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Radio **SERVICE DEALER**

FEBRUARY 1942

This Month

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Keep 'em listening...

A goal for radio's Minute Men

In these days of material shortages and production restrictions, the radio service engineer has his big opportunity to "keep 'em listening," no matter what the obstacles.

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The illustration shows several Mallory radio components: a vacuum tube on the left, a cylindrical battery in the top center, a coil and capacitor assembly in the top right, and a box of Mallory products in the bottom center. The box is labeled 'MALLORY' and 'APPROVED PRECISION PRODUCTS'.

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Radio SERVICE-DEALER

SOUNDMAN AND JOBBER

Reg. U. S. Pat. Off.

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RADIO SERVICE DEALER, published monthly at 34 N. Crystal Street, East Stroudsburg, Pa., by the Cowan Publishing Corp., Executive and Editorial Offices at 132 W. 43rd Street, New York, N. Y. Subscription rates—United States and Possessions, \$2.00 for 1 year, \$3.00 for 2 years; elsewhere \$3.00 per year. Single copies 25c. Printed in U.S.A. Entered as Second Class Matter October 3, 1941, at the Post Office at East Stroudsburg, Pa., under the Act of March 3, 1879.



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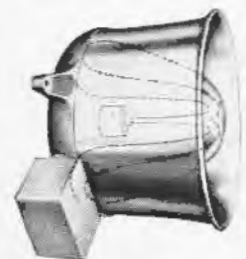
AT SEA . . . all leading Steamship Lines and the Navy use RACON's. Yes, where lives are at stake, and dependability important—and specifications extremely rigid — that's where you'll find RACON's.

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BLOOD, SWEAT AND TEARS

WHAT WAS WARM is now hot; and what is now hot will get hotter still, until some find it almost unbearable. And that holds for the war in general, war regulations, and the way of life the majority of us will have to follow until the war is brought to a successful conclusion. We will have to make sacrifices of a nature that we do not now dream of, and it is just as well that we all start bracing ourselves for the ordeal and cease picturing a well-ordered, pleasant and perfectly normal future for ourselves during the "diversion" . . . and stop thinking of it as a diversion from the usual routine. The war is now *everything*.

IT'S ALL-OUT NOW

The War Production Board has acted to meet huge Army and Navy demands on the radio manufacturing industry and to conserve critical materials by ordering sharp cuts in production of receiving sets, phonographs and radio-phonograph combinations for civilian use.

Class A manufacturers (those who sold more than \$1,000,000 worth of radio sets and phonographs for civilian requirements during the first nine months of 1941) were ordered to reduce output by 45 per cent. Class B firms, whose sales were under \$1,000,000, have been ordered to curtail production by 35 per cent.

The radio manufacturing industry has been asked to undertake a \$2,000,000,000 military production program. Civilian production must be reduced drastically so that receiver and parts makers and allied branches of the industry can participate in this effort to the *fullest possible capacity*.

Class A companies already have received or soon will be awarded big war orders, and swift conversion of their plants to 100 per cent military activity may be expected. Until a larger number of the small, Class B, firms receive more Army and Navy orders, the lighter curtailment ordered in their production will provide them with sufficient civilian operations to keep their skilled labor force intact.

Nevertheless, some Class B companies have already ceased *all* civilian production; and in some cases the 35 per cent curtailment order means little in the face of the priorities or allocation situation.

Civilian production cannot stand up in face of a 2-billion-dollar government order; that amount will more than use up the capacity of the industry. So, 100-per cent curtailment in both Class A and Class B plants appears inevitable.

IT'S UP TO YOU

It is estimated that 60 million radios are now distributed among 87 per cent of the American homes. What is still to be produced, together with stocks now in manufacturers' and dealers' hands, will meet *essential* replacement requirements.

Emphasis will be placed on parts for repair and maintenance of existing equipment, and it is *expected* that supplies will be available to meet these requirements. In line with this, the War Production Board, Division of Industry Operations, on January 27th, listed under the permitted uses of certain grades of aluminum: "Condensers for radio sets, provided they replace defective ones in existing sets and do not go into new sets."

But, things will get hotter; and what is permissible today may not be permissible tomorrow. Don't count on everything being sweet in your neck of the woods. It may not be. You may have to dig for your parts. But you'll make out just the same . . . if you use your head.

ALTERING ENEMY ALIEN MULTI-BAND SETS

UNDER the regulations, which were issued by authority of Presidential proclamations relating to enemy aliens, all German, Italian and Japanese nationals resident in the United States and its possessions, were ordered to surrender to the local police authorities before 11 P.M., January 5, 1942, any and all of the following equipment in their possession: (a) radio transmitters; (b) short-wave radio receiving sets; (c) hand cameras.

Under date of December 27, 1941, the Office of the Attorney General, Department of Justice, transmitted to all state and local police authorities a letter outlining the procedure and regulations involved.

The obvious intent of the regulations regarding the possession by an enemy alien of a "short-wave radio receiving set" is to prevent the interception of secret messages; but in no case is there the intent to deprive enemy aliens of the opportunity of listening to our own broadcast stations. Hence, provisions were made in the regulations that would permit such a person to reclaim his receiver if said receiver was made inoperative on the prohibited bands. And this is where there has been trouble.

The radio serviceman has a very definite responsibility in connection with these regulations, and it is necessary that he understand what this responsibility is and what the legal requirements are.

YOUR RESPONSIBILITY

An enemy alien, as you know, is a national of a country with which we are at war. Though the majority of these aliens may be classed as friendly to our country—and therefore should

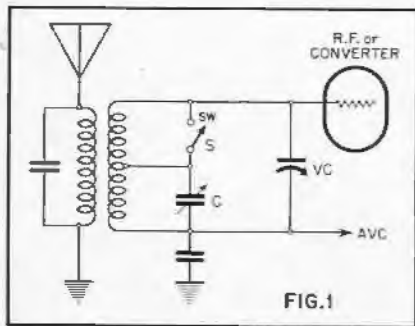


FIG. 1
Tapped coil is preferably removed, along with band switch and trimmer C, and new coil installed.

be accorded fair treatment—it is essential, nevertheless, that we do not take it for granted that all of them are. We know only too well that this is not the case, and we must, for that reason, leave no possibility for any so-called enemy alien to make use of the short-wave bands in a radio receiver.

That definitely means that you are possibly putting your country in danger if, in decommissioning the short-wave bands in a receiver owned by an enemy alien, you make it easy for that alien to recommission these bands after he has regained possession of his set. If he is an actual enemy, his position is then opportune, for you have

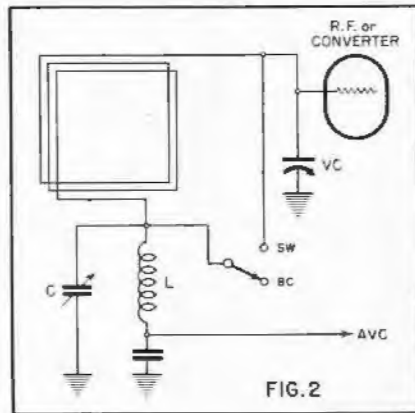


FIG. 2
Remove the works and replace with bc loop, or remove switch and trimmer C.

"cleared" him. We have heard of cases where servicemen have decommissioned the short-wave bands by shorting the oscillator coils allied with these bands. This is obviously not sufficient, for the shorting leads can easily be opened or removed. Neither is it sufficient to throw the short-wave circuits completely out of alignment.

The argument put up against this is that an enemy alien who is really a spy would chance getting caught with a professional job hidden away some place in his home—and such might be the case—but it would be less dangerous for him to obtain clearance on his multi-band "home" receiver and later recommission the dead bands.

The fact of the matter is that the receiver must be killed beyond question in the short-wave bands, so that any alien would have to resort to outside assistance in order to get it operating again. To set you straight on this, here are the specific rulings:

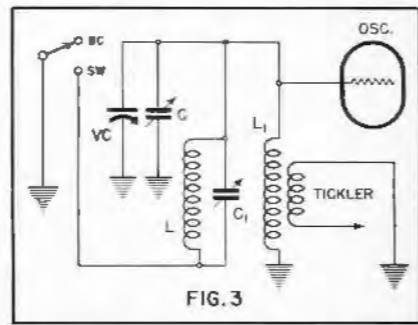


FIG. 3
Remove band switch, coil L and trimmer C1, as well as switch leads.

"Short-Wave Radio Receiving Sets—(a) No alien enemy shall use, or operate or possess, or have under his custody or control at any time or place any short-wave radio receiving set. For this purpose the words 'short-wave radio receiving set' are to be construed as including any apparatus designed to be used or capable of being used for the purpose of receiving signals, messages or communications of any nature whatsoever which signals, messages or communications are transmitted by means of radio waves of a frequency of 1750 kilocycles or greater, or of a frequency of 540 kilocycles or less.

"(b) A short-wave radio receiving set as defined in paragraph (a) hereof which set is also capable of receiving long-wave radio communications is deemed to be within the class of short-wave radio receiving sets prohibited unless the set is so altered or modified that short-wave radio communications or messages cannot be received by the said set, and further, unless the set is so altered or modified that it is impossible without the addition of more parts and the substantial rebuilding of the set to modify the set so that it will be capable of receiving short-wave radio communications.

"(c) No alien enemy who is found in possession of any short-wave radio receiving set will be excused in any manner on the ground that he did not know that the set was a short-wave radio receiving set or that the set could be readily converted into a short-wave radio receiving set. It shall be the duty of any alien enemy to ascertain whether or not any radio in his possession is prohibited; and any alien enemy having in his possession any radio receiving set whatsoever shall be held responsible for knowing whether or not

such set is a short-wave radio receiving set."

It is clear from the above that parts and leads should be removed, and in some instances—as we shall point out later—completely new parts installed. Shorting coils and removing leads from band switches is not sufficient.

LEGAL POINTS

Contained in the instructions sent out to police authorities is the following: "In each case the police authorities shall issue a receipt to the alien suitably describing the set or camera." Further, by terms of the regulations, the penalty for wilful failure to surrender prohibited articles is forfeiture (confiscation) of the articles and apprehension of the alien enemy, with possible internment for the duration of the war.

Since the deadline for turning in prohibited articles was January 5, 1942, a serviceman approached by an enemy alien on the subject of decommissioning or altering a multi-band receiver, should first ask to see the receipt issued by the local police department. If the enemy alien does not have a receipt for the receiver in question (and it may be possible that in some cases receipts were not issued) then the serviceman should check the matter with the local police authorities, and at the same time determine whether the police wish to file the parts to be removed, or whether a letter from the serviceman, stating the method employed to decommission the receiver and listing the parts removed, is sufficient. In the latter case, tag the removed parts and file them in your own shop.

Keep in mind the fact that no enemy alien should any longer have a dual- or multi-band receiver in his possession; and do not, under any circumstances,

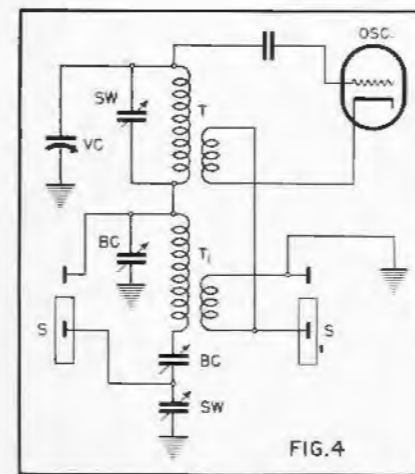


FIG. 4
No real necessity here for replacing T and T1. Removal of switch and s-w trimmer and padder will suffice.

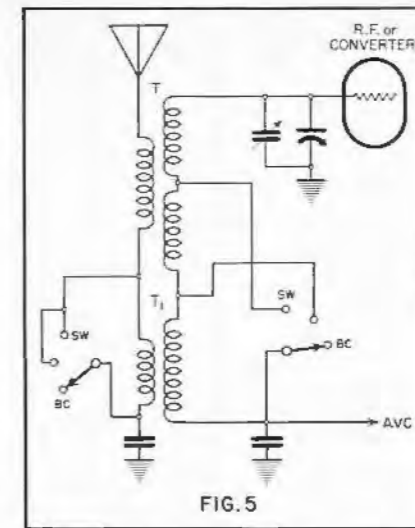


FIG. 5
T and T1 should be replaced with a broadcast-band antenna transformer.

decommission such a receiver unless the owner has substantial proof that the receiver has been released to him by the local police department for the purpose of having it altered.

There is still a great amount of this work to be done, as many enemy aliens have been slow in taking advantage of the opportunity of repossessing their receivers. But, in doing this work, make sure that you not only abide by the procedure as set forth by the police department in your locality, but also decommission a set to such a point that it cannot be made operative again in the short-wave bands without the purchase of additional parts and the employment of aligning equipment.

TECHNICAL ASPECTS

It will become apparent that many receivers capable of tuning to frequencies above 1750 kc cannot be effectively decommissioned without considerable alteration.

In many dual-band sets, for instance, the higher frequencies are reached by shunting a portion of the broadcast coil, as shown in Fig. 1. Removing the switch S is not sufficient, and if trimmer C sets the tracking for both bands, as it does in some jobs; then both S and C should be removed, the coil tap cut off, and a new trimmer shunted across VC. It would be better yet to remove the whole business and replace the antenna transformer with one that covered the broadcast band only.

Another bad proposition is shown in Fig. 2. In this case, the loop is shunted for s-w reception, and the loop functions as a capacity antenna. But the inductance of the loop in series with coil L is required for broadcast reception. Best bet is to remove the switch and the leads to it, and also trimmer C; and shunting a new trimmer across

VC. Or, replacing the whole mess with an antenna transformer or a loop covering the broadcast band.

The removal of short-wave oscillator coils is not always possible, though the arrangement shown in Fig. 3, is used in many sets. In this case the inductance of L1 is lowered for s-w reception by shunting it with the coil L. Here, of course, the switch and its leads, the trimmer C1 and coil L can be removed, and the circuit realigned by adjusting C. This is very effective.

But in the oscillator circuit of Fig. 4, we have the same general series arrangement, with shunting switches, similar to that shown in Fig. 2. Remove the complete switch, the s-w trimmer and padder, and realign; or replace with a similar type of oscillator coil covering the broadcast band only.

The type of antenna circuit shown in Fig. 5 is very bad. There is only one thing to do here, and that is to remove the entire antenna transformer and replace it with one covering the broadcast band only. Unless the new one has an adjustable iron core, some inductance trimming may have to be resorted to; but, in any event, the set can be made to operate moderately well over the broadcast band.

The oscillator circuit shown in Fig. 6 isn't quite so bad. Removal of the switch and the leads, as well as trimmers C1 and C2, would make it pretty difficult for anyone without the parts, the knowledge and the servicing equipment, to get the thing perkiog again in the s-w bands. But, it might be just as simple to remove the entire oscillator coil at the same time and replace it with a strictly bc one.

There are, naturally, many other variations of multi- and dual-band circuits, but the ones shown cover the

(Continued on page 21)

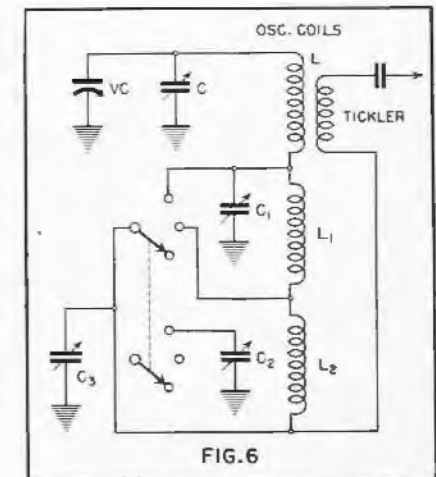


FIG. 6
Oscillator coils need not necessarily be removed in this circuit.

MODERN SLANTS ON INTERMITTENTS

John H. Potts

THE problem of servicing intermittent receivers has long been one of the most exasperating, if not the most difficult, which faces the industry. Although the advent of signal-tracing methods, with a special technique for localizing such troubles, has done much to simplify the troubleshooting end of the job, there still remains the need for making the receiver "cut out," and stay that way, while tests are being made. A good many practical methods have been devised to do just this, and they have helped in the majority of cases. Some of these have been described and are in general use; others, to the best of our knowledge, have not been previously discussed. In this article we want to go over a number of these methods and show where they will fit into the picture in the more difficult cases.

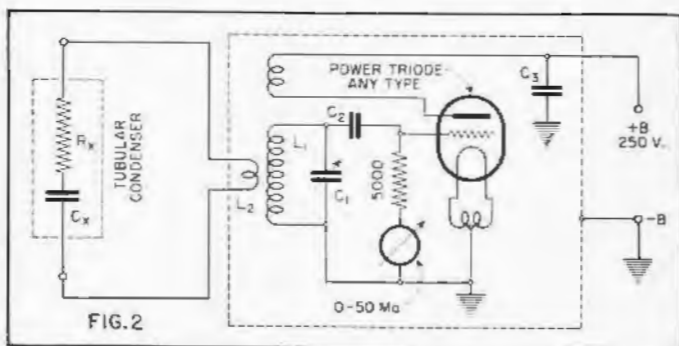
The basic cause of intermittent operation is almost always due to a defective connection somewhere in the receiver. It may be in a tube—often is, in fact—or due to a rnsin or cold-solder joint. Occasionally the trouble is eliminated as soon as the receiver is removed from the cabinet; this is the case when parts are caused to touch intermittently because of straining of the chassis due to warping of the cabinet. The vibration of the speaker may cause the trouble when all the apparatus is together in the cabinet, where these vibrations are easily transmitted to susceptible parts; yet, when the set is put on the service bench, it may play normally indefinitely. The receiver performance is often affected by temperature and humidity, conditions which are not duplicated in the shop to which it is removed for test. All these and other factors combine to make the problem of inducing intermittent operation on the test bench often a difficult one.

MECHANICAL TESTS

The first step in simplifying the task—and this cannot be too strongly emphasized—is to make certain that the trouble is in the receiver and nowhere else. This means careful questioning of the customer to find out just how often the trouble occurs. If seldom, it is a good idea to postpone, if possible, servicing the set until it cuts out fre-

quently. The associated equipment should be carefully examined. Make certain that the lead-in strip, if used, is in good condition. Often the aerial will sway and touch another, or some metallic surface; there may be a break in an aerial or lead-in joint, covered up with a piece of tape. Or the wire itself may be broken inside the insulation. All these little things cause intermittent action in the receiver, and naturally no amount of work on the set itself will be of any avail in locating the trouble.

Intermittent condensers can be blitzed with an r-f oscillator, as shown.



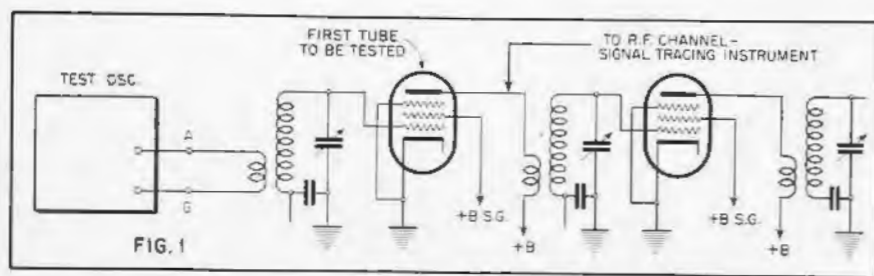
The first step in causing defects of a mechanical nature to show up is to tap or knock the tubes and chassis. For the tubes, each should be tapped in turn, noting if noise results in the

by checking the signal output of each tube in turn while undergoing the tapping process. One should start with the first tube—r-f section—as illustrated in the skeleton diagram of Fig. 1. In this manner all other tubes and stages are eliminated from the test, since the signal being tested will be examined directly at the tube output, where it is not influenced by any troubles present in the following stages. If the circuit is such that some reaction on the stage under test may occur, as the result of AVC action, etc., the tube immediately following the stage under test may be removed, or its grid circuit may be opened.

If the tubes have been eliminated as a possible source, the next object is to cause the set to cut out by pounding the chassis. If this has no effect, cables should be moved about and connections should be checked, using an insulated prod while the receiver is operating, and noting any change in output.

ELECTRICAL TESTS

If no mechanical troubles are revealed by the foregoing tests, electrical tests may be instituted. Because one of the most common causes of intermittent operation is defective tubular



Tie a signal tracer in on a stage at a time. In this manner all other tubes and stages are eliminated from the test.



Another Instance of How IRC Helps Servicemen Build Business

THIS little tag, factory-packed with all IRC Volume Controls sold through the jobbing trade, is designed to be hung on the control knob whenever you use an IRC Control for replacement. Read it carefully. You'll quickly see that there is no better way of building public confidence. No customer will fail to see it. None will fail to be impressed with the fact that you have used a replacement of highest quality.

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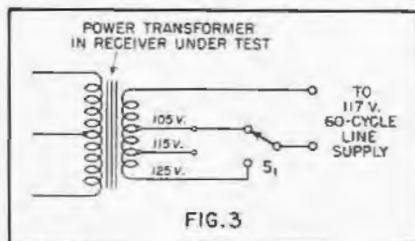
RESISTORS and CONTROLS

INTERNATIONAL RESISTANCE COMPANY, 401 North Broad Street, Philadelphia, Pa.

condensers, many servicemen arbitrarily replace without test every condenser of this type when an intermittent receiver is brought in. This rather heroic method often does not work out and is altogether impractical in larger receivers employing a great many tubulars. Further, it is possible that the very condensers which are put in to correct the trouble may in themselves be defective. A more logical method is to make certain that the trouble lies in the part being replaced, and in the long run this is by far the most economical and satisfying.

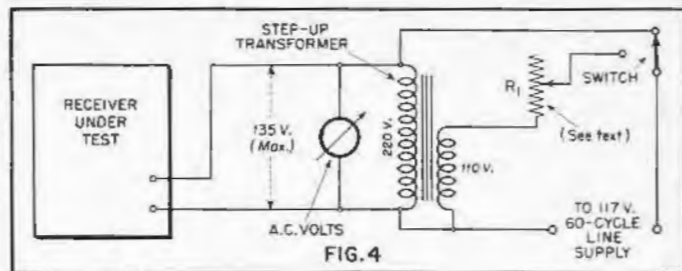
One method of uncovering defective tubulars is shown in Fig. 2. Defective action is generally due to a poor weld or joint at the point where the lead to the condenser connects to the foil. This forms a high-resistance joint which is represented in the diagram as R_x . This resistance is in series with the condenser itself, shown as C_x . Since the connection cannot be inspected without damaging the condenser, some means of test which does the trick must be employed. In Fig. 2, the idea is that a high-frequency current will pass through a high capacity without effect, but will cause a resistance to heat. Thus, the high-resistance contact at the foil is heated under radio frequency and, if the r-f power is great enough, the high-resistance contact is burned out. Then we have merely an open condenser to test, and such are easily located by substitution or by capacity checkers.

In Fig. 2, the recommended frequency is somewhere between 200 and 500 kc. The oscillator coil $L1$ may be wound with 200 or 300 turns on a 3-inch form, using wire no smaller than No. 24. The tickler can have about one-half as many turns, and the pick-up coil $L2$, consisting of about one-tenth the number of turns on $L1$, may be wound right over $L1$. The tube may be any power triode, or a beam-power tube such as the 6L6 connected as a triode. The milliammeter indicates the depth of oscillation, and should show at least a 25-ma reading. Greater power output may be obtained, if required, by increasing the B-supply



Upping receiver voltages will often knock out an intermittent. This is the shock method.

The same thing (Fig. 3) can be done with a 220-v to 110-v transformer in reverse, as shown.



voltage, or by using a low-power oscillator to drive a Class C output stage. This data is given for experimental purposes, since there are no rigid requirements as to design, frequency, etc. When the condenser to be tested is not shunting a low-resistance circuit, the test may be made without taking it out of the set. Care should be taken, however, that the r-f power, when applied, does not go through some other circuit where it may cause damage. A safer method is to disconnect the condenser when making the test.

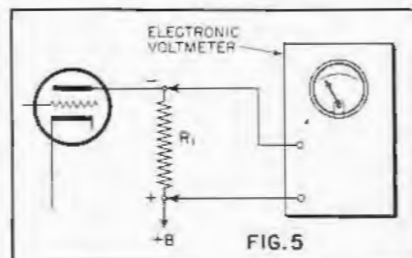
VOLTAGE SHOCK METHOD

The foregoing method has proved of some value but has never had wide application, although many swear by it. A more enthusiastically adopted method of inducing intermittents to cut out is the voltage shock method, illustrated in Figs. 3 and 4. The principle here is to snap from a lower to a higher voltage so that the sudden shock will cause defective components to show up. This method has been found very successful. In fact, it is quite often the case that the reason a receiver will cut out in a customer's home and not in the shop is simply because of a difference in the line voltage.

When the receiver under test utilizes a tapped power transformer, as shown in Fig. 3, the application of this method is simplicity itself. The line voltage is connected to $S1$ and to one terminal of the power transformer. After the set has heated at the lower voltage, when the switch is on the 125-volt tap, $S1$ is snapped back and forth from the 105-volt tap to the 125-volt tap, allowing about a minute, or less, between snaps until the set cuts out. Then trouble-shooting follows. This operation is repeated if the set starts playing normally during test.

When the line voltage is normally low, the method shown in Fig. 3 is not satisfactory because the voltage is not sufficiently increased when switching in this manner. By using an auxiliary step-up transformer, as shown in Fig. 4, we may raise the voltage to a degree depending upon the rating of the transformer. One easily-obtainable

type of transformer has a 100-watt rating and steps down a 220-volt line to 110 volts. By operating this transformer in reverse, applying the 110 volts to the secondary and connecting the set to the 220-volt winding, it is possible to raise the voltage. This would provide a 2-to-1 step-up, which is too much, so the resistor $R1$ is employed in the line input circuit to reduce the voltage. A husky resistor will be required, about 100 watts rating for the average receiver, and the resistance may be adjusted by setting a sliding tap while the set under test is connected. A 200-ohm resistor, so tapped, will provide an adequate range for sets having power ratings from 40 to 125 watts. The tap should be so



Use of v-t voltmeter for checking doubtful resistors.

adjusted that the voltage applied to the set under test is never in excess of 135 volts. This is necessary in order to protect the tubes. The method of operation is to switch from the step-up transformer to the receiver directly, as shown, until the cut out is induced.

TEMPERATURE AND HUMIDITY

None of the above described methods is effective when the trouble is due to the effects of temperature or humidity. Resistors, in particular, are often subject to considerable changes in value as a result of temperature and humidity changes. In some instances, it has been found that unprotected resistors may drop to a small fraction of their normal value when exposed to high humidity for a day or so, only to recover their normal resistance again when they dry. In such cases, an effort should be made

(Continued on page 21)

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Serviceman's Diary

J. P. Hollister

THURSDAY: Jerry was standing in front of the store when I drove up and parked at the curb. He looked sore.

"Where've you been?" he demanded. "I phoned to your last call and they told me you left over half an hour ago."

"So what?" I asked him. "Didn't it ever occur to you that I've got to eat once in a while, and it's nearly one now. At that, I only took time to grab a ham sandwich and a cup of coffee—"

"And spent the rest of the time kidding around with the new blonde waitress," he growled. "Anyhow, we've got a rush job on at the High School Gym, so we'll have to hop to it. The p.a. system there has gone sour and they've got to give a lecture or something to a group of volunteer ARP workers at three o'clock. So I told them we'd set up our 25-watt job for

them while we're fixing up their outfit."

I didn't bother arguing with him. He had the amplifier all ready to go, so we just damped each part in the back of the truck. I remembered that we might need a long extension cord in case there wasn't a handy outlet, so I grabbed one and chucked it in. Then Jerry thought of something he had to tell the kid who was minding the shop. But eventually we got started.

The Gym is a swell place for demonstrations and lectures of the type they had in mind. There is a running track which forms a balcony around the floor, being just about on a level with the basket-ball backstops, so everybody in the balcony can see everything which goes on on the floor. We set one of our portable speakers at one end of the hall and the other one directly opposite.

At first we had a little trouble with acoustic feedback when the gain was turned up enough to fill the Gym. I went upstairs and adjusted the position of each of the speakers while Jerry talked into the mike. In the midst of the work, a big husky fellow whom I remembered as the director of athletics at the school, came in and walked up to Jerry.

"Well," he said briskly, "I see you've got the apparatus working in fine shape. Just let me try it for a moment." He stepped up to the mike. "My friends!" he roared. The speakers rattled and the windows shook. Jerry made a quick dive for the mike switch and warned him not to shout into the mike again.

"Okay, son," the director said, "and maybe you'd better stay around here during the performance. I may need you." Then he went away.

The hall started filling up in about half an hour, all of the audience consisting of women and girls, most of whom wore brown slacks and shirts, part of the ARP uniform.

When the director returned it was nearly time for the lecture to start. He looked a little worried.

"I'm afraid I'll have to draft you as model for the first-aid demonstrations," he told Jerry. "I had planned to use a dummy for the purpose, and it was supposed to arrive but hasn't got here yet. And I don't want to keep the audience waiting."

"He'll make a swell dummy," I told the director. "He's my partner and I know."

Jerry gave me a hard look. "My partner," he said loftily, "would hardly serve as a suitable model for first-aid-treatment. One of the important points which must be borne in mind is that the audience must be sympathetic or they won't learn. If my partner got hurt, any ARP worker would simply take one look at him and then roll him into the nearest gutter. You need me and I'll be glad to help."

I let him get away with it. They hauled in a big table and got Jerry to lie down on it. Then the director demonstrated how to bandage the ankle, leg and forehead. When he had finished he made an announcement.

"Now," he said, "my assistant will take charge and show you, that you, as well as she, can handle this work."

(Continued on page 21)



"Now my assistant will take charge and show you that you, as well as she, can handle this work."

TECHNICAL

SERVICE PORTFOLIO

SECTION XVI

PRACTICAL NEGATIVE FEEDBACK

WITH the possibility of a shortage in replacement parts, the likelihood of a trend toward receiver rebuilding, and a desire for improved tone in the ever-growing field of the phonograph, negative or inverse feedback takes on new meaning.

The application of inverse feedback to an audio amplifier is simple and inexpensive. Though not a cure-all, its use provides many advantages; the advantages to be derived depending upon the method in which it is applied.

ADVANTAGES

Generally speaking, inverse feedback will reduce hum and circuit noise, increase gain stability, and reduce harmonic distortion. Certain feedback methods will, in addition, improve frequency response and/or the effectiveness of tone compensation.

These features can be of value to the serviceman in correcting receiver faults. For instance, in early receivers that suffer from hum, cabinet resonance or generally poor tone, the addition of inverse feedback may well be the most economical and effective answer to the problem at hand. This is even true of the many fine old receivers using single or push-pull 45's, though admittedly the addition of negative feedback is difficult, due to the transformer coupling. But, if the receiver is being rehabilitated, resistance coupling can be installed to advantage, and feedback added.

More to the point is the inclusion of feedback in the early pentode-output jobs where, in most cases, the pentodes run wide open. But even in those cases

where a resistance-capacity corrective filter shunts the primary of the output transformer, replacing it with a proper amount of feedback will bring improvement.

Insofar as tone correction is concerned, humps and/or dips in the overall characteristic can be erased by counteracting them with a non-selective feedback loop. Or a capacity or resistance-capacity filter can be inserted in the feedback circuit by one means or another, so that the feedback at certain frequencies will be greater or less than at other frequencies.

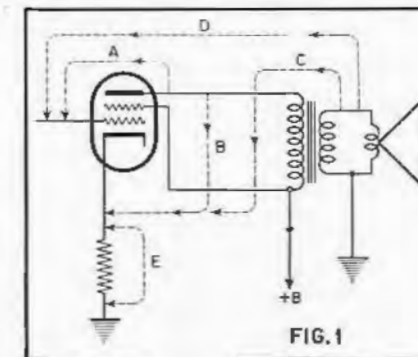
But it should be borne in mind that the use of negative feedback for the purpose of frequency boost or attenuation, or an out-and-out tone control, in many cases defeats the very purpose for which feedback is normally employed. If, for instance, the feedback circuit is made selective, then the degree of feedback at some frequencies may be so small that it fails to reduce

harmonic distortion in the selective range. But if tone compensation is all that is sought after, then feedback is an excellent means of obtaining it.

TYPES OF FEEDBACK

There are two general types of negative feedback. One is referred to as the constant-current type, and the other is known as the constant-voltage type. They do not have the same degree of effectiveness.

Whatever the type, the feedback from output to input must be 180 degrees or near to 180 degrees out of phase with the input voltage. Under these circumstances, the feedback voltage is a reflection of the output voltage and, assuming the feedback circuit to be non-selective, has exactly the same characteristics as the output, with the exception of phase. If, as an instance, the feedback is over only one tube, the voltage feedback will contain the audio frequencies involved plus any circuit noise or hum present in the stage. Because of the phase opposition between the output and input voltages, the feedback voltage will cancel a percentage of the input voltage; thus, in effect, reducing the tube gain. The amount of cancellation, of course, is dependent upon the degree of feedback; but the point to bear in mind is that, for anything less than 100 percent feedback, where gain becomes unity, it requires a smaller increase in input voltage to make up for the lost gain due to degeneration than the actual gain lost. For instance, a 20 percent increase in input voltage will make up for a loss in gain of 30 percent.



Various paths over which feedback can be applied, depending upon the elements in the feedback loop.

The result of this proportion is that distortion, for example, is reduced by the same number of db as the gain reduction that accompanies it; and the actual loss in gain can be made up for by a lesser degree of increase in input voltage. Many receivers have more gain than is normally required, with the result that the gain lost due to feedback can be made up for by turning up the volume control. Where this is not possible or feasible, the lost gain can be compensated for by the addition of another voltage-amplifier stage; or the voltage-amplifier tubes in use can be replaced with tubes having higher gain, in which case the same effectiveness can be obtained with a smaller degree of feedback. That is to say, increasing the feedback factor by increasing amplification per stage through the use of high- μ tubes, rather than increasing the degree of feedback, provides the same results. By virtue of this, the effectiveness of inverse feedback not only increases with amplification per stage, but also with the number of stages included in the feedback loop.

FEEDBACK PATHS

Feedback from output to input may be over a number of different paths, as shown in Fig. 1. If a condenser is used, the feedback may be from plate to grid, as indicated by A. Or it may be from voice coil to grid, as indicated by D. If the feedback circuit contains a resistor only, the feedback may still be from plate to grid, as at A, if the resistor connects to the plate of the preceding tube, with the grid blocking condenser in between.

If the cathode resistor is unbypassed, then the feedback voltage is developed across this resistor, as indicated by E. Under the same circumstances, additional feedback voltage may be fed through a condenser from plate to cathode, as at B; or from voice coil to cathode, as at C.

The feedback may be over the power stage only, from A through C, as shown in Fig. 2; or the output transformer may be included in the loop, in

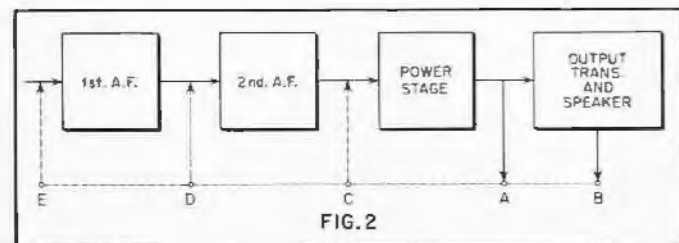


FIG. 2

Showing the feedback paths for degeneration over one, two or three stages.

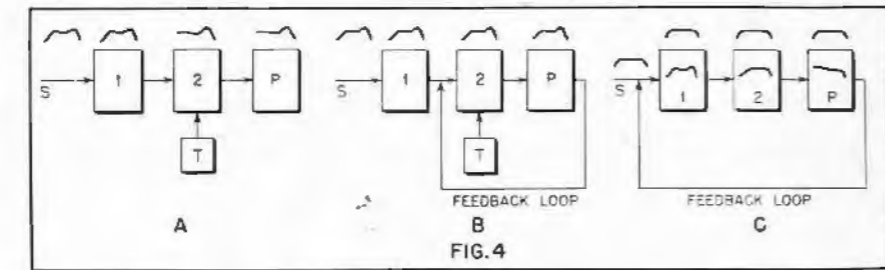


FIG. 4

Showing the effects of feedback on a tone control contained within its loop; and on amplifier stages.

which case the feedback is from B through C.

Likewise, the feedback can be from points A or B over two stages (through D), or over three stages (through E), although a three-stage loop may prove unstable, due to large phase shifts between the input and feedback voltages.

LIMITATIONS

If negative feedback reshaped the signal, it would be a cure-all; and this is an error often made. Actually, the reduction in circuit noise and distortion, and the improvement in frequency

response due to degeneration, can take place only within the feedback loop.

This is readily appreciated by reference to Fig. 3. Here we have a 3-stage amplifier with the feedback loop over the last two stages. At the input we have the signal voltage plus a noise factor N and a distortion factor D—both a part of the signal. The first amplifier stage introduces additional noise (N1) and distortion (D1), so that the sum at the output of this stage is the original signal including the factors N and D, together with N1 and D1. Hence, the input to the second stage is

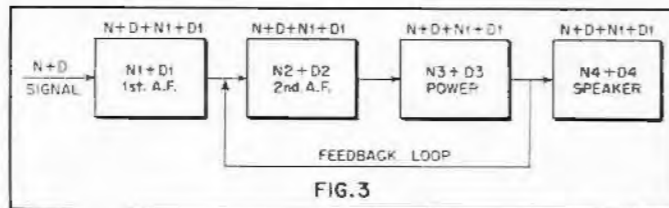


FIG. 3

Negative feedback cannot improve signal characteristics; only the stages contained in its loop.

response due to degeneration, can take place only within the feedback loop.

This is readily appreciated by reference to Fig. 3. Here we have a 3-stage amplifier with the feedback loop over the last two stages. At the input we have the signal voltage plus a noise factor N and a distortion factor D—both a part of the signal. The first amplifier stage introduces additional noise (N1) and distortion (D1), so that the sum at the output of this stage is the original signal including the factors N and D, together with N1 and D1. Hence, the input to the second stage is

ness of the feedback extends only over those stages included in the loop. If the loop were over all three stages in Fig. 3, then the output would be the signal together with N+D.

In the circuit shown, the speaker is not included in the feedback loop, but the effect of the feedback on the power stage tends to (theoretically) cancel the N4+D4 common to the speaker and the output transformer. The case would be nearer to correct if the feedback voltage was taken from the voice-coil circuit, providing phase shift in the transformer is discounted.

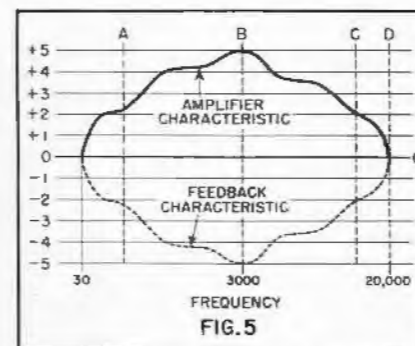
To carry the matter further; though the feedback cannot alter the characteristics of the input signal itself, it has a pronounced effect on the frequency characteristics of all amplifier stages included in the feedback loop. Here, again, some errors of judgment can be made.

For instance, we have at A in Fig. 4, a 3-stage amplifier with a tone-control T in the second stage. If we as-

sume the signal characteristics to be as shown above the diagram, and further assume that the characteristics of the 1st a-f stage are flat, then the amplified version of the signal in the first stage will be identical to the original signal characteristics. Assuming the remaining stages to be flat also, then we can boost the low end of the characteristic, if our control provides bass boost. Hence, the original signal characteristic is altered, as shown above 2 and P in the diagram.

In B of Fig. 4, feedback has been added over the last two stages, and the tone control T is included in the feedback loop. Again assuming an amplifier with flat characteristics, we see here that the signal at the output has the same characteristic as the input signal, even though our tone control may be in the "bass boost" position. The reason, of course, is that the bass boost applied to the 2nd stage becomes a part of the stage characteristic and also becomes a part of the feedback voltage, and this voltage tends to reduce the gain of 2 and P at these very frequencies. It is evident, then, that a feedback loop should not encompass a tone control or a tone-compensation circuit. Either the selective element should be in the feedback circuit itself or, in the case of B in Fig. 4, the tone control should be included in the circuit of the 1st a-f stage.

By the same reasoning, an amplifier having poor frequency characteristics can be made almost flat in its response by the addition of feedback, as illustrated at C in Fig. 4. Here we have indicated an input signal with excellent characteristics to begin with, and a 3-stage amplifier with each stage having different characteristics. The first stage is off at the low end; the 2nd stage is off at the high end, and the power stage is high at the low end. The effect of the feedback loop, which is over all



The feedback characteristic is a direct reflection of the amplifier characteristic, as indicated.

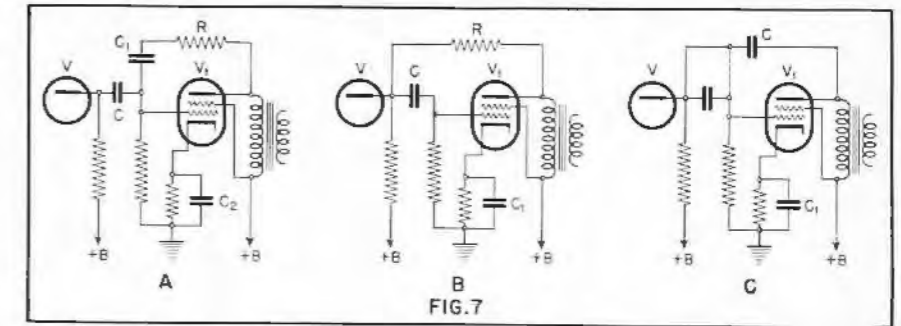


FIG. 7

Three forms of constant-voltage feedback over one stage.

three stages, is to flatten the response of each stage, so that the response at the output is practically identical with the characteristics of the signal at the input. This is indicated by the curves above each stage.

Why this is so is better illustrated in Fig. 5. Here we show the hypothetical overall response of an a-f amplifier, from 30 to 20,000 cycles. This is indicated as a positive function. Reflecting it, in the negative region, is the feedback characteristic, drawn in dotted line. It is seen to be an exact replica of the amplifier characteristic, except for its phase. Since the feedback voltage is a percentage of the output signal, it necessarily has the same characteristics.

Now, you will note in this drawing that the response of the amplifier has a dip in it at the low end, as indicated at point A. Therefore there will also be a dip in the feedback characteristic over the same range of frequencies. Hence, the degree of negative feedback within this range will be lower by an amount equivalent to the amplifier characteristic in region A, and there will be a lesser degree of cancellation in the gain of the amplifier, with the result that the feedback voltage tends to flatten out the dip at A.

By the same reasoning, the hump B in the amplifier characteristic produces a similar hump in the feedback characteristic. Therefore, the degree of negative feedback in this region is higher, and the amplifier gain is reduced, again with the tendency of the feedback to flatten out the amplifier characteristic.

The same applies to point C, where the gain will be boosted due to less feedback, and therefore less cancellation at the input. At point D, however, there is, theoretically, no change in characteristic because the gain of the amplifier is zero at 20,000 cycles, and there can be no feedback.

PHASE SHIFT

Practically, the situation may be quite different, due to phase shift in the amplifier within the feedback loop. There is a certain degree of phase shift in both resistance-coupled and transformer-coupled amplifiers, but the degree of shift is much less where resistance coupling is employed.

The maximum shift with either type of coupling takes place at the extreme low and high ends of the frequency range, with the shift at the high end causing the most difficulty. Let's see what happens.

For the sake of discussion, let us assume that the output transformer is in-

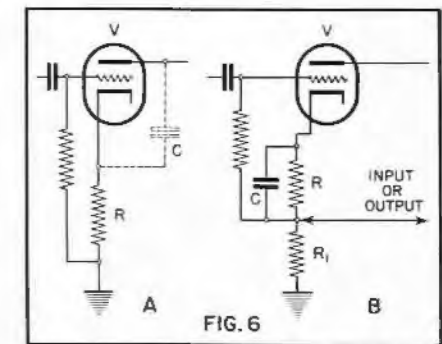


FIG. 6

Two forms of constant-current feedback.

cluded in the feedback loop, and assume an amplifier characteristic similar to the one shown in Fig. 5. At the mid-frequencies, there is little phase shift through the output transformer; therefore the feedback voltage will be 180 degrees out of phase with the input voltage, and the degenerative action will be 100 percent effective if we discount any other possible shifts in phase in the amplifier circuit. But at the low and high ends of the frequency range, there will be a shift in phase through the output transformer, with the result that the feedback voltage at these frequencies will not be exactly 180 degrees out of phase with the input voltage.

As a matter of fact, there will be a lead, with the result that cancellation will not be 100 percent effective. At the highest frequencies, the phase shift may be so large that the feedback voltage will be substantially or completely in phase with the input voltage, in which case the gain of the amplifier is substantially increased, due to regeneration. If the shift is large—and it often is—then the amplifier will be thrown into violent oscillation, and the output tubes may be seriously damaged.

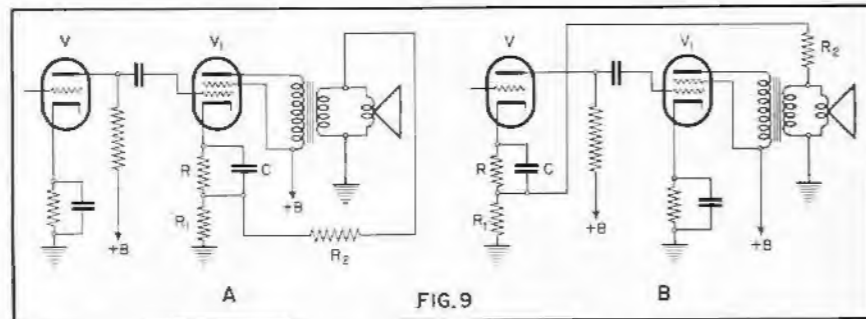
Now, let us apply this condition to the characteristic shown in Fig. 5. If there is considerable phase shift taking place in the frequency range between C and D, the regenerative action will tend to boost the amplifier characteristic in this range, either causing unwanted emphasis of the higher audio frequencies, or oscillation. The tendency may well lift point D above zero, in which case there would be feedback at 20,000 cycles, but regenerative in nature due to the wide phase shift present in the output transformer.

It is for this reason that feedback over even a single (power) stage is usually impractical if the input as well as the output is transformer coupled. And it is also for this reason that feedback from the voice coil over more than one stage is often impractical, even if the amplifier is resistance-coupled. Less trouble is encountered if the feedback is over but one stage; or, if more than one stage is to be included in the feedback loop, it is often

preferable to take the feedback voltage from the plate of the power tube rather than from the voice-coil circuit.

The troublesome effects of phase shift can be reduced somewhat by loading the primary of the output transformer with a resistor, which tends to dampen the effect of the series-resonant circuit presented by the primary winding. Moreover, if at least one (resistance-coupled) stage in the amplifier is designed to be substantially flat in response, then there will be sufficient degeneration produced at the low and

With constant-current feedback, particularly as applied to an output pentode or beam-power tube, the voltage developed across R is proportional to the plate current and not the voltage developed across the primary of the output transformer. Since the feedback factor varies with load impedance, this type of degeneration does not correct the frequency discrimination produced by a variation in load impedance. It has the effect of increasing the apparent plate resistance of the tube. Therefore, the frequency response in



Feedback from voice-coil to cathode, over one and two stages.

high ends to overcome the effects of phase shift. For instance, if the region C-D were to be boosted, the feedback voltage would also rise, and so long as the phase shift was not too large, there would be a sufficient degree of degeneration to overcome any tendency toward oscillation.

CONSTANT-CURRENT FEEDBACK

If the cathode bypass condenser is removed from the circuit of a triode or pentode voltage-amplifier or power-amplifier tube, the audio voltage appearing across the cathode resistor will be in series with the grid, but opposite in phase. This method is shown at A in Fig. 6. So long as there is no capacity shunting the resistor R, the arrangement is non-selective, and the degree of feedback will be substantially the same at all audio frequencies. If it is desirable to have the system selective—for treble boost, for instance—a small capacity can be placed in shunt with R. This condenser will bypass the higher frequencies and therefore decrease degeneration in this range.

Multiple feedback can also be employed, and the feedback factor increased, by connecting a condenser C from plate to cathode. With this arrangement, both constant-current and constant-voltage feedback is obtained, but the voltage feedback is selective unless the value of condenser C is quite high.

the output stage is not improved, though this type of feedback does reduce harmonic distortion and hum, and increase gain stability, making the latter independent of supply-voltage variations and tube gain.

The degree of degeneration present in the circuit at A in Fig. 6, is dependent upon the value of R. With a value for R equal to the usual plate load resistor, degeneration is 100 percent and the gain is unity. If the value of R is divided between the cathode and plate circuit, the tube may be used as a phase inverter, with the output voltages taken from plate and cathode.

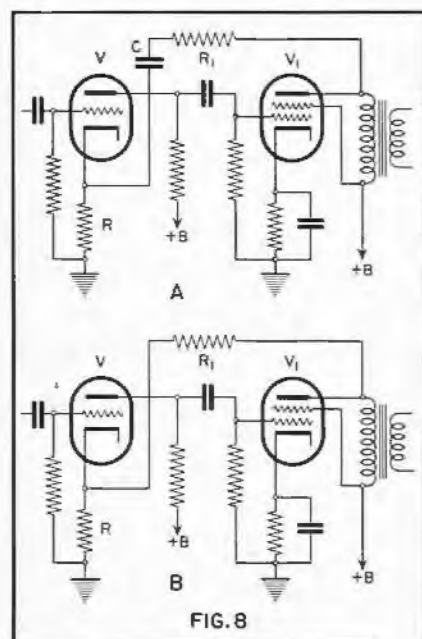
With the arrangement shown at B in Fig. 6, the cathode resistance is divided into R and R1, with R serving as the bias resistor and the grid returned to its low end. With this arrangement, the gain of the tube is retained, although it is divided between the plate and cathode circuits if the tube is used as an inverter.

The same arrangement may be used as a point of negative feedback input, with the feedback voltage developed across R1. In this case, however, the grid should be returned to ground.

CONSTANT-VOLTAGE FEEDBACK

In this system of degeneration, the feedback voltage is proportional to the output voltage, which may be the plate

(Continued on page 25)



Two forms of constant-voltage feedback over two stages.

CIRCUIT COURT

Crystal Pickup Response

SINCE THE TERMINAL impedance of a crystal pickup is capacitive, and the impedance is highest at the low frequencies, a high value of load resistor will provide greater response at low frequencies.

As a matter of fact, the characteristics of a crystal pick-up are such that it is usually desirable to attenuate the bass response for the sake of providing a flatter over-all response, and this is readily accomplished by using a low value of load resistance; the latter, in most cases, being the volume control.

Thus, the recent trend toward the use of high-resistance volume controls in receiver circuits is not always compatible with crystal pickup requirements. In the more expensive phono-radio combinations, complex pickup compensation or equalizer circuits are employed to offset this condition.

Where cost is a factor, the simple expedient employed in the *Silverstone* 7056 is of interest. As shown in Fig. 1, the crystal pickup is shunted by the 2-meg resistor R. When the Phono-Radio switch S is in the Phono position,

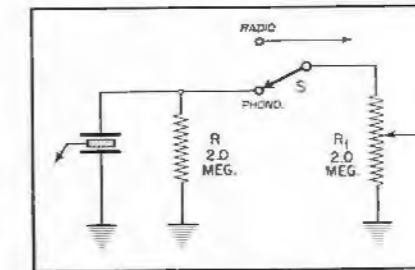


Fig. 1. Compensated pickup circuit.

tion, R also shunts the 2-meg volume control R1, thus halving the pickup load resistance and holding bass response within reasonable limits.

AC-DC Phono-Radio

THERE ARE A number of points of interest in a new *Emerson* series-heater-type phono-radio combination. Models GH-437 and GH-447 are for a-c operation only, since the phono motor is of the induction type. Model GH2-447 may be operated on either ac or dc, as the phono motor is of the universal type. The complete circuit, shown in Fig. 2, is for the GH models.

Since an electro-dynamic speaker is employed, power requirements are heavier, and two 35Z5 rectifiers are used in parallel connection. This, in turn, calls for two series-heater lines, as the total of all heaters is above the line voltage. Note that the main pilot lamp (a Mazda No. 47) shunts one-half the heater of each 35Z5; that is, the low-voltage, "pilot lamp" section, between pins 2 and 3.

To prevent radio break-thru during phono operation, the detector diode is divorced from the a-f voltage amplifier, by the use of a 12SF7 diode-pentode; the pentode section serving as the i-f amplifier.

The separate, a-f voltage amplifier is also a pentode (12SJ7)—not a common application. This can be attributed to two factors; the first being that the pickup voltage output is low because of heavy compensation and the presence of degeneration; and the second being that a pentode develops less harmonic distortion at low input levels than does a high-mu triode with its greater input requirements for the swinging to maximum output of a given power tube.

When in the Phono position the

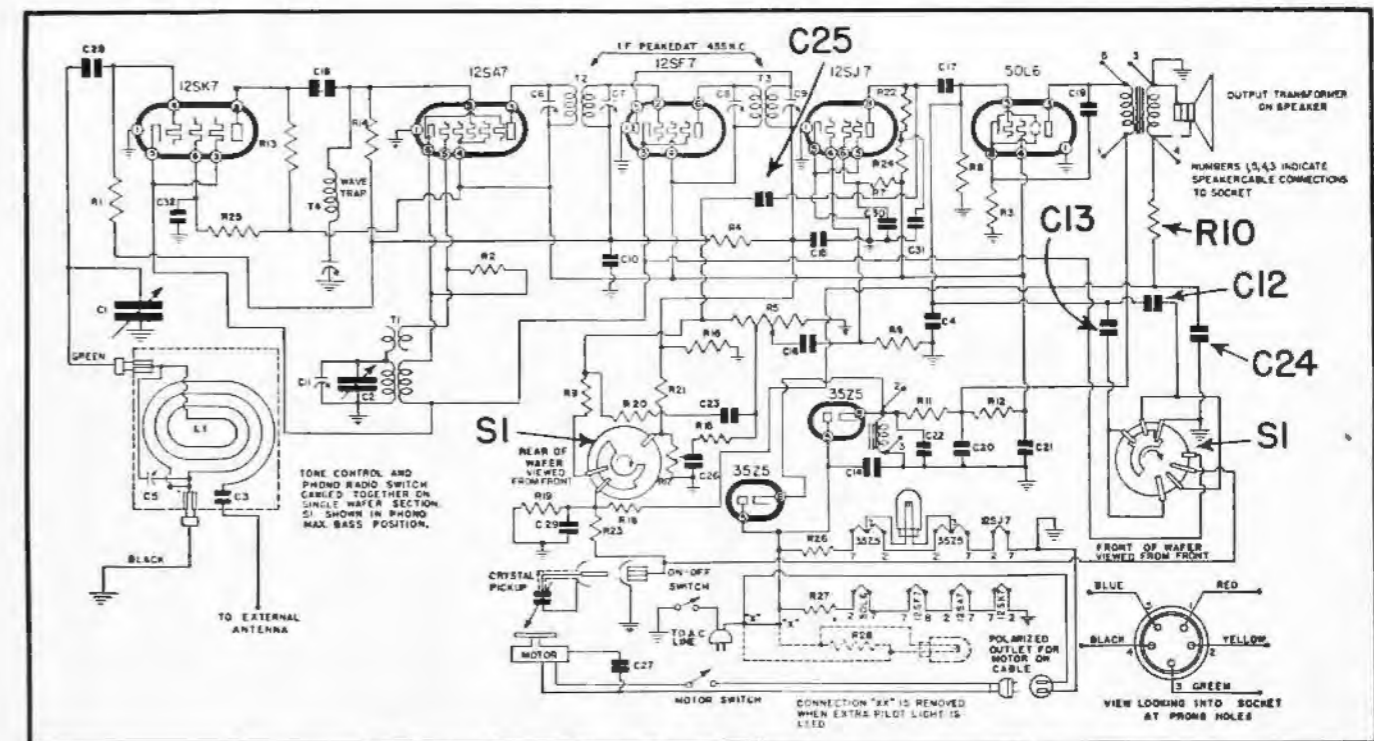


Fig. 2. Emerson's ac-dc phono-radio, GH-437 and GH-447.

audio circuit is degenerated at the lower frequencies by means of feedback from the speaker voice coil to the pickup circuit. The feedback voltage is developed across the voltage divider consisting of the 50M resistor R_{10} and the .05 condenser C_{24} . The purpose of this feedback is to eliminate phono-motor rumble.

When the left-hand section of switch S_1 is in the Radio position, the voice-coil feedback circuit is disconnected from the volume-control circuit.

Additional degeneration, in both Phono and Radio positions, is to be found in the circuit of the 12SK7. The feedback is from the plate of this tube to the high end of the volume control, via condenser C_{25} , which has the small capacity of .000026 mfd. The degeneration, therefore, is in the treble range only, and since this reversed-phase voltage is developed across the volume control, the degree of effective degeneration is dependent upon the position of the volume-control arm. Its maximum effectiveness will be at high volume levels; hence, it serves to reduce surface noise on records played with the volume control well up.

The right-hand section of switch S_1 is the tone control which progressively shunts condensers C_{12} (.0006) and C_{13} (.0015) across the power-tube grid bypass C_4 (.0004). Separate and opposite contacts are provided for the Phono and Radio positions, so that the same progression takes place in each case. An additional contact is provided for grounding the Phono pickup when the switch is in the Radio position.

Selective Regeneration

AS A MEANS OF imparting to the small receiver the tone realism of larger sets, Zenith has introduced into their late ac-dc jobs a system of selective audio regeneration, as shown in Fig. 3.

The 12SK7 voltage amplifier is degenerated by virtue of the unbypassed cathode resistor R . The 50L6 is also

degenerated, as its cathode resistor R_4 is unbypassed. Hence the gain of each of these tubes, individually, is reduced by the appearance of reversed-phase voltages across the cathode resistors.

However, the high side of the 50L6 cathode is coupled to the high side of the 12SK7 cathode, through a low-pass filter made up of resistors R_1, R_2, R_3 and condensers C, C_1 . Therefore only low frequencies are fed back.

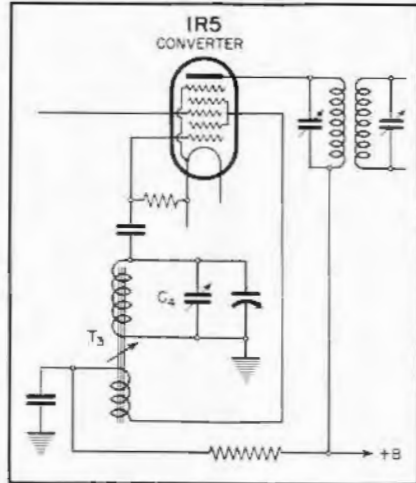


Fig. 4. Oscillator coil has adjustable core.

The phase relationship between cathodes is such that the feedback voltage through the low-pass filter is opposite in phase to the degenerative voltage developed across the 12SK7 cathode resistor R . Therefore the degree of degeneration in the 12SK7 circuit is reduced and the gain of the tube increased. In effect, then, the action is regenerative.

The circuit introduces a certain amount of low-frequency distortion that is pleasing to the ear, and provides an apparent fundamental bass response that is not actually reproduced.

Oscillator Core Adjustment

THE OSCILLATOR COIL in the Emerson Model GC-448 three-way receiver has

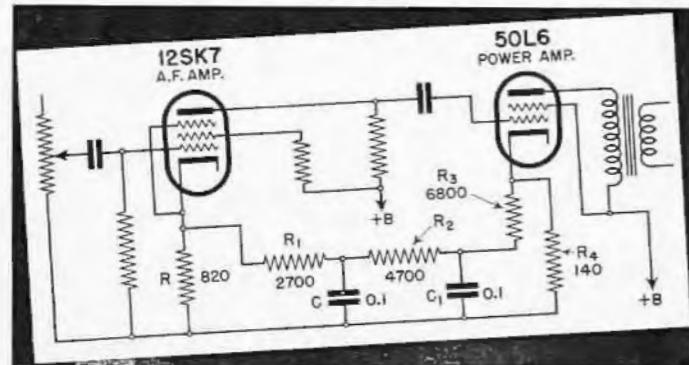


Fig. 3. Low-pass regenerative audio circuit of Zenith ac-dc set.

an adjustable iron core, as shown in Fig. 4.

Alignment at 1600 kc is accomplished by adjusting the antenna trimmer, and the oscillator trimmer C_4 . At 600 kc, the padding adjustment is made by means of the movable iron core in the oscillator coil T_3 .

Antenna Wave Trap

THE I-F WAVE TRAP in the Silver-tone Model 7039 is of the series-resonant type and is shunted across the antenna primary L_1 , as shown in Fig. 5. When tuned to the same frequency as the i-f peak of the receiver, any interfering signal at or near this frequency is bypassed to ground; for, at this peak, the capacitive reactance of C_{49} cancels the inductive reactance of L_4 .

This receiver also covers two short-wave bands. When using an external antenna in the short-wave bands, the high-frequency signals take the path through the low-capacity shunt condenser C_3 and the signal voltage is developed across the primary of the dual short-wave antenna transformer L_3 , and appears again across one or the other of the two secondary windings, depending upon which of the two is resonated to the signal.

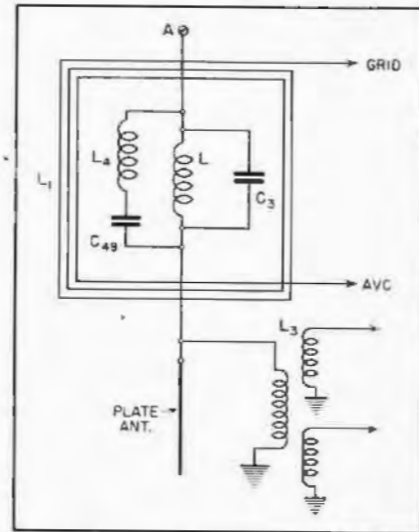


Fig. 5. Antenna wave trap in Silver-tone set.

A short-wave plate antenna, built into the cabinet, is also provided, which may be used instead of an external antenna. This antenna is also connected to the high side of the primary of L_3 , so that no switching is required.

Loop Transformer

A COMBINATION LOOP loading coil and antenna transformer is employed in (Continued on page 30)

Pass the Reefers, Please!

THERE is not the slightest doubt that the radio industry and the magazines which serve it have been "all-out" for business-as-usual! Now the rude awakening is taking place, and the "snow is all around"!

There can be no excuse for the glum looks, the air of injured innocence, the "what will become of us" expression which greets one from nearly every nook and cranny of the trade. But, if one is honest, there is not the least bit of hesitancy in saying that the radio industry *must* have known that it would happen.

However, the trade was too busy "puffing its reefers," giving itself injections of false confidence, and generally indulging in too much wishful thinking.

Well, the water is over the dam now, and curtailment is on us. And again we predict that by the end of 1942 it will be close to 100%.

It may be that the Government may say that it will wish to have at least one working radio in every or nearly every home. But it is a cinch that that will be the very most it will say.

That means that in the homes where there are two or more radio sets, even if one is only a midget, there will be no repairs permitted until both are out of whack. And then repairs may only be permitted on the set cheapest—from the standpoint of raw materials—to repair.

And that does not mean that Uncle Sam will permit replacement of a part merely because reception is "scratchy" or not "high-fidelity."

Boiled down to brass tacks, this may compel servicemen to report every repair, certifying that the set was *totally* inoperative without the replacement or repair, whichever was required.

However, the serviceman will be able to collect for his work at a higher rate than ever before. Why? Because he will have to know his job well and completely. He will have to know what is wrong with a set to get the necessary replacement. He will have to be sure of himself before he signs any Government affidavit. So, he will have to spend more time on each job, and hence will start to charge on an hourly basis.

Working by the hour will bring a higher price than the "hit-or-miss" methods so prevalent today. Also the jerks, the clucks, the dopes, and the gyps will be unable to hold to their respective places with the clean-cut, honest and efficient servicemen. Since the gyp will be cut from his supply, not being able to diagnose set troubles, he will be unable to compete with the fully equipped shop.

What then should the serviceman do to prepare for the hard times ahead?

In the first place he can begin a systematic drive to sell "rebuilt" radio sets. The

serviceman takes many a set in trade. These are gathering the dust of time on the junk heap in the cellar or some forgotten corner of the store. Let him get those old midgets out and strip them, testing every part as he unsolders and disassembles. There is no curtailment being considered on these parts, and the serviceman can do many a nice job in repair and improvement, charging fair prices, on radio receivers which might not come under the proposed restrictions.

What parts can safely be used for "rebuilding"? Almost any recognized part the rating of which has not been exceeded. The determination of this salient fact rests with the serviceman. He should know what was wrong with the old "cluck" radio in the first place, and hence should be familiar with whether or not the particular part was overloaded or not. If it remains in good condition, even if something else in the midget or "cluck" broke down, then it can be used again.

So the first step in meeting the coming conditions will be to build up an inventory of parts resurrected from turned-in radio sets. When repairing a receiver it will be wise to advise the customer that a "reclaimed" part is being used, where that is necessary. But explain that this is a patriotic duty, and a conservation of those parts so badly needed by Uncle Sam's Fighting Men.

The next thing that the serviceman can do is to tie up with reputable distributors or factories. These firms have a real problem to meet, and if the serviceman is tied up with them, he will reap the profits of whatever arrangements the distributor or factory makes to stay in business and to keep the parts industry filling orders for non-defense. It will be found that the "fly-by-night" distributor or factory will shortly be weeded out, and will be unable to continue in business. The reputable concern will be in there fighting for its customers, the servicemen.

Finally, the serviceman can believe more of what he reads in the daily newspapers, what he hears from his pal the auto mechanic, and what his local bank president tells him, and less of the "reefer smoke" being passed out.

This is a people's war. It will be won by the people. And servicemen are part and parcel of the people!

If we lose the war—and we can lose it—the radio service business won't be worth a tinker's damn anyway!

But if we are to win—and we will win it—then everyone must pitch in and help. This means that each and every service-

man must begin to think in terms of "I," and not "him." This war will be won by a mess of "I's" all pushing together for the good of all; not by a few, and the rest seeing what they can get for themselves!

Odds 'n' Ends

That law suit in New York started by an irate customer who was refused the return of his radio set until he paid a dollar "inspection fee" to a serviceman should be won by the serviceman. If it is, we predict that servicemen will shortly be licensed by the State of New York on the basis that they are "giving an opinion" and hence are a "profession." While this may work a hardship on some, it will be a good thing for the trade . . .

The hams seem to be stymied for the duration. Since radio silence is something which must be preserved in any bombed area while the bombing is in progress, how could they do any good with their radio equipment even if low powered? We'd suggest that hams be allowed to operate 200 miles from any coast; on 112 mc as the lowest frequency and with 5 watts input to the final stage as the maximum power. But we don't think the Defense Communications Board will approve . . .

One good thing about the ham shutdown is the fact that no ground-work is being laid for the Powers That Be to say later, after the war is over, "Well, you can do all the experimenting on 112 mc and up. You did OK during the war; why should you get your old low frequencies back?" As we see it, the hams are better off shut down completely. Then they have a fighting chance to get their old frequencies back after it is all over . . .

One concern was all ready to bring out some new 112-mc gear when the FCC Order 87A came out and canned all ham activity . . .

Servicemen will do themselves a big favor if they will ask all who buy parts from them for what purpose they are purchased. Many a condenser and resistor is being bought for National Defense without the serviceman knowing it. The serviceman can use the record of sales to National Defense to replace his dwindling stocks. This may not seem important now, but just wait till parts are hard to get . . .

Hang on to your test equipment; don't be tempted to sell it for any sum. There just "ain't" none to be had for civilian work . . .

Get into phonograph record sales if you can; these will boom more and more as the war progresses . . .

And above all, don't forget to buy that bond once a week. Each time you do, you kick hell outa the firm of Hitler & Co.

Remember Pearl Harbor—Buy U. S. Defense Bonds

WILCOX-GAY "INSTA-MATIC" RECORD CHANGER

THE new Wilcox-Gay phono-radio combinations and "Recordios," Models A-105, A-111, A-112, A-113, A-113B, A-114, A-115 and A-115B, employ the unusual "Insta-Matic" Record Changer. This changer is of special interest since its operation does not depend upon an assembly of gears and levers and no power is taken from the motor in actuating the automatic changing mechanism.

Since the power to operate the changer is derived from a separate source other than the turntable rotating mechanism, it has been possible to design the unit to operate rapidly without putting demand for power on one source. This feature eliminates the necessity for a series of reduction gears which are both costly and complicated, and has permitted unique design with respect to changing from 10" to 12" records, using but one cam and set of adjustments for both record sizes.

Description of Trip Mechanism

Referring to Fig. 1, the eccentric groove on the record causes the pickup arm to oscillate in a forward and backward motion. The trip switch *J* contact is then closed by friction of the leather contact on the knurled rocker plate *A*. Closing of the trip switch energizes solenoid *B* and plunger is drawn into solenoid *B* through magnetic action of the coil. This action closes the lock-in switch *C* which still maintains closed circuit for the solenoid *B* even though trip switch *J* is now open. The main cam assembly *D* is then drawn forward by draw spring *E* against the snubbing action of the dash pot *F*. At the time main cam rubber bumper *G* strikes the solenoid plunger, the lock-in switch *C* is opened by arm *X* releasing current from solenoid *B*. During this inward action, pickup arm is raised by push rod and returned to replay position by rounded section of cam on pin *Y* on rocker plate. At the same time, cam action rotates record holding knob and record

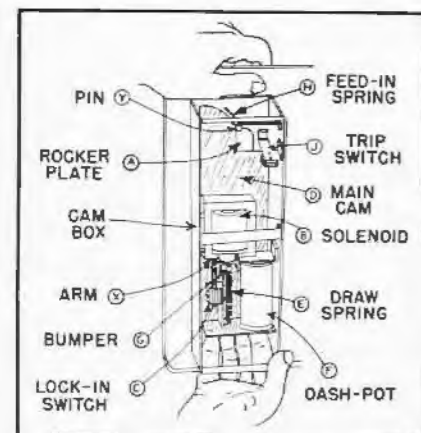


Fig. 1. Details of solenoid operating mechanism.

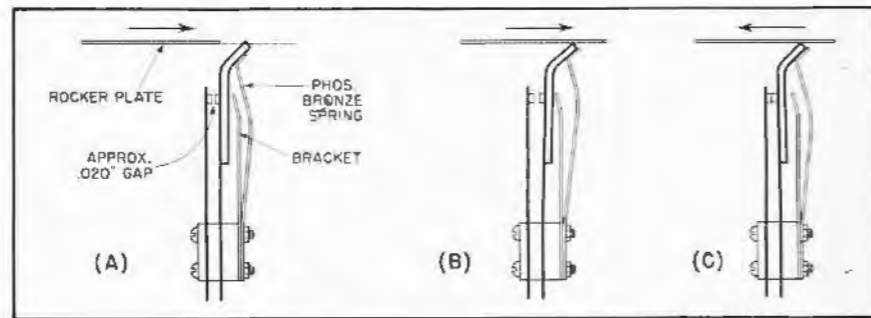


Fig. 2. How trip switch is operated by rocker plate movement.

selector arm finger releases bottom record to turntable. Reset pin is engaged in rocker arm return slot. Internal spring against dash pot action forces main cam *D* outward and reset pin follows rocker arm slot carrying the pickup arm to edge of record. The tone arm is automatically positioned on the record just inside the record periphery and the feed-in spring *H* acting upon the rocker plate attached to the tone arm pivot post, urges the phonograph needle, gently but positively, into the first record groove. Reset pin drops away from rocker plate due to hold down spring.

Removing Changer From Cabinet

Before removing record changer unit from cabinet, remove cutting stylus and position the recording arm near the center of the turntable to prevent damage to the follower arm in lifting the unit from the cabinet. (The arm should be returned to this position before replacing unit in cabinet.)

Remove playback needle if unit is type 11-D or 11-E. If unit is type 11-F place metal guard on pickup cartridge to protect sapphire needle against injury.

Remove mounting screws (one at each corner of unit base plate) and remove all plug-in connections between record changer unit and amplifier chassis.

Remove record changer unit from cabinet. Do not take hold of record support posts. Instead, grasp the base plate of the unit, at opposite sides.

Place unit on the service bench, tilted to a position that provides access to the under side of the unit. Do not place unit in upside-down position, as the record spindle may be sprung or bent.

Failure To Trip At End of Record

All commercial records manufactured in recent years have the eccentric (oscillating) type of trip groove. Make sure first that the record that does not trip the mechanism has the eccentric groove. Failure to trip is caused by lack of proper contact or friction of the leather finger on the trip switch with the knurled surface on the rocker plate. Too great an opening of the contact points will not allow the switch to close during an oscillating

action. Check and set points for .020" gap when trip switch is at rest (leather finger not in contact with rocker plate). The switch can be removed by taking out the two lockwasher screws in the slotted section immediately below the clamp holding the one red and two black wires. After the contact point clearance has been set and checked, the switch should be replaced and set to the point where the leather finger just makes contact with the rocker plate. A forward and back motion of the rocker plate should move the phosphor bronze support spring slightly. The phosphor bronze support spring eliminates the fatiguing of the leather finger to a semi-circular position and gives constant upward pressure on the leather finger. The trip switch should not be set too high whereby the leather and phosphor bronze spring both engage the rocker plate.

Positioning of Trip Switch

When the switch is correctly positioned, the switch contacts will remain normally open at all times excepting after the playback arm reaches a position near the center of the turntable. A slight reversal in the lateral movement of the arm will cause the contacts to close. See Fig. 2.

The contact spacing should be approximately .020" and the leather piece should just touch the stop bracket when the switch is "idle" or "at rest."

Position the switch so that the leather finger just touches the rocker plate surface, and note the point of contact between the leather and the phosphor bronze spring.

Raise the switch vertically (toward the rocker plate) until the end of the phosphor bronze spring nearly touches the rocker plate.

The correct switch position will be found to be approximately half way between these two extreme positions.

Mechanism Trips But Pickup Arm Does Not Return To Record

This is usually caused by failure of the lock-in switch to open when the cam assembly is at the end of its forward motion. The lock-in switch should have a clearance of approximately .025" and can be adjusted by bending forward or back-

ward arm *X* (Fig. 1). Bending the arm so that more pressure is exerted on the fiber stub of the long contact arm increases the gap and bending the arm so that less pressure is exerted decreases the gap contact. Failure of the arm to return to the record is sometimes caused by binding action of the reset pin and rocker plate or failure of the reset pin to engage the rocker plate. This will be covered in another paragraph entitled "Adjustment of Reset Plate Hold-down Spring."

Illustrations (A) (B) (C) (D) in Fig. 3 show four phases of the operation of the resetting device located between the main cam and inside surface of the cam box. The resetting action can be observed by viewing the cam box assembly from the end nearest the arm pivot post. At the beginning of the change cycle the cam moves in a direction shown by the arrow in illustration (A). The reset pin, moving with the cam, should travel beneath the rocker plate, illustration (B). Near the end of the initial cam stroke, the reset pin should snap into the enlarged opening in the rocker plate, illustration (C). With the return stroke of the cam, the reset pin should travel in the narrow slot of the rocker plate, illustration (D) and at the very end of the stroke drop out of the slot and resume position as shown in illustration (A).

The function of the hold down spring is to hold the reset plate down while bearing on one side of the fulcrum point, and to hold it up when bearing on the opposite side of the fulcrum point, illustration (A) and (C).

It will now be obvious that insufficient pressure of the hold down spring will cause (1) the reset pin to approach the rocker plate in too high a position, causing a possibility of jamming; (2) also at the end of the initial cam stroke, illustration (C), the reset pin will not protrude through the rocker plate far enough to allow proper retraction of the cam, illustration (D).

Pressure of the hold down spring in

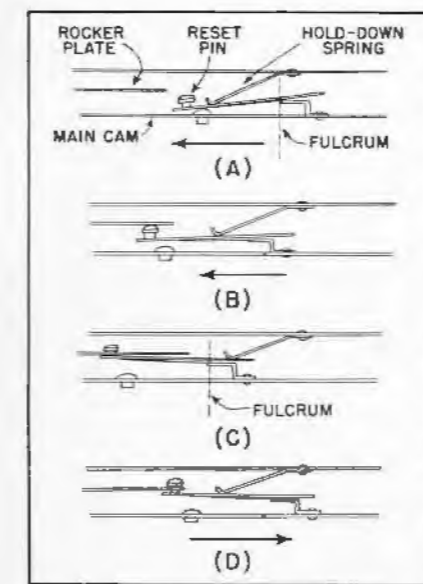


Fig. 3. Four phases in the operation of the resetting device.

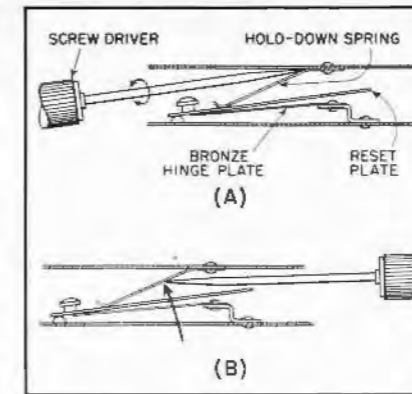


Fig. 4. How to increase or decrease hold-down spring tension.

excess of that required to produce correct operation as described above, will not result in any better operation of the resetting device, but will only introduce a source of undesired friction.

Greater hold down spring pressure may be obtained by use of a long slender screwdriver as shown in Fig. 4-A. With the screwdriver bit held into the "V" at the junction of the hold down spring and the plate to which it is attached, rotate the screwdriver in alternately opposite directions as shown by the arrows, thus increasing the downward pressure of the spring.

Less hold down spring pressure may be obtained by use of the screwdriver as shown in Fig. 4-B.

Adjustment of Pickup Arm To Set Properly On Record

The pickup arm when returning to the record should drop at a point half-way between the first playing groove and the edge of the record. The kick-in spring moves the pickup arm gently to the first playing groove. If the needle drops into the first playing groove, then loosen the screw in front of the pickup arm bracket and immediately under the pickup arm channel. Move the pickup arm bracket slightly outward and tighten the screw. If the arm drops at the edge of the record, loosen the screw and move the pickup arm bracket slightly inward and retighten screw.

Pickup Feed-in Adjustment

The feed-in adjustment can best be made by use of a record having no spiral feed-in groove. With record on turntable and changer set for size record used, the changer is caused to cycle by either depressing the reject button or allowing the arm to trip. When operating correctly, the arm should set down on the record and move gently into the first groove. If the feed-in is too violent, resulting in groove jumping, bend the feed-in spring toward the dotted line *A*, as shown in Fig. 5. If the feed-in action is insufficient, resulting in the arm not reaching the first groove consistently, bend the spring toward dotted line *B*.

Setting Mechanism To Release Records Properly

Remove screw and finishing washer in

top of record selector shaft. Replace so that the flat sections of the shaft engage the flat sections of the record selector finger. Install and tighten screw. Place the mechanism in the 10" operating position by rotating the Uni-point control knob so that it points directly to the turntable shaft so that the edges rest on the retaining arms. The selector finger and the record should have approximately 1/16" clearance. If this clearance is not correct, loosen the two screws on the tie rod assembly (formed rod underneath turntable connecting cam box and Uni-point control post) and move selector post inward or outward so that the clearance of selector finger and record is correct. Then tighten screws in tie rod securely. Adjustment for 10" or 12" dropping of records is exactly the same and if adjustment is made for 10" record, the 12" adjustment is automatically taken care of and vice versa.

It is very important that the Uni-point control post be positioned in the proper manner. Sometimes this post becomes bent inward slightly which "hangs on" to a 12" record too long and causes the record to flutter down instead of dropping down with a positive action. Breakage or cracking of records sometimes results.

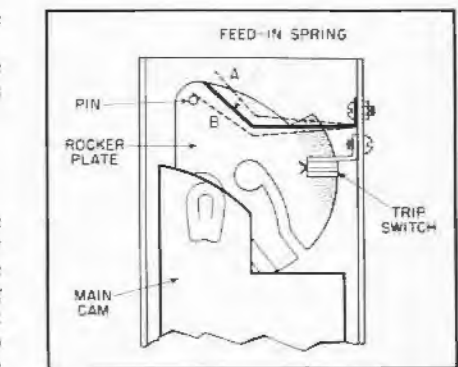


Fig. 5. Showing how to adjust the pickup feed-in spring.

The Uni-point control post is stationary but can be bent inward or outward by hand. The control post should be at a point where a 12" record is very near the edge of the record holding bracket.

Pickup Arm Remains Stationary At About The Center of Home Recorded Discs

Make sure first that the home recorded disc has a good clean groove and the proper depth of cut. Pivot posts of the pickup arm should be set to the point where very little play is evidenced but not to the binding point. The lower part of the pickup arm channel should just come flush with or a little bit lower than the top of the turntable. If the arm is above the turntable, the flat bracket immediately above the push rod in the center of the pickup arm shaft should be bent upward slightly. Positioning of the trip switch to the point where the leather finger engages the rocker arm too high sometimes causes friction which will hold the pickup arm in place when home recorded records

(Continued on page 23)

Shop Notes

CLAROSTAT POWER CORDS Voltage-Dropping Tolerances

That servicemen and jobbers are overlooking standard tolerances covering ohmages of voltage-dropping power cords and are thereby slowing up shipments of such items, is revealed by Vic Mucher of Clarostat Mfg. Co., Inc., Brooklyn, N. Y.

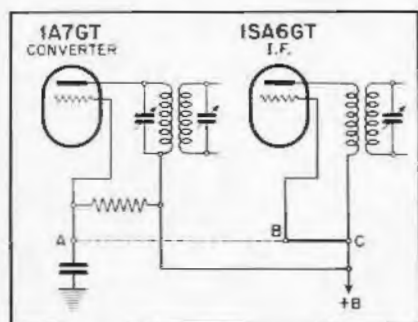
States Sales Manager Mucher: "We are receiving orders calling for off-standard power cords, in many instances not more than 10% or so off standard ohmages. Inasmuch as such cords are labeled with their ohmages, we have hesitated to ship standard items even though they may come within 10% of the requested ohmages.

"It is highly important in these days of shortages and delays, that servicemen and their jobbers note the standard 10% plus or minus tolerance on power cords. In other words, even at the labeled values the ohmages may vary that much, yet absolutely satisfactory results will be obtained. To expedite their orders, therefore, servicemen and their jobbers will do well to stick by standard values as listed, and to select those cords coming reasonably close to the exact ohmages. This will help everyone concerned."

EMERSON FV-426, FV-433 Circuit Change

In the earlier FV chassis, the screens of the 1A7GT and 1SA6GT are tied together, as indicated by the dotted line in the accompanying diagram; that is, points A and B are connected and points B and C are disconnected.

In later chassis, A and B are disconnected and B and C are connected, with



the result that the screen voltage of the 1SA6GT is higher than the screen voltage of the 1A7GT, which is applied through a resistor.

GENERAL ELECTRIC L915W Speaker Substitution

Electro-dynamic speaker RS1092 (marked K33J371) was substituted for

a portion of the production in place of speaker RS1085 (marked 33J365). Since this substitute speaker has a field-coil resistance of 400 ohms instead of 500 ohms for the RS1085, a 100-ohm resistor, RQ-621, is added in series with the speaker field coil to maintain proper socket voltages whenever the substitute speaker is used. When replacing the cone for either speaker, use No. RC9045.

RCA ALTERNATE SPEAKERS Circuit Connections

Both EM and PM types of speakers are used in many of the recent RCA receiver models.

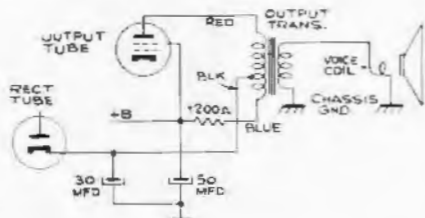


Fig. 1.

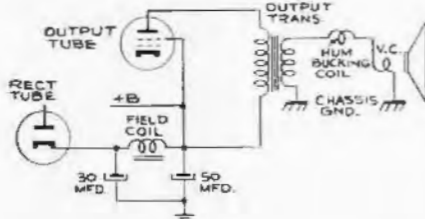


Fig. 2.

Where the speaker is of the permanent-magnet type, the circuit shown in Fig. 1 is used. Where the speaker is of the electro-magnet type, the circuit shown in Fig. 2 is used.

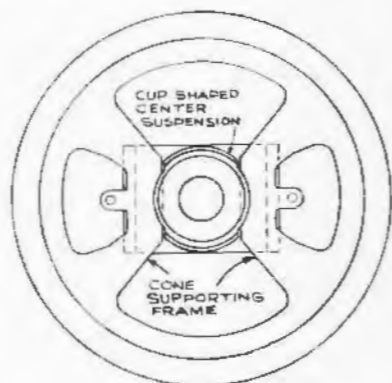
RCA REPLACEMENT CONES Installation Instructions

Certain types of replacement loud-speaker cones are now being supplied with a cup-shaped center suspension fastened to the cone instead of the flat suspension and cup-shaped metal plate which were originally used.

These replacement cones can be used without modification on many types of speakers. However, on certain types, the speaker frame extends in so close to the center pole that it interferes with the cup-shaped center suspension; in such cases it is necessary to cut away two edge sections of the suspension, as follows:

Put cone in position in housing and mark places on suspension cup where edge of cup must be cut away.

Lift cone out of housing and cut away edge of cup where marked.



Cement cone into position in the usual way, being careful that the entire edge of the cup is securely cemented down, including the edge at the places that were cut away.

Leave the centering gauge in position until cement is thoroughly dry.

The accompanying sketch shows how the flat edge of the cup-shaped center suspension is cut away in two places to provide clearance for the cone supporting frame.

RCA RP-160

Spring for Use With Zinc Mount

On RP-160 with aluminum pickup arm and aluminum-cased crystal, the spring that governs pickup pressure is No. 30585; with zinc pickup arm and aluminum-cased crystal, the spring is No. 39673. When installing a zinc-cased crystal in a zinc arm, cut 1½ turns off the spring, or install a No. 39754 spring.

RCA V-100

Phono Compensation Change

Capacitor C17 across the pickup is changed from .015 to .01 mfd., Stock No. 4937.

SILVERTONE MODELS 7004, 5, 6, 7, 8, 9

Production Changes

In these receiver models with the addition of suffix number "-1" to the factory identification number, the following changes have been made.

The speaker is changed from a permanent-magnet type to an electro-magnet type.

The bleeder resistor in the plate circuit of the power tube, originally 8000 ohms and identified as R4, is changed to 12,000 ohms and re-identified as R12 in supplementary diagram.

(Continued on page 35)

SERVICEMAN'S DIARY

(Continued from page 10)

A charming young woman stepped forward and went over to Jerry.

"I hope you won't mind if I bandage you," she said sweetly.

"Oh no," he grinned. "You go right ahead and do anything you want to."

"Very well," she said, "I think I'll start bandaging the hip."

Jerry sat up in alarm. "After all," he muttered, "this is a public place. Couldn't you pick out some other portion of my anatomy?"

"Nonsense!" she answered. "You don't have any choice in deciding where you get wounded, do you? How are they going to learn how to bandage a hip unless I show them?"

"But," he was getting desperate, "I've got a hole in my shorts."

"No matter," she replied decisively. "It won't show through the bandage."

I had an inspiration. After all, Jerry was my partner. I reached over with my shoe and kicked down the off-on toggle switch, shutting off the p.a. system.

"Something seems to have gone wrong with the p.a. system," I told the girl. "Perhaps you can persuade one of the girls in the audience to take my partner's place. I'll need his help to get the system working again."

"You can have him," she said disgustedly. "He won't even let me wrap a bandage around his pants leg!"

"But you said my hip!" Jerry protested.

"Yes, of course," she answered. "But you didn't think—" she stared at him—"my word!"

INTERMITTENTS

(Continued from page 8)

to duplicate the operating conditions by steaming the room, or a compartment in which the set is placed, until some approach to these conditions is obtained.

Another effect of high humidity is to cause leakage in high-resistance circuits, such as avc, when the insulation resistance of the wire used may drop to low levels. This has often caused trouble in commercial apparatus. The wire, unlike the resistors, does not entirely regain its high insulating properties once moisture has penetrated, and must be replaced.

The effect of temperature and humidity changes on a resistance in an operating circuit may be observed by using an electronic voltmeter, as shown in Fig. 5. The voltage across the resistor is measured when the re-

ceiver is operating under ambient temperature and humidity conditions. Then, when subjected to humidity or temperature change, any change in resistance is indicated by a change in the voltage drop across the resistor. This cannot be applied when the tube is a pentode, because the tube resistance does not remain constant and tends to counteract any change in resistance of the plate load. Under such conditions, an ohmmeter or bridge may be employed, with the receiver, of course, inoperative.

ENEMY ALIEN SETS

(Continued from page 5)

basic methods employed for reception on more than one band. Your own good judgment will tell you how best to treat the others.

When it comes to multi-band receivers employing separate sets of coils for each band, the procedure, of course, is simple: remove all coils and trimmers except those covering the broadcast band, and take the band

(Continued on page 23)

NEW UTAH AC FIELD EXCITED SPEAKERS

SUBSTITUTE FOR PERMANENT MAGNET SPEAKER NOW AVAILABLE

A serious problem for the radio and sound equipment industry has again been solved by Utah engineering. Several months ago critical shortages occurred in the raw materials needed for the fabrication of permanent magnet speakers. The condition made it necessary to develop a line of speakers to replace those in which materials vital to national defense were used.

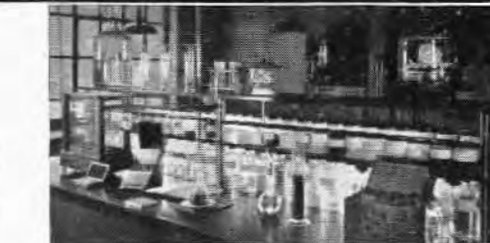
Utah solved the problem! A complete line of AC Field Excited Speakers is now available—humless in operation and equivalent in performance to the famous Utah Permo-Dynamic line. A speaker has been designed for every public address and sound requirement. They require only the addition of the AC Field Supply shown at right to substitute for any Permo-Dynamic application. The new Utah speakers have standard Utah weather-resistant construction.

If Your Jobber Can't Supply You
Write Us Direct



USE STANDARD UTAH OUTPUT TRANSFORMERS

Utah Transformers assure reliability and satisfactory performance under all operating conditions. They avoid failure due to



In the laboratories of the Utah Radio Products Company, engineers are constantly engaged in new developments and in intensive research—working day and night to meet the demands of the National Defense Program and its necessary restrictions of some materials. All the experience, knowledge and skill of the Utah production staff are required to comply with the ever-increasing demand for Utah Speakers, Transformers, Vibrators, and Utah-Carter Parts.

NEW UTAH AC FIELD EXCITATION SUPPLY PROVIDES HUMLESS OPERATION

This AC Field Supply is properly designed for humless operation of any of the speakers listed below. At 117 volts, 60 cycle input, the maximum output is 12 watts at 105 mills. The supply may be mounted directly in the speaker baffle. A separate supply should be used for each speaker. The price does not include rectifier tube, but includes ballast and plug. No cord is furnished. 1-50 Y6 GT rectifier tube is required. New Utah AC Field Excitation Supply, U.S.A. list price \$4.75. Special Bracket P-9030 for Mounting Field Supply on 12" Speaker, U.S.A. list price 25c.

NEW UTAH AC FIELD EXCITED SPEAKERS						
STOCK NO.	CONE DIAM.	VC IMP.	VC DIAM.	NORMAL WATT.	PEAK WATT.	U.S.A. LIST PRICE
8AC30	8"	6-8 Ohm	1 1/4"	12	18	\$9.50
10AC12	10"	6-8 Ohm	1"	9	14	6.60
12AC12	12"	6-8 Ohm	1"	10	15	7.75
12AC20	12"	6-8 Ohm	1"	13	20	10.00
12AC40	12"	6-8 Ohm	1 1/4"	16	24	12.50
12AC75	12"	6-8 Ohm	1 1/2"	21	32	19.25



SPEAKERS

VIBRATORS • TRANSFORMERS • UTAH-CARTER PARTS



"Co-operation is not sentiment, it is an economic necessity!"—Steinmetz

The many friends of Don Stover will learn with regret of his resignation as Executive Secretary of the RSA, in order to take a position with the Service and Installation Division of the RCA Manufacturing Co., in Camden, N. J.

Don's work for the past seven months as Executive Secretary is unsurpassed and cannot be praised too highly.

All RSA wishes him well and the very best of success in his new job.

The Executive Committee appointed Alfred A. Kilian, past Secretary of the Chicago Chapter of RSA, to succeed him, and hopes that membership and Chapters will show continued generous co-operation with the new management.

★

DUES ARE UP!

The National Dues were raised to \$2.00 per year, by action of the Board of Directors, effective February 15, 1942.

This move became imperative to cover increased costs and operating expenses. The increase should make it possible to continue and even extend the services and benefits available to RSA members.

★

THINK NATIONALLY!

Radio is national in scope. If we as servicemen want national representation for the Service Industry we must have a National Organization, and the stronger that organization, the more effective our voice will be.

Our local problems can, and are well taken care of through local organizations. Fortunately, the setup of the RSA provides complete freedom of action for each and every one of its Chapters for the handling of just such matters. However, even here, the advantage lies with the local group which has affiliation with a National Organization such as RSA, and can therefore exert its influence much more effectively than a local group which hasn't this national prestige.

It is with this thought in mind that we ask each and everyone in the Service Industry to help build this great National Organization into the effective unit it should be.

First thing to do is join RSA yourself. Second: Go out and get other servicemen to join. Third: Form a Chapter in your locality if it has ten or more servicemen. We will help you all we can to get started and to put it across.

RSA can show a healthy growth this year,—it's in the cards. But it won't happen if you yourself won't do your part. Arouse yourself! Exert yourself! Act! Nothing great has ever been accomplished without enthusiasm!

DON'T MISS OUT—

If you haven't sent for your copies of the RCA Victor Service Notes we told you about previously—over 225 pages of detailed service data on 1938, 1939, and 1940 RCA Victor receivers—better slip the 35c to cover mailing and handling costs in an envelope and mail it pronto to RSA National Headquarters, 414 Dickens Avenue, Chicago, Illinois.

The supply of notes on some models is limited, so it's first come, first served.

★

WELCOME, FAIRMONT!

It's indeed a pleasure to announce that the servicemen of Fairmont, West Virginia, have completed affiliation with the RSA and will be known as the Monongahela Chapter of RSA. The official Charter is now in preparation and will be presented shortly.

Officers are: President, Russell G. Dotson; V-President, John C. Gilbert; Secretary-Treasurer, Carl L. Roach.

Gentlemen, RSA is proud of you and invites your active participation in all its affairs.

★

CHAPTER NEWS

Monongahela Chapter:

The membership of our new Chapter expressed themselves as well pleased with the service notes furnished by RSA on the occasion of our first 1942 meeting held in Fairmont.

"Red" Rhodes gave a good talk on r-f circuits, seasoned by remarks and questions from his fellow members. Mr. Johnson, of Fairmont, came through as usual with some excellent information in the course of the discussion.

In the absence of Russell Dotson, of Granton, Vice-President John Gilbert, of Morgantown, presided.

E. H. Flowers, Publicity

★

Binghamton Chapter:

Election of officers for 1942 resulted in the re-election of the 1941 officers in their same positions. The best of all good things from us to you in the new year.

May we have ten sets of the RCA service notes Don has been writing to us about?

Please send us about 30 application blanks for membership in RSA.

Earl L. Pittsley, Secretary

★

La Porte Chapter:

Our Chapter meeting was held in the YMCA January 14, 1942, and regular business was transacted first. Then the sorrowful news of Mr. Don Stover, Executive Secretary, resigning, was read to all members and after praising him on his excellent work we all wished him success with his new work.

At this meeting we agreed to give U. S. Defense Stamps as attendance prizes.

This to be in bank night form. Whenever a member's name is drawn and that member is absent the prize is carried over to the next meeting and is doubled. This, we think, will create better attendance at all meetings.

We wish to thank the National headquarters for their effort in securing a door prize for our future meetings. We have cooperated with the plan of the Executive Secretary.

The meeting closed with a movie and ice cream, which was donated.

Stanley Kubit, Secretary

★

Wichita Chapter:

Due to the illness of Paul Mason, I have been appointed acting secretary until our election which is coming soon.

As you know, we have had a rather quiet Chapter here and you hardly know Wichita exists. But from now on you are going to hear noises from us, and our Chapter is buzzing with plans. Other Chapters get recognition because they do things that deserve recognition. Well, we are doing things now.

Here is our number one plan. For the next few months, we are conducting a first class technical school in radio servicing, based on current texts. I will give the first few lessons to get started, then call for volunteers to continue and to keep up interest. Believe me, it's going over with a bang.

Our present attendance is about twenty-five at a meeting.

We hope we receive proper credit for our efforts to uphold the principles of the RSA which means "better relationship and better servicemen."

Mack Lovern, Acting Secretary

★

Oklahoma City Chapter:

Our association has been having to shift their regular meeting first one way and then the other in order to get the men together, because most everyone has been having to do his own work lately. Uncle Sam has all of our extra help.

Our next meeting is scheduled for election of officers. L. G. Deering, our District RSA man, has just returned from the hospital after a short siege of pneumonia.

We are looking forward to a lot of hard work, and also helping in any way we can in any of our local defense work.

R. B. Cherry, President

★

Danville Chapter:

Excerpts from the Serviceman's dirt, Danville's dynamic, devilish, development for the good of RSA:

Editorial: Your time has come. Ever since the organization of RSA, both locally and nationally, you have heard advice, demands, pleas and every other kind of way of communicating with you on the

(Continued on page 24)

ENEMY ALIEN SETS

(Continued from page 21)

switch out with them. Realign, of course. Do not leave the switch in and seal it in some manner, because it can be unsealed.

AND BE ALERT

Remember that there is always the possibility that some enemy alien in your locality may try to pull a fast one. Dealers, jobbers and servicemen, and radio amateurs, too, should be suspicious of any person who may be presumed to be an enemy alien, who attempts to purchase radio parts, borrow test equipment, or seek your service in any alignment work outside of the broadcast band.

On the other hand, don't let your imagination get the better of you. Be reasonably sure of your suspicions before reporting any case to the local police or the FBI.

"INSTA-MATIC" CHANGER

(Continued from page 19)

are played. Be sure that the pickup arm cord is hanging free and is not under pickup arm bracket and arm channel.

Variation in Lowering of Pickup Arm

It will be observed that it is the retraction of the reset pin through the slot in the rocker plate, during the return stroke of the cam, that causes the arm to move from its outward position and reset onto the record. See Fig. 6-A. It can be seen that lost motion or "shake" in the lateral movement of the pickup lowering position to remain unchanged when records are changed automatically. To determine the cause for any variation in the position of the pickup lowering point, proceed as follows:

Move the main cam by the method illustrated in Fig. 1 and allow the cam to return to the position shown in Fig. 4-D. The relative positions of the rocker plate and reset plate, with the reset pin en-

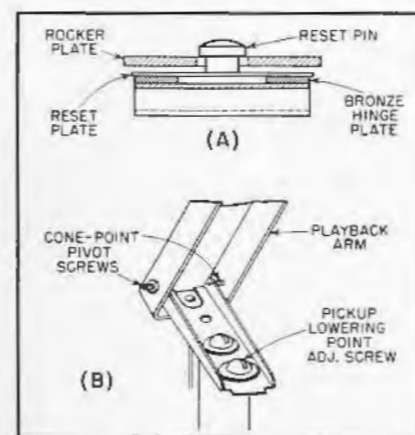


Fig. 6. A: Details of reset and rocker plate. B: Pickup pivot and lowering adjustments.

gaged in the end of the slot in the rocker plate. Holding the cam in this position, take hold of the pickup arm and by lightly applying force in alternately opposite directions (laterally) observe the resulting effect on the position of the reset pin. See Fig. 6-A. If the reset pin can be moved excessively in making this test, this gives indication of a broken hinge plate, which condition necessitates removal of the main cam with the reset plate assembly attached, and replacement with a new one.

Observe that the cone point pivot screws at the heel of the pickup arm are properly adjusted so that no lost motion in the lateral movement of the arm exists. See Fig. 6-B. Caution: Do not make this

adjustment too tight as abnormal friction in the vertical movement of the arm may result.

Note that the screw provided for adjusting the pickup lowering position (Fig. 6-B) is tightened securely.

Dash Pot

The dash pot (F in Fig. 1), which is an air chamber with an internal spring return piston and an air release, serves to govern the speed at which the main cam or changing process operates. At the start of the solenoid stroke, the contacts on the lock-in switch, which is connected in parallel with the trip switch, are closed,

(Continued on page 25)

A BIG NEW BUSINESS

THE SERVICING OF "AUTOMATIC RECORD CHANGERS & RECORDERS"

NEW RIDER BOOK
Just Out!

OUT APRIL 15th
RIDER MANUAL
VOL. XIII

1650 Pages — Price \$11.00

This new Rider Manual covers sets issued in 1941. The O.P.M. announces that 13,000,000 sets were sold last year. What a market! What a source of profit if you have the necessary data for efficient operation!

We are fortunate in being able to complete arrangements for publishing Vol. XIII. That is why we say

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744 pages (8½ x 11") \$6.00
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RSA NEWS

(Continued from page 22)

subject of price and high standards. Now as never before we need to think of ourselves and our future. Every job we put out should be the best we are capable of and the radios coming out of our shops should perform as near like new as is humanly possible. But for this service we should receive a fair return and by a fair return I mean one in keeping with these present times and with the quality of work we are putting out to our customers.

There hasn't been a "dirt" for some time due to previous commitments (some word, eh?) but for those who missed the Xmas party I think that they missed a nice time due to the efforts of Mr. and Mrs. Welch and the others co-operating. Of course it was a little tame for one of the guests, but the rest seemed to enjoy themselves. The M.C. was terrible but the crowd was polite and made him enjoy himself for which I thank you all. Wouldn't it have been awful to have been run out with fresh vegetables in the middle of the winter?

Danville has a new Bowling team. The old team is still in the field with Doc McKinney back in shape after his accident to his "howling thumb," but this new team is an addition to the league and they make their debut this Wednesday night.

From the "Serviceman's Dirt"

Pittsburgh Chapter:

Pittsburgh Chapter held its January 8th meeting in the corporation room of the Commonwealth Trust Co. Samuel Arins, the RSA attorney, gave full details regarding the registration of alien short wave radios.

We are having special tags printed with an affidavit on same showing who owns the radio, their address, the serviceman's name, address and phone. And at the bottom of the tag is the notice, "Do not tamper with this radio. Should you need service, notify the serviceman who signed the sworn statement."

The matter of wholesale selling of radio sets and parts by wholesale houses at wholesale prices to retail customers has been taken up with Senator Guffy. Mr. Guffy took this matter up with Mr. Leon Henderson of the OPA and Mr. Henderson promised an investigation. Further, the matter was taken up at the NRPDA meeting at Canton, Ohio, on Jan. 18th. If radio receivers and parts were sold through authorized dealers and servicemen only, the worst curse of the industry could be wiped out overnight. Now, when parts and radios are at a premium, it should be considered a waste of material for a wholesaler to thus discriminate against his legitimate trade channels.

The matter of licensing radio servicemen on a national scale has been taken up with the FCC but there is nothing definite to report as yet.

R. G. Dwaney

Chicago Chapter:

Since war was declared the problem in Chicago has been not where to find service jobs, but rather where to find the time to

fix 'em. We like it that way, however, and though it took a war to make people conscious of their radios, yet we feel sure that a good steady increase in repair business is with us for the duration.

We had a foretaste of what may be expected from the radio serviceman in handling the rather confused problem of enemy alien short wave radios. The RSA can and will lend an active hand to the government. We feel that the RSA should be recognized and used as a distributing center of information for all such problems and we urge the rest of you fellows in other Chapters to lend an active hand in gaining such recognition. It should not be necessary for the Government to go to extra expense, but rather we should cooperate with them.

Our last meeting at the Stevens Hotel on Jan. 21st was well attended. A service clinic kept the boys interested until the meeting got under way—a hint for late comers. We discussed the legal requirements of the Alien registration. Also Mr. Russell Jimieson, of the firm Walker Jimieson, Inc., gave us his views on the prospects of the future as concerns the parts situation. Russ brought out some points which made the boys sit back on their hanches and think. He made it clear that the radio serviceman who stands by his guns and plans for the future sen-

sibly will probably see 1942 go on record as his banner year.

Harold Cunningham told of the changes in the National office of RSA made necessary by the resignation of Don Stover, our highly efficient National executive secretary. We all wish Don the best of luck in his new venture, and know that he deserves the unlimited thanks of the entire RSA for his personal sacrifice and efforts for the good of the organization.

Al Kilian, who volunteered to take over the job with the assistance of the entire RSA, is already receiving active support from the active workers in the Chicago chapter. We know that the organization as a whole will rally to the cause and the increase in national dues should make the organization self-supporting, even though it entails personal sacrifice on the part of Al and others.

An election of Chapter officers was held and the following men were elected to carry on in 1942: Lowry E. Easley, President (re-elected over protest for a third term); Robert E. Clarke, Vice President; Robert L. Storey, Secretary; Hellmuth Junkel, Treasurer.

The Chicago Chapter plans a lot of activity for the coming year and hopes that more of its members see fit to lend an active hand in the work of the organization.

Lowry E. Easley, Publicity

RSD RADIO QUIZ

SO, you're a radio expert! Well, let's see if we can stump you. The winner gets no encyclopedia, but he will have the satisfaction of knowing that he is good. As a matter of fact, you're good if you get a score of 60 or 70; counting 10 points for each of the 10 questions. If you're not careful, a couple of them will trip you up. So, we're off!

1. Who is known as "The Father of Radio"; and what magazine recently ran a series of articles based on his life? (Give yourself 5 points for each correct answer).

2. If you have no reluctance in answering this question, then what does have?

3. If an SE-1420 isn't a tube, then what is it?

4. Will a degenerative circuit oscillate?

5. The dielectric in an oil condenser is oil; in a paper condenser it is paper. What is the dielectric in an electrolytic condenser?

6. If 73 is to 79, then 85 is to 88. But what are they?

7. You've used Astatic crystal pick-ups and mikes in your work. Well, what is the meaning of the word "astatic"?

8. If a.m. is to p.m., then f.m. is to what?

9. What type of tube is a 6AH7?

10. What is a side swiper? (Answers below)

- Answers to Radio Quiz:
1. Dr. Lee DeForest. The Saturday Evening Post.
 2. A magnetic circuit. Magnetic reluctance corresponds to electrical resistance.
 3. A famous Navy receiver used during the last war. The "SE" was the abbreviation used for the Bureau of Steam Engineering.
 4. Yes, if there is large phase shift.
 5. Oxide film on the surface of the condenser anode.
 6. 73 means "best regards"; 79 is a "love and kisses"; 85 is a tube type; 88 means "Astatic"; being in neutral equilibrium.
 7. Astatic: being in neutral equilibrium.
 8. Amplitude modulation is to phase modulation as frequency modulation is to amplitude modulation (phase- and frequency modulation are practically the same thing).
 9. A dual-triode driver tube.
 10. A double-acting radio or telegraph key; not a "Bug".

ANSWERS TO RADIO QUIZ

"INSTA-MATIC" CHANGER

(Continued from page 23)

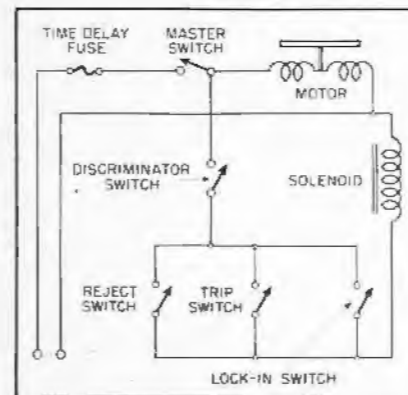


Fig. 7. Schematic of changer unit.

maintaining energy in the solenoid. The draw spring then functions to pull the main cam assembly forward against the snubbing action of the dash pot. At the end of the stroke, when the lock-in switch points are opened, energy is released from the solenoid and the internal spring of the dash pot returns the main cam assembly to its original position.

It can readily be seen from the above that if the dash pot through some manner has lost its snubbing action, the changing process of the unit will be very erratic and in most cases damage will result through the fast action. Always replace a defective dash pot and never attempt to repair or oil the plunger. This plunger is treated by a special process and further oiling will eventually ruin the leather.

Buzzing or Weak Solenoids

Incorrect spacing of the lock-in switch will oftentimes cause the solenoid to buzz or chatter during the change period. If the contacts are set so that they are just touching on the solenoid stroke, vibration will cause them to open and close, result-

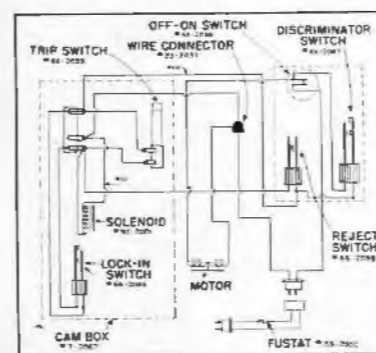


Fig. 8. Picture diagram of unit

ing in the solenoid being energized and de-energized at a very rapid rate. If the lock-in switch contacts are correctly set and buzzing still continues, it is usually found to be in the laminations of the solenoid and the only cure is replacement of the complete solenoid, including the core. The solenoid plus the core are matched at the factory and the complete assembly should be installed.

The solenoid on the Insta-Matic changer is designed to operate satisfactorily on line

voltages of 105 volts or above. Lower line voltages will cause the mechanism to either chatter or buzz and in some cases will not operate. If the line voltage is above 105 volts and the mechanism changes very slowly or the solenoid plunger is drawn only part way in, this is an indication of a weak solenoid and the only solution is to install a new assembly. This naturally is assuming that all other adjustments, such as the dash pot, reset plate and rocker arm, are correct.

Wiring Diagrams

A schematic diagram of the changer wiring is shown in Fig. 7. A similar, pictorial diagram, giving the location of the solenoid and the switches, is shown in Fig. 8.

SERVICE PORTFOLIO

(Continued from page 14)

voltage as developed across a resistor or the primary of an output transformer, or the voltage across the voice-coil winding of an output transformer. Consequently, variations in frequency response and load impedance appear as components of the feedback voltage, and are therefore corrected. In this form of degeneration, the feedback voltage has the effect of lowering the apparent plate resistance of the tube, so that in the case of a pentode or beam-power tube, the advantages of a triode are approached without losing

(Continued on page 28)

PROFESSOR SQUEEGEE SMASHES THE ATOM

After walking to his desk, Professor Oswald Z. Squeegee, PDQ., COD, carefully wound his watch, dropped it into the cuspidor and tucked his chew into his vest pocket. Then he faced the eager, upturned faces of his class.

"Listen to me, you intolerable numbskulls," he shouted. "Today we're going to study the Atom. What's more, we're going to smash the Atom right here in this room. S'help me!"

The Professor paused, reached for a coughdrop, got an eraser by mistake and chewed it vigorously. Then he cleared his throat and continued:

"The Atom, as you ought to know but probably don't, is the unit of all matter. It is the alpha of everything—the smallest, theoretically indivisible portion into which anything can be divided and still maintain its identity. In that respect, it is a good bit like the salaries most of you will earn when you graduate—if you ever do.

"How to smash the Atom has long puzzled scientists, including myself. However, we won't go into that today. Instead, we'll deal with an entirely different type of Atom—the Sprague Atom Dry Electrolytic Condenser, appropriately named for its small size and great durability. This, however, is a type of Atom that can be smashed. What's more I'm gonna smash it!"

After ten minutes search, the Professor finally found an 8 mfd. 450 volt Sprague Atom in his cigar case—also a similar midget dry electrolytic of another make. These he connected into a weird electrical circuit on his desk. Then he slowly turned on the juice.



"Now," he gloated, "both condensers are rated at 450 volts and that's exactly what they're getting. As you see, nothing happens. We'll step the voltage up to 500. Now up to 525. Note that the other condenser is beginning to sizzle, although the Atom is still in good shape. Here we go to 550 volts—now to 575—now to—goodness me!"

There came an explosion not unlike that of a giant firecracker and the heads of the class suddenly disappeared beneath their desks.

"You're all wrong," shouted the Professor gleefully after order had been restored. "You thought I smashed the Atom—but I didn't. It was the other condenser that blew up—not the Atom."

Sure enough, the Atom on the desk was still connected—now hissing a bit under the strain of over 600 volts but functioning perfectly.

"The Atom," continued the professor, "is especially protected against blow-outs—against moisture, heat and whatnot. The way to smash the Atom is not merely a matter of overloading it. The way to smash the Atom is this."

The professor grasped an axe hung over a sign "Use only in case of fire." Swinging this with the skill of a woodchopper and shouting wildly all the while he brought the blunt end down on the Atom—again and again and again.

"There!" he screamed, gleefully looking at the shattered remains. "We've done it. We've succeeded where others have failed. That, gentlemen, is how to smash the Atom. Class dismissed."

A TYPE FOR EVERY DRY ELECTROLYTIC REPLACEMENT NEED



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North Adams, Mass.

GOOD CONDENSERS—EXPERTLY ENGINEERED—COMPETENTLY PRODUCED

NEW PRODUCTS

OF THE MONTH

CLAROSTAT

Resistor Power Cords—A range of power cords for certain ac-dc radio set repair, as well as several universal types serving a wide variety of sets. These cords have



three conductors enclosed in heavy braided covering, with a tie cord at the chassis end and a molded rubber plug at the other. The three conductors furnish the necessary plate voltages for rectifier tube and the reduced voltages for the tube filaments. By Clarostat Mfg. Co., 285 N. 6th St., Brooklyn, N. Y.

RADIO CITY

Electronic Multitester—An electronically operated, high sensitivity, multi-purpose meter instrument known as the RCP "Electronic Multitester," Model 662.

Provides a total of 27 measurement ranges to take care of voltages, both a.c. and d.c., up to 6,000 volts; resistance to 1,000 megohms; capacities to 2000 microfarads. The low ranges for each of these types of measurement are such that values as low as 0.1 volt, d.c., 1.0 volt a.c.



0.2 ohms and 30 micro-microfarads (0.000,03 microfarads) can be read directly from the meter scale without interpolation or estimating fractional scale divisions. Any one of the 27 ranges is selected by means of two rotary switches, one of which selects the type of measurement desired, the other the numerical range.

The indicating instrument which is set into the face of the all-metal cabinet, is a 4½ inch square type D'Arsonval microammeter guaranteed accurate within 2%

of full scale. Its direct-reading scales are laid out on a 100-degree arc. Protection is provided which avoids the possibility of burn-out or other damage to this instrument through improper range selection or attempting measurement of live resistors, etc.

Its vacuum-tube and power supply circuits are built-in and operating power is drawn from any 105-130 volt line. Applied voltages are held constant by means of a built-in electronic voltage regulator, eliminating the possibility of error resulting from variations in the a.c. supply voltage.

Loading of circuits under measurement is made negligible by input resistance of 160 megohms for the higher ranges and 16 megohms for the lower ranges. Input capacity is 50 micro-microfarads. Test leads and all parts employed in the high-voltage circuits are insulated for 15,000 volts. Test leads provided, four in number, include two standard high-voltage leads, one shielded lead with an extension adapter for use in measurements in critical vacuum tube circuits, etc., and a short lead for certain special uses.

The entire instrument is self-contained in a metal cabinet 9¼" wide, 9¾" deep and 7½" in overall height. The sloping control panel contributes maximum visibility and operating convenience. By Radio City Products Co., 88 Park Place, New York, N. Y.

WABASH

Blackout Bulb—Designed for blackout lighting in air raids, the new Wabash Blackout bulb provides downlighting in a soft beam of blue light that is safe for indoor visibility during blackouts. The bulb is lined inside with a pure silver reflector lining that hides all filament glare and projects the light downward. Light leaks are prevented by a black silicate coating that covers the bulb up to the extreme lighting end which is a deep blue. Consumes 25 watts. By Wabash Appliance Corp., Brooklyn, N. Y.

GENERAL CEMENT

Hammer Finish Kit—Complete kit for providing a "hammer finish" to radio equip-



ment and other parts. Easy to apply. By the General Cement Mfg. Co., 919 Taylor Ave., Rockford, Ill.

MECK

10- & 70-Watt Amplifiers—A 10-watt amplifier, for use in call systems, small restaurants, etc. Has mike and phono input



channels, dual-action tone control, 4- and 8-ohm outputs for single or dual speakers. Provides field supply for dynamic speakers.

Model B-70C has 70-watt output, 4 independently controlled mike channels and one phono channel. Unit embodies two



separate power transformers and rectifiers to insure good regulation. Output impedances of 2, 4, 8, 166, 250, and 500 ohms are provided. By John Meck Industries, 1313 W. Randolph St., Chicago.

ALLIED

Bantam P. A.—The 20-watt "Bantam" Sound System is housed in an exceptionally compact case finished in brown air-luggage cloth, and measuring only 24" x 10¾" x 10¾". The weight is 40 lbs.

The complete "Bantam" includes a Knight 20-watt amplifier with tubes and built-in phono, a Shure xtal mike with 25-ft cable and desk stand, two 10" elliptical speakers with 25-ft cables and plugs attached. E.R.P.I.-licensed and fully fused for operation from 110-120 v., 60 cycles.

The amplifier with phono top has 4 and 8 ohms output impedances and supplies field excitation for two 2500-ohm speakers. Has one high-gain mike channel with individual control and two phono

(Continued on page 34)

NOTICE

INDEPENDENT SERVICEMEN

The Future Looks Very Bright

You now have less competition than ever before. Thousands of part-time radio servicemen have been drafted or have gone back to their regular jobs. Your income will increase. There are more old sets to service because they are getting harder usage and but few new ones are being produced. Speedier, more efficient servicing is the Order of the Day . . . "Time Wasted means Profits Lost".

The editors of RADIO SERVICE-DEALER will publish, during the coming months, hundreds of pages of important, exclusive and timely data to help you save time, energy and materials so that you, your customers and our Country will benefit. During the emergency knowledge will be important because you'll have to solve complex problems should no exact-duplicates be available. Yes—every radio serviceman will obtain much usable data from our regular feature departments—"The Technical Service Portfolio"—"Circuit Court"—"Shop Notes"—"New Products", etc.

RADIO SERVICE-DEALER has a larger paid circulation amongst and is read by more leading independent radio service-dealers, sound-men and jobbers than any other radio magazine. . . and we publish more pages of valuable, exclusive technical data relative to radio servicing. Subscribers pay but 12¢ per copy when they order one year subscriptions. Subscribe to RSD today. Get your associates to do likewise. Use the coupon below.



This distinctive six-inch decal-comania litho-wrapped in four colors (red, white, blue and gold) which will help your business, available FREE to all subscribers classified as independent radio service dealers on request.

----- TEAR OUT AND MAIL TODAY -----

RADIO SERVICE-DEALER
132 West 43rd Street, New York City, N. Y.

Sirs: Here is my check (or money order) for \$ Enter my subscription order to RSD for the next issues. (12 issues cost \$2.—24 issues cost \$3.) Canadian and Foreign subscriptions are \$3 annually. The information given below is accurate. If my subscription is rejected I expect an immediate refund in full.

Name (print carefully)

ADDRESS FIRM NAME Est. 19

CITY STATE My Position Is, Owner Service Mgr. Serviceman

Please check whether firm is (If any other, state what it is)

An independent servicing organization, we do not sell sets.
 An independent service-dealer (engaged primarily in service work)
 A service-dealer (does servicing, but is primarily interested in retailing)
 Selling, renting or servicing Sound Equipment
 Jobber Any other classification
 Manufacturer (State it)

I belong to a serviceman's organization Yes No

We stock the following checked items

<input type="checkbox"/> TUBES	<input type="checkbox"/> V-T Voltmeter
<input type="checkbox"/> PARTS	<input type="checkbox"/> Tube Checker
<input type="checkbox"/> RECEIVERS	<input type="checkbox"/> Analyzer
<input type="checkbox"/> BATTERIES, etc	<input type="checkbox"/> Oscillator
<input type="checkbox"/> SOUND EQUIP	<input type="checkbox"/> Signal Generator
<input type="checkbox"/> ELEC. APP'L'S.	<input type="checkbox"/> Volt-Ohm Meter
	<input type="checkbox"/> Others
	<input type="checkbox"/> MANUALS

GEO. F. SERVICE BRUZEE
MR. GEO. BRUZEE
 Geneva, New York

National Union Products have been one of the bases on which I have built the most successful service business in this trading area. I have sold National Union with full confidence for more than ten years and the results have fully justified my faith in the merchandise and the company. Naturally I have taken every advantage of National Union deals, but of equal importance to me is the fact that N. U. has kept the market clean and enabled me to make a sales profit.

WHERE YOU FIND
NATIONAL UNION
 YOU FIND BETTER
RADIO SERVICE

PREMIUM
Quality
TUBES



BATTERIES



CONDENSERS

also Transmitting tubes, panel lamps, cathode ray tubes, exciter lamps, sound equipment, photo electric cells, sound accessories, dry batteries, flash light bulbs.

NATIONAL UNION invites . . .

All radio service dealers to enjoy the benefits of the N. U. Shop Equipment Plan. The latest in tube testers and test equipment are available to you . . . prompt delivery. More than 60,000 completed deals prove the success of this plan. Investigate now.

Ask Your N. U. Distributor or Write

NATIONAL UNION
RADIO Corp.
 57 STATE ST., NEWARK, N. J.

(Continued from page 25)

the benefits of the high power-sensitivity and power-output capabilities of the pentode and beam-power types. Moreover, the addition of a satisfactory degree of feedback (around 10 to 12 db) increases the undistorted power output level of a given tube type.

With constant-voltage feedback, then, all of the advantages of constant-current feedback, plus the additional benefit of improved frequency response, are obtained.

It is well to point out here, that in applying either type of feedback to existing equipment, the output-transformer load requirements remain the same. It might be assumed that in the case of constant-voltage feedback, where the apparent plate resistance of the pentode or beam-power output tube is considerably lowered, that the load impedance of the primary of the output transformer should also be lowered. This is not the case; the load requirements should remain the same as if the tube were operated as a straight pentode or beam-power tube without negative feedback. In other words, the addition of negative feedback to any audio amplifier does not call for any changes in the output transformer.

Typical constant-voltage feedback circuits are shown in Fig. 7. In circuit A, the feedback is from plate to grid via R and C . This is a selective circuit, and the degree of feedback at any given frequency will depend upon the values of R and C .

The parallel feedback circuit shown at B is non-selective to all intents and purposes, since the feedback is through resistor R . However, the feedback is not directly between plate and grid, and the value of the blocking condenser C has an influence on the response unless it is of a rather high value.

In this type of circuit, the value of R must be high (.5 to 1.5 megs) because of its shunting effect on the plate circuit of tube V . This works out sat-

isfactorily if tube V is a pentode or a high- μ triode, with high τ_p .

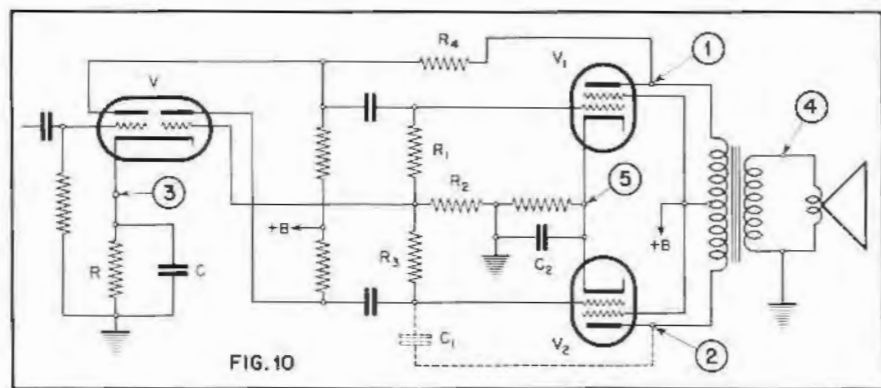
Circuit C in Fig. 7 shows the use of capacity feedback, either from the plate of V_1 to the plate of V , or from plate to grid of V_1 , as indicated by the dotted line. This arrangement is not satisfactory unless feedback is desired at the higher frequencies only, in which case condenser C must have a small value (.50 mmfd or so).

Circuit A in Fig. 8 shows constant-voltage feedback over two stages, from plate of V_1 to cathode of V , via C and R . The cathode resistor R is necessarily left unbypassed so that the feedback voltage may be developed across it. The value of R should not exceed that required for the proper bias for tube V , and the value of R should be from 10 to 15 times the value of R . Condenser C should be 0.1 mfd if the feedback circuit is to be substantially non-selective, or of a higher value if bass boost is desired—but it would be preferable to obtain bass boost in a stage preceding the circuit shown.

Circuit B is non-selective, and unique in that R functions both as the feedback channel and as a bleeder. Obviously, the value of R should be high, and the value of R should be reduced to compensate for the additional voltage drop across it due to the bleed current.

Circuit A of Fig. 9 shows feedback over one stage, from voice coil to cathode of the power tube. The feedback voltage is developed across the divider R_2 - R_1 . If R_1 is small, as it should be, the degree of constant-current feedback will be negligible, just so long as bias resistor R is bypassed. On the other hand, the value of R_1 and R_2 in combination should be at least 10 times the voice-coil impedance so as not to absorb too much power. Likewise, R should be about 10 times the value of R_1 if constant-current degeneration is to be obviated.

Circuit B of Fig. 9 shows the feedback over two stages, from voice coil



Self-balancing phase inverter feeding push-pull power tubes, with parallel-feed degeneration over one stage.



A WAR MESSAGE

to

ALL EMPLOYERS

★ From the United States Treasury Department ★

WINNING THIS WAR is going to take the mightiest effort America has ever made—in men, in materials, and in money! Every dollar, every dime that is not urgently needed for the civilian necessities of food, clothing, and shelter, must, if we are to secure final Victory, be put into the war effort.

An important part of the billions required to produce the planes, tanks, ships, and guns our Army and Navy need must come from the sale of Defense Bonds. Only by regular, week by week, pay-day by pay-day investment of the American people can this be done.

This is the American way to win. This is the way to preserve our democratic way of life.

Facing these facts, your Government needs, urgently, your cooperation with your employees in immediately enrolling them in a

PAY-ROLL SAVINGS PLAN

The Pay-Roll Savings Plan is simple and efficient. It provides, simply, for regular purchases by your employees of United States Defense Bonds through systematic—yet voluntary—pay-roll allotments. All you do is hold the total funds collected from these pay-roll allotments in a separate account and deliver a Defense Bond to the employee each time his allotments accumulate to an amount sufficient to purchase a Bond.

The Pay-Roll Savings Plan has the approval of the American Federation of Labor, the Congress for Industrial Organization, and the Railroad Brotherhoods. It is now in effect in several thousand companies varying in number of employees from 3 to over 10,000.

In sending the coupon below, you are under no obligation, other than your own interest in the future of your country, to install the Plan after you have given it your

consideration. You will receive—1, a booklet describing how the Plan works; 2, samples of free literature furnished to companies installing the Plan; 3, a sample employee Pay-Roll Savings authorization card; and 4, the name of your State Defense Bond administrator who can supply experienced aid in setting up the Plan.

To get full facts, send the coupon below—today! Or write, Treasury Department, Section B, 709 Twelfth St., NW., Washington, D. C.

HOW THE PAY-ROLL SAVINGS PLAN HELPS YOUR COUNTRY

- 1 It provides immediate cash now to produce the finest, deadliest fighting equipment an Army and Navy ever needed to win.
- 2 It gives every American wage earner the opportunity for financial participation in National Defense.
- 3 By storing up wages, it will reduce the current demand for consumer goods while they are scarce, thus retarding inflation.
- 4 It reduces the percentage of Defense financing that must be placed with banks, thus putting our emergency financing on a sounder basis.
- 5 It builds a reserve buying power for the post-war purchase of civilian goods to keep our factories running after the war.
- 6 It helps your employees provide for their future.

MAIL THIS COUPON NOW

Treasury Department, Section B
 709-12th St., NW.
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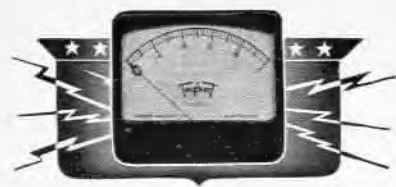
We want to do our part. Please rush full information regarding the Pay-Roll Savings Plan.

NAME
 POSITION
 COMPANY NAME
 ADDRESS
 NUMBER OF EMPLOYEES

MAKE EVERY PAY-DAY . . . BOND DAY!
U. S. Defense BONDS ★ STAMPS

This space is a contribution to NATIONAL DEFENSE by "Radio Service-Dealer"

RADIO SERVICE-DEALER, FEBRUARY, 1942



FOR TRIPLETT CUSTOMERS ONLY

Long before the state of emergency was proclaimed, the Tripletts Company was getting ready to do its part in building our national security. We knew that we must meet important new responsibilities. At the same time, we felt keenly our continuing obligations to our customers—old friends with whom we have had happy business relations through many years.

We doubled—then tripled—our output to fill the needs of our old accounts. We added to our production facilities . . . hired many more men . . . are working extra shifts at time-and-a-half.

All this has not been enough. We have been called on to produce more and more for national defense. We are proud of the job we are doing to help meet the emergency, but it is difficult not to be able to serve our old friends equally as well. In the face of these conditions, the Tripletts Company has adopted these policies "for the duration."

First: We will continue to serve you by our service to our mutual responsibility—the national emergency.

Second: We will continue to do everything we can to fill orders from our regular customers, even though some deliveries may be temporarily delayed. No business from new accounts has been nor will be accepted until after our old friends have been served, except where priorities make it impossible to do so.

Third: Our engineering and research departments will continue to work on the development of superior equipment and improved methods to serve you still better when we can resume normal operations.

The present emergency is incidental and as we work towards the future, we will do our best to continue to merit your confidence and loyalty.

Chas. L. Triplett

President
The Tripletts Electrical Instrument Company
Manufacturers of Precision Electrical Instruments

to the cathode circuit of tube *V*. The same rules applied to circuit *A* apply here, except that constant-current degeneration in the circuit of tube *V* is not the drawback it would be in the circuit of tube *V1*.

Naturally, any of the foregoing circuits can be applied to push-pull stages, but dual feedback loops must be employed unless the arrangement shown in Fig. 10 is used.

BALANCED INVERTER

In this circuit, the second section of tube *V* (such as a 6SC7) is employed as the phase inverter in a self-balancing arrangement. The output of the first or input section appears across resistors *R1* and *R2*. This voltage is 180 degrees out of phase with the input, and is applied to the second triode by connecting its grid to the mid-section of *R1-R2*. The voltage applied to the grid is, therefore, the voltage developed across *R2*.

However, the output of the second section, or inverter triode, appears across *R3-R2*. Hence, a portion of the output of each triode appears across *R2*, but in opposite phase. Therefore the voltage applied to the grid of the inverter section is the difference voltage after cancellation. The second or inverter section is therefore degenerated, for a portion of its own output is applied to its input, across resistor *R2*.

Negative feedback in this circuit is of the parallel-feed type, from the plate of *V1* to the plate of the input triode of *V*, via resistor *R4*. This feedback voltage is applied to the grid of *V1* and is also developed across resistors *R1* and *R2*. Therefore a portion of the feedback voltage from the output stage is also applied to the grid of the inverter triode, and appears in the plate circuit of the same tube section. Hence, the feedback is also applied to the grid of tube *V2*. For this reason it is not necessary to use an additional resistor connected from the plate of *V2* to the plate of the inverter triode. But this holds only in the event that the phase-inverter stage is of the self-balanced type.

If the high end of the response from a circuit of this type is excessive, it may be flattened out by adding the condenser *C1*, shown in dotted lines. The value should be quite low—from 10 to 50 mmfd.

Other points of feedback voltage are indicated by numbers in Fig. 10. If the bypass condenser *C2* is removed, multiple feedback may be had by the use of condensers connected from points 1 and 2 to point 5. Again, *R4* can connect to point 4 rather than point 1 if a

series condenser is added, or from point 4 to the grid of *V1* without the condenser.

Point 3 is the exception. Feedback cannot be applied at this point since the cathode and resistor *R* are common to both triode sections. If it is desired to apply the feedback at this point, a dual triode with separate cathodes and bias resistors would have to be used, and inversion developed in a preceding stage. Then the feedback could be taken from points 1 and 2, or from the secondary of the output transformer if a separate, center-tapped winding were available.

PRACTICAL APPLICATION

Aside from the few rules given, the cut-and-try method of applying negative feedback to existing equipment is satisfactory. One has the opportunity of trying various values of capacity and resistance, and altering these values up or down until satisfactory results are obtained. Though 10 db of feedback is desirable, lesser values provide beneficial results, and one can be guided by the amount of amplifier gain that can be thrown away without the addition of another stage or the use of tubes with higher gain. But, where gain can be added by the installation of another stage, then a good rule of thumb is to use as much feedback as will eat up the gain of one stage, so that the addition of another stage brings overall gain back to the original point.

CIRCUIT COURT

(Continued from page 16)

the *Silvertone* Model 7037 receiver, as shown in Fig. 6.

When an external antenna is employed, *L2* functions as a straightforward antenna transformer, with the exception that the primary is coupled

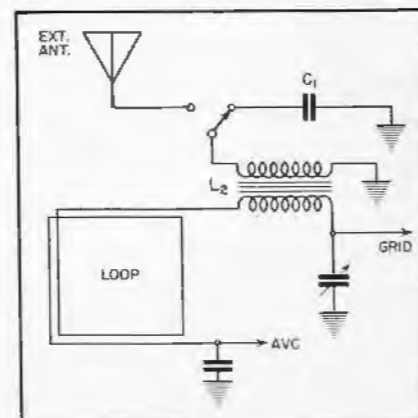


Fig. 6. *Silvertone* loop transformer, *L2*.

to only a portion of the total secondary inductance; the remainder being lumped in the loop.

In order to preserve tracking when using the loop, the primary of *L2* is shunted by the low-capacity condenser *C1* which replaces and compensates for the lump capacity of the external antenna when it is disconnected.

Self & Semi-Fixed Bias

THE BLEEDING OF current through the cathode resistor of a power tube for the purpose of increasing power output on signal peaks, was referred to last month in this department.

A similar arrangement as applied to an a-f voltage amplifier is used in the *Silvertone* Model 7037 receiver, as shown in Fig. 7.

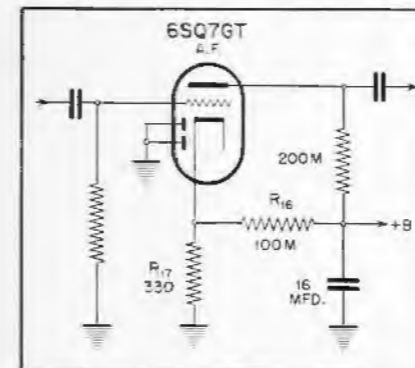


Fig. 7. *R16* bleeds through *R17* bias resistor.

Self bias is developed across the cathode resistor *R17*. Added to this is the voltage drop due to the current bled through *R17* by the bleeder *R16*, of 100,000 ohms.

The total voltage drop is only 1 volt, but a good portion of this drop is provided by the bleeder so that signal peaks cause a proportionately smaller increase in over-all bias.

Since the cathode resistor *R17* is bypassed, a small amount of degeneration is introduced. This is of no particular account as *R17* has a value of only 330 ohms. Hence, the usual electrolytic bypass can be dispensed with.

NEWS

Buy Defense Bonds—The employees credit union of the Thordarson Electric Mfg. Co., of Chicago, and the Burgess Battery Co. have purchased \$5,000 in Defense Bonds. Nice going!

New Tube Characteristics—A new Renewal Tube Characteristics Sheet has been released by the commercial engineering



ASTATIC PRODUCTS UNIVERSALLY USED

Convincing proof of the dependability of Astatic products is contained in Astatic's REPLACEMENT MANUAL for Pickup Cartridges, listing the various type cartridges used by a large majority of the manufacturers of radio phonograph combinations and playback equipment. This manual is a quick and valuable reference for Radio Jobbers, Dealers and Service Men who handle and service replacement parts.



To obtain your FREE copy of this handy Manual, see your Radio Parts Jobber.

ASTATIC

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Licensed Under Brush Development Co. Patents

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Choose THE TUBES SPECIFIED IN RADIO SERVICE EVERYWHERE



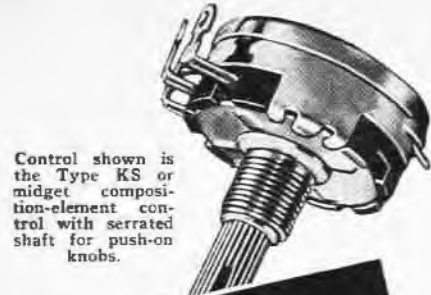
Radio Tubes

G-E Tubes Mean Dependability and Peak Efficiency

When you place your next tube order specify G-E.



GENERAL ELECTRIC



Control shown is the Type KS or midget composition-element control with serrated shaft for push-on knobs.

A fortune was spent on this control....

SERIES M
Composition-Element
CLAROSTAT

★ Out of the fortune spent and the two decades put into the development of the composition-element control has come this Clarostat Type M. Today you are offered the ultimate in the volume control art, with such refinements as perfected resistive coating on bakelite ring support; split-finger contact of special alloy; refined lubricant for smooth, non-binding rotation; foolproof soldering-lug terminals; etc. Make your own comparative test. Then draw your own conclusions.

★ See Our Jobber...

He'll gladly show you the perfected Clarostat Series M Control. Also the new and improved Ad-A-Switch. Ask for latest literature. Or write us direct.



CLAROSTAT MFG. CO., Inc.
285-7 N. 5th St. Brooklyn, N. Y.

department of the Hygrade Sylvania Corporation.

A new type format distinguishes this Characteristics Sheet from previous editions. Each tube type is horizontally ruled off so that any particular characteristic desired can be seen at a glance.

It is a twelve-page booklet and contains not only average tube characteristics, but also Panel Lamp characteristics and tube and base diagrams. It is available free, but, in view of paper shortages, it is requested that radio servicemen and service departments of radio shops order for bare requirements only and give a single copy the greatest possible use.

★

New RCA Tube Plant—Plans for the erection of a large new radio tube manufacturing plant at Manheim Township, Lancaster, Pa., by the RCA Manufacturing Company, were disclosed with the announcement that a large tract of land from the Frank McGramm properties adjacent to the Pennsylvania Railroad main line had been purchased by the radio company.

It is estimated that the new manufacturing activity on special purpose radio and electronic tubes, which is being undertaken in cooperation with the U. S. Navy, will ultimately provide employment for upward of 1800, of whom an estimated 80% will be female workers.

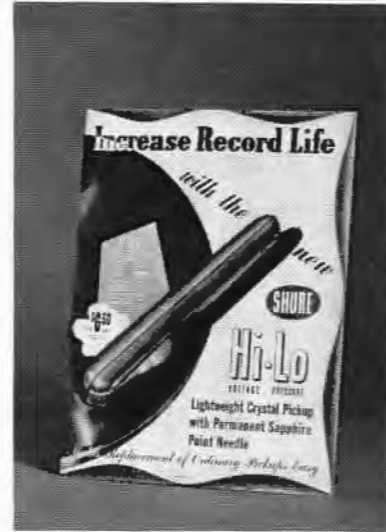
Grounds for the main building, which will occupy 326,000 square feet of space, will be broken around March 1st, and it is expected to be completed about September 1st.

★

RCP Catalog—The 1942 line of radio and electrical test instruments manufactured by Radio City Products Co., Inc., 88 Park Place, New York City, is presented in a 20-page, illustrated catalog just released. This new line includes more than 40 models of 22 basic test instruments and in this new Catalog No. 125 each of these models is illustrated and its specifications presented in concise, time-saving form.

Copies of the new catalog are now available from RCP distributors throughout the country, or from the manufacturer direct.

Display Card—Shure Brothers, Chicago, have released an attractive new display card and streamer on the Shure "Hi-Lo" 1-ounce Crystal Phonograph Pickup—for Jobbers' counters and windows.



In colorful brown, gray and black, with a large, striking photo of the pickup, these display pieces tell the "Hi-Lo" story at a glance. They point out the combination of high-voltage and low pressure (1.4 volts output at 1000 cps with 1-ounce needle pressure) and the low cost.

Such modern, eye-catching displays, with their strong sales appeals, will stimulate pickup replacement business. They are available to Shure Jobbers. Simply write to Shure Brothers, 225 W. Huron Street, Chicago, Illinois.

★

New Catalog—"What to Know and How to Select the Proper Antenna". These suggestions are incorporated in the new catalog released by the Vertron Manufacturing Co. of 132 Nassau Street, New York City. This catalog also describes the new series of "V" Antennae, recommended for noiseless reception of Frequency Modulation, Short Waves and Broadcast. The new 1942 Catalog is available at no charge upon request to manufacturer.

★

Television "Spot"—One of the first spot announcements to be made via television by a commercial sponsor was placed by RCA Victor recently with NBC's New York television outlet, WNBT.

Purpose of the "spot" was to locate the few RCA Victor television receivers that have not yet been adapted by factory representatives to receive transmissions under the new standards for television broadcasting which went into effect July 1, 1941. The change-over is being made without charge to the set owners.

Viewers saw an NBC announcer standing beside a television receiver, urging owners of RCA Victor television receivers that had not been adjusted to communicate with the manufacturer.



"Burt" Browne, well-known Chicago advertising executive, who made a gruesome discovery while on vacation. Story in left column.

Gruesome Discovery—Burton Browne, of Burton Browne, Inc., Chicago Advertising Agency relates a gruesome story of finding the body of an unidentified young man while vacationing on a ranch near Wickenburg, Arizona. Mr. Browne was horseback riding when he discovered the body protruding from a cave on the side of a canyon. The head and right hand had been blown off by a dynamite blast which apparently detonated as he was kneeling to fix the charge.

★

Wiltbank Recuperating—The many friends in the trade of Charles N. ("Chick") Wiltbank of Philadelphia will be glad to learn that he is recuperating nicely from a recent illness and expects to be back in harness by Spring.

Mr. Wiltbank was formerly Sales Manager for the Hugh E. Eby Company and operates now as Manufacturers' Representative in the Philadelphia and Eastern territory. His business has been carried on by associates without interruption.

★

RCA Changes—A re-assignment of two District Sales Managers of the RCA Manufacturing Company, and the appointment of a new District Manager has been announced by Fred D. Wilson, RCA's Manager of Field Activities.

John K. West, District Sales Manager at Cleveland since 1938, has been assigned to San Francisco, replacing E. J. Rising, who resigned. Harold M. Winters, assigned to Kansas City district, has been transferred to fill the vacancy at Cleveland. District Manager at Kansas City is now Harold R. Maag, heretofore in charge of merchandising activities in Southern California.

★

Endorse RCA Ad—An expression of appreciation to the RCA Manufacturing Company for the series of service advertisements published in *Collier's* magazine has been signed by 200 key service dealers in the Chicago area in the form of a testimonial addressed to L. W. Teegarden, Manager of RCA's Radio and Tube Divisions.

The testimonial reads in part as follows: We, the undersigned, radio service dealers in the Chicago territory do hereby give a vote of thanks to RCA for the splendid advertisement placed by RCA and featured in *Collier's*. We appreciate this message to the public, not only because of its timeliness during the present national emergency, but also because it stresses our constant purpose and desire to serve the public honestly and in a manner that will always merit the confidence and good will of radio owners.

Each signature was entirely voluntary after the dealer had studied the ads and discussed the scope of the program with representatives of the Walker-Jamieson Company, RCA Tubes & Equipment distributors in Chicago, who returned with the report that the Chicago service trade is "practically unanimous" in approving the advertising program.

★

Safety Award—A bronze plaque was awarded the Hygrade Sylvania Corporation by the National Safety Council in recognition of the excellent safety record marked up by the machine shop of the Emporium, Pennsylvania tube factory for the year of July 1, 1940 to June 30, 1941. During that period there were no lost time accidents.

The trophy was an award of the Metals Section of the National Safety Council. It was the first such honor won by the company in a national contest and, also, is to be noted that this was the company's initial entry in this particular contest. Further emphasis was placed on the award by the fact that Emporium Machine Shop has enjoyed a perfect no lost time accident record since August 1937.

Hygrade Sylvania Corporation has chalked up an imposing safety record during recent years. In the state of Pennsylvania Industrial Safety Contest, six departments of the Emporium plant out of eighteen received gold honor awards from the Department of Labor and Industry. These awards were made for no lost time accidents during 1940 by the Instrument Manufacturing Section of the State Labor department. In the radio parts industry, nationally, Hygrade



Individually
TESTED!

● Yes, even these inexpensive Aerovox paper tubulars are individually tested. That's true of every Aerovox condenser whether it be a ten-cent paper tubular or a ten-dollar oil-filled capacitor. Each and every Aerovox condenser is factory-tested for your convenience, peace of mind, ultimate pocketbook.

TUBULAR PAPER CONDENSERS

Compact; non-inductively wound; sealed in wax-impregnated paper tubes with wax-filled ends for longer life and protection against moisture.

- Type 484: 400 v. D.C.W. .01 to 1.0 mfd.
- Type 684: 600 v. D.C.W. .001 to .5 mfd.
- Type 1084: 1000 v. D.C.W. .001 to .1 mfd.
- Type 1684: 1600 v. D.C.W. .004 and .007 to .05 mfd.

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● Ask for the new Aerovox paper tubulars in the colorful yellow, black and red label jackets. Ask for latest catalog—or write us direct.



NEW BEDFORD, MASS., U. S. A.
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EXPORT: 100 Varick St., N. Y., Cable 'ARLAB'

NEW CATALOG

OF SOUND AMPLIFYING SYSTEMS
AUDIOGRAPH Sound Systems represent the latest in Public Address equipment—a complete line plus pre-tested accessories.

NEW LOWER PRICES

Outstanding quality and performance at prices that help you meet any competition.

WRITE FOR YOUR FREE COPY

AUDIOGRAPH

THE FIRST NAME IN SOUND
John Mack Industries—1312 W. Randolph Street, Chicago, U. S. A.

FLAT RATES SIMPLIFY YOUR SERVICE PRICING!!

- Eliminate labor losses
- Reduce price arguments
- Make estimating easier

A compact vest pocket volume containing complete flat rates for radio service work from A to V. Includes instructions on pricing procedures showing examples, storage charges, disposal of instruments and guarantee. If your jobber doesn't have it, send 25c for a prepaid copy.

Specify the Schedule you want.

RADIO EQUIPMENT CO.

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Minneapolis, Minn.

- Schedules for
- \$1.50
 - \$2.00
 - \$2.50
- per hour



4 STANDARD TYPES

of Amperite Regulators replace over 400 types of AC-DC Ballast Tubes now in use. Amperites are real REGULATORS... have patented Automatic Starting Resistor which prevents initial surge and saves pilot lights... Ask Your Jobber.

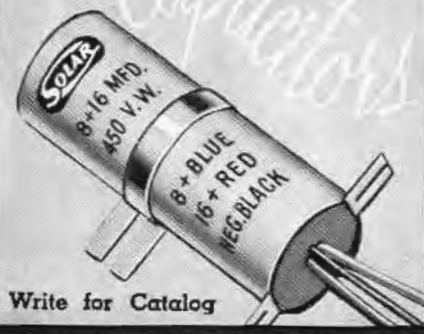
AMPERITE

THE *Simplest* WAY TO REPLACE BALLASTS

WRITE FOR REPLACEMENT CHART
AMPERITE CO. 541 BROADWAY, NEW YORK, N. Y.

New, Handy

UNIVERSAL REPLACEMENT



Write for Catalog
SOLAR MFG. CORP.,
Bayonne, N. J.



Sales for the E. M. Nelson Company, Hygrade Sylvania Radio Tube jobber, will continue on the rise with these sales getters. Left to right: Pat Patterson, Sylvania salesman, E. P. Demarest, Sylvania West Coast representative, E. M. Nelson, proprietor, Mrs. Nelson, proprietress, Paul Hanson, counter salesman and Steve Lockwood, radio service department chief.

Sylvania was awarded a special prize in 1940 for having had an unusually small number of lost time accidents in all departments of the Radio Tube Division of the Company.

The St. Marys plant in 1939 and 1940 received an honor certificate for no lost time accidents and received permission to fly the safety flag of industry of the State of Pennsylvania.

That Hygrade Sylvania is concentrating on safety is evidenced by the manner of teaching apprentices. The Emporium Machine Shop apprentice school which started classes on October 27th has safety lessons as an integral part of instruction. Every lesson and every operation will be studied not only from the standpoint of efficient operation of machines as working units, but also as instruments which require deft handling for safe operation. At the same time students are taught how to run the machine, they are taught how to run it safely.

New Tube Plant—A new radio tube plant for the manufacture of special purpose radio tubes will be constructed for the Hygrade Sylvania Corporation in Mon-

toursville, Pennsylvania, by the Industrial Properties Corporation, Subsidiary of the Williamsport Community Trade Association, according to an announcement made simultaneously by C. E. Noyes, Manager of the Williamsport Community Trade Association, and B. G. Erskine, President, and H. Ward Zimmer, General Manufacturing Manager, Hygrade Sylvania Corporation, Pennsylvania. The property comprises some 16 acres of land on Broad Street, just east of Williamsport on the Harrisburg highway. It is expected that ground will be broken for the new plant in the near future, and its construction rushed to completion.

Plans for the new plant in the Williamsport area call for a building with a total floor space of approximately 50,000 square feet. It has been designed by Clarence Wagner, well known architect of Williamsport.

NEW PRODUCTS

(Continued from page 26)

channels with fader. Also bass-treble tone control. By Allied Radio Corp., 833 West Jackson Blvd., Chicago.

G. I. "Smooth Power" Phono Products Help Sell Your Service

FORTY years of General Industries leadership steps out with you when you tackle a sale that includes G. I. equipment. "Smooth Power" phono-graph motors, home recorders and record changers. Styles and sizes to meet your needs, depending on torque requirements,



quality, price—and, of course, National Security demands. Ask your Jobber. For catalog and price sheet, please write us.

The GENERAL INDUSTRIES CO., Dept. 17, Elyria, Ohio

Order Cutting and PLAY-back Needles from our affiliate, General Phonograph Mfg. Co., Inc., Putnam, Conn.

SHURE

Voice Unidyne—The new "Voice" Unidyne, employing the Shure Uniphase principle, combines the advantages of true cardioid uni-directional performance with emphasis on "voice" response. It is dead at the rear, providing clear reproduction of speech or singing without interference from feedback, background noise or reverberation. The extra-rugged single-unit Uniphase construction makes it especially suitable for severe outdoor and indoor use. Uses a specially suspended double wind screened moving coil system, and is not affected by heat or humidity.

Swivel head, with standard 5/8"-27 thread for stand mounting. Built-in cable connector. Furnished with 25-foot shielded cable and plug. Model 55AV for 35-50 ohm circuits; Model 55BV for 200-250 ohm circuits, with internal transformer; Model 55CV, high impedance, with internal transformer. By Shure Brothers, 225 West Huron St., Chicago.

THORDARSON

Field Supply—Adaptable to practically any loudspeaker with 2500-ohm field. The switching mechanism permits operation of two 2500-ohm fields requiring approximately 14 watts field excitation; four 2500-ohm fields requiring approximately 8 watts field power; or, eight 2500-ohm fields requiring about 4 watts field power. Operates on 110-120 volts, 50-60 cycles, and measures approximately 9" long, 5" wide by 7" high. By Thordarson Electric Mfg. Co., 500 West Huron St., Chicago.

SHOP NOTES

(Continued from page 20)

REPLACING RCA ELLIPTICAL CONES In Speakers with Cemented Voice-Coil Supports

Remove old cone. Clean housing thoroughly.

Apply a thick bead of Du Pont household cement to yoke plate where cone centering support will fit.

Apply a thin coat of Du Pont household cement to housing where cone edge will fit.

Put cone in position using several thin strips of paper to center voice coil.

Press cone edge and centering support down in cement and allow to dry.

After cement is dry remove cone centering strips.

Solder voice coil leads to proper terminals.

Cement center dust cap in position.

RCA Q-16

Capacitor Change

To reduce flutter in Q-16 with "EM" speaker, the audio coupling capacitor C25 is changed from .0025 to .0015 mfd.

RCA QB1, Q16, Q17, Q27

Capacitor C33

C33 is changed from 18 to 15 mmfd., Stock No. 12896.

RCA RP-158, -160, -162

Slow Speed

In cases of slow speed, adjust the bottom bearing of turntable spindle to remove binding and to obtain free rotation. Refer to adjustment "B" in Service Data. Check by applying power to the turntable motor, allowing turntable to reach full speed, then pull motor away from turntable drive disc. The turntable should coast for at least twelve revolutions. (In RP-162, disengage motor from turntable by pulling idler away from turntable to observe coast.)

RCA V-105

Phono Compensation Change

C17 and R16, shunted across the pick-up are changed from .015 to .01 mfd. (Stock No. 4937), and from 47,000 to 68,000 ohms (Stock No. 13715).

RCA 28X

Change in 2nd Production

In 1st production, a capacitor C47 is connected from chassis to the junction of R1 and R27 in the r-f plate circuit. In 2nd production, C47 is omitted, and terminal 11 on the oscillator coil is connected to the junction of R1 and R27 instead of to the "plus B" bus.

RCA 28X, 28X-5

C4 Changed to 47 mmfd.

The oscillator grid capacitor is changed from 33 to 47 mmfd., Stock No. 13141.

RCA 28X, 28X-5

Hum Modulation

This form of hum becomes evident when a station's carrier is tuned in, and disappears when the set is tuned between stations. The hum may be present on only a few locals, or on many stations, depending, among other things, on the type and installation of the a-c supply line.

If hum modulation exists, check to see that there is an .05 mfd., 400-volt capacitor connected from the plate of the 25Z6GT rectifier to -B. Add this capacitor if necessary. The capacitor acts to by-pass r-f signals around the rectifier tube.

RCA 45X-1, 45X-2

Changes in 2nd Production

The a-c filter resistor R4 is changed from 2.2 to 3.3 megs., Stock No. 12928.

The output tube bias resistor, R8, is changed from 150 to 120 ohms, Stock No. 30189.

RCA 46X SERIES

Dial Lamp Burnout

In Models 46X-1, -2, -3, -11, -12, -13, -21, -23, -24, the dial lamp is Mazda No. 47 (.15 amp.). In case of frequent burn-out, Mazda No. 51 (.2 amp.) can be used for replacement.

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RCA VHR-207, VHR-407

Changing 470-mmfd Capacitor

Some cases have been reported of breakdown of capacitor C53 in the cutter circuit. A higher voltage rating capacitor is now available under the same stock number, 30433. The former type capacitor (black color) should be replaced with the new type (grey color) whenever these sets are serviced.

RCA 25BK & 25BT3

Distortion on Locals

Distortion on strong local stations (even with volume control turned low) may be caused by "front end" overloading due to excessive signal strength. This can be corrected by using a shorter antenna, or by connecting a small capacitor (about 50 mmfd) in series with the antenna.

RCA 1X, 1X2, 1AX, 1AX2, 45X5

Line Condenser

In some production, the .005-mfd line bypass is connected from plate to cathode on the rectifier tube, instead of from plate to chassis.

Capacitor Changes

With the exception of Model 45X5, second production receivers had the following changes:

C14 changed from .015 to .02 mfd. C17 changed from .085 to .02 mfd. C24 (1AX, 1AX2) changed from .2 to .1 mfd. R4 changed from 2.2 to 3.3 megs.

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- ★ Approximately 850-Hour Combination "A & B" Battery Pack
- ★ Full A. V. C. Action—7 Tuned Circuits

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tion may be *delayed*. You can easily sell your prospects on the advantages of getting modern radio reception *now*...with easy conversion to power-line operation at *any* time!

Housed in beautiful cabinets finished in costly walnut veneers—with batteries completely self-contained—these Radiola models are real self-sellers. Why not cut *yourself* a slice of extra profits—? See your Radiola Distributor today!



RADIOLA MODEL B-50

- ★ 4 RCA Preferred Type, Low-Drain Tubes
- ★ Selective Superheterodyne Circuit
- ★ Full A. V. C. Action—Tone Control
- ★ 5" Full-toned P.M. Speaker
- ★ 1000-Hour Battery Life



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