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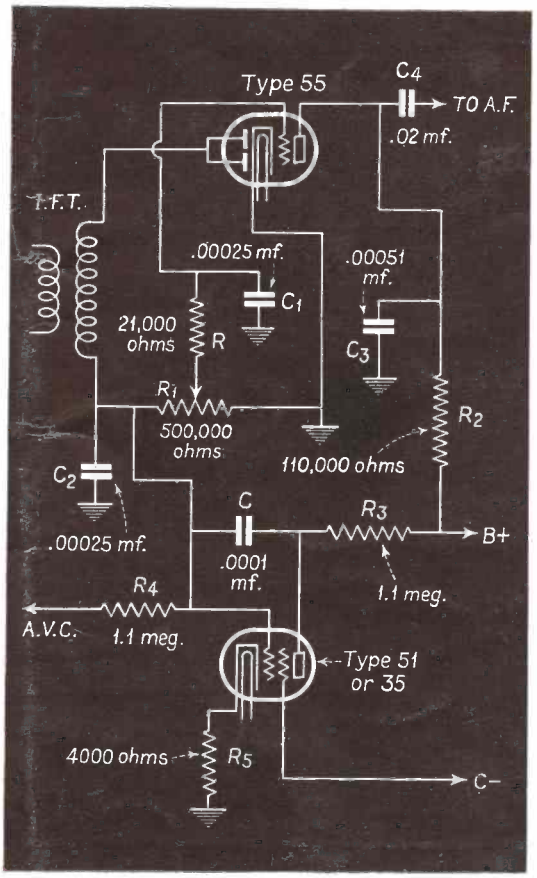

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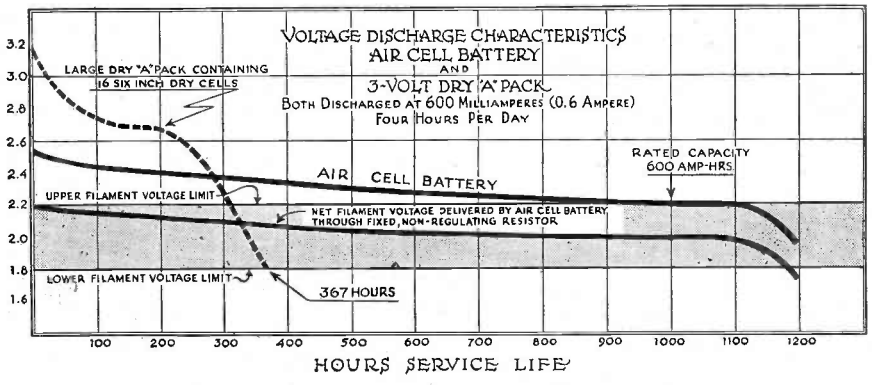

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SERVICE

A Monthly Digest of Radio and Allied Maintenance

JANUARY, 1934
Vol. 3, No. 1

EDITOR
John F. Rider

MANAGING EDITOR
M. L. Muhleman

EDITORIAL CONTENTS

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Published Monthly by the
Bryan Davis Publishing Co., Inc.
19 East 47th Street
New York City

SANFORD R. COWAN
Advertising Manager

A. B. CARLSEN
Circulation Manager

Chicago Office—919 N. Michigan Ave.—L. F. McClure, Mgr.
Cleveland Office—10515 Wilbur Ave.—J. C. Munn, Mgr.
Philadelphia Office—1513 N. 13th St.—H. S. Thoenebe, Mgr.
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Entered as second-class matter June 14, 1932, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Subscription price $2.00 per year in the United States of America; 25 cents per copy. $3.00 per year in Canada and foreign countries; 35 cents per copy.

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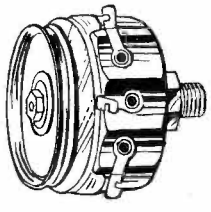
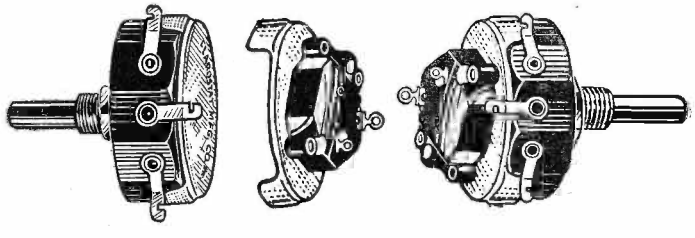


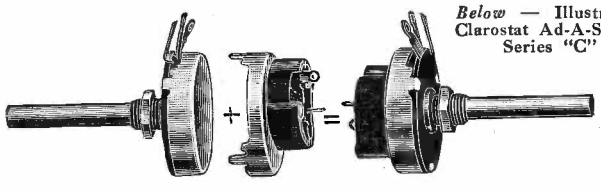
Left—Illustrating Clarostat "X" 123, replacement for Bosch 28, 29; Eveready 1, 2, 3

Below — Illustrating Clarostat Ad - A - Switch Series "W"

Clarostat Line Ballast Replacement for 27 makes — 81 models.



Below — Illustrating Clarostat Ad-A-Switch Series "C"



* Clarostat is the trade name used by the Clarostat Manufacturing Company, Inc., to identify its products. Products which bear this trade name are manufactured and guaranteed by the Clarostat Manufacturing Company, Inc.

NEW CONTROL REPLACEMENT GUIDE UPON REQUEST

CLAROSTAT MFG. CO., Inc.

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"AD-A-SWITCH" was originated by Clarostat

THE ANTENNA . . .

SERVICING NEEDS BOOSTING

WE have passed through approximately eight years of contact between America's Radio Service Men and Mr. Radio Public. The total number of men who have studied to become Radio Service Men and have entered the industry are not known, but at any rate, it is high time that something was done to acquaint the public with the fact that service work requires a technical education. We are fully aware of the fact that many will not agree with us—particularly the men who have used cut and try methods for years and have up till recently met with a certain amount of success. Wellington is arriving on the scene in the form of the receivers which have been sold during the past twelve or eighteen months and those which will be sold during the years to come.

We further realize that prior to the advent of local associations and a national radio service association, there existed no concentrated group sufficiently interested in each other, to embark upon such a task of acquainting the public. However, the time is ripe today. The promiscuous use of such appendages as "Expert Radio Engineer," "Radio Expert," and myriad others, accompanied by failure on the job, has undermined the mental attitude of the public to the extent that good men are not appreciated.

Good men suffer by comparison with the bad on the grounds that the good are not so good—the bad are terrible. If an effort were made to educate the public to the effect that today's good Service Man has studied his work for years—owns good equipment and knows how to use it—keeps abreast of latest developments and understands radio receiver construction and service work, much would be accomplished in the effort to secure proper remuneration from those who have the wherewithall.

Unfortunately the presentation of the idea is so much easier than the carrying out of the plan. However, with associations active in communities it might be possible for a group of men to prepare a little brochure or pamphlet—printed planograph or offset—bearing a title such as, "Why Your Local Service Man Is Dependable." It may be possible to secure the cooperation of local newspapers, particularly when Service Men and organizations are advertisers. It may also be possible to contact broadcasting stations. If we recall correctly, the I.R.S.M. has contacted stations and closer alliance between the public and the Service Men is sought. Other associations can do likewise. At any rate, whatever the medium used, or the manner in which it is accomplished, some means of educating the public should be carried on. It is not a far-fetched idea to even establish a "National Week" for that purpose.

• • •

WE have received numerous letters which bear very interesting captions relative to specialization. To all appearances, the writers are specialized in one or a number of manufactured receivers.

Now, specialization is all right, but it also has its drawbacks. One of these is the bad effect created if the Service Man fails to render a perfect service job on one of his "specialized" brands of receiver. This is far worse than if he were just an all-around man. It is very difficult to find an excuse for failure when you specialize.

Specialization in this day and age is somewhat different than years ago. Circuits may change over night. You may have been a specialist on A——, R——, C—— and P—— receivers prior to the advent of the superheterodyne, QAVC, reflexed circuits and what have you. To be a specialist today and to name the respective brands, you must expect anything and everything over night. And, generally speaking, a "specialist" cannot fail.

Specialization is not so hot from another angle. What with the large number of comparatively little known receivers which have been sold during the past year, your "specialization" advertising may prove to be a boomerang if the man who has a set to be fixed, has some brand other than that upon which you are a specialist.

In this connection we can cite our own reactions with respect to car repair specialists. Candidly speaking, when unable to locate a manufacturer's branch service station we have steered clear of those car repair organizations who displayed signs indicating that they were specialists upon other makes of cars. Of course, if we could not help ourself, we took the car to the most convenient place, but it was only natural since we were confronted with the problem of specialists, to seek him who specialized in our make of car.

We are not casting reflections upon these specialists. More than likely any one of the Studebaker, Nash or Chrysler specialists could fix our Buick, but—and we believe it to be a normal reaction—we prefer a general practitioner rather than a kidney specialist, for maybe, who knows our trouble may be just a case of the heebie-jeebies!

We believe that radio specialists are losing business on just that account.

• • •

ANOTHER I.R.S.M. Regional Convention and Exhibit will take place at the Hotel Sherman in Chicago on February 23, 24 and 25, 1934. Here's hoping that it will be as successful as the show held during January 1933 at the same place.

Once more Service Men in the middle west will have a place to gather for a three-day chin fest. No doubt the activities of the Institute during 1933 will be manifest in a greatly increased list of visitors.

As yet, no information is available concerning exhibitors, speakers or admission fee—three important items. However, we feel that the personnel responsible for the management of the show, having experienced two such conventions, will put on a good shindig. At any rate—here's luck!

If we recall correctly, last year's Chicago show had an enrollment of about 700. Let's see at least twice that number during the 1934 show. Will you be there?

John F. Rider.

ANNOUNCING

Volume IV

RIDER'S "Perpetual Trouble Shooter's Manual"

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- Volume IV picks up where the contents of the National Union Volumes I, II and III left off.
- Volume IV will contain a cumulative index which will cover all previous Rider's "Perpetual Trouble Shooter's Manuals," RCA Radiotron and Cunningham Complete Manuals and Volume III, and all National Union Volumes I, II and III.
- The entire Volume IV is devoted to service information, schematics, voltage data, socket layouts, electrical values, peak frequencies, etc., etc.
- Volume IV will include all of the latest receivers—in fact practically everything announced up to about the end of January.
- Volume IV will contain resistance data as well as voltage data on many receivers so that you can use your old and new service equipment with the greatest ease and practicability.
- Special attention has been paid to the numerous cigar-box receivers announced during 1933 and to the various smaller manufacturers whose receivers are in the market but not so well known. Volume IV shows manufacturers whose schematics have never been shown before.
- Volume IV will be printed on 20 lb. bond and will be bound loose leaf in the "instant removal" type of binder used for Volume III. This binder is covered with genuine Dupont Fabricoid and is fully guaranteed.

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Heretofore manuals were produced on a contract basis and it was possible to establish a resale price which was known to be permanent for at least six months if not a year. Such is no longer the case. Each print order is a separate transaction. . . . ***Consequently, we cannot guarantee that the resale price of Volume IV as stated in this advertisement will exist for an extended period during 1934.*** However, we can guarantee that the first printing of Volume IV, now in process, will be sold at $7.50.

It is, of course, possible that future printings will be available at the same price—but it is also possible that an increased price may be necessary after this first printing is sold. . . . We do know definitely that the economic condition of the nation will not permit a reduction in price.

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JOHN F. RIDER

1440 Broadway **New York City, N. Y.**

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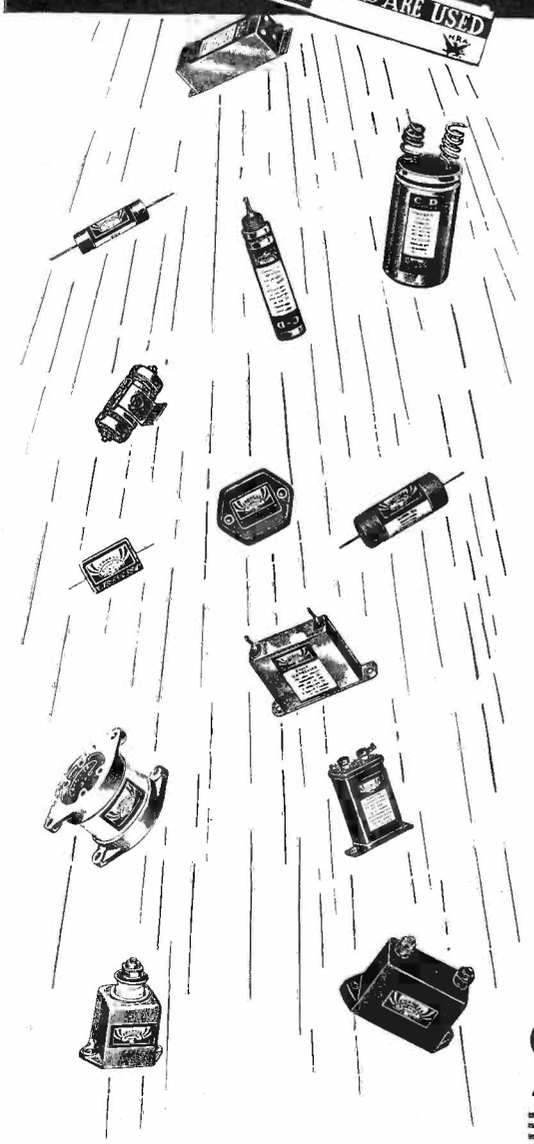

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SERVICE

A Monthly Digest of Radio and Allied Maintenance

FOR JANUARY, 1934

Diode Detection in Old Receivers

By G. S. GRANGER

THE thousands of tuned-radio-frequency sets now in use can be improved considerably by the addition of diode detection. This also holds true for many of the early superheterodyne receivers which employ low- or high-gain, biased detectors. Let us see what can be done in this direction.

Advantages and Limitations

There are two primary advantages to be gained from the use of a diode as a detector. First, diode detection is linear, which means that the inherent distortion contributed by grid-leak, biased, and power detectors is eliminated. This is particularly worthy in these days when the average listener appears to be more interested in quality reception than he has heretofore. Second, the use of a diode permits the easy application of automatic volume control to the receiver in which the diode is used. Moreover, the characteristics of the receiver permitting, inter-channel noise suppression may also be added. This latter system goes hand in hand with automatic volume control and is, of course, of little utility in a receiver having a manual means of controlling the gain.

Old receivers place a number of limitations in the way of diode detection and automatic volume control. In the first place, a diode detector does not amplify. Then if it is to be used in a receiver at all, the first consideration is that of gain. Has the receiver sufficient radio-frequency or intermediate-frequency gain to load up the diode? If not, the gain must be increased at pre-detection or post-detection. This is a matter we shall have to go into quite thoroughly.

Automatic Volume Control

Leaving the subject of detection for the moment, let us consider the matter of automatic volume control. It is not a perfect system at the most and if the circuit is not carefully designed the beneficial feature may be over-run by the decidedly undesirable distortion and motorboating which may be introduced. Moreover, this condition may well be aggravated by the inclusion of some system of inter-channel noise suppression.

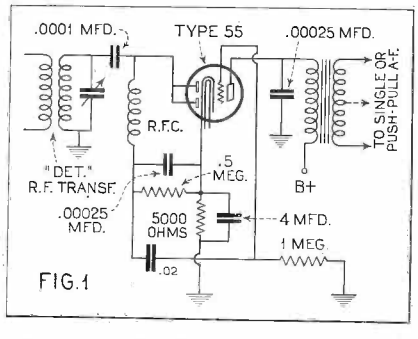
Automatic volume control and inter-channel noise suppression should not be added to a low-gain receiver unless the receiver is re-designed so as to have a greater gain than originally. Since automatic volume control is of no particular value on local stations—except in localities where the station ground waves are greatly attenuated—it hardly seems worth while to tackle it, particularly in view of the design difficulties which make each receiver a problem in itself. Its addition is not recommended.

Gain Considerations

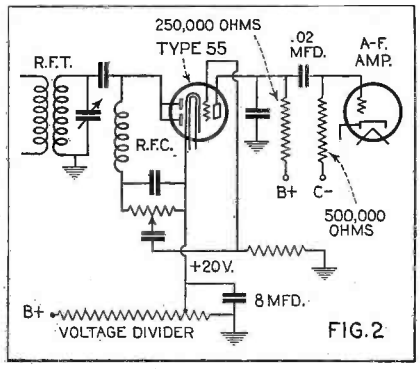
Now let us revert to diode detection, and determine what is required in the way of gain in order to make the diode effective. Keep in mind the fact that no matter the make of receiver, it was originally designed to have sufficient r-f and a-f gain to operate satisfactorily with some form of detector which in itself is capable of a certain degree of amplification. The gain in the detector stage will be low if the detector is a triode, higher if a screen-grid tube, and higher still if a pentode. Therefore, when adding diode detection, a combination tube such as the 55 or 85 should be used when replacing a triode detector, a type 2A6 or 75 (diode and high-mu triode) when replacing a screen-grid tube, and a 2B7 or 6B7 when replacing a pentode detector.

By the judicious use of these tubes, then, we can come close to matching the original gain in the receiver detector stage. We do it, of course, by adding gain in the a-f portion of the receiver to make up for the amplification deficiencies of the diode. We could, if desired, use the pentode portion of such a tube as the 2B7 or 6B7 as an r-f or i-f amplifier and obtain the gain in the r-f or i-f portion of the receiver. But this would mean the addition of an r-f or i-f transformer. It is much simpler to place the gain in the a-f, the only necessary precaution in this case being the total a-f gain. For example, had we a receiver with the detector feeding an a-f pentode voltage amplifier which in turn fed the power tube, then the addition of another stage of pentode or high-mu triode a-f amplification might result in instability and noisy operation.

Of course, it is not necessary to use combination tubes. A type 56 could be



Connections for diode detection in tuned r-f receiver. Note r-f choke



Diode detection with volume control in grid circuit of triode. The triode bias is obtained from the voltage divider

used as a diode detector—with plate tied to grid or cathode—and another tube in the r-f, i-f or a-f to provide the extra boost necessary. But we are dealing with the conversion of an old receiver into something more modern, and it would not be sensible to add another socket to the chassis when an adapter, or at most the changing of the old detector socket, is all that is necessary.

Receiver Types

If diode detection is to be added, the receiver must have at least three stages of r-f amplification, using tubes of the 24 or 35 type. If the receiver has but two stages, the r-f tubes will have to be replaced by type 58 tubes. This is not a difficult task and calls for very few changes in the chassis.

Superheterodynes having one or more stages of i-f will be satisfactory, but receivers of this type with the mixer feeding the second detector directly will hardly have enough gain to permit the inclusion of the diode.

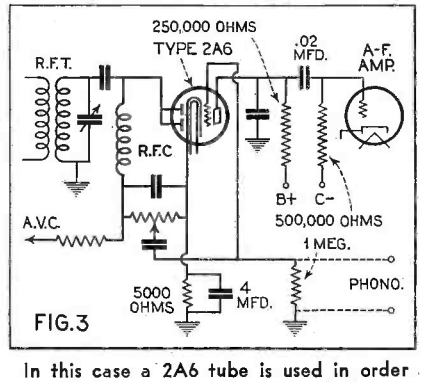
So much for the r-f end. As far as the a-f is concerned, any receiver having a single output tube can be converted with no difficulty. A type 55 diode-triode will swing a single 45, 47, 2A5, or similar type tube. Receivers having triode or pentode tubes in push-pull may call for the use of a 2A6 diode-triode. However, for the pentodes the 55 will be satisfactory providing the receiver has an intermediate stage of audio amplification. Moreover, if the receiver has high sensitivity or r-f gain, a 55 diode-triode in the detector socket will effectively work a pair of 45 tubes in push-pull without any additional a-f amplification aside from that supplied by the triode of the 55.

Diode Connections

It is a simple matter to connect a diode to the secondary of an i-f transformer; refer to most any diagrams of commercial receivers. However, it is not so easy to apply diode detection to an r-f amplifier because the rotor plates of the variable condensers are grounded to the chassis. It is next to impossible to isolate the variable condenser in the detector input stage from the rest of the gang. The thing to do, then, is to isolate the tuned secondary from the detector. This is shown in Fig. 1. Note that a .0001-mfd. blocking condenser has been introduced between the high-voltage end of the secondary winding of the r-f transformer and the diode plates (which are used connected together). This prevents the rectified audio voltage from entering the tuned circuit, but does not prevent the r-f voltage from reaching the diode plates. Then from between the blocking condenser and the diode plates there is connected an r-f choke of 85 mh which terminates in the 500,000-ohm diode load resistor. This choke prevents the r-f from entering the cathode circuit, but does not impede the rectified a-f voltage. Therefore, by the introduction of a small-capacity blocking condenser and an r-f choke there is formed an r-f and an a-f circuit separate from each other. This same arrangement is used shown in the other diagrams, and the values in each case are the same.

Volume Control

Most present-day broadcast receivers employing diode detection have the volume control in the grid circuit of the triode (or pentode) input circuit of the combination diode detector-amplifier tube. This is an admirable arrangement as it has no effect on the input to the diode, and it is important that the diode work on the straight portion of its curve if it is to be free from distortion. If the signal voltage input to the diode is reduced below a certain point, detection is no longer linear. Therefore it is customary to keep the diode well loaded so that distortion is not introduced.



In this case a 2A6 tube is used in order to obtain greater gain. A cathode resistor is used for obtaining the bias

Now refer again to the circuit of Fig. 1. No volume control is shown. But note that the triode portion of the 55 is directly feeding the power stage. It is obvious that if a single pentode, a single triode, or push-pull pentodes or triodes are used, the triode portion of the 55 must have a high voltage output in order to swing the power-tube grids. The output of the diode must also be high if the above condition is to exist. Therefore under practically all conditions the diode *must* be well loaded even for low volume output. In most cases, then, the original volume control in the receiver may be used—no additions being necessary.

High-Gain Tube

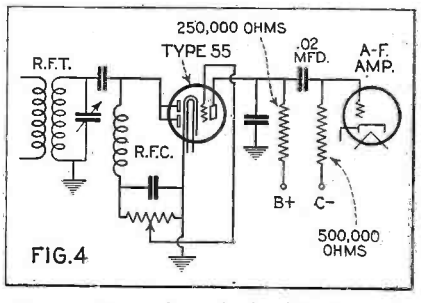
Now refer to the circuit of Fig. 3. Here a 2A6 is used to feed either a single power tube or a first a-f tube. In this case a low diode output would be sufficient for most purposes, as the triode portion of the 2A6 has a high amplification factor and it is not called upon to drive push-pull tubes directly. Therefore the volume control is placed in the grid circuit of the 2A6 triode so that the diode may be properly loaded at all times. The original volume control may then be used as a sensitively control and will prove handy in this role. The same would hold true if the arrangement shown in Fig. 2 were used. Here we have a 55 feeding a first a-f amplifier stage where a high gain in the diode-amplifier is not necessary, as sufficient gain is already present. (Such as a receiver using a triode detector.)

Biasing the Diode

The grid of the 55 tube in the circuit of Fig. 1 is biased by the voltage drop across the 5,000-ohm resistor in the cathode circuit. This or a similar form of bias should be used in all cases where the triode of the 55 feeds an a-f transformer or impedance. A similar form is shown in Fig. 2 where the cathode of the tube is connected to a point 20 volts up on the voltage divider and the grid returned to ground through the usual grid resistor. Since the grid is at ground potential and the cathode is at a potential of 20 volts above ground, then the voltage of the grid in respect to the cathode is negative 20 volts.

Either of the two methods above may be used. Employ the system which proves the easiest from the viewpoint of change in the receiver.

The triode grid of the 55 tube in Fig. 4 is diode biased. It will be noted that there is no blocking condenser in series with the grid lead, as there is



A type 55 used as diode detector and diode-biased a-f triode. In this case the cathode of the tube is run to ground

in the other circuits, so that the d-c voltage in the output circuit of the diode is impressed on the grid. Since this diode voltage alters in its value with that of the signal, the triode grid bias also alters. The higher the signal voltage, the higher the bias.

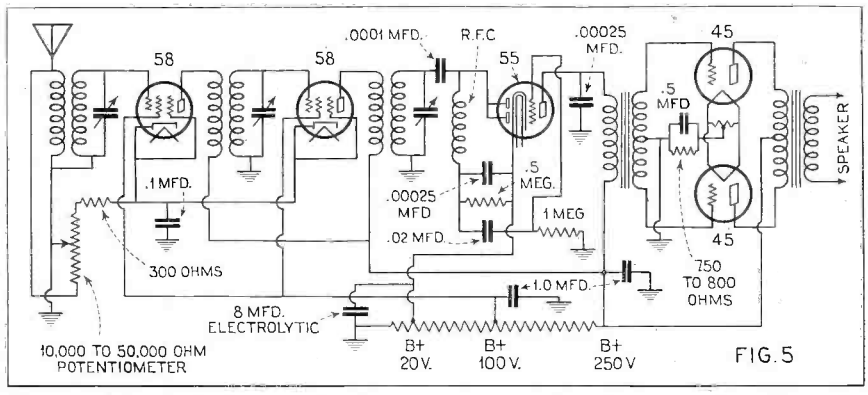
Diode Biasing

Two important points should be taken into consideration in connection with diode biasing. First, there is no bias on the grid of the triode during periods of no signal. The plate current therefore rises to a very high value unless the output circuit contains a current-limiting resistor, as it does in the circuit of Fig. 4. If diode biasing is used in conjunction with transformer coupling there is every chance of damage to both the transformer and the tube, due to high plate currents during periods of no signal.

The second point is this: If the signal voltage reaches a very high value, the bias on the grid of the triode is increased to such a point that the tube borders the plate-current cutoff point. The result is serious distortion of the signal. Initial volume can be controlled to prevent such distortion by placing the volume control in the grid circuit of the triode as shown in Fig. 4. However, there is no control in this case over the excursions of signal voltage into excessively high values.

General Design

A circuit of very broad design is shown in Fig. 5. Note that there are but two stages of r-f and that the triode of the 55 feeds directly two 45 tubes in push-pull. A fixed bias is placed on the grid of this triode by connecting the cathode to a point 20 volts up on the voltage divider. This portion of the divider is bypassed by an 8-mfd., 25-volt, dry electrolytic condenser to prevent degeneration.



The complete circuit diagram of a tuned r-f receiver using diode detection. The gain in this set is sufficient for good volume on all locals, if not distant stations as well

This circuit will operate satisfactorily, but is the most that can be done with a receiver of such simplicity and low r-f and a-f gain. But most receivers are better equipped than the one shown, so no difficulty should be experienced if you have at least this much to work with.

Volume is controlled in the antenna and r-f circuit. Under most circumstances r-f should not get to the grid of the 55 triode. If difficulty is experienced with overloading or oscillation in the a-f, place a second r-f choke in the 55 triode grid lead.

Phonograph Operation

Unless there is plenty of gain in the a-f amplifier aside from that supplied by the diode-amplifier, a type 55 as used in the circuit of Fig. 5 may not have sufficient gain for phonograph use. Therefore, a 2A6 tube should be used, as shown in Fig. 3, where the pickup is shunted across the triode grid resistor. Place a .01-mfd condenser in series with the ungrounded leg of the pickup. If the pickup is of the low-impedance type, it should be used in conjunction with an impedance-matching transformer.

Conclusion

In attempting the addition of diode detection to an old receiver, always keep in mind that the most satisfactory results will be obtained when the original gain in the detector stage is fairly well matched. If the gain is considerably reduced, the sensitivity of the r-f must be increased above the intended level for good volume. This would mean that in many cases there would be considerable background noise. Thus, in the circuit of Fig. 5, a type 2A6 would be more satisfactory than the type 55 tube.

NEW STEWART-WARNER NOISE SUPPRESSOR

(See Front Cover)

SOMETHING new under the sun—the Stewart-Warner Model 110 chassis employs a noise suppressor which might well be called an "automatic variable capacity." The method of application is interesting to say the least, and aside from eliminating "high-gain" background noise, the arrangement also functions to a degree as an automatic tone control.

Referring to the circuit on the front cover, the lower tube (type 51 or 35) functions as the noise suppressor. The control-grid of this tube is connected to the output of the diode portion of the type 55 tube. About 17 volts is impressed on the plate of the noise-suppressor tube through the 1.1-meg. resistor, R-3. About 17 volts is also impressed on the screen of the tube through the connection marked C—, which terminates at the high side of the cathode bias resistor for the push-pull power tubes. A slight bias is placed on the control-grid of the noise-suppressor tube, this being obtained by the voltage drop in the cathode resistor, R-5.

Speaking generally, the automatic noise suppression is accomplished by the 51 tube which is connected to act as a variable capacity across the audio output of the detector; namely, across the load resistor, R-1. This lowers the high-frequency audio response of the set as the signal strength decreases, and thus reduces the noise background which tends to increase as the incoming signal becomes weaker. Thus, it works hand-in-hand with the A. V. C. system so that when the sensitivity or gain of the receiver is increased to compensate for a weak or fading signal, the type 51 tube eliminates the consequent increased background noise by increasing its effective capacity across the audio output of the second detector.

The trick is accomplished by altering the "effective" or "dynamic" capacity of the condenser, C, connected between the plate and control-grid of the type 51 tube. Though this condenser has a value of only .0001 mfd, its effective capacity can be increased to about 50 or 60 times the original value. This happens when small negative voltages are impressed on the control grid of the noise-suppressor tube. A high negative voltage on the control grid tends to drive the plate extremely positive, in respect to the control grid. This extreme of potentials is reflected across the condenser C, the grid side assuming a negative value and the plate side tending to assume an equally extreme positive value. The "effective" capacity of the condenser is dependent upon the change in the input capacity of the 51 tube which in turn is dependent upon the extent of signal voltage. The stronger the signal the more negative is the grid of the 51, since it is connected to the negative side of the diode circuit.

General Data . . .

RCA Victor "All-Wave" Chassis

This 8-tube superheterodyne chassis is used in receiver Models 140, 141, 141-E, 240 and AVR-1. An intermediate frequency of 445 kc is used, which provides an especially good image frequency ratio and makes easier alignment of the oscillator at the higher frequency bands.

The chasses in this series come in either of two a-c power supply ratings: (1) 100-125/200-250 volts, 50-60 cycles and (2) 100-125 volts, 26-60 cycles. Both chassis types are equipped to permit rearrangement of the power-transformer connections to conform with actual voltage available. Thus, the 50-60 cycle models may be adapted for 100-115, 115-125, 200-230 or 230-250 volts; and the 25-60 cycle models for either 100-115 or 115-125 volts. These various connections are shown in the schematic diagram.

The Circuit

The receiver is of the continuous-tuning type utilizing a straight superheterodyne circuit in all bands. The bands are as follows:

Selector Switch Position	*Range (Kilocycles)*
X	150- 410
A	540- 1500
B	1500- 3900
C	3900-10000
D	8000-18000

One model receiver has band X omitted. In this model the condenser and coil units marked "X" in the schematic diagram are omitted.

The circuit (Fig. 1) is seen to consist of a stage of tuned r-f using a 58 tube, a 2A7 as combination mixer-oscillator, a stage of i-f using a 58, and a 2B7 the diode portion of which serves as second detector and AVC. The pentode portion of this tube functions as an a-f amplifier. It is resistance coupled to a type 56 tube which is employed as a driver for the type 53 tube used in a Class B circuit.

When the Range Switch is set to band D, an additional r-f stage using a type 58 tube is used. This is to increase the sensitivity and image frequency selectivity and to reduce the interference caused by tube hiss and 445-kc signals or static.

Adjustments

The receiver is aligned like any other broadcast receiver. That is, the three main tuning condensers are aligned by means of three trimmers in each band and on the three lowest frequency bands a series trimmer is adjusted for aligning the oscillator circuit. The other two bands do not require this low frequency trimmer, it being fixed in value. In the case of band D, it is necessary to adjust four trimmers due to the additional r-f stage used.

Fig. 2. Details of all line-up adjustments

External Oscillator Frequency	Dial Setting	Location of Line-Up Capacitors	Position of Selector Switch	Adjust for	Number of Adjustments to Be Made
445 K. C.	Any setting that does not bring in station	At rear of chassis	Any position that does not bring in station	Maximum output.	4
370 K. C.	370 K. C.	Bottom of chassis	X	Maximum output.	3
175 K. C.	Set for signal	Top of chassis	X	Maximum output while rocking dial back and forth.	1
1400 K. C.	1400 K. C.	Bottom of chassis	A	Maximum output.	3
600 K. C.	Set for signal	Top of chassis	A	Maximum output while rocking dial back and forth.	1
3900 K. C.	3900 K. C.	Bottom of chassis	B	Maximum output.	3
1710 K. C.	Set for signal	Top of chassis	B	Maximum output while rocking dial back and forth,	1
10 M. C.	10 M. C.	Bottom of chassis	C	Maximum output.	3
15 or 18 M. C.	15 or 18 M. C.	Bottom and top	D	Maximum output. Adjust oscillator trimmer until two points are noted where signal is heard. Use for adjustment the higher frequency of these two points. This will be the point lying counter-clockwise from the other point.	4

The i-f amplifier is aligned in a similar manner to that of a standard broadcast receiver except that it is aligned at 445 kc. It is necessary to employ a very stable oscillator covering the frequencies of 150 kc to 20,000 kc continuously. Use a non-metallic screwdriver and preferably an output meter of the thermocouple galvanometer type. This should be connected across or in place of the voice coil of the speaker.

The output of the test oscillator should be at the minimum value necessary to obtain a deflection in the output meter when the receiver volume control is at maximum position. The test oscillator output should be connected between antenna and ground for the r-f and oscillator adjustments and between the first detector grid and ground for the i-f adjustments.

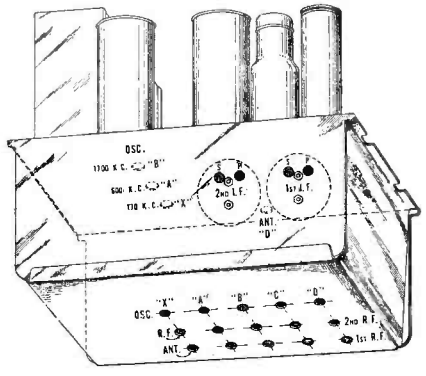


Fig. 3. Showing the location of all line-up condensers on the chassis

The "Tuning Wand"

The accuracy of line-up of each band may be checked without touching the trimmer condensers, by the use of an instrument known as a "Tuning Wand" (RCA Stock No. 6679).

One end of the wand consists of a brass cylinder. When this is inserted in a coil the effective inductance of the coil is lowered. The other end of the wand contains a special finely-divided iron suitable for use at radio frequencies. When this is inserted in the coil the inductance is raised.

To use the Tuning Wand a signal is first tuned in at the frequency at which a check is desired on alignment. The wand is then inserted slowly in the antenna and r-f transformers, using first one end and then the other end of the wand. Unless the alignment is perfect, it will be found that the power output indicated by the output meter will be increased to a peak for a critical position of the wand in the coils. The end of the wand required indicates whether the coil is high or low.

Alignment Correction

Of course, alignment correction at the high-frequency end of a tuning

range should be accomplished by the use of the trimmer condenser. If alignment correction should be required at the low-frequency end of a tuning range it may be accomplished by sliding the end coil of the transformer. The winding farthest from the trimmer panel is pushed toward the trimmer panel to increase the inductance, and farther away to decrease the inductance. On band D coils, the last two or three turns may be pushed in a similar manner to obtain the proper inductance.

This adjustment should not be attempted unless a quite appreciable improvement will result (as shown by the Tuning Wand).

The chart of Fig. 2 gives the details of all line-up adjustments. The receiver should be lined up in the order of the adjustments given on the chart. Refer to Fig. 3 for the location of the line-up condensers.

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Silvertone Short-Wave Notes

There has been complaint of insufficient short-wave sensitivity in some of the Silvertone Models 1722 and 1732. The following suggestions should prove helpful:

(1). A *good* outdoor antenna *must* be used for satisfactory short-wave reception.

(2). There is considerable variation in the efficiency of some type 56 tubes as short-wave oscillators. Try a number and pick the best one.

(3). Increase the coupling of the short-wave antenna coils. Referring to Fig. 1, the single turn of green silk covered wire, A, should be moved as close as possible to the other enamel wire turns of the coil.

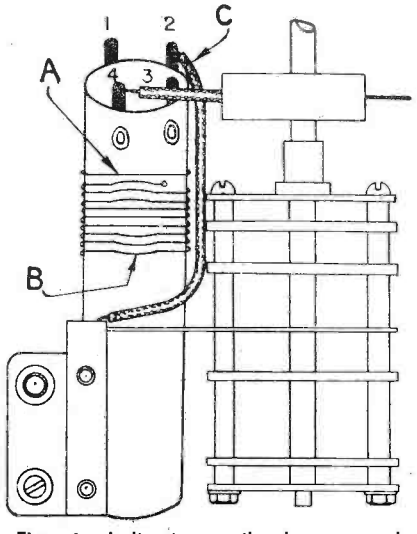

Fig. 1. Indicating coil changes and adjustments for Silvertone Models 1722 and 1732

(4). Run an *additional* ground connection from lug 2 (C in Fig. 1) to the low side of the trimmer condenser mounted on the wave-changing switch frame. (There is one ground connection from this lug to the variable tuning condenser frame. This connection should not be disturbed.)

Re-alignment Data

(5). Try re-aligning by tuning in a station of about 6000 kc on the short-wave range, and spreading the turns of enamel wire apart until maximum volume is secured. These turns are shown at B in Fig. 1. Start with rather slight spreading of only two or three turns and tune the set throughout its range (i. e., with wave-changing switch in the shortest wave position.) Note the sensitivity by the number and volume of stations picked up. Then try spreading a few more turns and again tune the set through its range. After a few trials the amount of spreading necessary for maximum sensitivity will be found.

When spreading the turns, use the finger nail, a bakelite rod or a piece of wood. Do not use a screwdriver as it will scrape the enamel off the wire. A pencil would leave leakage paths.

Secure the wire with collodion or ambroid after the proper spacing has been determined.

Do *not* touch the trimmer condensers in aligning the short-wave coil.

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Philco Models 89 and 19 Note

In the third run of these models, the first i-f transformer (18) is replaced by Part No. 32-1289 (Green Paint). Resistor (48), 32,000 ohms is superseded by one of 39,000 ohms. Condenser (5) (.09 mfd and 200-ohm resistor) is superseded by a .09 mfd condenser and 300-ohm resistor. The black and red leads from the first i-f transformer are reversed from their former position.

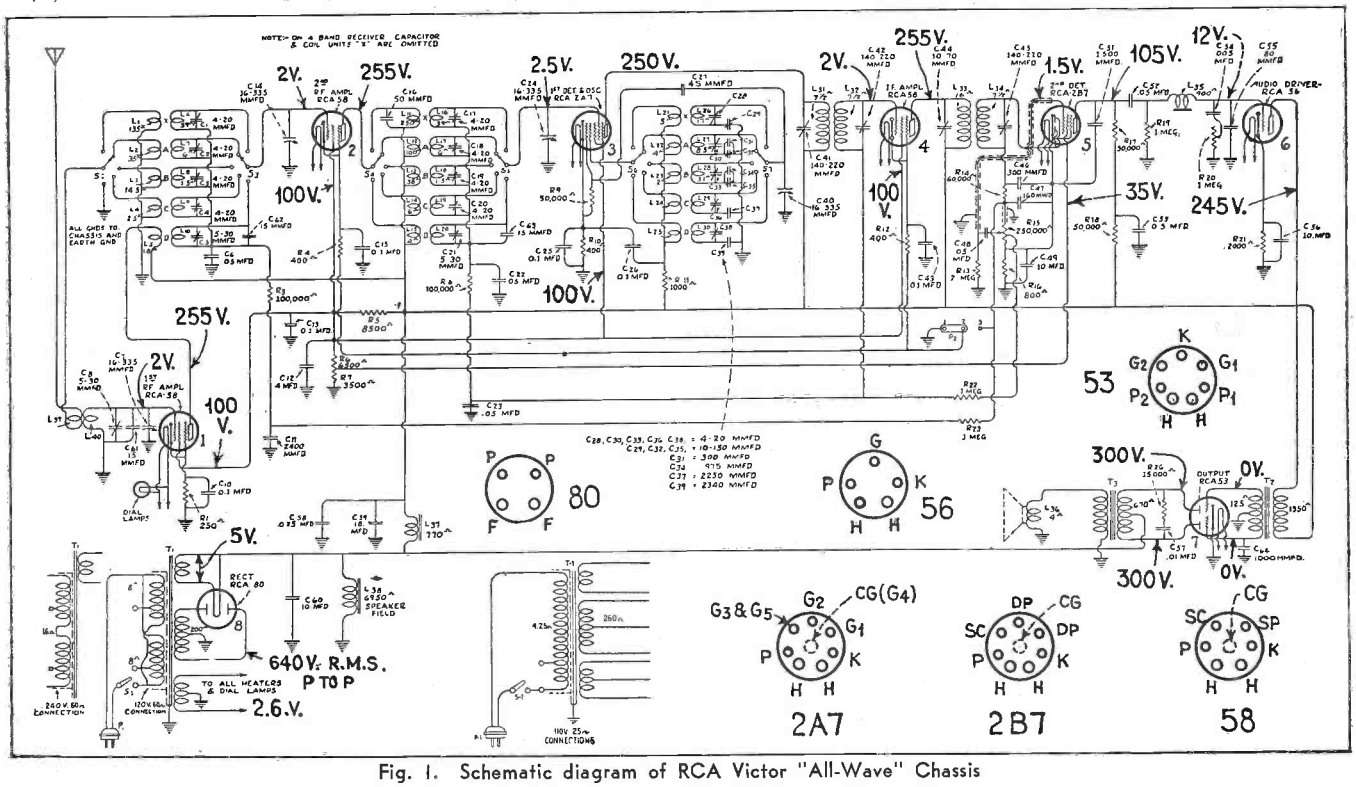
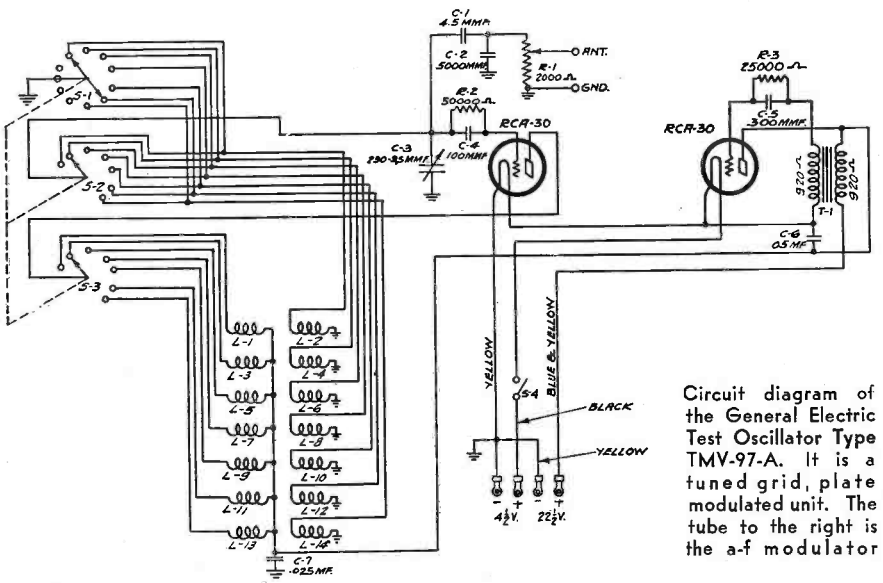


Fig. 1. Schematic diagram of RCA Victor "All-Wave" Chassis

G. E. Test Oscillator Type TMV-97-A

The Type TMV-97-A test oscillator is a self-contained, portable job designed especially for servicing and test purposes. It is an r-f oscillator modulated at 400 cycles and covers the frequency range from 150 kc to 25,000 kc in seven steps, as indicated in the accompanying diagram of the complete circuit. Power for the two type 30 tubes is obtained from two self-contained batteries. The instrument is entirely shielded in an aluminum case.



Circuit diagram of the General Electric Test Oscillator Type TMV-97-A. It is a tuned grid, plate modulated unit. The tube to the right is the a-f modulator

Frequency Range

The following frequency ranges are covered by the seven-position Range Switch.

Position	*Range (kc)*
1	150- 330
2	330- 720
3	720- 1460
4	1460- 3050
5	3050- 7400
6	7400-14300
7	14300-25000

Two batteries are required, one 4½-volt filament battery, and one 22½-volt "B" battery.

Operation

The output of the oscillator is connected to the receiver under test by means of two binding posts located on the front panel. The vernier tuning ratio may be varied from 6:1 to 20:1 by adjustment of the position of a small arm above the tuning knob. The latter ratio is very useful for critical tuning, especially on the higher frequency ranges.

The output of the oscillator is varied by means of a small knob on the right side of the panel. For comparing sensitivity, it may be necessary to further decrease the output from that obtained at the minimum position of the output control. This may be done by using two carbon resistors, one of 100 ohms and the other of 100,000 ohms, connected in series and placed across the antenna and ground posts of the oscillator. (The 100-ohm resistor must be connected to the ground post.) Connect the receiver antenna lead to the junction of the two resistors and the ground lead to the ground terminal. Then by recording the position of the output dial setting throughout the receiver range (for same signal output) a good indication of the relative receiver sensitivity may be obtained.

At the higher frequencies it may be necessary to move the oscillator a short distance from the receiver to avoid stray pickup.

Calibration

The oscillator may be calibrated by tuning in stations of known frequency in the various ranges on a receiving set and then beating them with the test oscilator at zero beat. The frequency of the test oscillator will then be identical with that of the station. By noting the oscillator dial reading and the station frequency, a very accurate calibration may be plotted.

For the lower frequencies, 150 kc to 550 kc, a calibration is readily made by using harmonics of the oscillator for checking against frequencies in the broadcast band. For example, 175 kc can be checked by beating its fourth harmonic with station WLW, the frequency of which is 700 kc.

Maintenance

The battery voltages should be checked if at any time the output of the oscillator becomes weak. The drain on the batteries is small, so that their expected life is about 15 hours' operation. However, the batteries should be replaced when the filament battery voltage is less than 3 volts and the "B" battery voltage is less than 17 volts. Always replace the batteries by withdrawing the entire unit from the front of the cabinet. Never remove the back panel.

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Stromberg-Carlson Nos. 55 and 56

For preliminary data and views of tuning unit and chassis for these two receivers, see page 351, October Service.

These two models are known as the Te-lek-tor-et. No. 55 has the tuning unit separate from the amplifier and speaker. No. 56 is complete in one console cabinet. The slight changes in the associated wiring of these two models are indicated by dotted lines in the accompanying diagram.

The Circuit

Referring to the diagram, the signal enters the system at the antenna and ground connections on the amplifier chassis. From these terminals it goes through a matching transformer, L-21, which feeds to the antenna transmission line in the flat cable. This transmission line terminates in the antenna transformer of the r-f amplifier, L-1 and L-2. (In the No. 56 the antenna connection is made directly from the antenna post to the selector unit.) The image-suppression circuit is incorporated in this transformer, consisting of C-1 and a portion of L-2. The r-f amplifier is a 78 tube and is connected to the r-f transformer, L-3 and L-4, which feeds the signal to the 6A7 composite detector-oscillator. The intermediate frequency output goes to the tuned circuit, C-10 and L-8, which is connected to the shielded transmission line in the flat cable to the speaker-amplifier unit. The output of this transmission line is connected through two tuned circuits, C-13, L-10 and C-14, L-11, to the grids of the i-f amplifier tubes.

A-F and AVC Channels

One i-f amplifier, the type 58 tube, acts as a signal channel only, and the output is fed to the diodes of the 55 tube. The audio resulting from the rectification of the diodes is fed through the triode portion of this tube as an audio amplifier, and thence to the 2A5 output tubes in push-pull.

The other i-f amplifier, the 2B7, acts as an AVC channel only. The i-f output from the pentode portion of this tube is fed to the diodes of the same bulb. The d-c voltage developed in the diode circuit is used for the AVC voltage, and is fed back to the control grids

of the 78 and 6A7 tubes through a conductor in the cable. A portion of this AVC control voltage is also applied to the grid of the 58 i-f amplifier to give partial control on this tube.

The manual volume control, R-3, is located in the remote selector, and operates by varying the bias on the control grid of the 58 i-f tube. Filters are placed in this circuit to keep the operation quiet. Filters are also included in practically all grid circuits, and at other points where they are of value in preventing modulation, etc.

REMOTE CONTROL RELAY

The On-Off switch is also located in the selector unit and controls the power supply to the main power transformer by means of the relay, L-23 and L-24, operated to either the on or off position by the auxiliary transformer, L-25 and L-26, when the On-Off switch is pushed in the desired direction. The connections to this relay are carried through the cable. This arrangement is used so that there are no 110-volt power supply wires carried to the remote selector in the cable of the No. 55. This auxiliary transformer is across the circuit at all times in the same manner that a bell-ringing transformer is connected. In the case of the No. 56, the 110-volt circuit is carried to the selector unit by an auxiliary cord, thus eliminating the relay and transformer in the amplifier chassis.

The heaters of the two tubes in the selector unit are connected in series to the 12-volt circuit carried through the cable. The 2.5-volt heaters of the tubes in the amplifier chassis are all connected in parallel on their own transformer secondary.

OSCILLATOR DRIFT CONTROL

A thermostatic condenser, C-40, is placed in shunt with the variable condenser which varies the frequency of the oscillator circuit in the remote selector unit. This thermostatic arrangement is used to prevent frequency drift which cannot be tolerated in connection with rigidly-tuned i-f circuits.

The voltage readings given in the diagram are based on a line voltage of 120 volts. Use a 1000 ohms per volt meter and take all readings with the volume control full on.

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Silvertone 1700 and 7062 Notes

The loudspeaker can be removed for replacement by taking off the 6B7 tube shield and removing the three speaker mounting screws. Be certain that the speaker leads color code is followed. Improper connection will cause excessive hum due to the hum bucking coil's increasing hum instead of cancelling it out.

Speaker rattle may be due to the cone being off center. Loosen the center adjusting screw, insert four 1/8" wide strips of heavy writing paper between the pole piece and the inside of the voice coil. Then retighten the adjusting screw, and remove the paper strips.

PRECAUTION

All metal parts of the chassis (including the a-c, d-c switch) are at high potential to ground. Do *not* attempt to attach a ground connection to the chassis—and don't touch the chassis with the line plug in the outlet.

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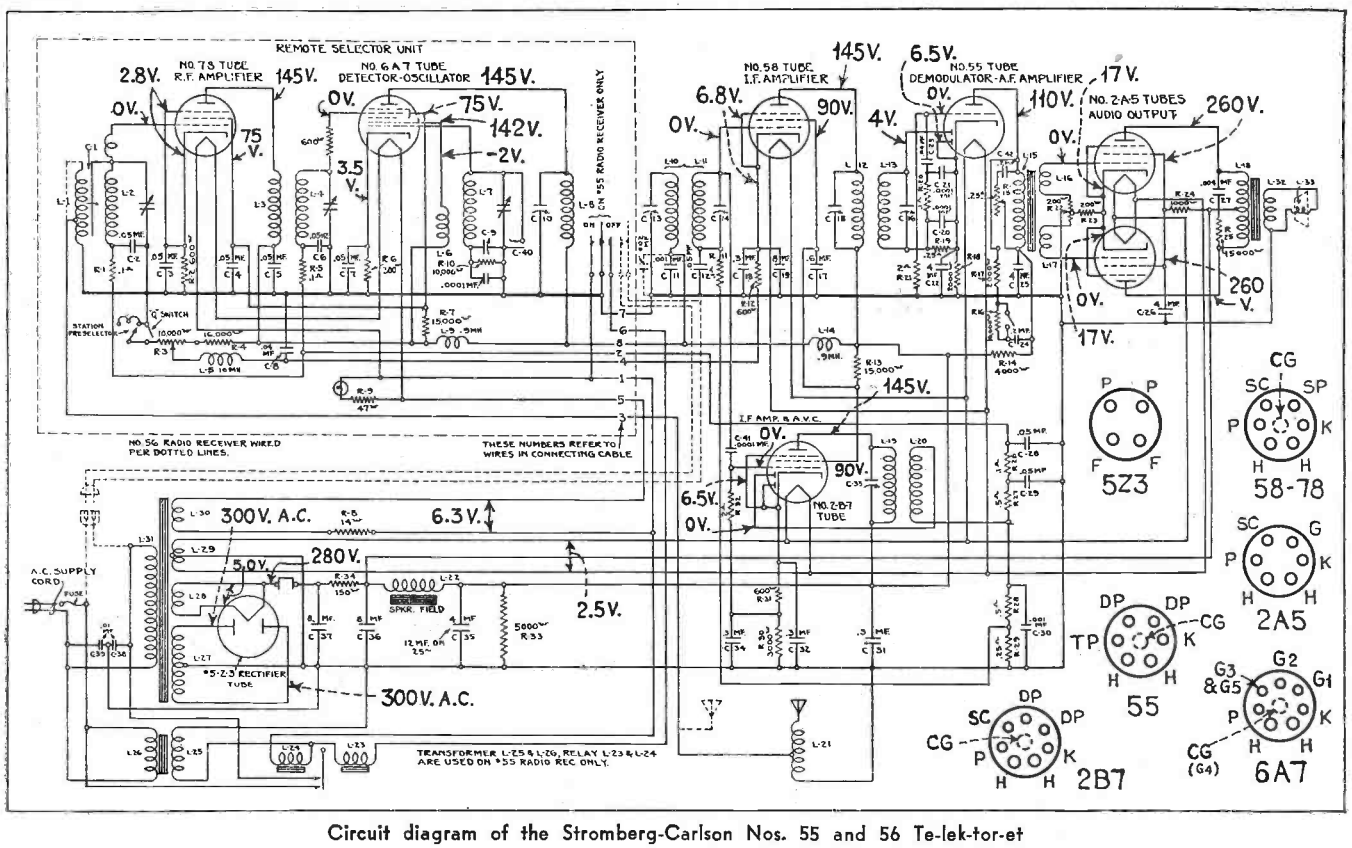
Knight Chasses and Models

In the list below is given the chassis numbers, number of tubes used, and models of the latest Knight (Allied Radio Corp.) receivers.

Chassis	*No. Tubes*	*Receiver Model*
F-9501	5	Model U, Dual Wave
F-9503	5	Model U DeLuxe, Dual Wave
F-9505	5	Model P
F-9521	4	Model R, Dual Wave
F-9511	5	Model P, Battery
F-9515	5	Model P, 32-Volt
F-9571	5	Battery Super
F-9566	8	All Electric, 32-Volt
F-9576	8	Battery Super
F-9541	6	Model T, Auto, All Electric
F-9616	12	Model SA-120
F-9610	8	Model SW-88, Multi Wave
F-9525	4	Model V
F-9527	4	Model V, DeLuxe
F-9551	7	All Electric, Auto

The F-9501 and F-9503 chasses are identical. The F-9527 and F-9551 are also identical.



Circuit diagram of the Stromberg-Carlson Nos. 55 and 56 Te-lek-tor-et

Capehart 400-B Series

The Capehart 400-B Series is in two units, the 400-B Tuner, and the 400-B, or Standard No. 1, amplifier. The two units are connected together with a cable between the respective terminal strips.

The diagram of the 400-B Tuner is shown in Fig. 1. The first 58 tube is used in a tuned r-f amplifier. The tuning meter is in the plate circuit of this tube. The second 58 tube is used as the first detector. The next two 58 tubes are the i-f amplifiers. The i-f transformers are peaked at 180 kc. A type 55 tube is used as diode second detector in full-wave connection, and AVC. The triode section of this tube is not used. AVC control is placed on all four of the type 58 tubes, the extent of the control being less on the two 58 i-f amplifiers.

A type 58 tube is also used as the oscillator. This is shown directly below the 58 first detector tube in the diagram. To the right of the oscillator is the type 57 inter-station noise control tube. The

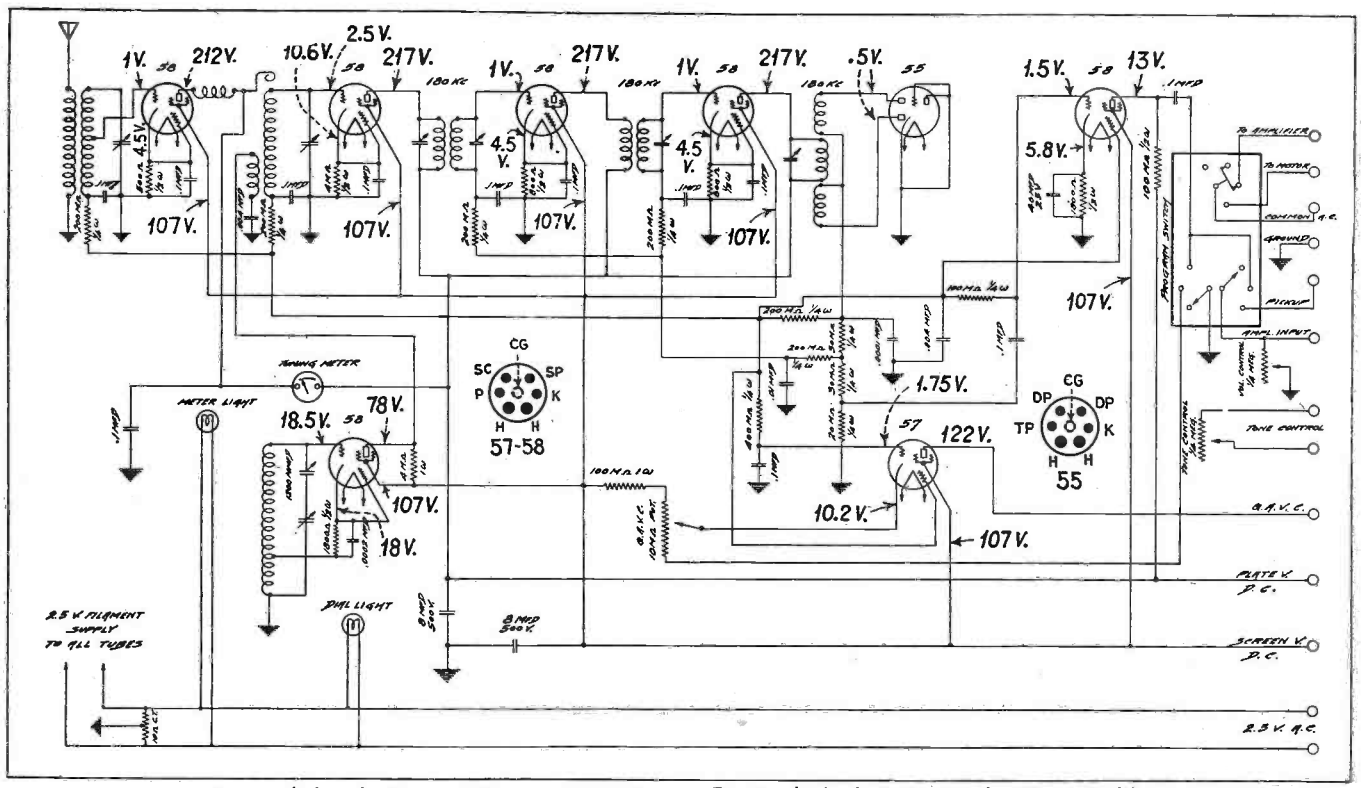
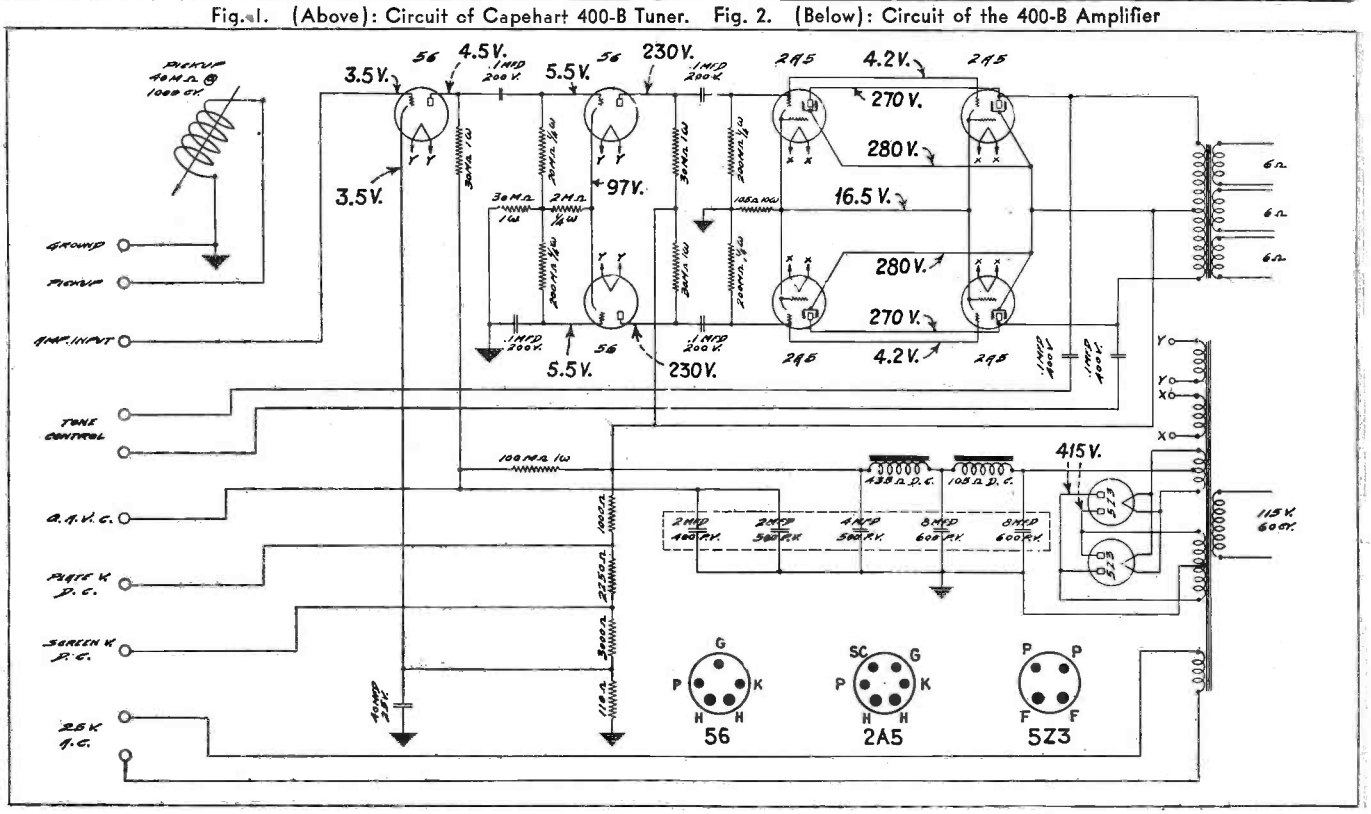


Fig. 1. (Above): Circuit of Capehart 400-B Tuner. Fig. 2. (Below): Circuit of the 400-B Amplifier



variable control for this tube is in the cathode circuit. The 57 controls the type 58 first a-f tube to the right of the second detector and this tube is resistance coupled to the type 56 second a-f tube by connection through the terminal boards. A glance at the terminal board in the circuit of Fig. 1 will show that the QAVC action may be made ineffective by the lower switch. The upper switch on the terminal board controls the phonograph motor and the shuttling from radio to phonograph operation.

Note that the arm of the lower right switch leads to a post marked "Amplifier Input." This line contains the volume control, which is used for both radio and phonograph.

The 400-B Amplifier

The diagram of the 400-B, 9-tube amplifier is shown in Fig. 2. This is seen to consist of a single 56 a-f tube resistance coupled to two 56's in a resistance-coupled push-pull circuit. The a-f voltage for the lower 56 tube is developed across the 30-000-ohm resistor connecting from mid-tap to ground, and is impressed on the grid of this tube through the 0.1-mfd blocking condenser.

The push-pull 56's are "push-pull" resistance coupled to four 2A5 power pentodes connected in parallel push-pull. The tone control consists of a variable resistance (shown in Fig. 1) in series with two 0.1-mfd condensers, and shunted across the output of the 2A5's. The output transformer has three 6-ohm secondary windings for connection to the dynamic speakers.

The power-supply system, which is a part of the amplifier chassis, uses two 5Z3 full-wave rectifiers connected in parallel, and a two-section filter.

Voltage readings are given on the diagrams. They are based on a line voltage of 115 volts. All measurements should be taken with the QAVC ineffective.

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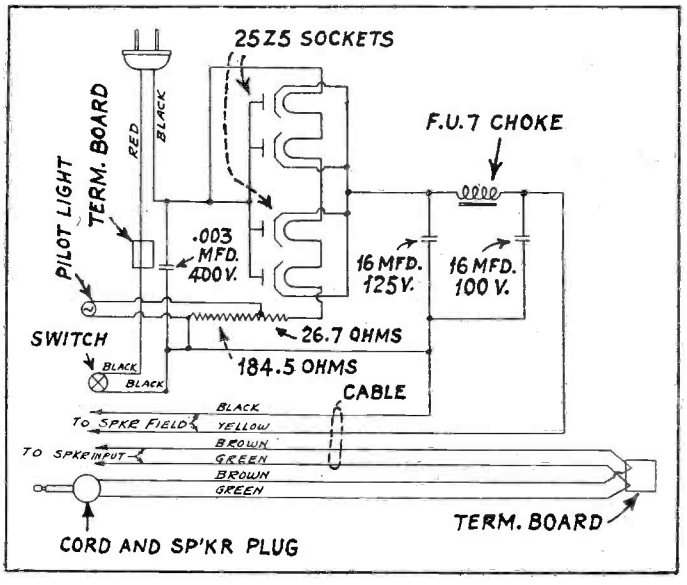
Reflexing

Numerous reflexed receivers are appearing. In a few cases, such as the Kadette Jr. covered in the December issue, the mode of reflexing is the same as that with which we were acquainted many years back—that is, one group of elements serve more than one purpose. In the case of the Kadette Jr. we find a pentode functioning both as an r-f amplifier and an a-f amplifier. By careful engineering and the correct apportionment of voltages, this form of reflexing can be used successfully without causing overload of the control grid. However, both the r-f and a-f voltages combine to increase the effective signal voltage on the control grid. Grid and signal voltages therefore must be properly handled else there will be distortion due to overload.



Circuit of the Crosley Model 38 Speaker Supply Unit, which is used in conjunction with midget receivers 173 and 173-S when the remote speaker type 390-6 is employed

Modern Reflexing

Modern reflexing is an entirely different animal. See the Majestic Model 500 in the December issue as an example. Here the signal is shuttled from one tube to another with absolutely no regard for physical direction, but in each case any given set of elements is used for but one purpose. So you see, in a sense it is not reflexing at all, for if we were to take the composite tubes used and replace them with single tubes of the correct characteristics, then our circuit would resolve itself into quite a matter-of-fact affair.

From the viewpoint of the Service Man, the difficulty lies in the visual confusion of the circuit and the uses to which certain tube elements are put. A grid may well function as a plate and this in itself lends a bit of dizziness to the picture. So it is a case of having to watch your step when it comes to the reading of circuit or voltage values.

You will have to get used to this circuit shuttling and to the use of tubes connected in backwards—such as the 2B7, which is not always used in the same manner. Sometimes it is a stage of i-f and diode and in other cases it is a diode and a-f.

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Crosley Model 38 Speaker Supply Unit

The Model 38 Speaker Supply Unit, the schematic for which is shown on this page, is used with chassis Models 173 and 173-S, and remote speaker 390-6.

It is seen that this unit employs two type 25Z5 rectifier tubes connected in parallel. These supply the current for exciting the field of the dynamic speaker.

The values given in the diagram are for the latest run of this unit. In earlier runs, the tapped resistance in series with the rectifier heaters had a value of 197 ohms and 28 ohms. There were also three 16-mfd condensers, one with a rating of 125 volts and two with a rating of 100 volts.

The .003-mfd, 400-volt condenser shown in the circuit is an addition and did not appear in the earlier runs.

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Crosley I-F Peaks

In the following table is given the i-f peaks of the Crosley receivers recently announced:

Model	*I-F Peak*
98	181.5
99	181.5
102	181.5
143	181.5
154	456.0
159	456.0
160	181.5
163	456.0
166	456.0
168	181.5
169	456.0
170	181.5
171	181.5
172	456.0
173 and 173-S	456.0
174	456.0
175	181.5

Receiver Models 166 and 172 employ the same chassis. The only difference is that Model 172 is a dual-band receiver.

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Sparton 61 Chassis Models

The Sparton receiver Models 61, 61-A, 61-B and 62 employ the 61 chassis. This is a midget universal set covering the broadcast and police bands.

Majestic Model 490

The Model 490 Chassis, employed in the Model 491 and 493 Majestic 32-volt d-c receivers, is a straight super (meaning not reflexed) with 6E7 r-f, 6A7S mixer-oscillator, 6E7 i-f amplifier, 85S diode second detector, diode delayed AVC and triode a-f, a 42 power pentode, and a 6Y5 full-wave mercury rectifier.

Special Points

The set operates over a line voltage range of 26 to 45 volts. The chassis is practically identical to the Model 460 chassis in the audio-frequency end except that it employs 6-volt tubes instead of 2.5-volt tubes.

It is imperative that a very good ground be installed for this receiver, and the antenna should be from 50 to 100 feet in length. The antenna and line cord should be kept apart at the back of the receiver.

The chassis is equipped with two fuses rated at 3 amperes and these should never be replaced with fuses of higher rating. Due to the series-parallel connection of the tube heaters, the line switch must never be left on if a tube is to be changed or taken out of the socket for any reason. If this precaution is not observed the tube in parallel with the one removed will be greatly overloaded and there is danger of the heater being burned out. The same holds true for a burned out tube or pilot light . . . the set should be turned off immediately. A defective pilot light should be replaced by one rated at 200 milliamperes at 6.3 volts. A larger size pilot light will overload the 42 and 6Y5 heaters.

Power Supply

The Duro-Mute vibrator unit is designed to deliver 285 volts at 53 mils at the input to the filter when the line voltage is 35 volts. At this voltage normal primary current is 0.58 ampere d-c.

The vibrator unit in the Model 490 employs steel springs in order to eliminate spring fatigue, and tungsten points to insure long life at 32 volts. The detailed manner of servicing and readjusting the vibrator is exactly the same as for that used in the Model 66 auto radios.

The Duro-Mute vibrator unit is non-polarized and therefore it makes no difference which side of the line cord goes to the positive or negative side of the line.

Testing

The voltages and socket connections are given in the diagram. The measurements are based on a line voltage of 35. The voltage readings across the tube heaters may vary from between 5.7 to 6.8 volts, depending upon the tubes and line voltage. The speaker field coil has a d-c resistance of 14.5 ohms at 70° F. and it is connected in series with the tube heaters.

When aligning, the volume and tone controls should be set at maximum clockwise positions. Supply a 175-kc signal to the 6A7-S mixer grid and adjust the three i-f aligning condensers for maximum sensitivity.

With gang condenser in minimum capacity position, supply a 1730-kc signal to the input of the receiver and align the three r-f circuits for maximum sensitivity.

When necessary to re-calibrate, turn the gang condenser completely in mesh. Set dial to the gauge mark beyond 540 kc and lock dial in place.

•

Majestic 460 Chassis and Models

The Majestic 460 Chassis is used in receivers Models 461, 463, 196, 67, 68, 69, 666, 776, 886 and 996, with speakers G-24-C and G-22-K.

•

Colonial I-F Peaks

The Colonial Model 150 uses a peak frequency of 480 kc. All other new chasses use an i-f of 175 kc. They are as follows: T-397, C-495, C-595, C-695, C-995, T-345, C-399, 250, 279, 300, 400, and 106-B. The last is an auto receiver.

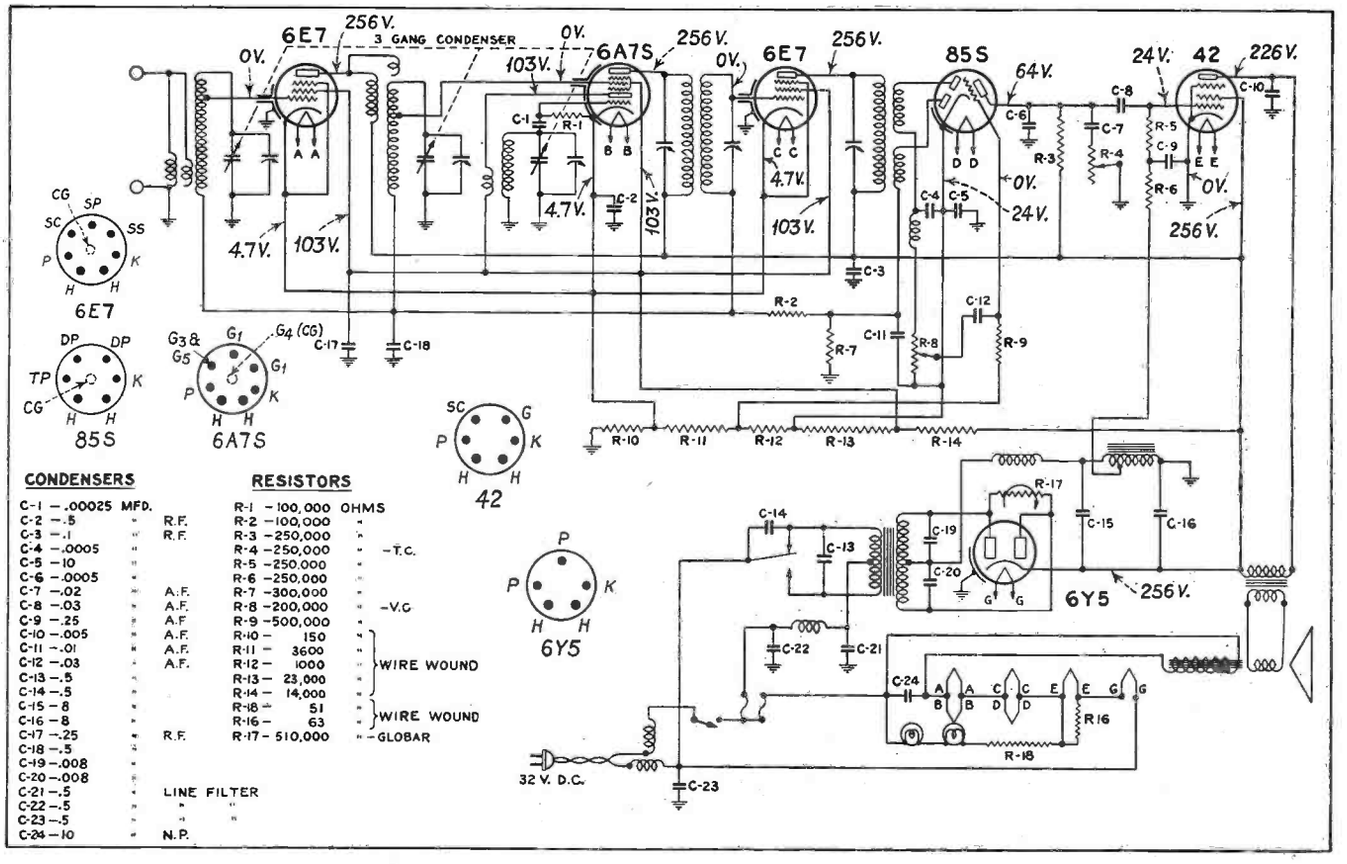
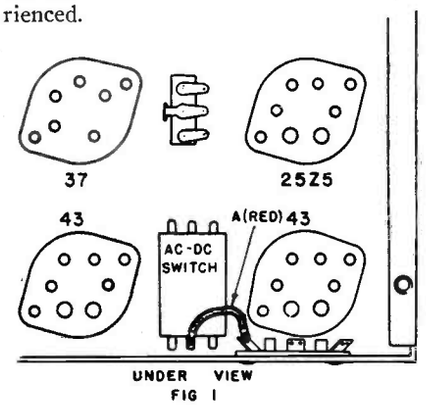


Diagram of the Majestic Model 490 receiver for 32-volt lines

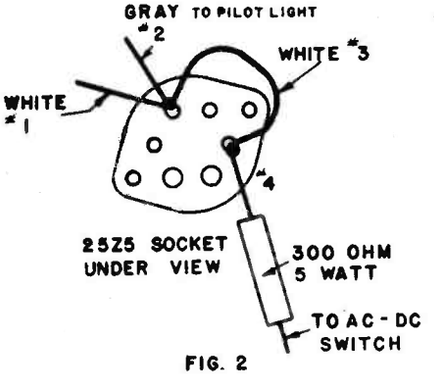
Silvertone 1750 Changes

The following changes will eliminate any difficulty in connection with the blowing out of filter condensers or short life of the 25Z5 rectifier tube. It is suggested that the changes be made in all Model 1750 receivers irrespective of whether or not trouble has been experienced.

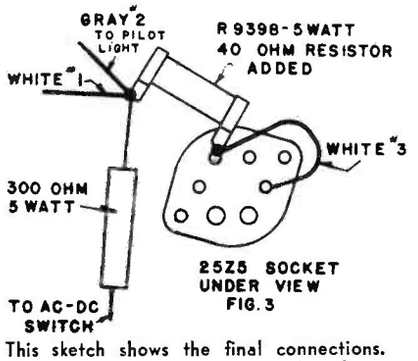


The flexible resistor, A, in the Model 1750 should be shorted.

In the Model 1750 receivers which have not been changed in the production run, there is a 200-ohm, 3-watt resistor, in series with the speaker field and ground. This resistor should be shorted out. A 40-ohm resistor should then be connected in series with the plate of the 25Z5 connecting to the line cord, and the original connections eliminated.



The second change; the leads 1, 2 and 4, as indicated, should be opened.



This sketch shows the final connections. Note that a 40-ohm resistor has been added in series with the leads 1 and 2.

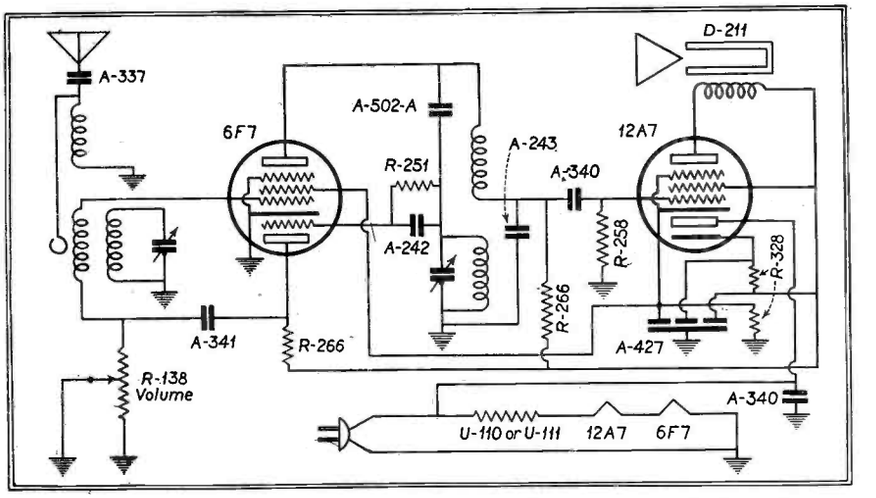


Fig. 4. The circuit diagram of the third type of the Kadette Jr., Model F. It will be seen that the volume control is in the grid circuit of the r-f section of the 6F7 tube.

Making the Changes

The sketch of Fig. 1 shows the position of the 200-ohm resistor which should be shorted. This resistor is marked "A (Red)" in the drawing. If this resistor is omitted from the set, then no changes whatever have to be made.

The sketch of Fig. 2 shows the underview of the 25Z5 socket. The leads No. 1, No. 2 and No. 4 should be opened. They should then be brought together at one end of the added 40-ohm resistor, as shown in Fig. 3. This will complete the job.

Kadette Jr. Model F Changes

The circuits and values for the Kadette Jr. Model F, first and second run chasses were given on page 432, December issue of Service. There has since been other circuit changes—principally in the arrangement of the volume control.

The circuit shown in Fig. 4 is for the third run of the Model F chassis. The circuit for the fourth and final run of the Model F is shown in Fig. 5.

In Fig. 4 the volume-control potentiometer is in the control-grid return circuit of the 6F7 tube. Also note that the screen grid of this tube connects to the cathode of the power tube. This places a slight positive voltage on the screen in respect to ground. The voltage value is equal to the bias voltage for the power tube.

In Fig. 5 the volume control is in the screen circuit of the 6F7. The control in this case varies the screen voltage which is supplied through the resistor R-255.

The values of most of the parts in these two circuits will be found in the tables on page 432 of the December issue of Service. The other values are not as yet available.

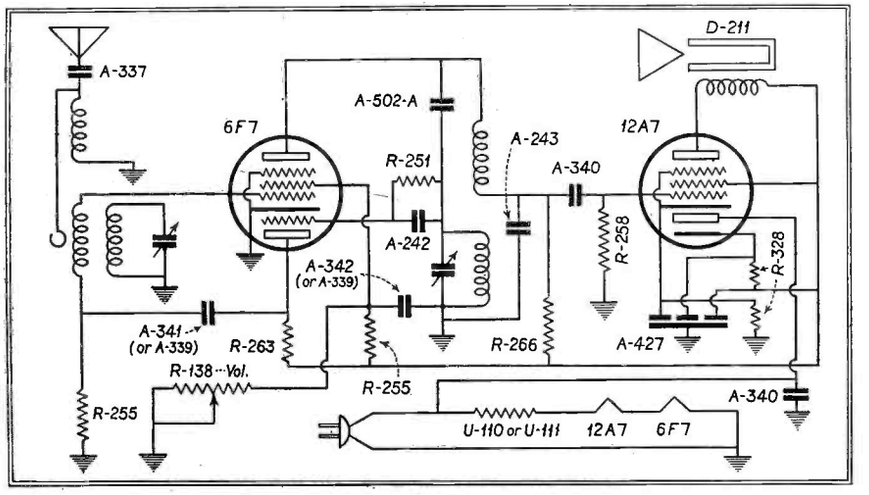


Fig. 5. Circuit of the final run on the Kadette Jr., Model F. In this set the volume control is in the screen circuit of the r-f section of the 6F7 tube.

Public Address . . .

USING 2A3 TUBES IN POWER AMPLIFIERS

THE introduction of the 2A3 tube made possible high power output with comparatively low plate voltage. Heretofore the type 50 tube held the spotlight in the medium-power field, but required a plate voltage of 450 and a rather large signal input voltage.

The maximum plate voltage for the 2A3 is 300, which comes within the limits of the standard power-supply units designed for radio receivers and power amplifiers. Yet, at this voltage, and plate current of only 40 mils, a pair of 2A3 tubes provide an output of 15 watts as against an output of only 10 watts for a pair of 50 tubes at a plate voltage of 450 and plate current of 55 mils.

The above figures indicate the superiority of the 2A3 over the type 50 on practically every count; namely, less plate voltage, decreased plate current, lower grid bias, higher sensitivity (less signal voltage), considerably greater power output, and the secondary points of an increased safety factor due to lower plate-supply voltage and the possibility of employing standard power-supply equipment.

Some difficulties have been experienced with the 2A3 tubes due in most cases to poor circuit design and in general to a lack of sufficient technical data on the proper use of this tube. The Engineering Laboratories of the RCA Radiotron Co., Inc., have supplied us with the following information on the use of the 2A3, which should be of great value to those of our readers who install, service and build public-address equipment.

Class A Operating Considerations

The usual operating point of grid-bias voltage for a Class A amplifier lies approximately midway between zero bias and a bias sufficient to cause plate-current cut-off. If a single tube is used in Class A operation, the operating bias voltage must be such that the d-c plate current does not change appreciably when full signal voltages are applied to the grid. Only under such conditions can an output having low distortion be obtained.

Strictly speaking, no type of output tube has absolutely linear characteristics. Consequently, a small amount of rectification of the signal voltage usually occurs. The non-linearity of characteristics is therefore responsible for the distortion produced by the tube.

When two tubes are operated in a Class A push-pull circuit, the non-linear sections of their characteristics are made to complement each other to give a substantially linear overall characteristic. This method produces an output free from second-harmonic distortion. For this reason it is possible to use a higher bias voltage for push-pull operation than is usually employed for single-tube operation. An increased bias voltage lowers the internal dissipation of the tube and permits the use of higher plate voltages. Higher plate voltages, in turn, make possible higher power output.

In order to obtain the higher power output of which the 2A3 is capable, two of these tubes are operated in push-pull under bias-voltage conditions which cause considerable rectification in each tube. Additional plate current, then, is drawn because of rectification, but this increased plate current is useful in securing higher power outputs. Under normal recommended operating conditions in a push-pull amplifier, where a plate-supply voltage of very good regulation and a fixed-bias supply voltage are used, the plate current is not cut off during any fraction of the cycle. Consequently, even though the recommended operating conditions specify over-bias grid voltage, this system may be operated as a strictly Class A amplifier.

The 2A3 tubes should not be operated with more than 300 volts on the plate. The grid-bias voltage should be —62 volts when operated from an a-c filament supply and —60 volts when operated from a d-c supply. The corresponding static plate current for an average 2A3 is 40 ma. This voltage and current rating for no-signal input should not be exceeded for best results.

Fixed-Bias Operation

Fig. 2 shows a circuit arrangement for the 2A3 in which the bias voltage is obtained from a small triode used as a rectifier—in this case a type 26 tube. This triode rectifier must be of a type whose cathode comes to an operating temperature quickly in order that bias will be available to prevent abnormal plate current in the 2A3's. High values of plate current would more than likely damage both the tubes and the power-supply unit. Either a type 26 or 01-A is suitable for use as the bias rectifier.

With the circuit of Fig. 1, changes in the d-c plate current of the 2A3's produce some change in bias. With the circuit of Fig. 2, the bias voltage is substantially independent of the plate current of the 2A3's.

In the circuit of Fig. 2, a type 5Z3 is used as the rectifier in the power-supply unit. An 83 tube may be used with slightly inferior results.

The plate circuits of the 2A3's should be fused in the center-tap lead of the output transformer, as shown in Fig. 2. This is especially important when fixed

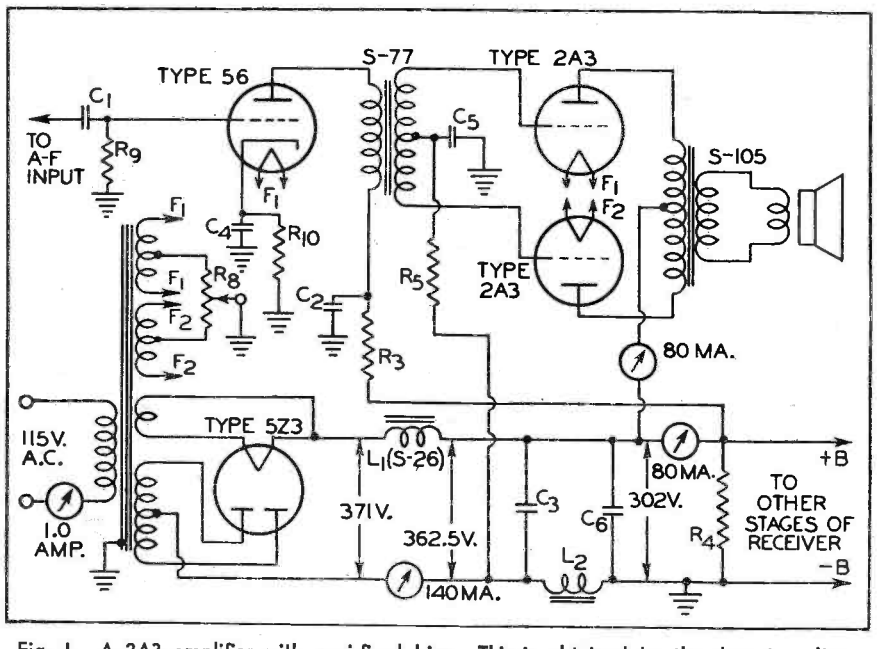


Fig. 1. A 2A3 amplifier with semi-fixed bias. This is obtained by the drop in voltage across the speaker field L-2. Potentiometer R-8 is the hum balancer

bias is used. Should the bias-voltage rectifier tube be removed or damaged, the bias on the 2A3's becomes zero. In that event, unless a fuse is provided for protection, excessive plate current can flow and damage the amplifier. A suitable fuse is one similar to the small glass-enclosed type often used to fuse the power-supply line in radio sets and rated at 150 milliamperes.

Self-Bias Operation

When 2A3's are operated in a push-pull circuit and are self-biased, a rise in d-c plate current with increasing signal voltages increases the voltage drop across the self-biasing resistor and raises the bias on the tubes. When this occurs, the operating point on the characteristic curve is shifted downward. This shift tends to increase distortion and to lower the power output. Under these conditions, operation intermediate to Class A and Class B is usually obtained at full output since the plate current is cut off for an appreciable fraction of the operating cycle. (These are the conditions under which 2A3 tubes are most commonly operated in radio receivers and public-address amplifiers. —Ed.)

When self-biasing circuits are used for the 2A3, it is necessary, therefore, to employ a higher value of plate-load resistance than is used with a fixed or semi-fixed bias arrangement. The purpose of this high resistance is to lessen plate-current swings, limit distortion, and prevent plate-current cut-off at negative signal swings.

Semi-Fixed-Bias Operation

Fig. 1 shows a circuit arrangement employing semi-fixed bias for the 2A3. The bias voltage is obtained across the speaker-field resistance. Since the plate current for all of the tubes (referring specifically to radio receivers) flows through this resistance, the bias voltage is less affected by the d-c plate-current changes in the 2A3's than it is in a self-biasing circuit.

The circuit constants for the diagram (given in the table of Fig. 3) are those for a typical radio receiver. Since the

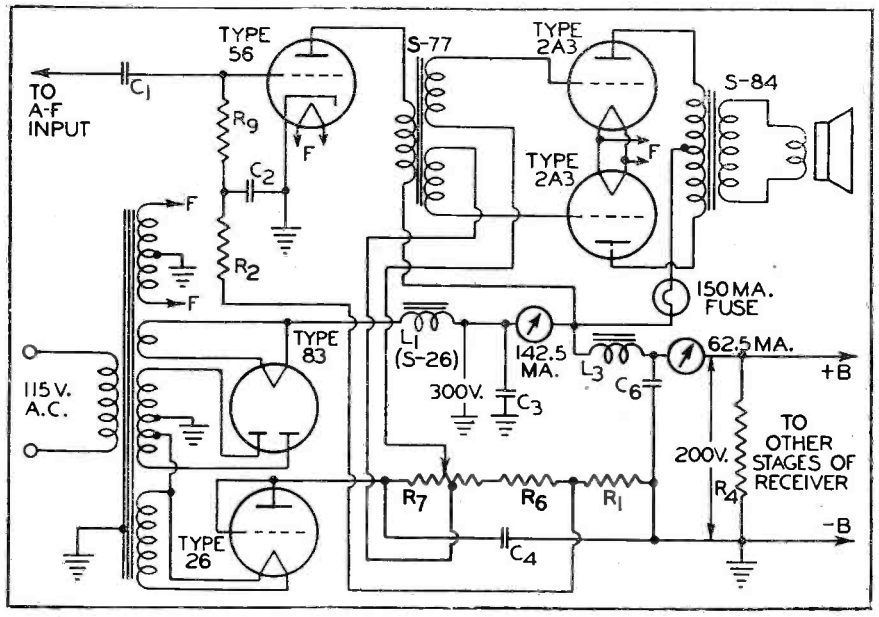


Fig. 2. Circuit of 2A3 amplifier with fixed bias, which is supplied by the separate type 26 tube. In this circuit R-7 is the hum balancer

speaker-field resistance determines the 2A3 bias, it follows that the choice of resistance depends on the total plate current drain of all tubes in the set.

Balancing 2A3 Circuits

It is usually advisable to provide some means of balancing the plate currents of the 2A3 tubes, as this has the effect of balancing out hum voltages present in the plate-supply voltage.

Two methods of accomplishing this are shown. In Fig. 1, a small potentiometer, R-8, is connected between the center taps of the filament windings to permit an adjustment of bias voltage. In Fig. 2, the secondary of the input transformer consists of two separate windings. One lead is attached to the center of the potentiometer, R-7, and the other to the slider or arm of the same potentiometer. Adjustment of the potentiometer varies the bias slightly on one of the 2A3's.

Small amounts of hum due to various causes can often be eliminated by adjustment of the potentiometer. Adjustment of the potentiometer for minimum hum usually gives equal plate currents. The potentiometer is adjusted by listening for minimum hum when the 2A3's are first installed, and further adjustment should not be required until one of the 2A3's is changed.

Both the circuits of Fig. 1 and Fig. 2 are designed for use with typical commercial power transformers. There are no special features involved in the design of the power transformer. Any make of transformer having the appropriate voltage windings, correct rating, and good regulation may be used.

Pre-Amplifier Stage

A type 56 tube is used in the pre-amplifier stage, since this tube gives excellent power sensitivity. The 56 is also an economical type.

A plate-supply voltage of 200 volts for the 56 is adequate to give the output signal required to swing the 2A3's. The 56, with 200-volt plate supply, is operated with a bias of —11 volts. The plate current is 3.6 milliamperes.

Input Transformer

The ratio of the input transformer is 1.4 to 1 from the full primary winding to one-half of the secondary winding. The peak voltage which will be induced in the secondary winding is 2 x 90 or 180 volts at the point at which the 56 tube begins to draw grid current.

In order to keep down cost and size, a step-down ratio is used. A step-up ratio would require a larger transformer design in order to provide space for the additional secondary turns. However, under the circuit conditions shown, the step-down ratio can give a signal input to the 2A3's sufficiently large to obtain their full output.

C_1 = BLOCKING CONDENSER—0.01 μf	R_2 = 200000 OHMS
C_2 = BY-PASS CONDENSER—0.25 μf	R_3 = 10000 OHMS
C_3 = FILTER CONDENSER—10 μf	R_4 = BLEEDER
C_4 = BY-PASS CONDENSER—5 μf	R_5 = 50000 OHMS
C_5 = BY-PASS CONDENSER—0.05 μf	R_6 = 22000 OHMS
C_6 = FILTER CONDENSER—5 μf	R_7 = CENTER-TAPPED POTENTIOMETER—2500 OHMS
L_1 = FILTER CHOKE—10 HENRIES AT MAX. MA., 60 OHMS	R_8 = POTENTIOMETER—100 OHMS
L_2 = SPEAKER FIELD—430 OHMS	R_9 = 0.5 TO 1.0 MEGOHM
L_3 = SPEAKER FIELD—1600 OHMS	R_{10} = 2700 OHMS
R_1 = 5000 OHMS	

Fig. 3. The unit values given in this table apply to the circuits of both Fig. 1 and Fig. 2. These values should be adhered to when building either type amplifier

Auto-Radio . . . .

Stewart-Warner Model 112

This chassis is used in receiver Model 1121. The circuit is seen to consist of a 6A7 detector-oscillator, 78 i-f amplifier, 75 diode detector, AVC and a-f amplifier, and a 41 power pentode. The high voltage is supplied by a vibrator-transformer in conjunction with a type 6Z5 or 84 rectifier. The relay, 18, in the high-voltage circuit of the rectifier tube is a protective unit. When the set is first turned on, the relay is arranged to connect a resistance load (resistance 1) of 6,000 ohms across one-half of the high voltage winding of the transformer, thus holding down the voltage peaks to a safe value until the heater type tubes warm up and start drawing plate current. This plate current flows through the relay solenoid, causing it to open the 6,000-ohm load. Note that the solenoid of the relay is also used as a choke to filter the rectified "B" voltage.

Voltages and Values

The voltages on the diagram were measured with a high-resistance voltmeter between elements and ground, with volume control full on. The readings are based on a battery voltage of 6 volts.

Readings will vary, depending on voltage range of meter, being higher for higher range instruments. This variation is most marked for second detector plate voltages because of the high resistance in this circuit.

Capacity and resistance values are given in the accompanying table.

Adjusting

In aligning the i-f, use a weak oscillator signal so that the AVC is not set off. Set volume control full on and peak the i-f transformers at 456 kc. The trimmer condenser adjustments are located on the front of the chassis just below the speaker. In some sets, four separate trimmers are used; on other sets the i-f transformers have double trimmer adjustments, a slotted screw for one trimmer and a hex nut around it for the other.

For calibrating and aligning the r-f circuits, turn the variable condensers of the chassis all the way out of mesh. Connect the tuning dial drive and set the red arrow of the tuning control to the first mark below 15 on the dial (this represents 1,550 kc).

Then tune the set to 14 on the dial (this is 1,400 kc.) and with oscillator connected to input of receiver and set at 1,400 kc, adjust the trimmer on the rear of the variable condenser for maximum output. So much for calibration.

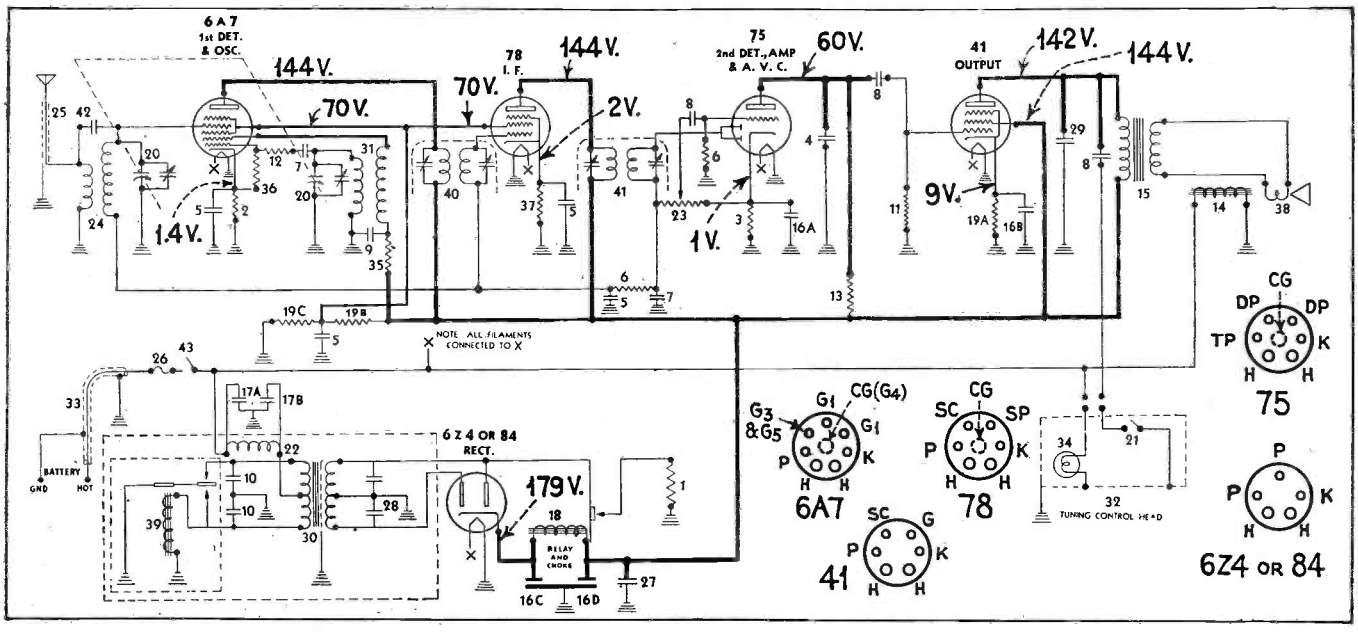
Now adjust the front trimmer of the variable condenser for maximum output, taking care to retune the set several times during the adjusting process.

Eliminating Interference

In installations where normal means of shielding and bypassing fail to completely remove ignition interference *due to chassis pickup*, the following slight change in the radio set may materially reduce the trouble.

In later production sets, which can be distinguished by the fact that the transformer housing top is soldered all the way around, the following change should be made. Remove the short black wire which connects the black pilot-light terminal lug to the filament of the 6A7

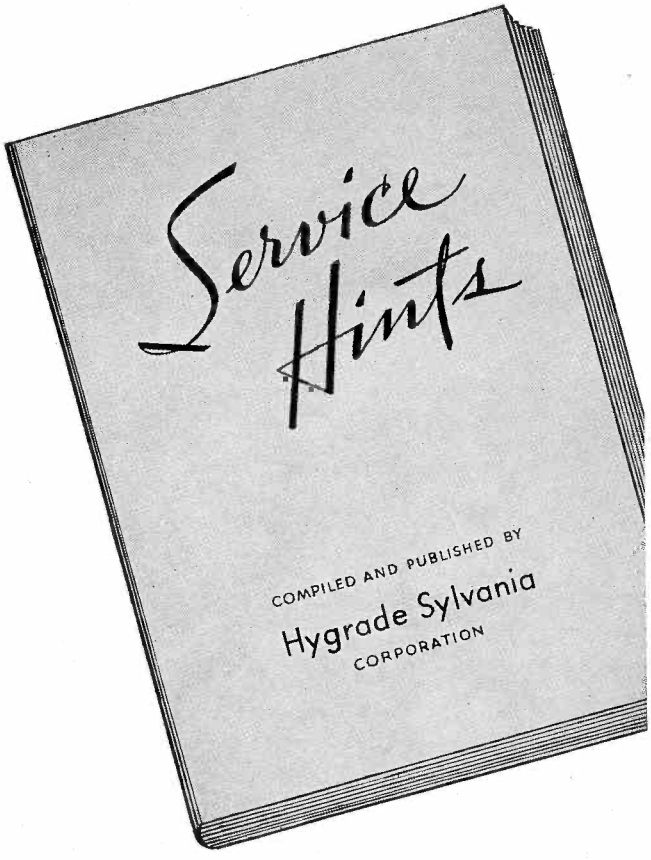
No.	*Value*
1	6000 ohms, 5 watt enamel
2	200 ohms, 0.25 watt
3	6000 ohms, 0.25 watt
4	.0001 mfd cond.
5	0.1 mfd, 100-v. cond.
6	1.1 meg, 0.25 watt
7	.00051 mfd cond.
8	.02 mfd, 600-v. cond.
9	.004 mfd, 600-v. cond.
10	.25 mfd, 100-v. cond.
11	510,000 ohms, 0.25 watt
12	2000 ohms, 0.25 watt
13	260,000 ohms, 0.25 watt
16-A	5.0 mfd. 25-v. dry
16-B	5.0 mfd. 25-v. dry
16-C	8.0 mfd, 225-v. dry
16-D	8.0 mfd, 225-v. dry
17-A	1.5 mfd, 100-v. dry
17-B	0.5 mfd, 100-v. dry
19-A	650 ohms, 1.0 watt enam.
19-B	7500 ohms, 3.0 watts enam.
19-C	10,000 ohms, 1.0 watt enam.
23	500,000 ohms, vol. control
27	0.25 mfd, 250-v. cond.
28	0.02 mfd. 1000-v. cond.
29	0.01 mfd, 600-v. cond.
35	10,000 ohms, 0.5 watt
36	21,000 ohms, 0.25 watt
37	300 ohms, 0.25 watt
42	8 mmfd coupling cond.



Circuit of Stewart-Warner Model 112. Note that 18 is both a relay and choke

How To Make..

even the small jobs Pay!



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tube. (The terminal lug referred to is the lower one on the terminal strip which is located between the condenser and volume control shafts on the chassis.) Now solder a wire between the pilot light lead terminal and the receiver side of the filament switch. You will find that this switch terminal is in turn connected to the filament prong of the 41 output tube.

In earlier production sets without the soldered transformer housing cover, a somewhat different procedure is followed since the wiring arrangement is somewhat different. In these earlier sets the pilot light terminal lug is already connected to the switch. In changing these sets to eliminate ignition interference noises, cut out the wire leading from the pilot-light terminal to the 6A7 filament prong and connect the ungrounded filament prong of the 41 output tube to the main A battery circuit at the top terminal of the large shielded bypass condenser (17A in diagram). The terminal referred to is the upper one on the condenser when the chassis is turned upside down.

For data on eliminating vibrator hash in this receiver, see page 460, October SERVICE.

•

Remler 27 A-C and Auto

This receiver is so designed that it may be operated from a 110-125 volt, 50-60 cycle line, or from a 6-volt battery when used in conjunction with a power box.

When operated from an a-c source, an auto-transformer in the receiver is used to provide the high voltage for the plate and dynamic-speaker field supply, and the filament supply for the tubes. The various voltages required are obtained by taps on the power transformer, as indicated in the diagram. Since an auto-transformer is used, the chassis is directly connected to the power source, and contact between chassis and ground should be avoided.

On battery operation, the cable plug connects the 6-volt supply to the filaments of the tubes, and the plate and field supply from the power box to the filter in the set. Neither the auto-transformer nor the 1-v rectifier is in use when the set is battery-operated.

The power box contains a vibrator-type interrupter and transformer, and a type 84 rectifier tube with necessary filter system. Diagram is shown. The cover of the power unit may be removed by taking out the four screws around the edge of the base. After several hundred hours' use, the vibrator contacts may require a slight adjustment due to wear. The necessity of this adjustment will be indicated by a marked reduction in the plate-supply voltage. A 20-ampere auto-type fuse is provided for protection to battery and wiring system.

LOCATION OF UNITS

The mixer coil is in an aluminum shield can in back of the variable gang condenser.

The oscillator coil is inside the chassis and is trimmed with the front-section trimmer on the variable condenser. Mounted with the oscillator coil is the first i-f coil which is trimmed by the condensers accessible from the back of the chassis.

The second i-f transformer is also located within the chassis and may be trimmed by the condensers located under the holes in the chassis bottom.

On account of the action of the AVC, when aligning the set, use a weak signal—or oscillator-input; and output meter to indicate resonance.

The voltages and socket connections are given in the diagram. The potential across the speaker field is 75 volts.

•

Servicing Philco Model 5

If, when installing or servicing the Model 5, it is necessary to remove the lid, care should be exercised when replacing the lid, so that no parts are damaged.

The speaker cable should be dressed toward the vibrator end of the housing. The condenser plates should be fully meshed, so that they cannot be bent out of alignment by the speaker field or cable.

•

Car Battery Connections

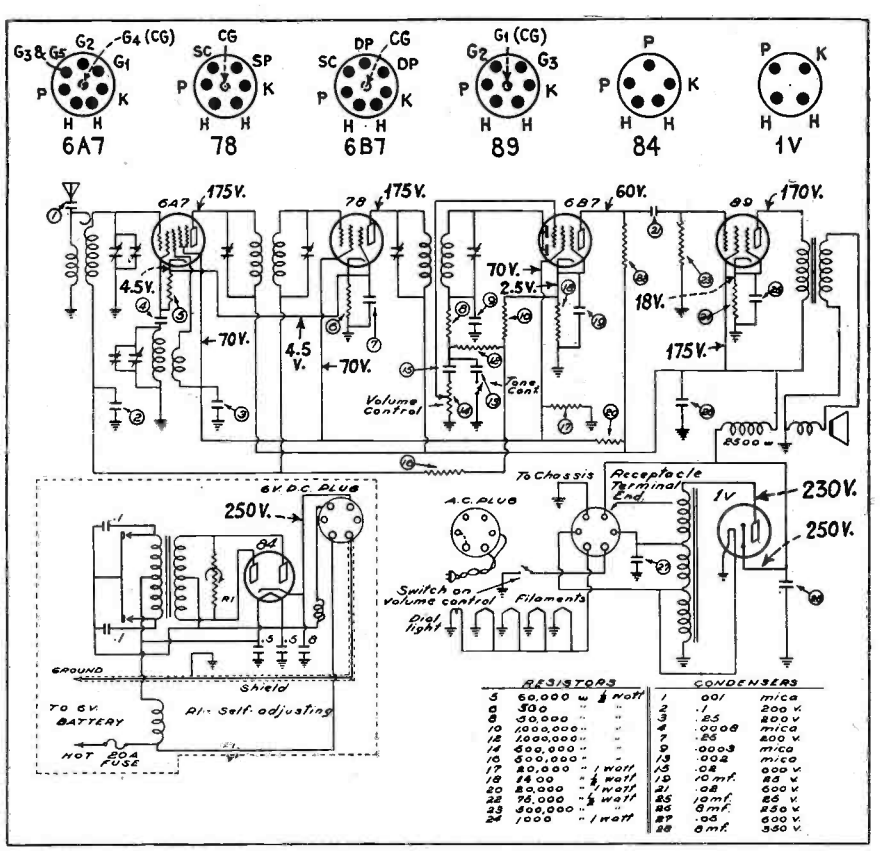
The following list, provided by Philco, shows the polarity of the ground connection in American automobiles and will prove useful in service work. (Let the foreign battery connections go back where they came from!)

(A —) Grounded

Buick	Durant	Oldsmobile
Chevrolet	Essex	Pontiac
DeVaux	Hudson	Reo
Deusenberg	Nash	Stutz
	Willys	

(A +) Grounded

Auburn	Franklin	Packard
Cadillac	Graham	Peerless
Chrysler	Hupmobile	Pierce Arrow
Cord	LaSalle	Plymouth
DeSoto	Lincoln	Rockne
Dodge	Marmon	Studebaker
Ford	Nash (Twin Ignition)	



Circuit of Remler 27 receiver which may be used as an auto radio or an a-c receiver. Diagram of auto power unit is also shown

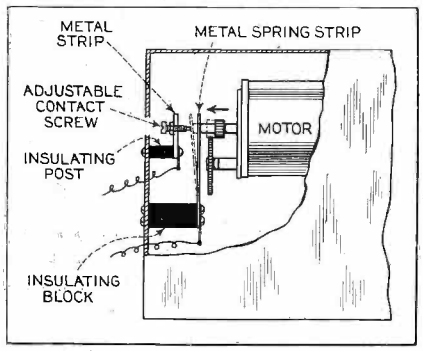
ON THE JOB . . .

"Silent-Tuning" Remote Control

What amounts to interstation noise suppression can be easily and effectively obtained on receivers using the RCA Remote Tuning and Volume Control Units. A great number of these units are being sold for use with any type receiver, and they provide all the convenience desired with the exception of silence while tuning from one station to another.

First, let's give an example of operation: Suppose the set is automatically tuned from a low-wave to a high-wave station. All stations in between are heard as the gang condenser is rotated by the control unit—and if the volume control was previously set to a high value, these intermediate station signals will be loud and even background noise may be bothersome. But suppose that during the operation of the control unit, the primary of the antenna transformer was shorted, and not opened again until the desired station was reached. Then the automatic tuning operation would be silent.

The RCA Remote Tuning and Volume Control Unit is so constructed that this object can easily be obtained. A single motor, operated at high voltage for tuning and low voltage for volume control, takes care of all operations. When tuning the set, the shaft of the control motor slides out (just like a Bendix starter in an auto) and engages the tuning gear. In doing so, it displaces a metal spring strip (shown in sketch). When the desired station has been tuned in, the motor stops, and the spring strip shoves the motor shaft back to its normal position.



By taking advantage of the reset spring action in the RCA Remote Control Unit, silent tuning can be obtained

Therein lies the trick. If we provide a contact, insulated from the frame of the control unit, that will just touch the metal spring strip while the motor is turning over the gang condenser, we have a closed circuit which exists only while the motor is tuning and which opens as soon as the motor stops. Then, if we connect the two wire terminals shown in the sketch to the primary terminals of the antenna transformer, this coil will be shorted and the antenna will be grounded during the tuning operation. The result is "silent tuning."

Though the metal spring strip is mounted on an insulating block, it is nevertheless grounded to the frame of the unit. (The insulating block is actually mounted on an inside frame, rather than in the manner shown.—Ed.) Therefore it is best to attach the lead from this spring to the ground terminal of the antenna transformer primary.

The added contact must be adjustable, and care should be taken that it does not retard the action of the spring strip. It should be set so that with the motor operating in the tuning position, the screw just makes contact with the metal spring and exerts no undue pressure.

C. F. HINDS.

•

Finding Condenser Opens

In many cases of an open condenser, when you shunt another condenser across it the surge seems to "weld" or connect the "open" inside the condenser. The result is that you have to wait from several minutes to several days for this condenser to open again.

The method we use very seldom causes this to happen, as we employ a very small capacity to "probe" with. This small capacity has a very small surge current and therefore it has little effect on the delicate loose connection in the open condenser.

We usually use a .0005-mfd to .001-mfd, 600-volt, pigtail condenser and shunt it across the various sections of the bypass condensers in the set while it is operating. The condenser section upon which it seems to have the most effect is usually the defective one.

This method will even show up an open in a large electrolytic condenser if it is bypassing some r-f circuit.

ROBERT SCHLOSSER,
811 West Moulton St.,
Pontiac, Ill.

•

Dynamic Speaker Substitute

Very often the Service Man is confronted with the problem of testing a receiver chassis when the dynamic speaker designed for the particular chassis is not available. This is especially true of distributors' service departments, for dealers often send in chassis minus the speakers to lessen the transportation charges and simplify packing. A very effective substitute for the dynamic speaker is shown in the accompanying diagram.

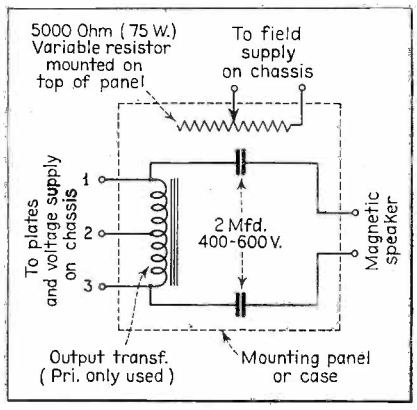


Diagram of the dynamic speaker substitute used in testing receivers minus their speakers

You will note that the idea is to couple the output tubes to a good magnetic speaker and that the variable resistor is merely a substitute for the field coil and is of course connected in the field circuit of the chassis and adjusted to the same resistance as that of the dynamic field for the chassis under test. This arrangement is often a time saver and well worth the cost of construction. The values for the parts are given in the diagram.

Receivers with a single output tube should be connected across terminals No. 1 and No. 3 of the output transformer.

Receivers employing the field coil of the speaker as part of the filter circuit are apt to reproduce an increased amount of hum. This of course should be taken into consideration when testing. The variable resistor selected was chosen for the reason that practically 90 percent of present-day radios employ a speaker field resistance of less than 5,000 ohms.

H. B. BENNETT,
623 Fairfax Ave.,
Norfolk, Va.

•

Apex 32, Montgomery-Ward 332-W

Remove high-voltage leads to '80 plates (white wires) at rectifier socket and at transformer. Check for short between wires and between wires and ground. If shorted either place, open up wire group and re-insulate at burned spot. Replace high-voltage leads with wires of heavier insulation.

S. F. PUSEY,
Madera, Pa.

HIGHLIGHTS . . .

Exit 1933

Old man 1933 is six feet under. He's now fodder for skunk cabbages. But he wasn't so bad at that.

The scribe of the *New Yorker* magazine said he would always remember 1933 as the year a midget sat in J. P. Morgan's lap. We will always remember 1933 as the year a midget sat in the radio manufacturer's lap.

Maybe both midgets were good things in their own way. In any event, the midget radio showed the public how rotten some radio could be, and showed the radio industry what radio engineers could do (when pushed) towards getting $1000 worth of pure genius into a snuff box. This "midget" knowledge is now paying dividends, even if J. P. Morgan isn't.

•

Enter 1934

It's wet behind the ears still. All red and shiny from an alcohol rub. It looks good. After a wiff of grape dew, it looks swell.

J. P. Morgan won't let any more midgets sit in his lap. Radio manufacturers follow suit. The emphasis is on bigger sets—and quality.

All the economists have quit saying that business is picking up, which is a sure sign that it is. You can feel it if you can't see it. A. T. & T. lost only 16 telephones last month. Boy! Next month we bet they gain a hundred.

There ought to be a pick-up in servicing any time now. People are *still* spending, and here it is *way* after Xmas. Some of the money will go to you, but you may have to whistle for it. No hog-calling, though.

•

To Mr. Bell's Friends

Mr. L. J. Bell, Service Manager of Fada Radio, has been confined to bed by sudden illness. For the time being he is forbidden any visitors, but hopes (and so do all of us) to be well enough in a short while to see his friends.

Mr. Bell has many friends scattered all over the map. Those who read this notice will surely wish to write him. His present address is, The Hamilton, 39-50 60th St., Woodside, Long Island, N. Y.

During his absence, Mr. Bell's assistant, Mr. McNicholas, is taking care of things at the office.

Take it easy, L. J. We're all wishing for your quick recovery.

•

Fun in Bed

If you've ever wondered what hospital patients do besides read and twiddle their thumbs, you'll be set right for all times by the following "technical report" provided by Sound Systems, Inc.

"Curiosity proves to be a costly trait in the maintenance of head-sets for a hospital centralized radio system. It is hard to believe that patients in hospitals, presumably too ill to remain at home, could, literally speaking, tear headphones apart faster than they can be repaired, but such is the case. They amuse themselves (the patients—not the headphones) in idle hours by unscrewing caps, disconnecting cords, loosening every attachment possible and breaking hard-rubber caps, by accident of course. One hospital has secured cast aluminum caps, soldered every screw and nut and installed heavy rubber-covered cords, but still the repair bench is heaped up with damaged headsets."

One answer to this problem would be a regulation requiring every patient to bring his or her own headphones. But in this fast-moving country of ours where the government is becoming more and more social conscious, such a scheme wouldn't work. Sound Systems, Inc., have done the next best thing by designing a centralized radio system, and special wall speakers (out of reach of the patients) which provide ample volume for the room but not sufficient to creat a-f stew in the hallways.

•

Emerson Moves

Emerson Radio and Phonograph Corporation doesn't live in the old place any more. Their executive offices and factory have been enticed into the new Port Authority Commerce Building, 111 Eighth Ave., New York, N. Y.

. . . so don't go around to the old place, 'cause Emerson doesn't live there any more.

•

Sylvania Auto Tube Chart

To facilitate the ordering of initial tube equipment as well as handling tube replacements for automobile radio sets, the Hygrade Sylvania Corporation, Emporium, Pa., has just issued an up-to-date automobile radio set tube chart.

Listing 69 automobile set manufacturers and their various models, the chart indicates the total number of tubes for each set, the detector and amplifier requirements, the power amplifier and the rectifier.

Printed on heavy cardboard, the chart may be placed on a wall near the counter or test bench. It lists all tubes, including those not made by the organization. The chart may be had for the asking.

•

P-A Work

Editor, SERVICE:

I have one or two questions I would like to put to the readers of SERVICE. Public-address work is more or less a new thing, and it would be interesting to a lot of us to hear how the other members of the servicing profession are faring. The average p-a man gets into some tight corners and gets some odd jobs. Why not extend an invitation to the boys to open up and tell a few tall ones?

Another thing—what about a standard price schedule for p-a work? Has such a schedule been worked out? I use a rather elastic system based on a minimum charge for the set-up, plus a certain amount extra for the time and coverage required. This has worked out fairly well for the past year, although there are occasional cases that require "special treatment."

A. B. ROMSAS,
Box 353,
Minot, N. Dak.

•

(We'd be happy not only to receive a few "tall ones" from the boys, but also any comments relative to servicing or service charges in connection with p-a systems. It's about time someone spoke up on this subject. We had come to believe that most of the boys had turned into "big, silent men from the west." Probably it was just the holidays that made 'em tongue-tied.—THE EDITORS.)

•

Lone Wolf

Editor, SERVICE:

I seem to be alone in this army of Service Men, and I'm just beginning to notice it. In fact, in all my ten years of radio building and servicing, I have never had a chat or letter with any of the real gang.

I do all repairing and servicing of any set and have quite an up-to-date work shop. Have averaged seven sets a week for the past year. I feel that this ought to entitle me to a ticket of admission to something—but what I want is a card or letter from some of the gang.

I do wish someone would lay down the old soldering iron long enough to tell me a yarn or two, and I'll cut the switch and relay back.

Hope we'll be "lined up" soon.

CLAUDE M. PREW,
New *London, N, H.*

(Hope you get your wish. Here is a yarn for you, anway: A man bought a midget set to hear the election returns—that was way back in the deep, dark era. He connected it up, turned on the switch and got exactly nothing. It was then after six o'clock, and the store where he bought the set was closed.

He took the set over to an electrical contractor friend of his who went through the same process. Again no music. By this time the man was plenty hot under the collar.

The contractor suggested they take the set to a Service Man . . . and a few minutes later one of our local boys and a visit from the contractor and his irate friend. The Service Man also connected up the set and turned on the switch, and no sooner he did so than both men said, "See? No music! What *a dud* that *set is! Said the Service Man, "Just a minute, you fellows. You're in too much of a hurry. Give the tubes a chance to heat up!"*

You see, Claude, that's the trouble with we city people . . . we're in too much of a hurry most of the time. If it weren't for the cities, the tube people would never have bothered with quick heaters. Out-of-town people can sit back and wait for their music.—THE EDITORS).

•

Battery Charging Rate

With the cold weather upon us, many car owners are going to experience the same old difficulties in so far as starting and lighting is concerned. Unless, of course, they have their storage batteries checked and the generator charging rate boosted to take care of winter conditions.

All of this is particularly important to people who have auto-radio sets. When installing or servicing, check the car battery and if the charging rate of the generator has not been boosted, boost it for 'em. It will be so much more to your credit.

ASSOCIATION NEWS . . .

I. R. S. M. Annual Convention

The General Office of the Institute of Radio Service Men is busily engaged in making preparations for the Second Annual Regional Convention to be held at the Hotel Sherman in Chicago, Friday, Saturday, and Sunday, February 23 to 25.

The interest in this convention and exhibit surpasses that of last year. It is evident that, like last January, there will be a complete sell-out, if not an oversale, of display space inasmuch as 40 percent of the available booths had been subscribed within ten days after the announcement went to exhibitors.

The arrangement of the convention facilities is being changed, although practically the same space will be used again this year. The Louis XVI Room, utilized last year as the meeting room, is being devoted to exhibits. The technical sessions are to be held in the Crystal Room which was one of the main exhibition halls at the previous meeting.

"Clinics," in which set manufacturers will participate, will constitute one of the major features during the convention. It is very likely that the greater portion of the day sessions will be turned over to the holding of the clinics, although it is too early to say definitely on this point.

•

M. R. S. A. (Minnesota)

The Minnesota Radio Servicemen's Association, with headquarters at 386 Minnesota St., Saint Paul, Minn., was founded March 1, 1933 and has been growing rapidly ever since.

Mr. Fred C. Kennedy, the Secretary, reports that the Association is working to eliminate "gyp" service and also trying to get the cooperation of jobbers and manufacturers.

As time goes on, more and more associations are waging war against the man who cares little for the servicing profession aside from the quick money he may be able to make at the expense of both the public and the industry. We will yet see the day when the "gyp" will have little chance to stay in business. May that day be soon.

The M. R. S. A. welcomes new members. Those interested in joining should communicate with the Secretary at the address given above.

•

Real Xmas Cheer

More than 400 families, in some instances a single individual, in Cleveland are enjoying radio today as a result of the collaboration of the Radio Department of the Cleveland Press, the Cleveland Section of the Institute of Radio Service Men, and the WGAR Broadcasting Company. An appeal was made through the columns of the press and over the air through the facilities of WGAR for radio sets and accessories to be reconditioned and distributed to the shut-ins at Christmas time. The members of the Institute gathered nightly to get the apparatus in operating condition.

Other organizations cooperated fully in the program. Tubes were contributed by all the distributors in the city, and by RCA-Raditron Co. Storage batteries were donated by the Willard Storage Battery Company. Dry batteries were contributed by the National Carbon Company, General Dry Battery Company, and Underwood. Willard service stations gave free charge slips. The Spang Baking Company through Gene and Glenn furnished doughnuts to the members of the Institute as they worked on the sets.

Why not do the same thing in your city or town? Not next Christmas, but now.

•

LET'S make things POP!

WHAT with the return of old man Barleycorn, the Christmas holidays, and New Year's, most everyone was too excited and busy to worry much about those matters which go to make up one's normal day. We—and probably most people—felt that other things could wait a while.

But, now the holidays have passed, old man Barleycorn is no longer a novelty, and we have all decided to settle down to the new year with our new-born resolutions all ready to be broken as they were last year and the year before. Everyone is again turning to the business of life and making plans for the future. Things are starting to pop—but being an extra-special year with silver-bellied clouds and all, things should pop better than ever.

We are all set. Are you? During the lull, we dropped the "Forum" page, as most everyone was much too busy to write. Now the letters are again flocking in, and next month will see the return of the reader's page. Even "Association News" has suffered because of the holidays. Now that things are again normal, we hope that association secretaries will see to it that we receive reports of meetings, etc.

Let's go! It's going to be a big year.

THE EDITORS.

R. T. A. (San Francisco)

The Radio Technicians' Association, of San Francisco, Calif., has been in existence but four months and already has 80 members. For the past three months they have published the "R. T. A. News," the last issue of which ran to nine pages. Future issues are to be printed!

According to an editorial in issue No. III, "gyp" Service Men in San Francisco have been put on the run. R. T. A. is conducting a very strenuous campaign against any Service Man who oversteps the line of good grace and good business practice. That's certainly a step in the right direction.

Members of the R. T. A. appear to be in favor of some form of state licensing for Service Men. We quote a portion of their text:

"Each of us should make the realization of state licensing a goal for which to strive. We can, if we honestly try, attain this goal. We must publicize the idea—convince our fellow technicians, convince the jobbers and wholesalers, convince the manufacturers, the broadcasters and the public that therein lies the means of establishing the radio service field on the same plane of other professions."

Should the R. T. A. succeed in its attempt for state licensing, we will have what a lawyer might call a "test case." It will give the other service associations the opportunity of studying the advantages and disadvantages (if any) of such a system as it swings into use.

We can't help but feel that such a progressive move on the part of the R. T. A. indicates a form of courageousness not often exhibited. There's no turning back, once started. If the outcome is successful, the R. T. A. will have benefited the whole service field. They look like leaders out there.

The R. T. A. has also tackled the subject of examinations for Service Men. As yet there is nothing definite, but we hope to hear more of it later after the groundwork has been laid, and methods of classification have been planned. Here again we have a "test case" well worth watching. How will it work in practice?

Those wishing to join the R. T. A. should communicate with the Secretary, Mr. Charles W. Lugar, 680 A Ninth Ave., San Francisco, Calif.

•

Detroit Section, I. R. S. M.

The Detroit Section of the Institute of Radio Service Men recently enjoyed lectures given by Mr. Geo. Bain of the Engineering Department of the KenRad Tube Corp., and Mr. Fred. Wenger of the Triplett Electrical Instrument Co.

The Radio Distributing Co., a local parts dealer, gave a very enjoyable feather party for the Institute members and their lady-friends. (What do you do . . . throw feathers?—ED.)

The local group put on an old-fashioned supper and "keg bust" November 28th, and it was a real get-together with the local parts dealers participating and contributing freely of their support.

The most recent meeting was devoted to, "How to Sell Service"—with demonstrations by some of the members. This subject was prompted by a thought that is uppermost in the minds of many men today; namely, knowledge is useless unless the possessor is educated to sell that hard-earned asset. The demonstrations were good and members felt that something had been accomplished.

"Non-members in the Detroit area are fast realizing that if they hope to see the service business develop into a well-founded industry, they must tie in and support a national organization," states Mr. Cody, the Secretary. "This realization is commencing to swell our membership list," he added.

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51

SINCE 1904, Readrite engineers have pioneered many important developments in electrical measuring instruments. The new 419-711 tester is regarded as a milestone in Readrite progress.

No longer is it necessary to take more than one instrument out on a service call. This practical and flexible unit permits you to make every necessary radio set analysis, to quickly check both good and bad tubes.

Furnished with a practical selector switch, this instrument enables you to test voltage and resistances at set sockets. In addition, voltage, resistance and capacity tests are available through the meter jacks. Equipped with the new Triplett D'arsonval Voltmeter, which has 1,000 ohms per volt resistance.

The No. 419-711 tester makes testing of new and old tubes a simple, easy, quick operation. The shaded two-color scale is an exclusive Readrite feature—making it possible to read tube values in *plain English* . . . in language your customers can understand. The position of the needle immediately indicates to what degree a tube is either good or bad.

YOUR JOBBER CAN SUPPLY YOU

. . . at the dealer's net price of $48.75
See him today

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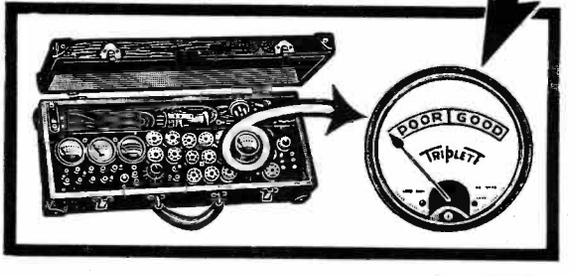
98 College Avenue Bluffton, Ohio



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Gentlemen:

Send me catalog on Readrite Tester No. 419-711 and complete line of servicing instruments.

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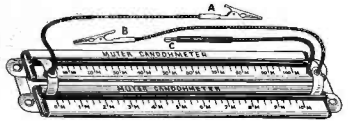
City ..... State .....

THE MANUFACTURERS . . .

Muter Candohmeter Indicator

The Muter Candohmeter, made by the Muter Co., 1255 So. Michigan Ave, Chicago, Ill., is an accurate, uniform, wire-wound resistor insulated from and enclosed within a metal housing with a narrow slot on top permitting contact with the resistor at any desired point. A contactor or test prod, mounted in an insulated handle, is furnished with each unit.



The Candohmeter is used for determining proper resistance values for replacement, as a voltmeter multiplier, as a calibrated resistor for experimental work, etc.

Candohmeters are made in four different ranges to enable the experimenter to determine the exact resistance value desired. Two dual-range units are also supplied, similar to the one illustrated, containing 10,000- and 1,000,000-ohm scales, also 100- and 1,000-ohm scales.

●

Lafayette Theatre Amplifier

Wholesale Radio Service Co., 100 Sixth Ave., New York, N. Y., announces a new 28-watt, Class B, Lafayette Theatre Amplifier especially designed for use with the photo-cells of movie projectors—or electric phonograph pickup. The unit may also be used in conjunction with a microphone and pre-amplifier.

The Theatre Amplifier employs a 57 tube in the first a-f stage, a 56 in the second stage, a 59 in the driver stage and two 59's in push-pull in the output stage. The output transformer has taps for connection to 4-ohm, 8-ohm and 15-ohm voice coils, a 250-ohm or 500-ohm speech line, mixer line, multiple speakers, or recorders.

A special exciter lamp transformer is built into the amplifier and provides 8 volts at 4 amperes, or 10 volts at 7.5 amperes.

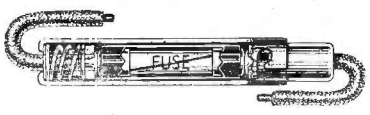
The power level is stated as being 36.8 db, and gain 96.1 db. Hum level is 74.4 db below maximum output.

●

Littelfuse Fuse Retainer

Littlefuse Laboratories, 1772 Wilson Ave., Chicago, Ill., have brought out a new Fuse Retainer and Antenna Coupler for use in connection with auto-radio receivers.

The Fuse Retainer will take the regular 3 AG automotive fuse and hangs directly in the "hot" line, leading to the receiver. It takes auto cable up to 5/32" diameter, and the shielding, where necessary, can be attached to the retainer. Fuse renewals are made by turning the small bayonet lock.



When used as an Antenna Connector, the fuse is omitted, and the contact buttons are placed directly together instead of at the fuse ends. Contact is maintained by a strong spring pressure.

Gates P-A Tube Socket

The Gates Radio and Supply Co., Quincy, Ill., have released a new "front of panel" socket for all standard-base tubes having four to seven prongs. This socket is especially designed for use with public-address systems, test panels, etc., where the tube should preferably be mounted vertically and on the front of the panel.

●

"Universal" Recording Feed Unit

The Universal Microphone Co., Inglewood, Cal., have introduced a Recording Feed Screw Device which moves any recording cutting head across the face of the recording disc and thereby grooves the record at the time of making the recording.

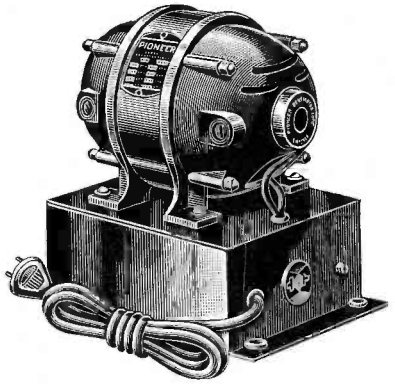
The device is so constructed that the recording head may be lifted from the record without disturbing the feed screw.

No critical adjustments are required in the operation of the device, and the instrument will fit any phonograph turntable. Records up to 12 inches in diameter can be accommodated and the thread is cut at the rate of 80 grooves an inch.

●

Pioneer D-C to A-C Converters

A complete line of converters for changing 32-volt and 110-volt direct current to 110-volt alternating current has been added



to the products of the Pioneer Gen-E-Motor Corp., 1160 Chatham Court, Chicago, Ill.

Two series are available; the standard series which has a 110 volt-ampere rating and has ample power for operating all usual size a-c radio sets; and the heavy-duty series which has an output of 150 volt-amperes and will operate the largest radio sets.

These units are provided with complete filter systems. They have additional features, such as ball bearings packed with a lifetime supply of lubricant, and self-ventilation.

Additional models are available without the built-in filter unit where it is desired to use the converter for operation of electrical appliances only.

●

Sylvania 35/51 Tube

Hygrade Sylvania Corp., Emporium, Pa., has developed and is now offering its type 35/51 tube in place of types 35 and 51. Characteristics of the 35/51 type are such that satisfactory performance will be obtained in receivers designed for either tube, it is stated.

Alden Speaker-Phone Adapter

The Alden Speaker-Phone Switching Adapter permits the use of either speaker or phones at the output of a radio receiver. A switch is provided to change from one to the other. When the speaker is being used, the phones are shorted out of circuit.

The Speaker-Phone Adapter comes in four models; for connection to single five-prong pentodes, single six-prong pentodes, and push-pull five- and six-prong pentodes.

●

Universal Test Instruments

The Sound Engineering Corp., 416 North Leavitt St., Chicago, Ill., has introduced three separate test instruments for servicing work on radio receivers, p-a systems, etc., each being self-contained.

The No. 90 Test Set is a multi-range universal a-c, d-c voltmeter, milliammeter and ohmmeter, providing 7 voltage ranges and 3 resistance ranges, as well as means for measuring inductance, capacity and impedance.

The No. 91 Analyzer, when used in conjunction with the No. 90 Test Set, provides a point-to-point analyzer suitable for any form of continuity test. It also provides means for tube testing. The No. 91 Analyzer is provided with 4, 5, 6, and 7 prong tube sockets for checking any of the tubes now in general use.

The No. 92 Oscillator is a modulated, electron-coupled, signal generator and operates from a 110-volt a-c line. It covers the frequencies from 90 to 1600 kc without the use of harmonics; when required, harmonics may be used to cover the higher frequencies.

These three units may be obtained separately or together complete, in a carrying case with cable and adapters.

●

Electronic Labs Eliminators and Converters

Electronic Laboratories, Inc., 122 West New York St., Indianapolis, Ind., are now marketing two new converters and "B" eliminators for use on 32- and 110-volt lines.

The 32-volt d-c converter has an output of 110 volts a-c at 100 watts. The 32-volt d-c "B" eliminator for battery-operated radio sets has an output of 200 volts d-c at 40 milliamperes. The 110-volt d-c converter has an output of 110-volts a-c at 200 watts.

The complete line also includes a 6-volt "B" eliminator for auto-radios.

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ON THE JOB DEPARTMENT

INDEX TO ADVERTISERS

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for the

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WE will make a very important announcement concerning Set Testers, Analyzers, Diagnometers, and other such Servicing Equipment now being used by Service Men and organizations, in the February issue of SERVICE.

IF you are interested in receiving more complete information than can be presented in an advertisement, register with us. Just drop us a post card, asking for Catalogue SE-1.

IN the meantime, have you a complete set of Rider's Manuals? Volume I is still available at $7.50 postpaid, Volume II, $6.50 postpaid, and Volume III, $7.50 postpaid. *Volume IV is described elsewhere in this issue.*

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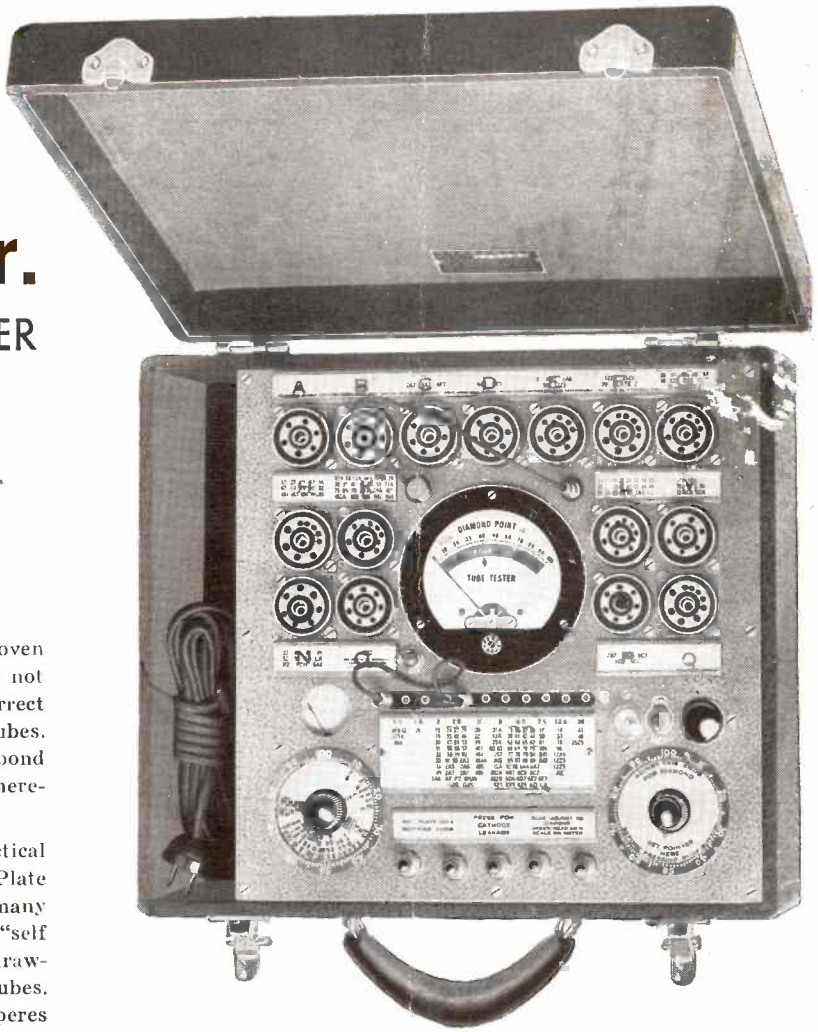

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Years of experience have conclusively proven that to merely employ a Fixed Grid Shift is not good Engineering Practice, and is not a correct and satisfactory method of testing Radio Tubes. It is the function of different Tubes to respond to Grid Swings of different magnitude. Therefore, they should be treated differently.

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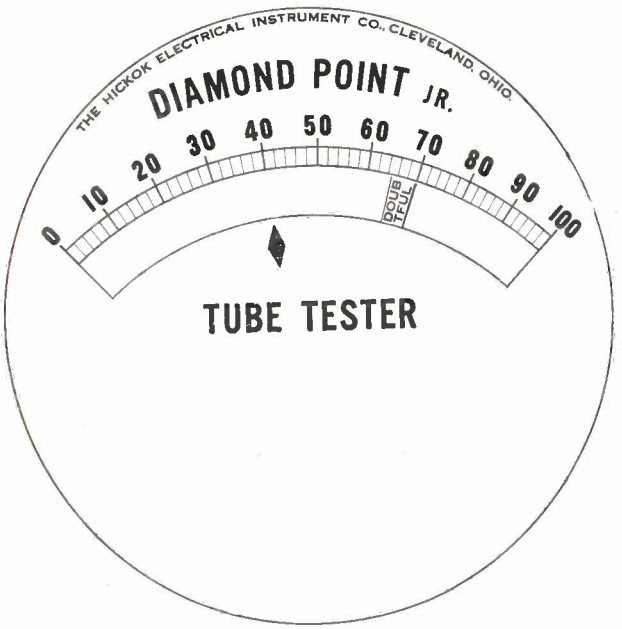

Exact Meter Scale as used in Diamond Point Jr. Tube Testers "POOR" indicated in "RED"—"GOOD" in "GREEN"

These objections have been entirely eliminated in the Hickok Method employed in the Diamond Point Tube Testers, providing a different Grid Swing for every Tube, and this Grid Swing matches the Tube. Moreover, it is not necessary to adjust a special dial to accomplish this feature. It is inherent in the circuit and established by an integration of several different Characteristics of the Tube.

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