ex- d the bias voltage, thereby creating tortion. If this is the case, the gain the driver stage may be reduced by nting the plate resistor of the driver ge with an equal resistor to reduce stage gain.

•

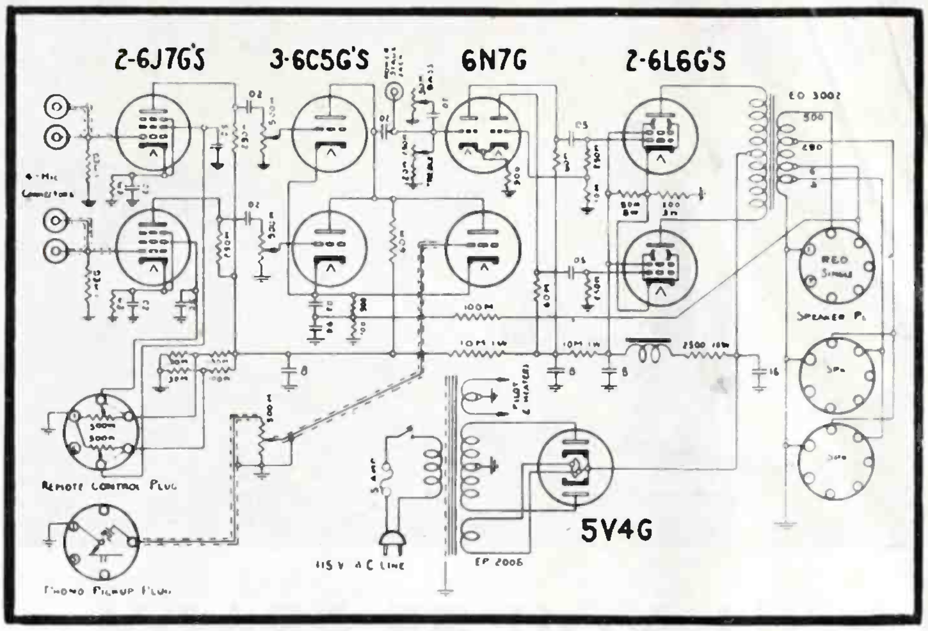
HEARING AIDS

ove . . . Extremely small hearing-aid tubes de- oped during the past few years. These tubes vide unusually high gain and are finding ap- cation in many special types of miniature plifiers. Below . . . Typical hearing aid h miniature tubes. Exacting parts placement essential in these small units to avoid feed- k and thus afford maximum amplification with minimum of distortion.

(*Courtesy Maico*)



SER-CUITS



(*Continued from page 28*)

Fig. 2 . . . Silvertone 8935-8942 thirty-five watt amplifier with four inputs for high impedance and phone-plug pickup.

meters connected between ground and separate voltage dividers, via a remote-control plug. These dividers consist of 100,000 ohms and 30,000 ohms in series and are connected between B+ and ground. Bass- and treble-tone controls and an auxiliary power stage jack are connected to the 6N7 amplifier grid. The bass control has the conventional shunt capacitor and series resistor; .02-mfd capacitor in series with a 50,000-ohm variable. The treble control is simply a 250,000-ohm rheostat shunting the audio input.

A universal output transformer has taps for 3, 6, 250 and 500 ohms. A feedback link is taken from the 6-ohm tap and returned to the second stage cathode circuit for the benefits of degeneration. This link runs through 100,000 ohms to a paralleled .05-mfd capacitor and 100-ohm resistor, then to all three 6C5 cathodes via a 20-mfd capacitor which bypasses a 900-ohm bias resistor. The 6N7 has no bypass on its 900-ohm bias resistor. The inverter is excited from the grid leak of the first 6L6. The 6L6 self-bias resistor of 200 ohms is connected to B+ through 50,000 ohms for increased bias stability, which also increases the peak power output. The output plates are supplied directly from a 5V4G rectifier output, the screens from the first section filter containing both inductance and resistance, the 6N7 stage from second section filter and first and second stages from the third filter. This arrangement affords the greatest filtering and also serves to prevent undesirable coupling by way of the plate supply.

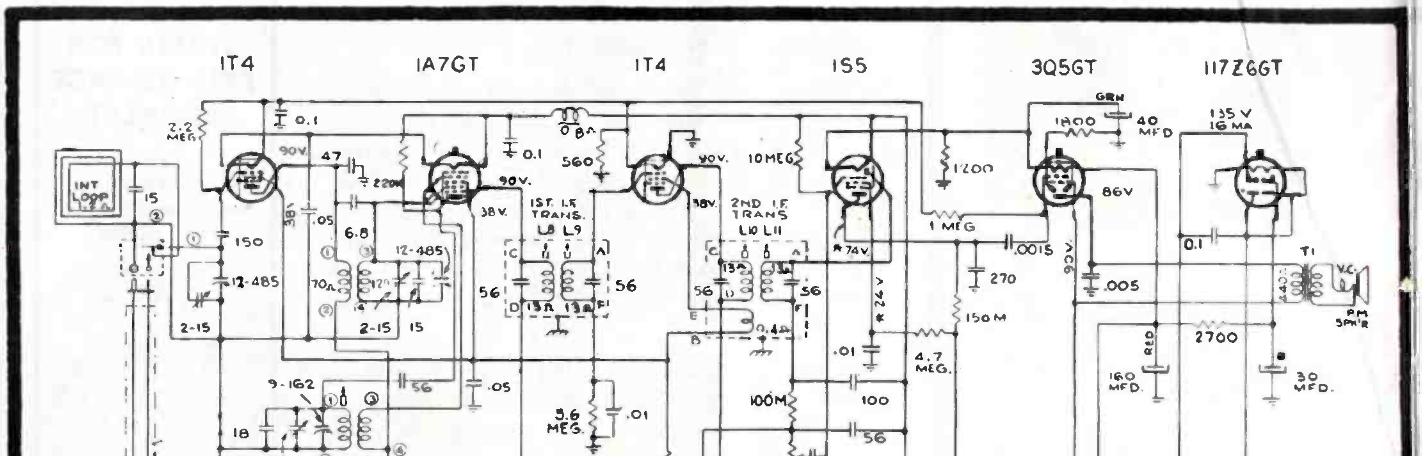
Since the output tubes are fed directly from the rectifier with only a 16-mfd filter condenser, they must be electrically balanced for complete hum cancellation; hum voltage across each half of the output transformer must be equal. Hum and extraneous noise can also be caused by defective tubes, 6J7s in particular, since the gain is so high and they operate at a high input impedance.

RCA 26BP

In Fig. 3 we have an interesting portable, RCA 26BP, which has a t-r-f stage and an external loop attachment. The r-f amplifier uses a 1T4, with a 2.2-megohm grid leak bias operating from either internal or external loop. Switch-

(*Continued on page 44*)

Fig. 3 . . . RCA portable, 26BP, with external loop. Rectifier has a split *A* and *B* supply, with separate resistance filters for line operation.



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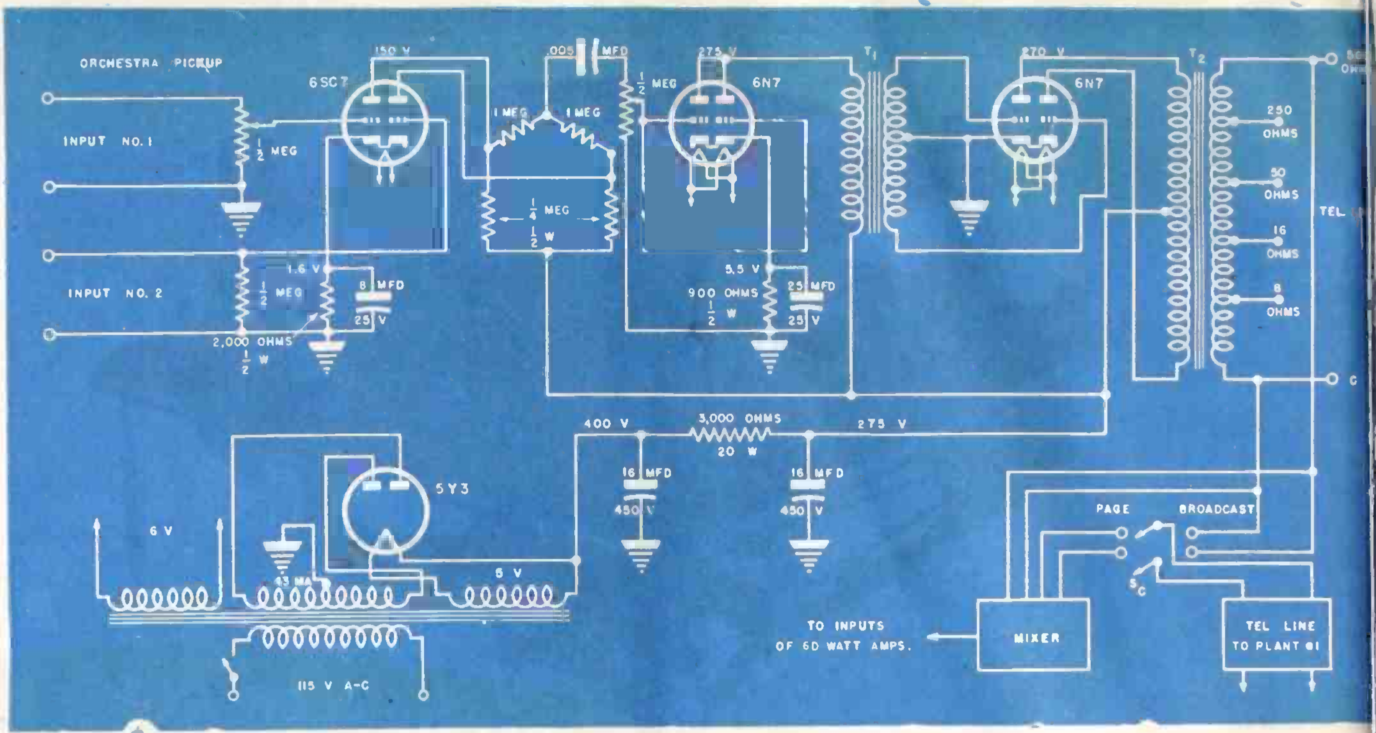
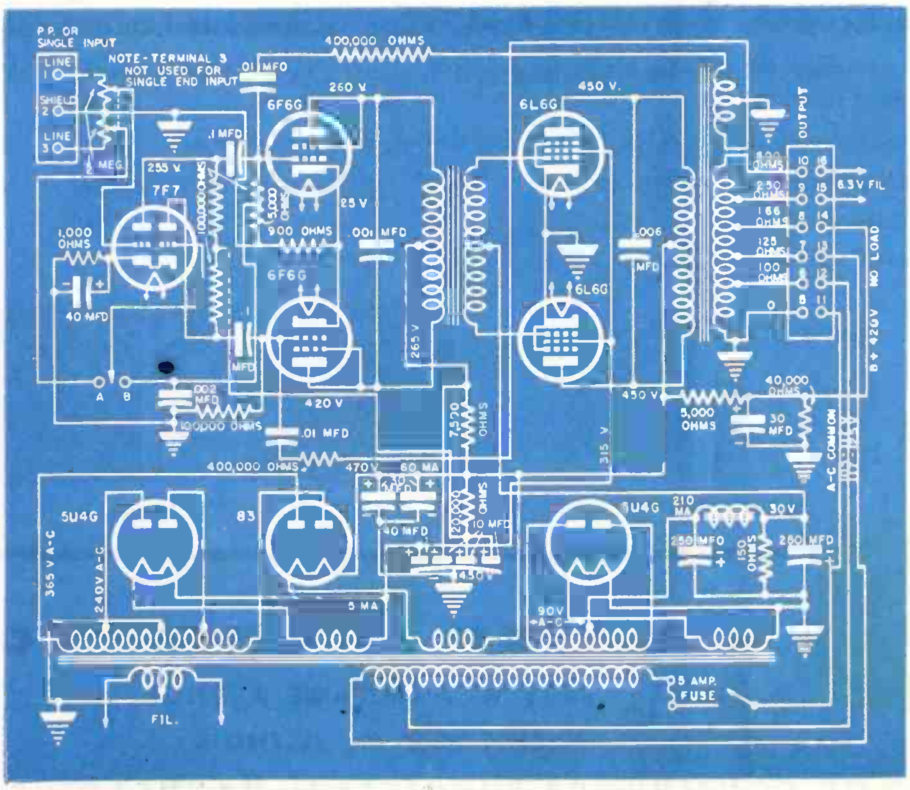


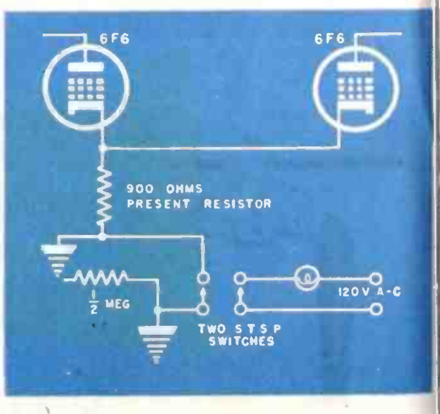
Fig. 1 (Above). . . . A mixer circuit for use with the 60-watt amplifier shown below. Two inputs are provided for microphone pickup. A switch permits paging over the same system as well as b-c rebroadcast. A mixer is also used for plant intercommunication.

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



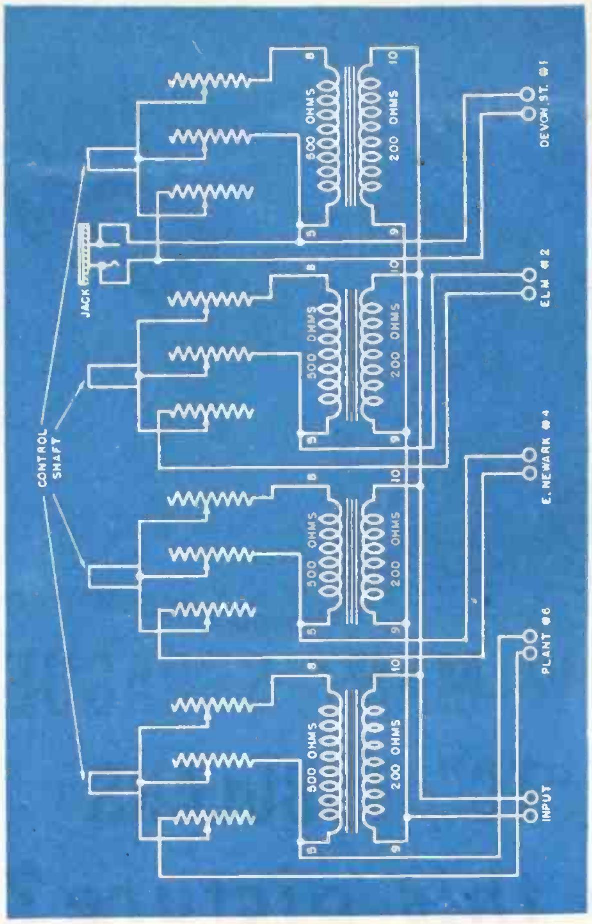
On this page and page 36 appea circuit diagrams of sound units use in a 6-plant installation. In the Jun issue appeared an analysis of th 800-cycle signal generator, nine-cha nel mixer, ten-watt booster amplifie and four-channel equalizer used in thi installation. The article was writte by Harold Lewis of the Sound Mai tenance unit at the Pollak Manufac turing Company, where the installatio was made.

Fig. 3 . . . A half-power circuit for use wit power amplifiers. The use of this circui permits a low musical background for voic announcements. Driver tubes are in 60-wat amplifier.



POWER AMPLIFIERS

(*See page 34 for additional power-amplifier circuits*)



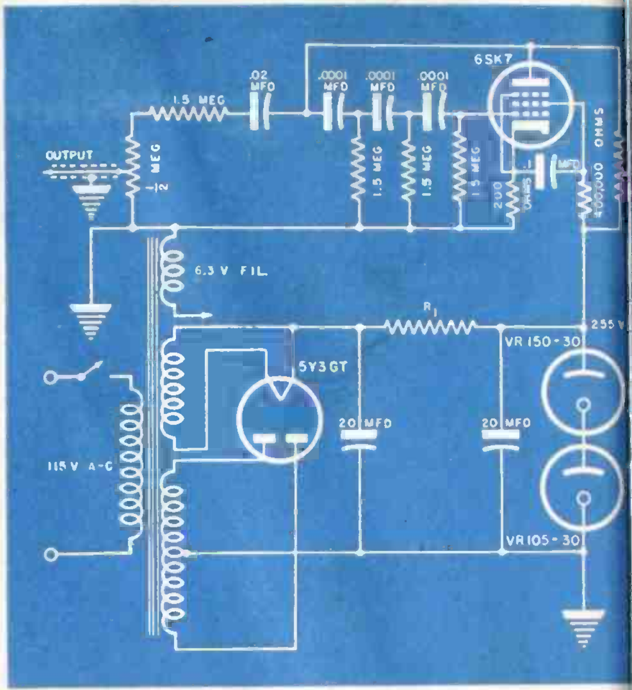


Fig. 4 (Left). . . . A four-plant transformer-type volume-level c trol unit. A single input may be used and redistributed to four plants, with the volume control monitored from one stu

Fig. 5 (Above). . . . A 400-cycle ph shift oscillator for use in conjunction w plant-amplifier systems. Attention sign or fire alarms or any type of coded sig may be transmitted with this dev

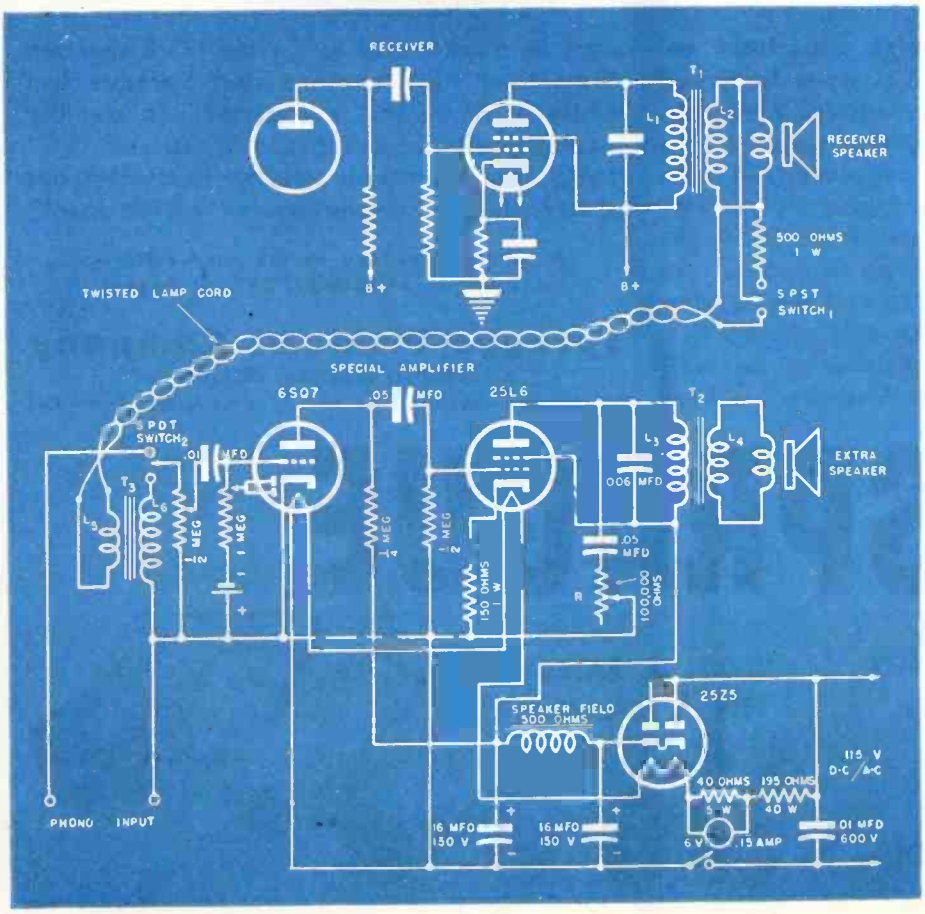


Fig. 6 (Left). . . . A separate ro amplifier for minimizing reaction back the receiver circuit. This unit perm separate control of volume and tone. (S Willard Moody article, "Loudspeaker A ditions for Improved Tone Quality" SERVICE, June, page 16.

NEWS

UTAH RADIO AND DETROLA TO MERGE

proposal to merge Utah Radio Prod- Company, Chicago, and International rola Corporation, Detroit, was made ntly.

eetings of stockholders to vote on proposal will be held soon.

iternational Detrola recently acquired rolling ownership of Rohr Aircraft poration, California.

* * *

NRY HUTCHINS BECOMES PRESI- ENT OF JOHN MECK INDUSTRIES SALES CORP.

enry Hutchins, formerly with Na- al Union Radio Corp., as sales man- , has been elected president of John k Industries Sales Corporation. Of- s are at 35 East Wacker Drive, Chi- o, Illinois. The unit will handle na- al sales of Meck radios.

* * *

J. FINN NOW RCA RENEWAL TUBE & PARTS SALES MANAGER

avid J. Finn has been named man- r of the renewal sales department of RCA tube division.

r. Finn will be in charge of the sale tubes, component and replacement ts sold through distributors and re- ers.

Prior to his appointment, Mr. Finn Chicago regional sales manager for A Victor.

* * *

EWS OF THE REPRESENTATIVES

. B. Patterson, 1124 Irwin-Keasler g., Dallas, Texas; John M. Maynard, 7 Shenandoah, Dallas, Texas; and F. Klicpura, P.O. Box 3113, Houston, xas, have become members of the thwestern chapter. Dale G. Weber of 6 S.W. Capitol Highway, Portland 1, egon, has been added to the roster of Northwest chapter and Douglas H. uksta of 408 York Road, Towson 4, M., has become affiliated with the Mid- ntic chapter. The New York chapter accepted associate membership appli- ion from Jack Fields, 27 Park Place, w York 7, N. Y.

David Sonkin, national secretary has re- tly moved his office to 347 Fifth Ave.

(*Continued on page* 45)

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 o 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)

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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]

a-c magnetic field reaction against stray field.[9]

)ther protective measures designed effect conservation of the cathode- tube life involve its proper opera- after long periods of use. These ticular precautions require that the be properly tested for its electrical dition periodically during such iods of protracted use.

Tests

mong the various electrical tests ch indicate the electrical condition the cathode-ray tube, the most im- tant concern its cathode heater stance and electrode current records ch reveal the deterioration of cath- emission and tube vacuum. If such trical tests are to indicate the con- on of the tube under consideration, s essential that a periodic record of h function be properly established, e cathode-ray tubes of similar de- n do not usually exhibit similar elec- le functional characteristics.

'he cathode-heater resistance test vides a direct and reliable indication the rate at which the mass of the trode falls through slow loss by tronic emission. A periodic record the electrode resistance indicates a w rise in the heater resistance as a ult of constant operation over long iods of time. Since the emission m this electrode is feeble, and the perature at which it operates is tively low, the recorded rise in its istance is correspondingly slow. wever, any indicated rise in the istance of this electrode is a direct rning that precautions must be taken prevent shock or vibration.

Periodic records of the electron-gun trode currents are effective in re- ling the condition of cathode-oxide ting, as well as the envelope vac- n. Since the first and second anodes the only electrodes of the electron n which draw appreciable current, ept in those cases where the tube is vided with an intensifier electrode, periodic records of these currents st always be taken under exactly the ne operating conditions. Thus, the e under test is placed into operating dition and is so adjusted that a gle horizontal trace approximately in length is written on the electron een. Under these conditions, the ay electrons which reach the first l second anodes are those not hav- sufficient velocity to escape the raction exerted by these positively

(*Continued on page* 40)

[9]If the shield about the tube envelope exhibits es of permanent or residual magnetism, that tron beam is permanently deflected by reason the electro-magnetic influence resulting be- en the two.

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-

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

Commercial cathode-ray tubes range, in electron screen diameter, from 1″ to ...″ in diameter. Where the tube is specially designed for application to television reception systems, it is technically designated as a *kinescope*.[10] In general, kinescopes vary little from the fundamental design characteristics of the cathode-ray tube proper except that, in some kinescopes, magnetic focussing 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 along optical considerations. It is capable of producing visual written images 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.

[10]HB-3, *RCA Vacuum Tube Handbook*, C. R. ...es.

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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 midget 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.

OLD TIMER'S CORNER

by SERVICER

WHILE 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-fixit* 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 lines 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 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 ohmsifter 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 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 follows 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

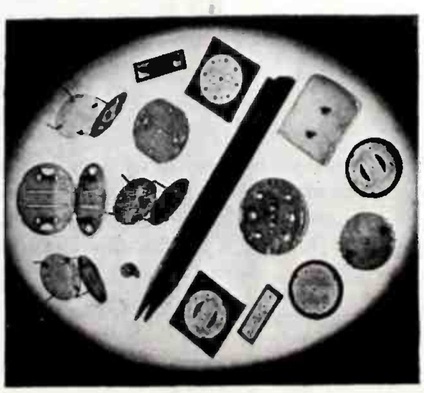
This seemed rather a hit-or-miss method to me, but Johnny told me that as you work at it, you get sort of a sixth sense which tells you which component is at fault. Most times, and especially when the set had been repaired several times, it was a matter of finding some condenser or resistor which was 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!

MODERN TUBE PARTS



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

(Courtesy Sylvania.)

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, tromberg-Carlson 515 FM, appear on e cover, this month. In the r-f am-ifier, which uses a 6AC7, two tuned rcuits are fed by a doublet antenna nd a 33,000-ohm damping resistor om grid to ground to broaden the re-ponse. 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-mmfd 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)

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

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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.

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, 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.

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 of tacling contacts; contact metal compo ions; welding and brazing tips, and vaious others.

* * *

ARTER MOTOR SALES BULLETIN

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

* * *

LSON FLUORESCENT LIGHTING CATALOG

catalog featuring fluorescent fixtures is eing offered by Olson Radio Warehoe, 73 E. Mill Street, Akron 8, Ohio. Decribed are industrial and commercial fixres as well as kitchen units and bed lans.

* * *

)U MONT C-R PHOTOGRAPHY CREEN DESIGNATION BULLETIN

bulletin, *New Designations of Screns for Cathode-Ray Photography,* ha been published by Allen B. Du Mont Laoratories, Inc., Passaic, N. J.

ntered are data on screen materials. Hetofore two general types of blue scien materials have been used commerciay for photographic work. Both have be designated as P5. It has now becoe apparent, however, that these materils, each offering distinct advantages in ertain photographic applications, are suciently different to warrant different ty designations. These two types of scien materials, sulphide and calcium tustate, are discussed in the bulletin. RIA and the Armed Services have ag ed to designate the screens having the ch acteristics of calcium tungstate as P5, an those of sulphide as P11. Du Mont tu s in the past have used the sulphide ty screen. Therefore, the change to the P1 designation will not represent a chge in screen material to those who ha been getting P5 photographic screens fro Du Mont.

he general characteristics of P5 and P screens compare as follows: Both are of he short persistence, blue fluorescent ty, and of high photographic actinity. Tl main difference is the considerably hi er photographic and visual efficiency of ie P11, and the shorter persistence of th P5. P11 is advantageous for all still ph ographic applications particularly hi-speed phenomena, and for continuou moving picture recording up to the lirt where persistence produces blurring of ie picture (approximately 10,000 cps). T use of the P5 screen is for highsped continuous motion-picture recording ab e the limit of the P11, or up to 60 kc w out blurring.

* * *

S LUDWIG NOW PRODUCING AUTO ANTENNAS

idney Ludwig, formerly chief engineer of Ward Products, Cleveland, has becoe owner and general manager of a ne company, The Radel Manufacturing Cnpany, 6300 Euclid Avenue, Cleveland 3, Ohio.

complete line of auto antennas, parts ai inter-office communication equipment wl be produced.

* * *

WSTINGHOUSE AIRBORNE TELEVISION/F-M BROADCASTS

lans to transmit television and f-m p grams from stratosphere airplanes cuising six miles in the air, as soon as pmits and equipment can be obtained, we announced recently by Westinghse.

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.

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 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.

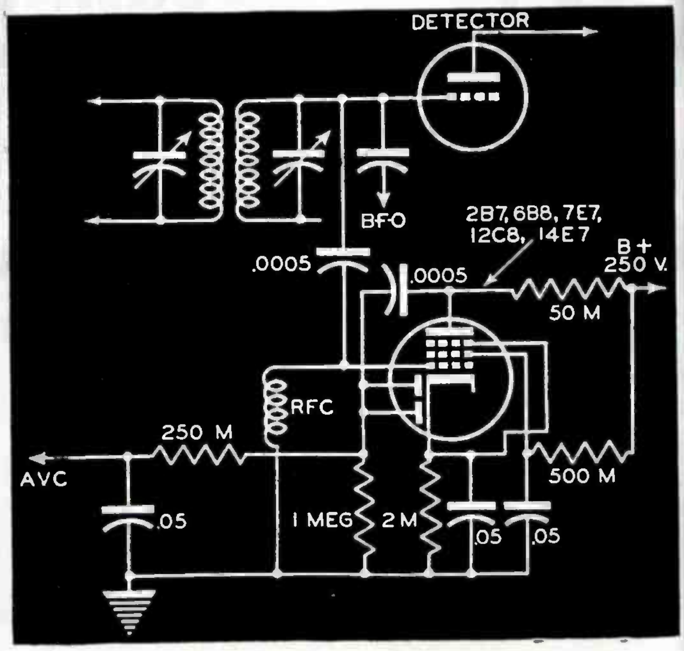


Fig. 8 . . . An avc circuit for use with any receiver. In this system, an r-f voltage is picked off before the detectors, amplified by a pentode and fed to a diode with a 1-megohm load resistance.

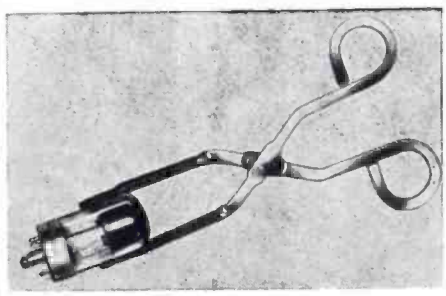
NEW PRODUCTS

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.



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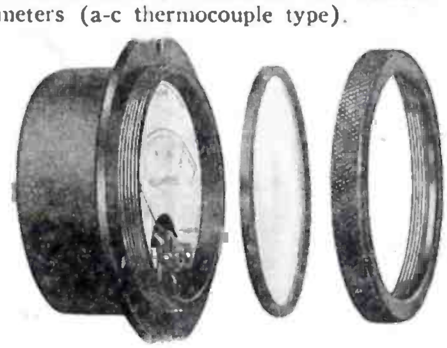
TRIPLETT HERMETICALLY SEALED INSTRUMENTS

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).



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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)

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.

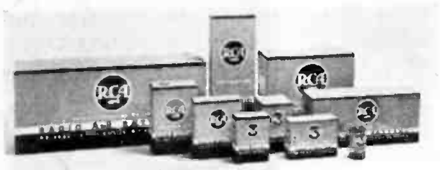
* * *

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 ±.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 ±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 measurements the galvanometer and internal 1½ 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, a more sensitive external galvanometer may be desirable, although most measurements between 1 and 10 ohms may be satisfactorily made by using an external 1½-volt battery.

* * *

FAIRCHILD POTENTIOMETERS

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

Camera and Instrument Corporation, 475 10th Avenue, New York.

The potentiometer was developed for use in bridge T attenuators in an airborne electronic computing gunsight. At present, one standard size, with a 1⅞" 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 4⅝" 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 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 1¾" bakelite knobs have been announced by the General Cement Mfg. Co., Rockford, Illinois. Complete with ¼" brass insert and set screw. Over-all height, ⅞".

* * *

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 ⅝", 27 thread.

Weighs under 2 pounds for shipping. Diameter, 3¼"; depth of 2⅜".

* * *

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.

JOTS AND FLASHES

FUTURE 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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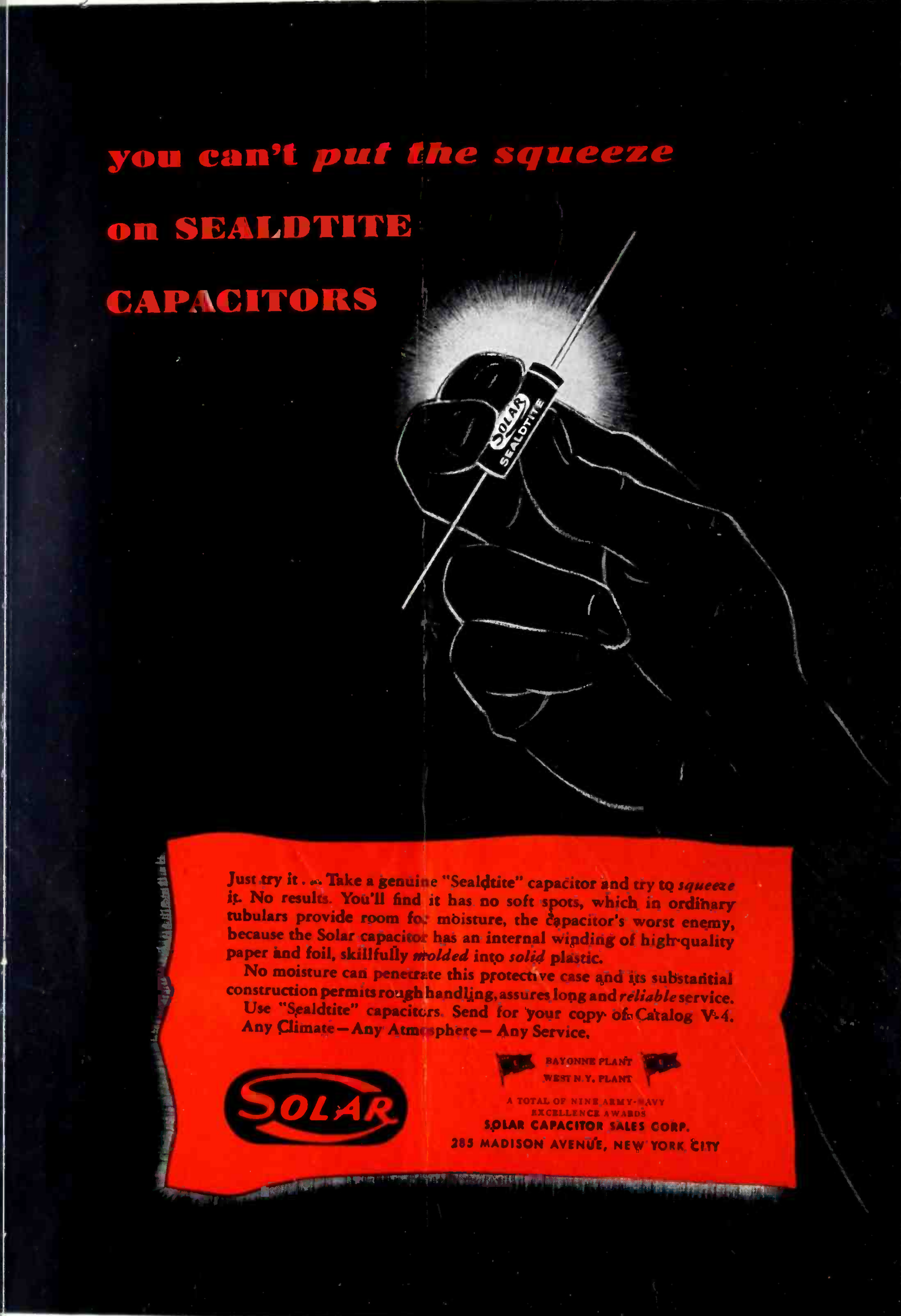
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