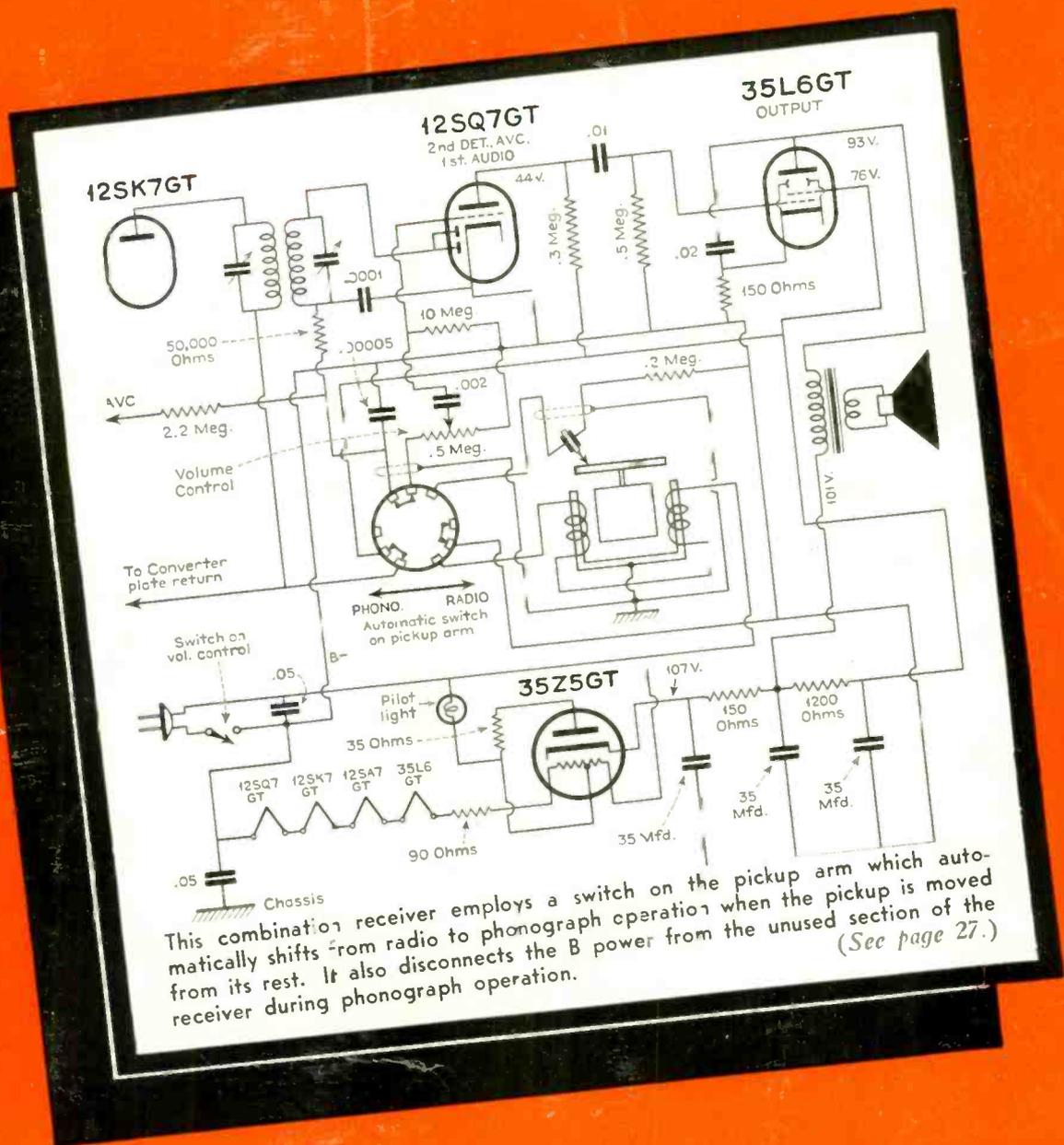


SERVICE



**JANUARY
1942**

This combination receiver employs a switch on the pickup arm which automatically shifts from radio to phonograph operation when the pickup is moved from its rest. It also disconnects the B power from the unused section of the receiver during phonograph operation.
(See page 27.)

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A Monthly Digest of Radio and Allied Maintenance
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IT HAS been suggested to us by a prominent manufacturer that we devote part of this column toward enlisting the Service Man's aid in combating the spread of disheartening and dangerous rumors. Service Men, especially, can help fight this form of sabotage since they come into close daily contact with the public.

The President, in his address during the first few days of the war, pointed out that the purpose of fantastic claims and rumors "is to spread fear and confusion among us, and to goad us into revealing military information. Our government will not be caught in this trap, and neither will our people," he said.

It is suggested that Service Men take time to point out, to those impressionable and over emotional persons who continue to spread misinformation in spite of these warnings, that their action serves no useful purpose and can be extremely dangerous. Where you have reason to believe that such conduct is deliberate, proceed with caution and report the persons involved to the nearest government agency.

WE ARE proud to present in this issue a galaxy of famous authors who write on timely topics. Our feature article on "Industrial Electronics" (page 5), by Alfred A. Ghirardi, is one of a series on the general subject, "Expanding Service Opportunities", which began last month. Mr. Ghirardi will continue in subsequent issues.

With the ever increasing popularity of record making and playback equipment it is rapidly becoming one of the most important fields for the radio Service Man. With this in view, we present "Phonograph Motor Repairs", by John F. Rider, on pages 15 to 19.

Each new day makes the problem of parts shortages more and more acute. To help you solve this problem we give you two articles on the subject this month. On pages 9, 10 and 11 we have our continued feature covering the oscillator section of the receiver. S. Gordon Taylor delves into the subject of parts values (particularly condensers) and gives a novel idea on how to help overcome shortages of particular values on page 20.

Another item which we feel sure will prove interesting to our readers is Charlie Farrell's column, "Farrell Says", on page 22, where he makes noteworthy comments on the happenings of the day, mixed with typical Farrell pleasantries.

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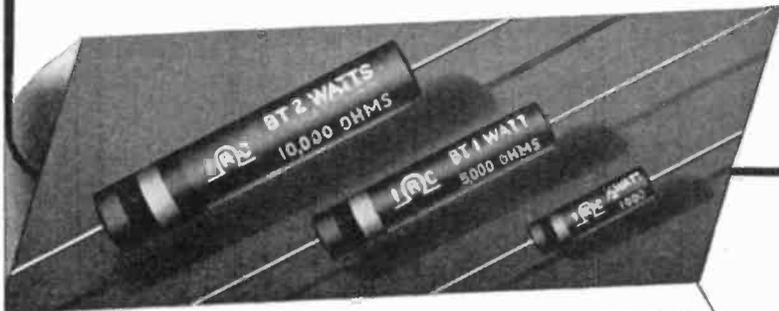
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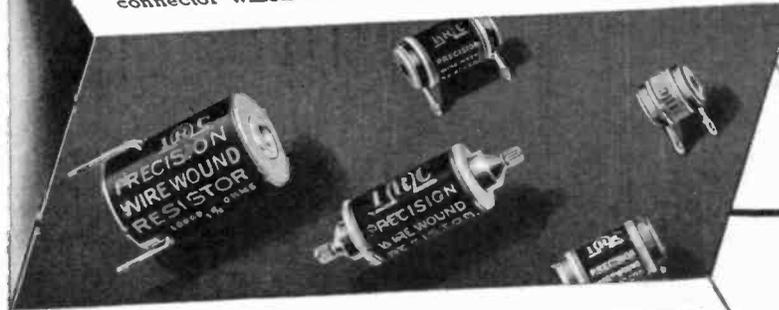
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INDUSTRIAL ELECTRONICS

By ALFRED A. GHIRARDI

DESPITE economic conditions far from favorable for the application of new developments to industry, the late depression years witnessed a marked trend toward the use of electronic devices in all sorts of automatic control, timing, measurement and conversion applications. Vacuum tubes and associated equipment have in many cases replaced much more expensive (or less effective) mechanical devices; have reduced the vagaries introduced by the human element; and have made possible entirely new degrees of speed and precision in controlling mechanical, chemical and electrical operations or processes.

When industrial production was stepped up for defense purposes these electronic devices lent themselves admirably to the speed-up and now with industry going on an all-out war basis they have been accepted as an imperative necessity and are daily finding new applications. One may be a new timing application involving speeds figured in micro-seconds; another may be in sorting a product automatically as it comes off the production line; others, the automatic control of illumination, or precise timing of repetitive mechanical operations, and so on without end.

All of this is important to the Service Man who is anxious to expand his field of activity. Here is a field that is made to order for him, yet one which will also test his mettle, for while his familiarity with radio tubes and circuits will prove tremendously helpful, this alone will not qualify him to tackle the new activity. It will require no little concentrated study on his part, not only to familiarize himself with fundamental and detailed technicalities involved, but to develop a quite different business approach than that obtaining in the promotion of his regular radio service business.

In general the electronic equipment employed in industry is a far cry from the typical, built-to-a-price radio re-

ceiver. If a radio set goes sour it does no more than cause inconvenience to its owner. When an electronic device breaks down in an industrial plant it may tie up an important machine, a department, or an entire production line. For this reason much of this industrial

other tough conditions of service, there is a need for careful, capable and frequent maintenance attention.

Servicing Profitable

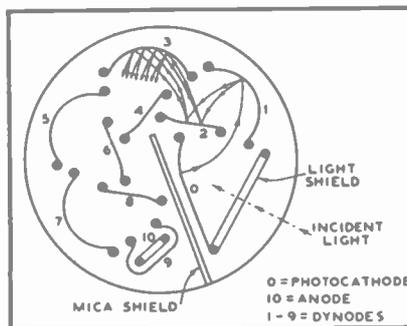
The servicing of industrial electronic equipment therefore offers a profitable field for the qualified Service Man. Needless to say there are also many opportunities for developing electronic devices to meet the requirements of individual jobs. In a sense this opportunity compares with the old days of the "custom-built" radio business but with the difference that such modern electronic design is perhaps more likely to combine commercially available assemblies rather than individual resistors, capacitors, tubes etc., assembled from scratch by the designer.

Just how the Service Man will fit himself into the industrial picture depends a great deal on the individual, his business set-up and his connections. Obviously the manufacturer of electronic equipment is not going to recommend to the owner that he depend on every Tom, Dick and Harry for its servicing. On the other hand, it is often not practical to maintain travelling factory service—and just as impractical for the owner to suffer delays that would be involved in returning equipment to the manufacturer for service. Realizing this, a number of manufacturers have established sales, installation and service representatives in strategic localities. This served their purposes in normal times but not in time such as the present or such as the immediate future will witness.

Assuming that a radio Service Man has familiarized himself with the fundamentals of modern electronic equipment and has gained at least a fair knowledge of its applications, a good bet would seem to lie in tying-up with an equipment manufacturer as his authorized local representative, preferably to handle not only the servicing, but likewise the sale and installation of his equip-



Figs. 1 and 1A. The RCA 931 is a multiplier type phototube that consists of an anode and a 9-stage electrically focused amplifier all housed in a 3 11/16 inch glass envelope.



equipment is designed with cost as a definitely secondary consideration. Extra safety factors are built-in as a matter of course. But where operation is often on a basis of 24 hours per day, 7 days a week, as in the present emergency, and equipment subjected perhaps to extremes of temperature, vibration or

ment in the local territory. Even the biggest and best manufacturers will in most cases be more than glad to cooperate in such arrangements in territories where they do not already have adequate set-ups—and today, with industry springing up in every hamlet, such territories are legion.

Where such an arrangement can be consummated, the manufacturer will provide leads which will help the Service Man get business. Moreover, his appointment as an official representative by a reputable manufacturer will give him a certain standing which will aid him in soliciting both sales and service business. It should be emphasized again, however, that knowledge of radio, no matter how intimate it may be, is not enough to gain such an appointment from a manufacturer who values his reputation. Nor would such an appointment be of any value to the Service Man, without the knowledge necessary to perform the duties involved.

This knowledge of radio servicing is more than a half-way start in the new field. Amplifier systems are extensively utilized in industrial control operations, as are conventional radio tubes and many other familiar radio components. Trouble shooting operations are likewise similar, although usually more simple, to those involved in radio. Further, test equipment adequate for competent radio servicing will usually meet every requirement in checking industrial electronic equipment.

The additional knowledge required involves familiarity with phototubes and various special tubes which are employed extensively in industrial applications although for the most part entirely

trial applications—tubes such that a single one may perform the combined functions of amplifier and electro-mechanical relay, and in addition provide precision timing of its own relay operation.

With an understanding of these tubes, the remaining step is to study the actual electronic equipment and its applications. The literature offered by the manufacturers of tubes and equipment will be helpful in this effort. Likewise articles, circuits and data which appear quite regularly in electrical, electronic and radio publications. It doesn't pay to be too choosy or selective in this study. Anything and everything pertaining to the subject contributes to the desired background of knowledge, particularly in this field where a device designed to perform some special function in a lace factory, for instance, may incorporate ideas equally applicable in a shoe factory, a steel mill, or even a private home. It might be said here that the term "industrial" as applied herein to electronic devices is a general one which broadly covers equipment used not only in industry but in commerce, the home, in advertising displays, etc. Principally it indicates types of apparatus distinct from conventional radio and sound equipment and primarily utilized for various control functions.

It is the purpose of this and the following article to present information which it is believed will be helpful to radio Service Men contemplating this expanded field of activity. This material will by no means represent a complete course of study. Its purpose is more to provide a "sampling" of equipment and applications, and perhaps sug-

will be devoted to a discussion of them and of phototubes.

Phototubes

Conventional phototubes find highly diversified applications in industrial equipment. Their use in protective systems where interruption of a beam of light by an intruder sounds an alarm, in sound reproduction where the modulation of a light beam is reproduced by the electrical output of the phototube, and in automatically turning on lights or illuminated signs as daylight wanes, are well known. Less well known and therefore worthy of study are their uses in a myriad of other applications involving these same and other principles.

The phototube consists essentially of a cathode of relatively large area on which is deposited a photoactive material, and the anode or collector. Like the radio tube, these are enclosed in an evacuated glass bulb with terminals brought out to provide plug-in, screw-in or cartridge-type mounting connections.

If a small amount of gas such as neon or argon is released in the envelope after evacuation, the effect is to greatly increase the tube's sensitivity. This results from the tendency of fast moving electrons to release other electrons from the gas atoms by collision. These new electrons are drawn to the anode, increasing the total current flow. The remaining gas ions, are forcibly attracted to the cathode where they dislodge other electrons. Thus the total

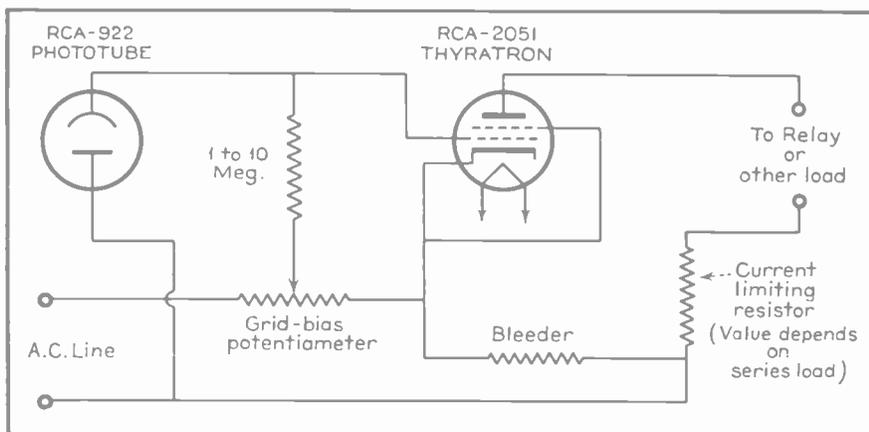


Fig. 2. In simple light operated relay circuits the thyratron tube is driven directly from the phototube.

foreign to radio. These are the tubes that perform the many relay, trigger, timing and other functions which play a predominantly important part in indus-

trial applications. Because the special tubes referred to above find prolific application in this type of service but are virtually unknown in the ordinary radio and sound fields, the balance of the present article

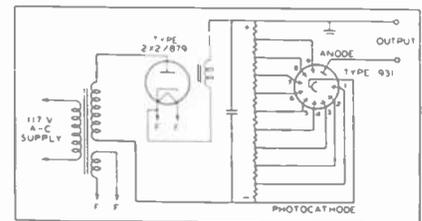


Fig. 1B. D-c voltages for the operation of the multiplier phototube can be obtained from a simple half-wave rectifier.

electron flow is increased in two ways by the presence of the gas molecules.

Phototubes of the gas type are used extensively in sound reproduction work, also in other applications where high sensitivity is paramount. Otherwise the high-vacuum type is preferred in many industrial applications because this type provides somewhat more uniform operation, has higher internal resistance and is less susceptible to damage from excessive voltages or current.

In selecting a phototube for a specific application there will usually be one type best suited to the particular requirements. Its choice will be influenced by a number of considerations including sensitivity, spectral (color)

response characteristic, required anode voltage, permissible load resistance, stability, size, shape, terminal arrangement, etc. Space does not permit detailed discussion of these considerations here but a good deal of helpful information on the subject is obtainable from a 16-page manual issued by RCA on their line of phototubes, and from similar material and data sheets from other manufacturers of phototubes.

Multiplier Phototube

Of particular interest, and apparently offering outstanding advantages for many applications, is the Multiplier phototube. The RCA type 931 shown in Fig. 1A is such a tube. It consists of a light-sensitive cathode, an anode and a 9-stage electrically focused amplifier, all enclosed in a single tube having an overall height of only 3-11/16 in. Actually this amplifier consists of a series of 9 secondary emitters (dynodes) so arranged that electrons are directed by electrostatic fields from one to another in fixed sequence as shown

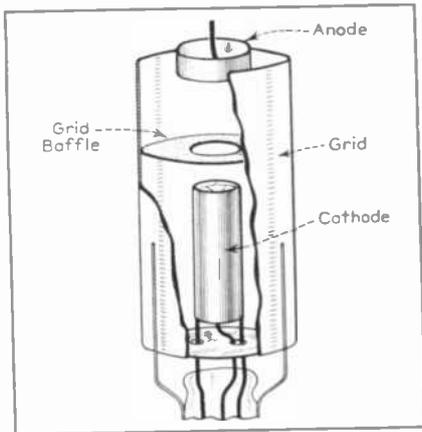


Fig. 3. Because of the almost complete shielding between cathode and anode a small negative grid voltage will cut off anode current flow.

in Fig. 1. Thus electrons discharged by the cathode, as a result of impinging light, are drawn to the first dynode by virtue of a positive voltage applied externally to the latter. Striking this electrode the electrons dislodge many others (secondary emission) which join the first ones in a rush toward dynode No. 2, directed by the internal fields and the still higher positive voltage on this electrode. This same process is repeated at each stage with the result that minute currents (electrons in motion) produced at the cathode by relatively weak illumination are multiplied up to 230,000 times by the secondary emission added at the successive dynodes. Total supply voltage up to 1,250 volts may be used with the 931, each succeeding dynode being connected to a tap at a higher point on a voltage

divider connected across the voltage source, to provide the progressively increasing voltages necessary. Fig. 1B shows a simple half-wave rectifier power-supply circuit with a voltage divider for supplying suitable d-c voltages to a type 931 phototube. Note the use of familiar radio receiver type components throughout this circuit: standard rectifier, filter and voltage divider circuit, etc.

The values of voltages applied to the various dynodes determine the total amplification obtainable from the tube. A convenient form of gain control may be provided by varying the voltage to a single dynode, making the voltage step unequal to that of the others.

Multiplier phototubes provide at least two advantages over the ordinary type. First is their ability to respond to extremely low values of illumination; sec-



The Westinghouse Type 256A is a three-element, argon filled thyatron with an indirectly heated cathode and a five-pin base.

ond, the need for following them with less vacuum-tube amplification, because they are capable of full output at low light values such as would provide only the weakest response from a standard phototube.

Thyatron Tubes

The special tubes to which reference was made earlier are the thyatron types extensively employed in place of vacuum-tube amplifiers, relays, or both in some phototube and other industrial circuits. These tubes are essentially grid-controlled rectifiers which, when conducting, offer very low internal impedance and high power handling ability.

The function of the control grid in thyatron tubes is to maintain the tube in a non-conductive state until a critical value of grid voltage is reached. At this point the grid loses all control and full anode current flows. The tube is then said to "fire." The grid cannot again regain control until the anode voltage has been reduced to practically zero.

With the grid biased to a point just

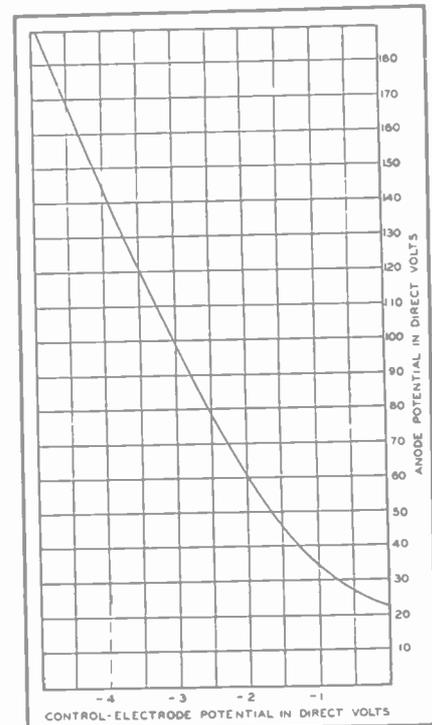
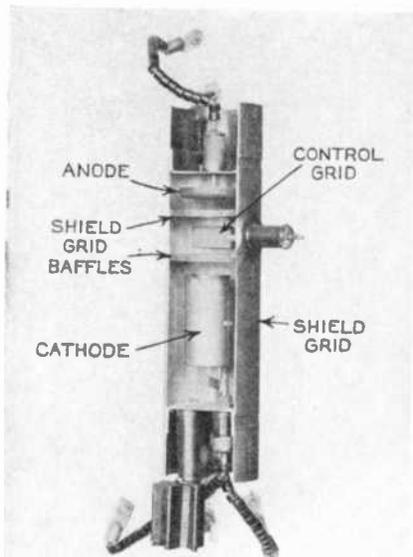


Fig. 4. The value of grid voltage required for anode current cut off depends upon the applied anode voltage.

slightly below its critical value, no anode current will flow. However, a very small increase in the voltage applied to the control grid by an external circuit (such as that of a phototube, for instance) will cause the tube to break down and full anode current to flow. The required control voltage is so small that in many applications a change of a fraction of a volt in the potential applied to the grid will release high power. This high power may be used for the direct operation of devices connected in series with the anode circuit, or through the medium of a mechanical relay included in this series circuit. Because of the high control sensitivity of these tubes, it is entirely practical to operate them directly from phototubes, as shown in Fig. 2, without any form of intermediate amplification.

In Fig. 3 the internal structure of a simple thyatron is shown. This consists of an indirectly heated cathode and an anode, enclosed within a large cylinder; this latter cylinder constitutes the grid. Also a part of this grid is a baffle with a hole in its center through which electrons must pass in transit from cathode to anode. Because of the almost complete shielding (except for this hole) between cathode and anode, a small negative voltage applied to the grid is ample to prevent the passage of electrons to the anode, even though the latter be maintained at a relatively high positive potential. The actual value of grid voltage required to just prevent current flow depends on the applied anode voltage, as indicated by the curve



The General Electric FG172 is a metal envelope type thyatron that incorporates a shield grid in addition to the control grid.

of Fig. 4 for the WE256A thyatron. At an anode voltage of 120, for example, this particular tube becomes conductive only when the negative bias on the grid is reduced to 3.5 volts. So long as the bias is more negative than this value the tube will not conduct.

Theoretically the bias could be adjusted to a value of say 3.6 volts, for this value of anode voltage, then a change as low as 0.1 volt in the signal applied to the grid would cause the thyatron to become conductive. Actually it is not practical to work so close to the critical grid-control value. Slight fluctuation in supply voltages or extraneous voltages induced in the input circuit or wiring might cause the tube to fire. It isn't necessary, however, even when operating from weak inputs to work so close to the limit. The grid circuit characteristics of some thyratrons are such that grid load values up to 10 megohms can be employed. Across a resistor of this value even a very slight change in phototube or other input current will provide a very appreciable change in the voltage applied to the grid of the thyatron.

With the 3-element thyatron of Fig. 3 it is not practical to work out of circuits of such high impedance for the reason that there is some slight flow of grid current, even when the tube is not conducting. This current flowing through a high grid resistor places a voltage on the grid and must be neutralized by the application of correspondingly higher negative bias. More than this, however, the grid current is likely to vary somewhat, making this undesired voltage a variable factor.

To minimize this and other difficulties, and permit operation from high-

impedance circuits, thereby gaining the advantage of greater effective sensitivity, thyratrons have been developed in which a shield grid is included. Such a tube is shown in Fig. 5—the RCA-2050 (and 2051). Here the shield grid (3) completely incloses the other elements and also isolates the anode (5) from the cathode (1) and grid (2) by virtue of a partition (4) in which there is a narrow aperture. The grid takes the form of a looped ribbon, the inner dimensions of which correspond with the aperture in the shield grid partition. The electron path from cathode to anode is through these aligned apertures.

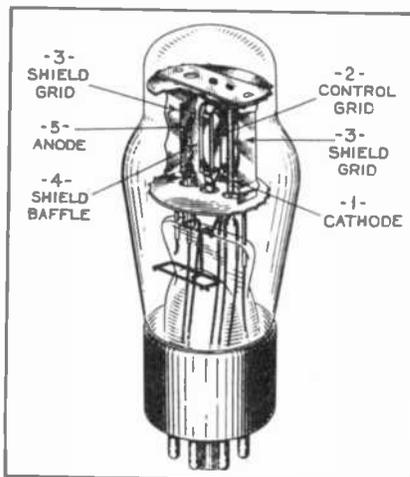


Fig. 5. In the RCA Type 2050 thyatron a shield grid which completely encloses the other elements is employed.

In this arrangement the shield is normally at cathode potential and, so long as the grid remains sufficiently negative, limits the influencing field of the anode to the confines of its compartment of the shield. Gas currents are reduced and in addition such as do exist are "grounded" through the shield to cathode connection and therefore produce no voltage drop in the grid circuit. The position of the control grid gives it more complete control over the electron stream and thus improves the control ratio of the tube.

Increased operating flexibility is also provided by the shield grid because the control characteristics of the tube can be adjusted over a rather wide range by varying the shield voltage. Changes in this voltage will vary the control-grid voltage at which breakdown occurs for a given anode voltage. The shield also makes this critical value of grid voltage less dependent on the anode voltage. This is indicated by the sharpness and the steepness of the 2050 control characteristic curves of Fig. 6 (as compared with the curve of Fig. 4). These curves of Fig. 6 also show the effect of different shield voltages in shifting the critical value of control-grid voltage.

The two tubes of the type illustrated

are among the smallest of the thyratrons, yet are capable of directly controlling power loads of up to 65 watts from such low inputs as those provided by a phototube. If the tube's load be made a relay, then the tube and relay permit control of almost unlimited power.

It was mentioned that once the tube is "fired" its grid loses control, and that control is again only established by reducing the anode voltage to zero or thereabouts.

Where the anode supply is alternating current, the grid can again gain control whenever it becomes sufficiently negative, because the anode voltage is effectively cut off during one half of each cycle. As long as the grid voltage remains at or above the firing value the tube will become conductive during each cycle. With d-c supply, therefore, the tube is the equivalent of a locking type relay. Once tripped, it remains so unless some other means are provided for unlocking it. On a-c it will remain tripped only so long as the condition which caused it to trip is maintained—

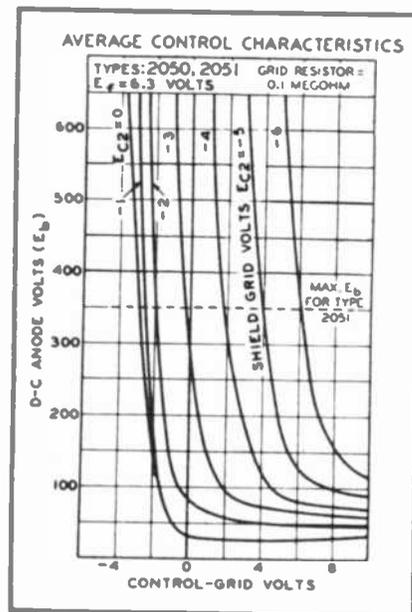


Fig. 6. Changes in the shield grid voltage will vary the control voltage at which breakdown occurs for a given anode voltage.

for instance, such as an increase in illumination on a phototube. The instant the phototube illumination falls below the critical value the tube resumes its original, non-conducting condition.

Application

It is obvious that thyratrons are useful only for off-and-on and intermittent control operations. They cannot, for instance, reflect intermediate changes in the illumination on an exciting phototube. On the other hand, this type of

(Continued on page 31)

SOLVING SHORTAGE PROBLEMS In Oscillator Circuits

By ROBERT G. HERZOG

EDITOR

FOR the past few months, on these pages, we have been discussing possibilities of using alternate values in making replacements and repairs in receiver circuits. In last month's article interstage r-f circuits were covered and mention was made of the fact that in the superheterodyne receiver the greatest step up in radio-frequency amplification is obtained in the intermediate-frequency amplifier. Great amplification can be realized because of the fact that a relatively low frequency can be used, such as 175 kc or 455 kc, where the radio-frequency losses in coils and tuning condensers are much less than at high frequencies. To convert the incoming radio signal to the frequency of the intermediate-frequency amplifier it is necessary to use a local oscillator within the receiver. This oscillator is tuned to a frequency above or below (usually above) the incoming radio signal by an amount equal to the frequency at which the i-f amplifier performs. In most receivers today the first detector or mixer tube is of a type which combines the functions of mixer and oscillator in one bulb. It will be noted in the diagram that the oscillation circuit has two coils designated L_2 and A_2 . A_2 is the tickler coil in the plate of the oscillator section and is fixed in position with respect to the secondary coil, L_2 . L_2 is tuned to the

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proper frequency by condenser C_t . It will be noted in Figs. 1, 3 and 5 that in series with coil L_2 and condenser C_t

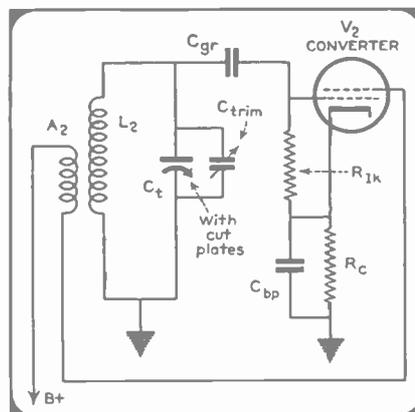


Fig. 2. In many receivers specially cut oscillator plates are employed instead of a padding condenser to track the oscillator with the r-f stages.

is a variable condenser designated C_{pad} . The purpose of condenser C_{pad} is to help make the combination of L_2 and C_t tune to a higher frequency than the signal circuit of the r-f stage. Without the use of the series padding condenser shown the oscillator circuits would not track properly with the r-f circuits.

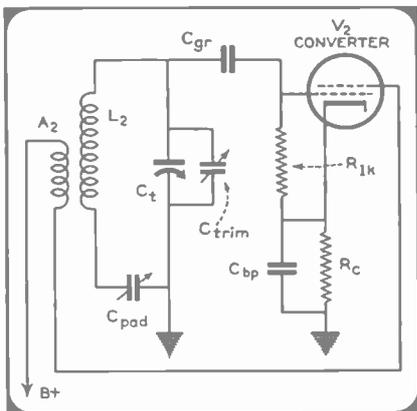
The capacity of this padding condenser depends largely upon frequency used for intermediate-frequency amplifier. For example, 175 kc i-f would re-

quire a capacity between 0.0001 and 0.0014 mfd, whereas 455 kc would require 0.00025 to 0.0005 mfd.

If the oscillator section is made to operate at a frequency 175 kc or 455 kc higher than the signal frequency, the signal produced by the local oscillator will beat against the signal being received from the antenna and a new signal which is the difference of the two will be fed into the primary of the first intermediate-frequency transformer from the plate of the converter tube. In this way the intermediate frequency is generated or produced. In magazines and text books oscillograms are used to illustrate the kind of signal which is produced by the converter. It consists of a carrier having a frequency which will be passed and amplified by the i-f amplifier and it will be found that the audio modulation present on the original signal delivered from the antenna is present on the i-f signal.

The remaining elements which go to make up the converter stage are the voltage-dropping resistors for the screen grids, which grids are tied together within the tube, and the oscillator-plate section, and also by-pass condensers and the elements which go to make up the oscillator grid circuit. The control grid of the oscillator section of the mixing tube is usually connected with the cathode through a grid leak (R_{1k}) and

Fig. 1. In this simple tickler feedback oscillator the padding condenser helps maintain the frequency difference between the oscillator and r-f stages.



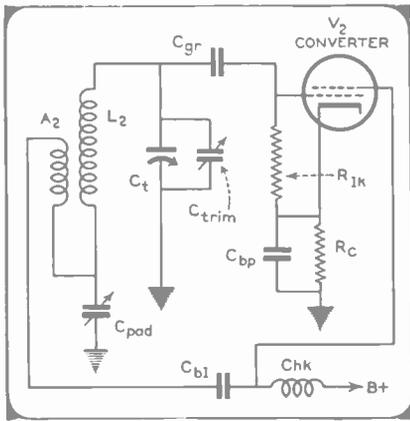


Fig. 3. In modified Hartley oscillator circuit shown, padding condenser is a common impedance in both tuning and tickler circuits. This arrangement balances voltage output over the frequency range and makes for better conversion.

to the tuning coil and condenser through a blocking condenser C_{gr} . This blocking condenser has a low value of capacity generally never above 0.0001 mfd. In receivers using heater type tubes the grid leak has a resistance of 25,000 to 50,000 ohms, depending upon the particular type of tube used. In dry-battery operated receivers values from 100,000 to 200,000 ohms can be found.

Individual Variations

Figs. 1 to 6 illustrate oscillator circuits in use in present day radio receivers. The types of tubes employed in these circuits (V_2) were discussed in last month's article. The cathode resistor (R_c) and its by-pass condenser (C_{bp}) were likewise discussed and the information presented is equally applicable to the circuits shown herewith.

As was mentioned above, Figs. 1, 3 and 5 use a padding condenser (C_{pad}) in series with the tuning condenser (C_t) and the tuning coil (L_2) to maintain the fixed frequency difference between the oscillator and tuned r-f circuits. In Figs. 2 and 4, on the other hand, this fixed frequency difference is maintained by employing specially shaped plates for the oscillator section of the gang tuning condenser. Such plates are readily distinguishable from the r-f sections of the gang tuning condenser.

Except for this difference in tuning condenser plates the circuits in Figs. 1 and 2 are identical. An oscillator circuit of this type is commonly called a "tickler feedback" circuit.

Fig. 3 employs a circuit known as a "modified Hartley." In such circuits the padding condenser (C_{pad}) acts as a common impedance in both the tuning (L_2) and tickler (A_2) circuits. This connection thus provides additional capacitive coupling between the two circuits. An r-f choke (or a resistor) is used to feed the B plus to the oscillator anode grid. An additional condenser

(C_{bl}) is used to block this voltage from the tickler and tuning circuits.

A circuit that is quite popular in recent model receivers is shown in Fig. 4A. In this circuit the cathode of the converter tube is returned to a tap, about $\frac{1}{4}$ to $\frac{1}{2}$ from the low end, on the tuning coil (L_2). In such circuits the oscillator anode grid, which would be the screen in the case of the 6SA7, is connected directly to the B plus circuits. This type of circuit is known as a "Hartley oscillator." Fig. 4B is a similar circuit using a tickler winding, instead of a section of the tuning coil, in the cathode circuit. Here again the oscillator anode grid is connected directly to the B plus circuits.

A tickler feedback circuit using a separate tube for the oscillator is shown in Fig. 5. An additional coupling winding (L_{cu}), wound on the same form with the tuning and tickler coils, is shown connected in series with the cathode of the first detector tube. This winding

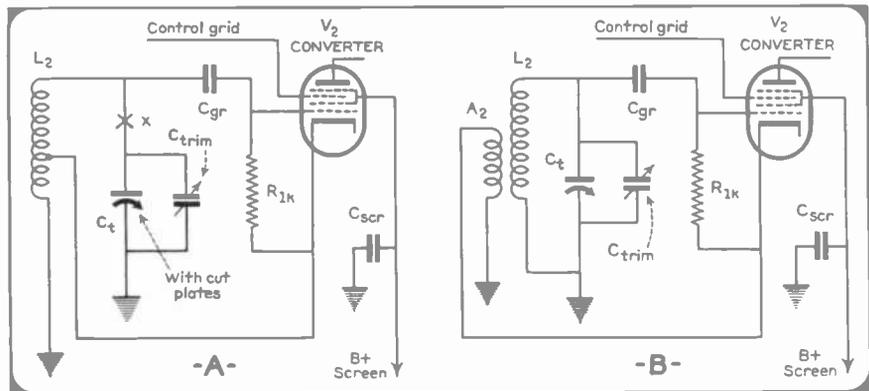


Fig. 4 A and B. The advent of the 6SA7 has made the Hartley circuit shown more popular. In the two versions presented, cut plates are employed for the oscillator section of the gang. A padder would be connected at "X" if used in Fig. 4A.

feeds the oscillator signal to the detector tube where it mixes with the incoming signal to produce the intermediate frequency.

Although a tickler feedback oscillator is pictured for the separate oscillator of Fig. 5, this need not be the case. Any one of the circuits illustrated or any other oscillator circuit could be employed with a separate oscillator tube.

Fig. 6 shows a Colpitts oscillator that has found considerable use in the individual button circuits of push-button tuned receivers.

Two adjustable trimmer condensers are used in tandem across the iron-cored tuning coil. These trimmers are ganged and can be adjusted simultaneously. Their capacity range depends upon the frequency limits desired for the particular push button that connects them to the receiver's circuits. The various coils employed in the push-button tuning assembly also differ in inductance, de-

pending upon the range they are required to cover, so as to provide the most suitable L/C ratio for maximum efficiency.

Alternate Values and Repairs

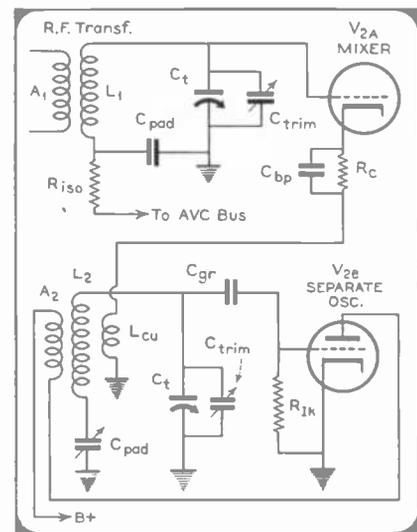
The following suggestions are given only as possible alternatives in the advent that you should find difficulty in obtaining the exact parts required for a particular repair. It cannot be over-emphasized that, at best, any alterations will produce only a makeshift. More than one of the changes mentioned will certainly produce noticeable effects in the receiver's performance. In every case the exact value prescribed by the set manufacturer's specifications should be used if it is at all available.

In previous issues we have mentioned that breaks in coils could generally be repaired. In r-f coils, on the broadcast band, one or even two turns more or less will not noticeably affect receiver performance. In tickler windings, too,

a single turn may be removed if necessary to effect a repair.

The inductance of the oscillator tuning coil (L_2), however, is much more critical because it governs the dial cali-

Fig. 5. Some larger receivers employ a separate oscillator tube. Such circuits often have an additional winding on the oscillator coil to couple the output of the oscillator to the mixer tube.



bration of the receiver. Breaks in these windings should be repaired by patching rather than by the removal of turns. In individual push-button circuits this does not apply. A small percentage of turns may be removed in these latter circuits if necessary to effect repairs. If the number of turns removed are few, receiver performance will not be affected noticeably but the range of the button will be shifted slightly. Because receiver manufacturers provide suitable overlap between buttons, the shift makes little difference.

In the large majority of cases breaks in coils occur either at the soldering lug or at the point where the coil wire passes through the coil form. Repairs at these points are not difficult.

Because of the heavier wire used on short-wave tuning coils, breaks are not common. Should such breaks occur, however, they are generally simple to repair.

Since the position of the oscillator coil with respect to the other components of the receiver has an effect upon its inductance due to absorption, and since this inductance is critical in that it affects the dial calibration, the location of the oscillator coil on the receiver chassis is important. Replacement of this coil should always be made in its original position. The parts surrounding the oscillator should also be replaced in their original positions should there be cause for such replacement.

As mentioned in previous issues, a change of value up to 25% is permissible in cathode and screen dropping resistors. A decrease in value up to 20% is permissible in the accompanying by-pass condensers as well as in the blocking condenser C_{b1} . Any larger size may be used in these same circuits.

Similarly, an alteration of 20% either plus or minus is permissible in the grid leak (R_{1k}) and in the grid condenser (C_{gr}). Occasionally, however, short-wave oscillator circuits are more criti-

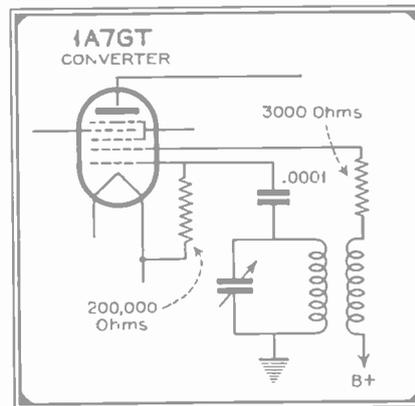
cal and such wide changes may cause dead spots at the low-frequency end of the short-wave band.

In replacing fixed padders it is advisable, in any case, to use exact duplicate values with close tolerance. This is especially true in band-spread circuits. Variable padders on the other hand may be employed with any unit or combination of units that will cover the required capacity. Thus, a fixed or adjustable padder with a maximum capacity of 1,350-mmf can usually be replaced with a 0.001-mfd fixed condenser and 350-mmf adjustable padder connected in parallel. 0.00025-mfd fixed condenser and 250-mmf adjustable padder can be used as an alternate replacement for a 500-mmf padder.

A resistance of 10,000-ohms may be employed instead of the r-f choke shown in Fig. 3.

Variable Tuning Condensers

One of the chief difficulties encountered in variable tuning condensers, in the field, is noise during tuning. A



Airline 148R573A is a battery portable that employs a novel tickler feedback circuit with a 3,000-ohm resistor in the anode circuit.

thorough cleaning with carbon tetrachloride will go far toward reducing such noise, and a pigtail connection from the rotor wipers to ground will completely eliminate it.

It has been the practice in many shops in the past, to replace tuning condensers that developed bent plates and other slight mechanical defects. In the light of present conditions, however, it is advisable to repair such defects.

Metal particles lodging between plates can be burned out by "flashing" the condenser. A simple method of flashing employs the receiver's own B power. After grid leads are disconnected from the gang the receiver's B plus can be connected to each rotor in turn. If the condenser frame is not connected to ground a temporary connection will be required to complete the B circuit. It is preferable to take the B voltage after the first filter so as to

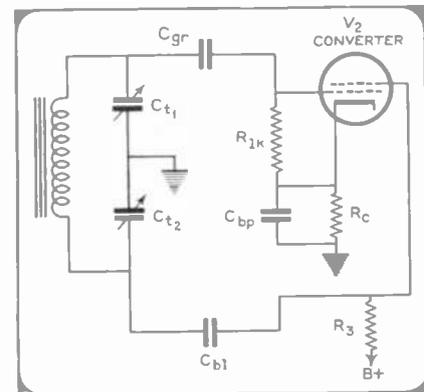


Fig. 6. A Colpitts oscillator is employed for this push-button circuit. Any one of the other types of oscillator circuits may be employed in such circuits, however.

prevent any possible damage to the rectifier during the flashing process.

Where condensers do not turn freely lubrication of the bearings is indicated. Any number of specially prepared lubricants may be used for this purpose.

Summary

In the oscillator circuits pictured in the accompanying illustrations some of the components shown were discussed in previous articles of this series. The same considerations apply to the respective parts in the circuits shown herewith.

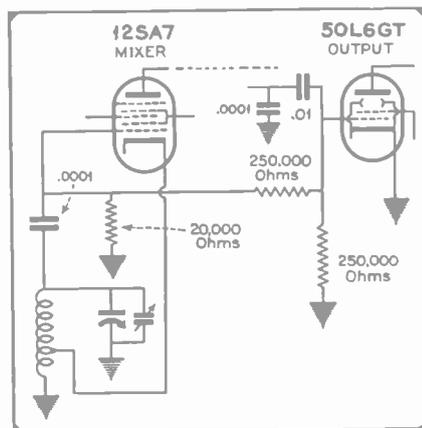
Oscillator circuits are used in super-heterodyne receivers to provide a local signal which beats with the incoming station signal to produce the intermediate frequency. Because the period of the oscillator circuits sets the calibration of the receiver's dial, values of the coil (L_2) and tuning condenser (C_1) are somewhat more critical than those of the r-f circuits discussed previously.

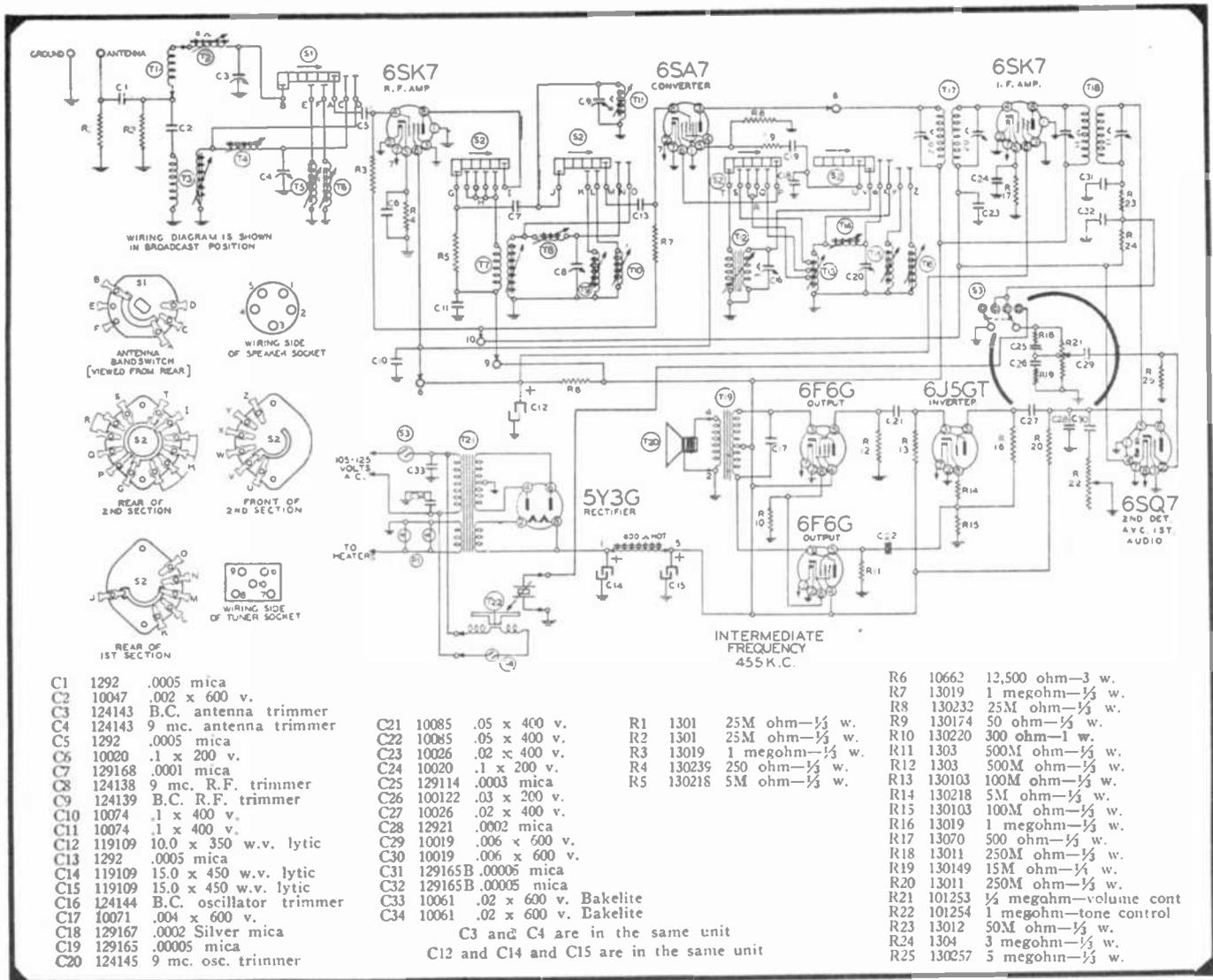
Increasing the values of by-pass condensers in the screen and cathode circuits generally improves the stability of the circuit in question. A decrease in value up to 20% is often permissible in these circuits. Resistor values in these same circuits may be altered as much as 25% either way without noticeable effects in the receiver's performance; 25% variation either way is permissible in either R_{1k} or C_{gr} . Short-wave oscillator circuits may be somewhat more critical in respect to replacements, however.

Fixed padders should be replaced with exact duplicates, especially in band-spread circuits. Variable padders may be improvised by means of combinations of fixed and adjustable condensers.

Whereas in the past variable tuning condensers were replaced when defects developed, repairs are called for today. Cleaning and pigtails will help noise and flashing with the receiver's own B supply will burn out loose particles between plates.

DeWald 563 employs a Hartley oscillator and taps off a portion of the voltage generated by the oscillator to furnish bias for the 50L6GT output stage.





a 7A4 signal-divider type inverter. (See Fig. 1.) Sensitivity is controlled by varying the bias on the 7B8 converter and on the 7A7 i-f stage. A decoupling

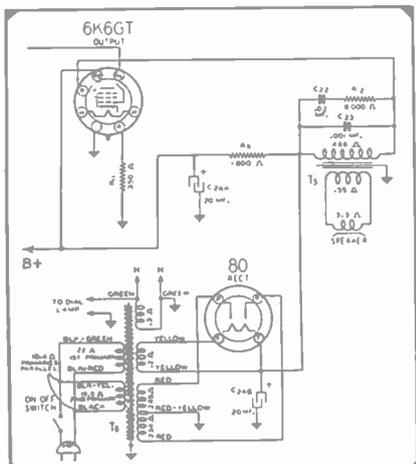


Fig. 5. Westinghouse Model M101 has a double equalizer circuit across the transformer in the 6K6GT output stage.

filter of 150 ohms and a 0.05-mfd condenser isolates the i-f cathode from the converter. The r-f stage is resistance

coupled to the permeability-tuned mixer stage in such a way as to provide a voltage step-up in the iron-cored coil much the same as would be accomplished in an auto-transformer. Note the low values of plate and grid resistors (10,000 and 68,000 ohms, respectively). Note also the triode inverter feeding the push-pull 7C5 output stage.

Philco's Model C1908 for the Plymouth-Chrysler series also features a sensitivity control but, in this case, the control works on the r-f and mixer cathodes. This receiver has an elaborate iron-cored push-button unit.

R-F Coupling

Sears Roebuck Silvertone Model 7093 is a 6-tube set with push-button permeability tuning and an i-f of 270 kc. This job provides for mounting the speaker behind the instrument panel, within the case, or in a separate case on the bulkhead. Fig. 2 shows the unusual coupling system between the tuned r-f stage and the tuned converter. It appears to be a series resonant circuit utilizing permeability tuning. Note also the high-frequency choke (L2) in the

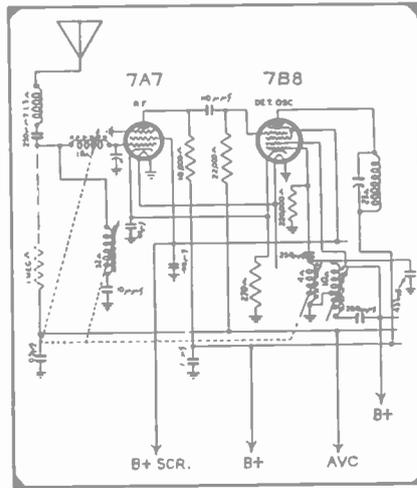
Fig. 6. Belmont Model 8AE1 employs permeability tuning throughout the r-f and i-f circuits.

antenna lead to the r-f stage grid.

I-F Regeneration

The Silvertone Model 7091 uses i-f

Fig. 4. Studebaker-Philco Model S1924 features three-gang inductive tuning with the third section used as a tuned trap for the image frequency.



regeneration to increase the i-f gain and thereby provides adequate overall sensitivity in a 5-tube job. Having no pre-selection, 455 kc is chosen for this i-f. The tickler is in the screen grid circuit

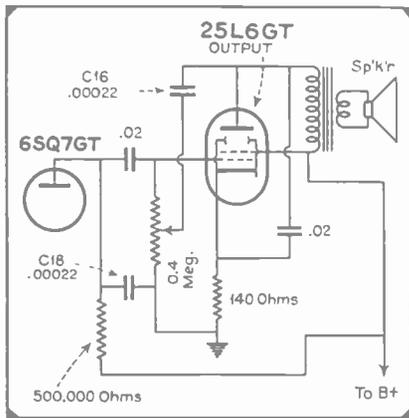


Fig. 7. Emerson Model FH413, FH440 has a degenerative tone control in the 25L6GT output circuit.

of the i-f stage and is coupled to the second i-f transformer. (See Fig. 3.)

Although a tuning condenser is used for station selection (with a mechanical push-button attachment) iron-cored antenna and oscillator coils are used. The oscillator circuit is padded by adjusting the iron core. Note also that the r-f resistance-capacity filter (R5-C7) in the diode detector circuit is part of the i-f transformer, thus conserving space and materials.

Tuned Wave Trap

Studebaker-Philco Model S124 is an unusual six tuber with a three-gang inductive tuning unit and straight resistance coupling between the r-f and converter. The third tuning section is used to tune a wave trap instead of tuning the detector circuit. The trap is thus kept tuned to the image frequency (instead of the usual i-f) throughout the tuning range. Fig. 4 shows the entire tuning system, which includes an iron core for padding the oscillator. This iron-cored shunt is used in preference to the usual trimmer condenser plus temperature compensating condenser.

Audio Equalizers

Next we have a few unusual audio equalizers. Instead of the typical single by-pass condenser (values from 0.003 to 0.01 mfd) connected across the output tube plate circuit, Westinghouse Model M101 utilizes a network composed of a 0.001 mfd shunted by a 0.02 and 8,000 ohms in series. Pentodes have critical load values for minimum harmonic distortion; hence, more tricks may be played with the audio response than with triodes.

The power transformer in this re-

ceiver has two primaries. The windings are parallel connected for 115-volt operation and series connected for 230 volts. (See Fig. 5.)

Permeability Tuning

Belmont Model 8AE1 8-tube, 5-band, a-c combination receiver has permeability tuning throughout. A conventional layout is used with a tuned r-f stage. The external antenna is brought in through a pi-section filter the same as in the Airline model previously described in these columns. A shunt network is placed across the half-meg volume control for equalizing, shown in Fig. 6.

Degenerative Tone Control

Either a 6SG7 or a 6SD7 may be used as a mixer in Emerson's FH413 and FH440, 6-tube, a-c, d-c, 2-band receivers. A 6J5GT serves as a separate oscillator. Note the unusual tone control used in these sets utilizing a degen-

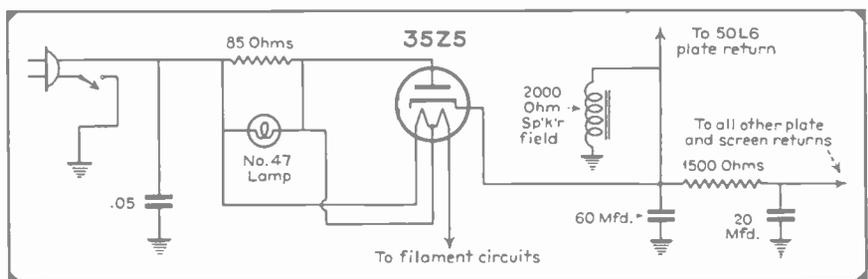


Fig. 8. Garod Model 1B50 switched to a 2,000-ohm shunt excited speaker field instead of the p-m employed in earlier models.

erative feedback system through a 0.00022-mfd condenser (C16) in Fig. 7.

Shunt Excited Field

Garod's 1B50 Series receivers, which formerly were equipped with p-m speakers (Series A), are now fitted with electro-dynamics. The 2,000-ohm field is shunt excited (across the entire B supply) which allows greater flux density than would a 450-ohm series type field. Greater sound conversion, improved efficiency, and better quality are also realized. This method of field excitation is the one that was almost universal in a-c, d-c receivers before the advent of p-m dynamics.

In order to minimize hum a 60-mfd input filter condenser is employed. This large capacity gives an excessive surge current, upon turning the receiver on, which would ruin the pilot lamp if it weren't for the 85-ohm pilot-lamp shunt resistor shown in Fig. 8. The 50L6 output tube cathode bias resistor is without a by-pass condenser. This permits some degeneration in this circuit.

Partial Degeneration

In another a-c, d-c receiver, Garod

Model 1B55L, the cathode resistor is shunted with a condenser and resistor in series, providing partial degeneration. (See Fig. 9.) This receiver also uses a 2,000-ohm shunt field but in this case the B-plus power is not taken directly from the filter input. A 150-ohm section is employed for the entire plate supply with a second 2,500-ohm section for the r-f and first audio circuits.

More Elaborate Portables

Portables are getting more elaborate, r-f stages, filter chokes and dual output tubes being common. The dual output refers to the use of a power pentode on line operation which gives greatly increased output. Some receivers use a separate rectifier tube, others a combination rectifier-pentode. Emerson's FU Series are of the latter type, using a 117V7. A 3-gang condenser with a t-r-f stage makes an i-f wave trap unnecessary. The battery tube filaments

are connected in the cathode circuit of the power tube as in the early days of portable receivers when they first went "three-way." A filter choke is used for the B supply.

Some of these circuit kinks are like changing fashions, disappearing for a while, then returning. Prices, or economic trends, dictate the policies to be followed—r-f or no r-f, tuned or untuned, one or two i-fs, transformer or

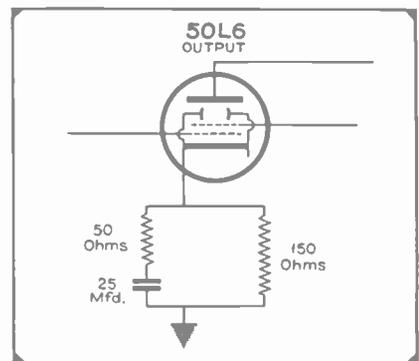
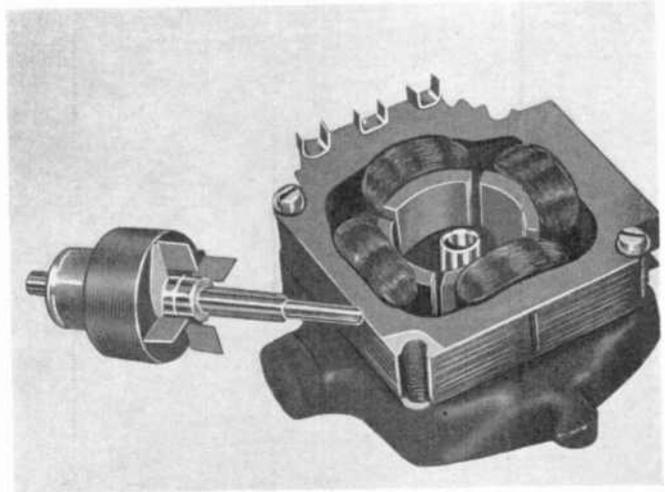


Fig. 9. Garod 1B55L uses partial degeneration in the cathode circuit of the 50L6 output tube.

resistance coupling in the r-i or i-f, filter chokes or resistance filters—and a hundred others. At present it's not
(Continued on page 33)

PHONOGRAPH MOTOR REPAIRS[†]

By John F. Rider



AFTER all is said and done, the topic of motor maintenance is the most important portion of a text on motors. It is here that the man who uses this material may look for troubles and remedies. No matter how complete the listing, however, it is at all times impossible to cover every single ailment. In the final analysis, general knowledge coupled with common sense will prove to be far more valuable than a specific tabulation.

Troubles in modern fractional horsepower motors of the kind used in record changers and recorders are comparatively few. The majority of these devices employ strictly a-c motors which have relatively few moving parts. The number of parts which may go bad or which may wear out are therefore anything but numerous.

Commonplace Troubles

A motor is like any other electrical device in that specific continuity of circuit is necessary in order that the device operate. However, unlike other devices which come into the hands of the Service Man, very little information is available concerning such things as ohmic resistance of windings and the reaction of motor windings. It is consequently, useless to speak about the measurement of resistance as a means of determining the condition of the various circuits within a motor. This does not, of course, eliminate the possibility of making different types of continuity tests for they do serve a purpose. However, because of the limited servicing facilities available in the average radio service shop as far as motor maintenance is concerned, about the only form of continuity test that really means anything and which comes within the province of the radio repairman is that to establish whether or not current is flowing in a circuit or if the proper voltage is being applied.

[†]Preprinted from "Automatic Record Changers and Recorders", by John F. Rider.

If we break down the various classifications of troubles which exist in motors of the type being discussed here, they would amount to three. These are:

- 1) The motor does not start;
- 2) The motor runs hot;
- 3) Mechanical noise.

Suppose that we consider these in the order in which they are presented.

Motor Doesn't Start

In this case it is necessary to correlate the possible troubles with the type of motor. What we mean by this is that there may be certain items which are subject to scrutiny as possible causes for the creation of this condition, as applicable to a universal motor and not applicable to an induction motor. These must be borne in mind as the various contributing causes are considered.

The supply voltage is at all times an important item for if it is too low, the motor will not start because of the drag of the load. In fact, it may not start even without any load, hence, one of the important things to do, if not the most important item, in order to check why a motor does not start is to measure the line voltage at the motor terminals. As a general rule, tolerances in motor voltages run approximately plus and minus 10%. If the voltage at the motor terminal seems normal yet the motor does not start but instead there is a hum, apparently from the motor, either the load is too great for the motor or some part of the motor mechanism, reduction gear mechanism, or turntable is jammed and prevents the motor from turning over. The fact that a hum is audible and seems to emanate from the motor is evidence of the fact that power is being applied to the motor. Whether or not this is correct is something else, but at least it is known that current is flowing through the motor windings.

The next logical step in order to identify the reason for not starting

with voltage being applied, is to remove the load from the motor. An alternate method to establish if something in the drive arrangement is jammed or if the motor bearings are frozen, is to remove the supply voltage and to try and turn the motor by means of the turntable, or if the turntable has been removed from the recorder or record changer, to check the motor itself and see if the rotor can be turned. In those instances where reducing gears are used it may be necessary to open this case and check the condition of these gears for jamming. In some cases this may be somewhat difficult to do for in many installations the reduction gear and motor are one assembly. However, since the original parts were put together in the plant, it is possible to disassemble the two units and the first step should be the drive reduction gear mechanism.

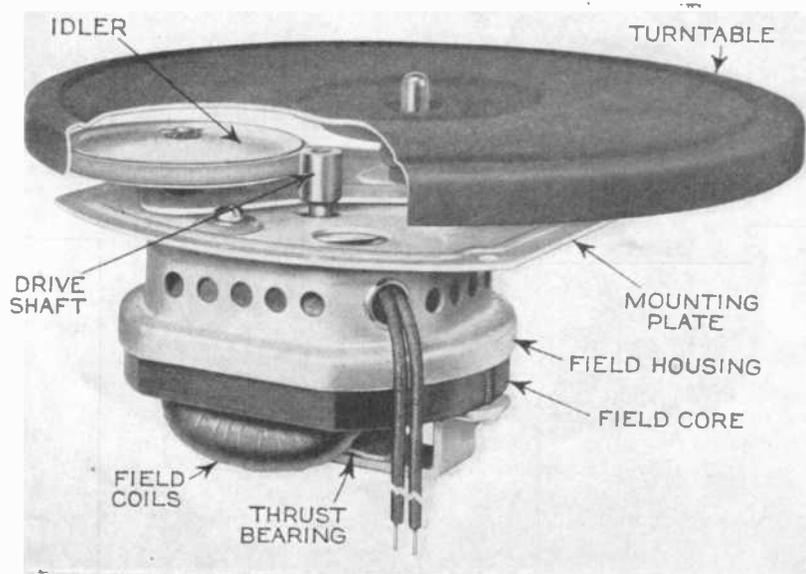
Inasmuch as it is possible to have the line voltage at the motor terminals, without necessarily having proper continuity through the motor windings, it is necessary to use whatever convenient means are available for establishing if current is flowing through these windings. If a current meter of the proper type is available, it can be inserted in series with one side of the supply voltage line and a motor terminal. This meter must, first of all, be of the proper type to accommodate the power being supplied, that is a-c or d-c. Second, it must have a current rating, several times the normal current requirements of the motor when running under full load. The reason for this is that if the motor is locked so it cannot turn, the power consumption of the motor is increased above that when the motor can turn freely. Thus a motor which would normally require a 0.5 to 1 ampere meter for current checking, requires an ammeter rated at about 5 amperes full scale.

If the ammeter indicates the flow of current into the motor, the next step is

to take the motor apart and check to see if the freezing of the rotor is due to bearing trouble. In the case of the majority of record changer motors, the bearings are of simple kind and more than likely will not freeze. In the case of universal motors any number of items, as for example too much tension on the brushes, lack of lubrication as

ever, such a motor will run if started initially although it is possible that when under load the motor will stall. This depends entirely upon the design of the motor, that is, the extent to which the presence of the starting coil in the circuit contributes to its operation. Normally in the larger classifications of motors, these starting coils are

are used in record changers, the bearings are of very simple type and the means of lubricating the moving parts is in the form of oil-soaked felt washers which either surround the rotating shaft or make contact with it so that the oil gets into or between the moving parts. In some of the more elaborate motors as used in the recorders, specific lubricating holes are provided through which oil is caused to flow into the various bearings. As a rule, in the simple type of bearing arrangement, those which employ oil-soaked felt washers, the manufacturer of the motor at the time of production impregnates these washers sufficiently so that they can be used satisfactorily for long periods of time without any further oiling. If, however, oiling is necessary, a very thin motor oil such as SAE 10 or lower should be used. Some manufacturers specify that these oil-soaked felt washers provide proper lubricating for about one thousand hours of operation. When oiling is necessary, it does not take more than a few drops of the type of oil mentioned.



The majority of the record player mechanisms on the market employ simple a-c induction motors.

to bearings, a sprung armature shaft, are among those which will tend to bind the rotor and prevent it from revolving. In addition, if any foreign particles have lodged in between the armature and the field pole pieces, that too many cause the rotor to stop and this applies as well to the induction motor as it does to the universal, hysteresis or any other type which is being used. Troubles due to foreign particles or to too much tension on the brushes can be repaired in the radio shop. But troubles of the other type, which require special machinery, should be taken care of by those who have the equipment to do the work.

A very simple and effective method of establishing whether or not current is flowing through a motor which is not turning over, and for which measuring equipment isn't available, is to check manually for heat being developed in the winding of the motor. A motor which is carrying current but which is not turning over, will become quite hot rapidly; that is, if it does not blow a fuse even before its temperature rises appreciably.

In the case of split-phase motors, trouble in the starting circuit may prevent the motor from starting. How-

ever, such a motor will run if started initially although it is possible that when under load the motor will stall. This depends entirely upon the design of the motor, that is, the extent to which the presence of the starting coil in the circuit contributes to its operation. Normally in the larger classifications of motors, these starting coils are disconnected from the circuit. In the small record changer type of motors, on the other hand, the starting coil is left in the circuit and is always in operation. Inasmuch as the majority of split-phase induction motors used in record changes employ a condenser in one leg, trouble in such a starting circuit is invariably associated with this capacity and its connecting leads.

Since the condenser used in such split-phase systems is of the paper dielectric kind, normal tests applicable to condensers of this type are perfectly satisfactory. The fact that the condenser is used in connection with a motor does not introduce any special consideration into the test.

Short-circuited windings in either the stator or the rotor, or both, depending upon the type of motor involved, will prevent the motor from running. These can be checked by any one of the methods already described, hence this reference is nothing more than a supplementary listing of a condition which will prevent the starting of the motor.

Motor Runs Hot

We have already made some references to conditions which will cause a motor to run hot. Lack of proper lubrication is, of course, a very important item and the following should be of definite value.

In the majority of small motors which

It is, of course, necessary to realize that those motors which employ such impregnated felt washers, must be dismantled from the motor board and taken apart in order to soak the washers. Motors of this type do not have lubricating holes. In the case of those motors which have lubricating holes, it is not necessary to remove the motor from the mounting board for lubrication. At times, however, it may be necessary to seek out the proper lubricating holes. In some cases these holes may be sealed with a screw plug and it is necessary to remove this plug in order to insert the oil.

As to conditions responsible for the motor running hot, the following should be known: If the bearings are too tight, yet not tight enough to freeze the shaft, the temperature at that point will increase and this increased heat will naturally be radiated throughout the unit and thus cause a rise in temperature. Short-circuited coils in either the stator or the rotor will cause the motor to run hot. While it is possible to approximate the location of the shorted coil by virtue of the fact that it will be hotter than other coils, we do not recommend, as stated before, that such coils be removed and rewound by the radio repairman. Another condition which contributes, or may contribute, to the motor running hot, is when the rotor is rubbing against the stator pole. Such a condition can be created by incorrect alignment of the rotor or side plate. As a rule, such a condition is accompanied by noise, that is due to

(Continued on page 19)

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How would you like to have, available at call, the assistance of the factory engineer for that receiver you have on your work-bench—a factory-trained man, who would tell you just what part will make the best replacement—how the part should be installed?

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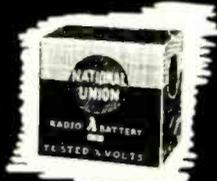
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PHONOGRAPH MOTOR REPAIRS

(Continued from page 16)

the actual physical contact between the rotor and the stator pole.

Mechanical Noise

Mechanical noise is a major problem. As you can probably appreciate, a new motor should run very quietly, but there are, of course, conditions associated with the motor, yet which are not all directly in the motor, which will contribute to the creation of noise. Consequently, in order to isolate the origin of such mechanical noise, it may be necessary to proceed in various ways, depending not only upon the construction of the motor, but also upon the construction of the various drive mechanisms whereby the rotation of the motor is conveyed to the turntable. Very often a bad case of motor noise may appear to exist, whereas actually it is not as bad as it sounds. The fact that it is very loud is due primarily to the manner of mounting the motor to the mounting board. If the motor is rigidly fastened to the mounting board, any vibration in the motor will be conveyed to the mounting board which by itself will act as a sounding board and in that way amplify the motor noise. Proper mounting will in most cases remedy this situation: the absence of direct contact between the motor mounting support and the mounting board. An example of proper mounting is given in Fig. 28.

Then again, noise may seem to originate in the motor yet it actually originates in the reducing-gear mechanism if such is used; hence if the driving arrangement involves a number of elements between the motor and the turntable, it is necessary, in order to

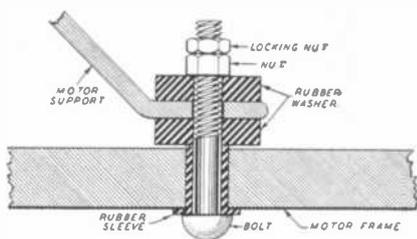


Fig. 28. The motor should be fastened to the mounting board by means of rubber washers or springs.

establish the point of origin of the noise, to separate these various devices. In this instance, as well as that previously mentioned, it is imperative to check the noise without the use of the mounting board. This means that the motor and the gear assembly must be removed from the mounting board. If the noise

which originates in the motor is not excessive and is amplified when the motor assembly is mounted upon the board, then it becomes necessary to check the means of mounting. Often times mountings as shown become rigid instead of remaining loose as they should be.

If particles of dirt or other foreign matter find their way into the spaces between the rotor and the field magnet poles, the result will be intermittent noise. To eliminate such noise it is necessary to take the motor apart. Previous handling of the rotor may have created a nick or burrs that are high enough to make contact with the stator pole pieces. If such is found, this can be removed by means of sandpaper or emery cloth. In the case of the induction type rotor, which usually is a solid piece, an emery cloth can be used. You will recall that this type of abrasive is not satisfactory for use upon commutators or upon commutator type armatures.

Mechanical noise in the form of vibration may be due to a number of different conditions. One of them is loose bearings; another is too much end play, and a third is a rotor which is not running true in its bearings. Improper centering of the rotor or armature in the flux gap will result in a non-uniform torque being applied to the motor. This is very important when reduction gear devices are used with the motor for it results in the non-uniform turning motion of these reduction gears and invariably causes a chatter.

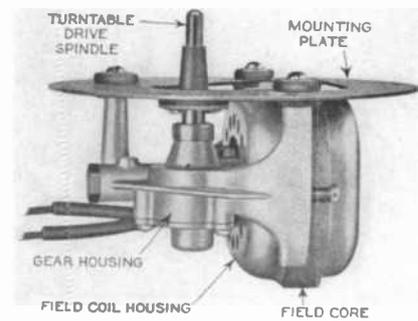
Noise of various kinds such as buzzing will result if any of the accessories employed in the motor are not tight in their mountings or supports. This applies to the laminations as well as to all other parts. If the laminations are not tight, they will tend to move under the varying magnetic stress of the applied current and resultant fields. In some cases such buzzing sounds would seem to originate from the laminations and may indicate that the polarity of one of the field windings is wrong. As you can readily understand, this seldom is the case in a new motor but is a possibility in one which has recently been repaired.

Temperatures and Voltages

As a rule, the permissible rise in temperature of a motor is between 60 to 100 degrees above the temperature of the surrounding air. As stated before, permissible tolerances in applied line voltage are plus and minus 10% and about 5% plus or minus in frequency. When measuring operating voltages, they should be determined with the motor functioning under full

load. Here again a 10% variation is permissible.

Anyone who is interested in more specific standards covering fractional



Some type of speed reduction mechanism must be employed between the motor and turntable drives.

horsepower motors, we refer them to the National Electrical Manufacturers Association which has published a bulletin identified as "Motor & Generator Standards."

Cleaning

If it becomes necessary to clean those parts of the motor where the lubricant has become gummy, the best method to pursue is to take the motor apart and to clean those parts with kerosene.

As a matter of fact, such periodic cleaning of the motor is advisable after perhaps 500 hours of operation. Of course, if the performance of the device indicates that such cleaning is necessary, it should be done irrespective of how many hours the motor has been in use. Although, we have referred specifically to the motor, the comments also apply to the gears and the bearing in the reduction gear housing, if one is used with the motor.

Power and Speed

As to the power consumption of motors of the type being considered here, the average among those that are used on record changers is approximately 22 watts and the minimum to maximum range is from about 11 to approximately 40 watts. As to the normal speed of motors which are classified as synchronous and already adjusted by means of the drive arrangement to rotate the turntable at approximately 78 rpm, the normal range of such rotation is from about 77 to 81 rpm. With respect to the speed of induction motors, and for that matter some which are identified as capacitor-synchronous motors, the range is from about 1240 to approximately 3600 rpm. As to the motors which are used in recorders, their power consumption ranges from about 60 to about 85 or 90 watts under normal operating conditions.

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CLEVELAND, OHIO

CAPACITOR REPLACEMENT

By S. GORDON TAYLOR

DESPITE the best efforts of the manufacturers, it is unavoidable under the pressure of the present emergency that some delay be encountered in supplying even standard types of replacement capacitors. The greatly expanded production facilities that have been provided by some of the manufacturers have scarcely been able to keep pace with growing government and high priority demands and normal business has necessarily suffered somewhat as a result.

Fortunately, from the standpoint of the Service Man, capacitors to meet his requirements are obtainable, even though not always as promptly as he would like. To avoid the hardship of delays it is suggested that he plan his requirements reasonably well in advance, order in adequate quantities and maintain a careful check on his inventories in order that replenishment orders can be placed far enough in advance to insure maintenance of stocks on hand. While this article

concerns itself with capacitors, many of the suggestions presented apply to other replacement parts as well. aluminum, which is so extensively employed in the manufacture of capacitors. Waste which results when a still usable capacitor is discarded because its leakage is slightly high, where a multiple unit is thrown out because one of its sections is broken down, etc., may involve a relatively large volume of aluminum and other materials. It is conceivable that a time may come when there will be limited quantities of these materials allocated to capacitor manufacturers for other than government products. At such time service jobs which use or discard capacitors unnecessarily will, in effect, be cutting down the supply by just that much.

It goes without saying that this sort of thrift not only helps the national market situation but the individual Service Man as well. A capacitor which demonstrates a leakage value which makes it unsatisfactory for coupling or blocking service may still be entirely satisfactory as a replacement for a defective by-pass

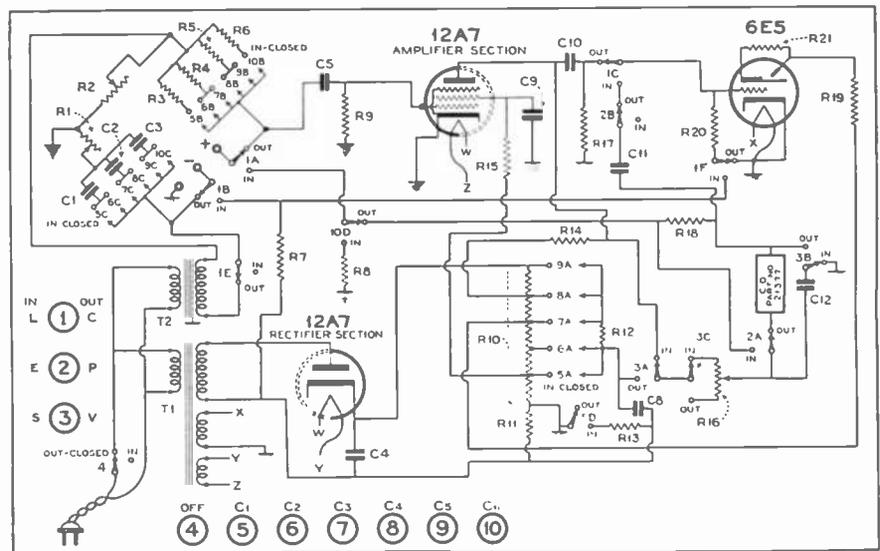


Illustration courtesy Cornell Dubilier

concerns itself with capacitors, many of the suggestions presented apply to other replacement parts as well.

A definite contribution that every Service Man can make toward minimizing difficulties during the present emergency is the strict avoidance of waste. We know that there are pressing shortages in certain basic materials, such as

Fig. 1. A capacitor analyzer will provide information as to the exact value and condition of a capacitor. This information can prove exceptionally helpful in these times.

unit and will thus save the cost of a new capacitor in this latter job. Or where a single section of a multiple capacitor is shot, the addition of a separate, single

capacitor in place of the defective section not only makes for economy of parts cost but avoids the headache of searching the market for an equivalent multiple replacement unit.

To follow this suggestion for conservation requires some form of instrument capable of not only measuring capacity values, but analyzing capacitor characteristics. If such an instrument rendered no other service its use in a thrift campaign might perhaps not be fully justified. It is widely recognized, however, that it can serve many other purposes. To such an extent is this true that capacitor bridges and analyzers have become substantially essential equipment in every well equipped shop and laboratory, especially during the past year or two.

Such an instrument is shown in Fig. 1. It provides direct reading measurements of capacity values from 10 mfd to 240 mfd for all types of capacitors. Power factor measurements from 0 to 50% are also read directly. Leakage values are indicated by the 6E5 tube. Shorts and opens of both constant and intermittent types are directly indicated and the instrument may be used for measuring values other than those of capacitor units. Thus insulation resistance of various materials can be measured to 1,500 megohms or higher, capacity between wires of a cable or between transformer windings can be accurately measured, etc. In addition the instrument can be used as a sensitive bridge-balance or output indicator.

Let's go back to the subject of capacitors. An instrument such as this one will provide definite information on the quality of a capacitor under test and thus supply information which will determine whether this capacitor is normal or, if subnormal, whether it is suitable for any use in a radio circuit.

When the Service Man could replenish his capacitor stocks from day to day, or week to week, he didn't have to worry too much about either the variety or quantities he carried on hand. The larger stocks required under present conditions involve careful consideration of these factors, however. Augmented stocks call for increased investment and therefore for careful planning if this investment is to be held to a minimum and the job of stock-keeping made as easy as possible.

One way of keeping the investment down is by avoidance of "exact duplicate" multiple replacement units. These are relatively expensive, and, as suggested above, are seldom required because it is usually only a single section that breaks down and a standard capaci-

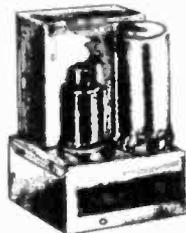
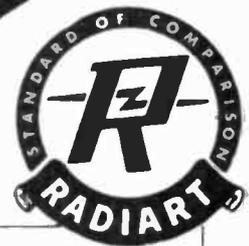
(Continued on page 23)

AMATEURS

planning to play your part in

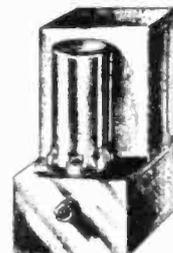
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CLEVELAND, OHIO



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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.

President
The Triplett Electrical
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MANUFACTURERS OF PRECISION
ELECTRICAL INSTRUMENTS

22 • SERVICE, JANUARY, 1942

FARRELL SAYS:—

By C. H. FARRELL

Anno Domini 1942 Pundits, seers and soothsayers have had a field day telling the cockeyed world exactly where it is headed and when and where it will arrive. It's a game, this crystal gazing, and of course it is just as transparent as cellophane. Bluntly, it's a fake. For nobody but the Creator can say, with any degree of certainty, what the next twelvemonth will bring to John Q. Servicer or anyone else.

But nobody can deny that there is a certain amount of pleasure to be derived from speculating on what the morrow will bring. And all speculation is not idle. Just as the weather can be charted with a high degree of accuracy, business trends can often be spotted somewhat in advance on the basis of past performances and experiences. The setting down of some of the apparent trends in the radio servicing business on whatever dope is available is to be forgiven, therefore, and is not to be confused with oracular outpourings. I am not a Swami.

To me it appears that the radio servicing industry is about to experience a long overdue renaissance. This belief is based on many factors which are common knowledge. There seems little doubt but that the production of new radio receivers will be curtailed sharply—perhaps cut out entirely—in 1942. We know that radio communication is a vital part of our war effort. And we know that many Service Men have gone into the factory and many more have gone into the armed services. We know, too, that the public wants to be informed of world happenings. Add up all of these factors, and the answer seems quite obvious. More service jobs than ever before.

Doughty Don Dunphy All branches of the radio industry are interdependent. The sponsor who spends beaucoup dollars to put on the Fred Allen show is dependent on the Servicers who keep receivers in good working order. Fred Allen is also dependent on the Servicers who help provide him with a large listening audience. And, vice versa, Servicers are dependent on radio artists who lure listeners to loudspeakers at regular intervals and

thus contribute to the eventual breakdown of a tube or part.

Did you ever think of that?

This train of thought was started by a dinner conversation with Don Dunphy the sports announcer. You have listened to his epic blow-by-blow descriptions of leading boxing bouts, over the Mutual Network. If you listened to the Cotton Bowl game broadcast on New Year's day, you heard Don. If you were tuned in on the Buddy Baer-Joe Louis fight on January 9, you probably were thrilled by the Dunphy brand of descriptive radio reporting.

The largest radio audience in history was attracted by the President's address to the Nation at the time he declared a State of Emergency. The surveys showed that 70% of the population in the United States listened to the President. On the night of the Billy Conn-Joe Louis fight for the heavyweight championship of the world, surveys showed that 64% of the citizenry listened to that ring classic.

When a radio announcer or artist attracts that kind of an audience, it is vital to his future success that the radio sets of the country are functioning. And I believe that Don Dunphy speaks for the majority of folks on the other side of the microphone when he stresses the fact that every radio performer owes a debt of gratitude to Mr. American Service Man.

Dunphy, to this writing, has broadcast 18 major sports events for the Gillette razor people. The figures of his total listening audience would appear astronomical. Certainly, many a radio tube and condenser has been kayoed by the extra usage it has been subjected to by the Dunphy audiences.

If all the tubes which were rendered *hors de combat* by Doughty Don Dunphy were laid end to end, it would be a sight to warm the cockles of any Servicer's heart, wouldn't it?

Confusion Thrice Confounded That Servicer who called me the other day and asked me to advise him how to go about replacing a meter which had burned out, wasted his time

(Continued on page 24)

CAPACITOR REPLACEMENT

(Continued from page 21)

tor of suitable value will serve as the repair for this. Another means is to standardize on as few types and sizes as possible. This may not decrease the potential investment greatly, but it does simplify the inventory and reordering jobs.

In the case of electrolytic filter capacitors, for instance, it is often practical to standardize on a single general type. A round cardboard unit with universal means for mounting either vertically on the chassis, or horizontally under the chassis, will serve as a replacement for can, box and tubular types and is at the same time the least expensive of these types. There are indeed few filter replacement jobs that this type cannot satisfy.

The variety of capacity values and voltage ratings carried can also be minimized by recognition of certain facts. One of these is that filter capacity requirements are not critical as to value, providing only that the replacement capacity be not much lower than the original. Thus where the receiver manufacturers specifications call for values between 4 and 8 mfd an 8 mfd unit will serve. For values between 8 and 16 mfd a 16 mfd unit will prove satisfactory, etc. Eights and sixteens will also serve where capacities of up to 12 and 24 mfd, respectively, are required. These are points which perhaps call for some explanation.

In filter applications the receiver manufacturer usually employs the lowest practical values of capacity for the sake of economy. It is for this reason that replacement values should never be more than 20% lower than those originally specified. On the other hand a replacement can usually err as much as 100% on the plus side, usually with improved filtering as the result.

Electrolytic capacitors are made with tolerance of 20% to 30%. Actually an 8 mfd replacement unit may show capacity anywhere from minus 20% (6.4 mfd) to plus 30% (10.4 mfd). Because the lowest of these values is only about 60% above 4 mfd, a "low" 8-mfd unit would make a satisfactory replacement where either 4 or 6 mfd units are called for. At the same time a "high" 8-mfd replacement might easily fall within the minus-20% range of a 12-mfd original. Thus a stock of replacement capacitors rated at 8 mfd will likely provide suitable replacements for every value from 4 to 12 mfd. To take advantage of this will, of course, require some means of measuring the actual capacity of the replacement units—classifying them either by their actual capacities or into groups of "high," "low" and "normal." This is one of the valuable services ren-

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dered by an instrument such as the analyzer mentioned above.

The variety of voltage ratings in which filter capacitors are to be carried comes down to a matter of arithmetic. Many Service Men feel that it is simpler to carry filter electrolytics in only two values rather than in all four of the common values, 150, 250, 350 and 450 volts. A replacement 8-mfd unit rated at 450-volts costs perhaps 3c more than one rated at 350 volts. Where voltage values called for are 350 volts the larger unit provides an extra factor of safety and the elimination of a 350-volt stock reduces bookkeeping time and expense.

When it comes to mica and paper capacitors these same ideas can be applied although it must be borne in mind that some of the circuit applications in which these types are employed may be more critical than those for filter electrolytics. But the general line of reasoning presented above for electrolytics will apply to these other types as well even though in perhaps more limited degree.

It is believed that more thought in the planning and maintenance of replacement stocks will help the Service Man over some of the bumps unavoidably presented by the current market situation.

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FARRELL SAYS:

(Continued from page 22)

on me because I was burned up. Burned up because a radio set manufacturer had called me the previous day and asked me to dig up a certain piece of test equipment for his laboratory even if it was second hand. I couldn't get the unit—not even at second hand.

According to people who should know, the demand for meters so far exceeds the supply available for civilian use that it is no longer funny. From one usually authoritative source comes the information that some meter manufacturers are 100% on the defense production line.

I've heard stories to the effect that if you do any testing of police radio or municipal or broadcasting facilities, you are able to get a priorities rating on test equipment used in such work. I've never seen it work out, however. Probably due to "Servicer Inertia."

Best suggestion to date: Proceed on the assumption that your present test equipment is irreplaceable and treat it as gently as you would a Sevres Vase. Ascertain from your jobber whether or not the manufacturer is in a position to repair or rebuild the units which are not replaceable. Try to repair broken down units yourself.

And above all, don't put the blast on your parts jobber because he doesn't happen to have just the item you want—when you want it. He is an extremely harried individual these days. If you think you have headaches, just multiply your pain by about 200. Then you'll get an idea of the depth of your jobber's OPM blues.

Rebuilt Radio Receivers An advertisement in a New York paper caught the eye. It offered rebuilt radios for sale. The advertiser was an installment furniture house. Never before in its history did this concern attempt to market repossessed receivers via the medium of newspaper advertisements. And thereby hangs a trend.

One of the scourges in the lives of Servicemen during the past few years has been the minuscule receiver which was priced at about \$10.00. Many people bought them with the thought in mind that when, as and if they gasped their last, they'd be given a good throwing away instead of a servicing job. The citizens who asked for an estimate on a repair job on this type of radio usually threw up their hands in horror when they were told that \$4.50 would cover it.

There are plenty of these sets lying around inoperative. Many a Servicer

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MODEL 432-A

The Outstanding Tube Tester Value
Checks all type tubes including Loctals, Bantam Jr., 1.4 volt Miniatures, Gaseous Rectifier, Ballast, High Voltage Series, etc. Filament Voltages from 1.1 to 110 volts. Direct Reading GOOD-BAD Meter Scale. Professional-appearing case with accessory compartment large enough for carrying Model 739 AC-DC Pocket Volt-Ohm-Milliammeter, thereby giving the serviceman complete testing facilities for calls in the field.
Model 432-A with compartment, Dealer Net Price \$20.73. Model 432-A in case less compartment . . . \$19.65. Model 739, Dealer Net Price \$10.89.

WRITE FOR CATALOG—Section 117, College Drive

READRITE METER WORKS, Bluffton, Ohio

has bought them in and repaired them. And sold them—at a profit.

We will see much of this business before the sanguinary mess in Europe and Asia has run its inevitable course. And, as the saying goes, "You can't be ruled off for trying."

"Taps" for the Japs Radio has enlisted for the duration and that means that every man who keeps radio sets working is helping to sound "Taps" for the Japs. Perhaps the chauvinistically minded person will suggest that we should dedicate our efforts without stint or profit until the victory has been won. Mebbe so! Mebbe so! Perhaps the subject of filthy lucre has no place in a discussion about the part you must play in our Victory Drive. But I'll risk your condemnation and suggest that now is the time for Service Men to climb out of the underpaid class and get themselves on the financial plane to which they are entitled by reason of their highly specialized skill, knowledge and labor.

I decry the thought of profiteering. You do too. But is it profiteering to ask a factory worker who is making \$78.00 a week to pay you what your services are worth? The majority of highly paid factory workers cannot match the skill of the majority of low paid Service Men. Why should this highly skilled technician work for a less skilled worker for an average weekly pittance of from \$25.00 to \$30.00? Merely because competition in days gone by has ruined the price structure and conditioned the public to cheap radio repair service is no reason why you should continue to accept compensation which, in many cases, keeps you just one step ahead of the sheriff.

By all means, be patriotic. Be so patriotic that you earn money to pay income taxes in the \$4,000.00 brackets. Charge what your services are worth. And don't figure on 'junk' parts in order to shave an estimate. Funny how many 'free repeat calls' have resulted from the use of unreliable parts).

Mechanical Plus Electrical One of the largest manufacturers of radio combos figuratively tore his hirsute adornment out by the roots a little over a year ago. The reason: lack of properly trained men to repair the record changing mechanism of his radio-phono combinations. He started his own training program and selected topace Service Men in all parts of the country, trained them at his expense and turned them loose in pastures lush and green. These men, however, know only the particular type of record changers this one manufacturer puts out.

Repairing record changing mechanism

Completely Covers the Subject

RIDER'S "Automatic Record Changers and Recorders"

OFF
PRESS
JAN.
22nd

The maintenance of the country's hundreds of thousands of record changers and recorders is providing a steady source of profits for the wide-awake service shop. The volume of this work has increased so rapidly that your efficient operation in this field requires complete authoritative servicing information and data. Rider's "Automatic Record Changers and Recorders" covers, by means of explanatory text, mechanical and electrical diagrams and drawings, EVERYTHING you need know on any automatic record changer or recorder coming to your shop.

It outlines a plan of analysis that applies to any type of changer, whether it be the "drop," "throw off," "turnover" or "two side non-turnover." To illustrate this plan a step-by-step analysis of a simple drop-type record changer was made, and each step photographed and explained.

The book carries manufacturers' service data on practically every automatic record changer and recorder on the market today, with notes on the functioning of the devices, their adjustment and care.

The index contains a cross reference index so you can identify which record changer or recorder is used with any particular radio-phonograph and where the data can be found in the book. They are also listed under their own maker's names. Altogether a book you need and need right now if you are going to show the best profits from your work on

"Automatic Record Changers and Recorders"
by JOHN F. RIDER

744 pages, 8½" x 11"—Out Jan. 22nd, \$6.00

JOHN F. RIDER Publisher, Inc.
404 Fourth Avenue, New York City

Export Division: Rocke-International Elec Corp
100 Varick St., N. Y. C. Cable ARLAB

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SERVICING BY SIGNAL TRACING	360 pages—188 illus.	\$3.00
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ALIGNING PHILCO RECEIVERS	Vol. I \$1.50. Vol. II	\$1.75

Compare! RIDER MANUALS the only source of complete servicing information

Not just "wiring diagrams," but everything you need on i-f peaks, operating voltages, alignment frequencies, parts values, voltage ratings of condensers, wattage ratings of resistors, coil resistance data, dial cable adjustments, etc., etc. Compare what you get before you buy.

Abridged Vol. I to V—Covering sets from 1930-35
2,000 pages—\$12.50
Vols. III to VI—Cover 1932-35—\$ 8.25 each
Vols. VII to XII—Cover 1935-41—\$11.00 each

is not a pushover. I ran into a chap the other day who has been compiling data on all types of this equipment. He told me that it took him two and a half months to accurately dissect and put together again one rather well known record changer. Of course, he wasn't in a hurry. His job was to put down on paper the complete details of the gadget and to compile all maintenance information possible.

Not one Service Man in ten can properly repair even a simple record changer. And probably every Service Man in the business will be called upon to do plenty

of this type of work from now on.

From where I sit it looks as though the smart Service Man will burn beaucoup midnight oil and bone up on this subject. The chap who said that "Knowledge is Power" knew whereof he spoke. In the case of the radioman, "Knowledge is Powerfully Profitable" . . . if that knowledge embraces the repair of record changers.

**It takes money to beat the Japs.
Buy U. S. Defense Bonds
and Stamps today.**

SERVICE, JANUARY, 1942 • 25

RCP 662 ELECTRONIC MULTITESTER



Reach for a

DANDEE

- When you need a handy, dependable, inexpensive electrolytic in a hurry, reach for a Dandee.

And to play safe in these days of impatient customers whose sets must operate hour after hour, day after day, tuned in to the very latest news bulletins, always have a supply of the popular 450-8 Dandeeds on hand for those rush jobs. Note this wide choice of values.

TYPE PRS DANDEES
SINGLE-SECTION:
450, 350, 250, 150, 50 and 25 v.
D.C.W. 4 to 100 mfd.

DUAL-SECTION PRS-A:
450, 200, 150, 50 and 25 v. D.C.W.
8-8 to 20-20 mfd. Concentrically
wound. Three leads.

DUAL-SECTION PRS-B:
450, 250 and 150 v. D.C.W. 8-8 to
20-20 mfd. Separate sections. Four
leads.

• Ask Your Jobber...

He has a stock of these Dandeeds on hand in all popular values for your immediate needs. Be sure they're Dandeeds! Buy them in the five-to-a-box or ten-to-a-box cartons. Ask for latest catalog—or write us direct.



IF TEST equipment of the type that employs vacuum-tubes in its operation, such as the electronic multitesters which are now coming into popular use in service work, is to function at highest accuracy, it is important that the voltage applied to its tubes be maintained constant within reasonably close limits. For practical reasons the modern equipment of this type usually depends on power lines for its source of supply and such lines may be subject to



rather wide voltage variations at different hours of the day and with changing loads. It naturally follows that where line voltage varies perhaps 10% from normal (a quite common condition), the accuracy of a v-t voltmeter operating from the line is going to be materially affected unless provision for regulation is included in its design.

Features

In the newest Radio City Products' electronic multitester a gas regulator tube is included in the plate supply circuits to overcome this difficulty. With constant plate voltage and the use of self bias the Model 662 is said to be capable of maintaining its rated accuracy under extreme conditions of line voltage variation.

This model provides a total of 27 v-t ranges for measuring a-c and d-c volts, resistance and capacity. Its input resistance for d-c measurements is 16 megohms for low ranges and 160 megohms for the higher ranges. A-c input capacity is 0.00005 mfd. Special operating advantages include a polarity switch which eliminates the necessity for reversing test leads; zero adjustment of ohmmeter without the necessity for shorting test leads; no readjustment of zero required when shifting from one ohmmeter range to another or from one capacity range to another; no danger of shock during measurements of high resistance or low capacity values; a 4½-inch meter with

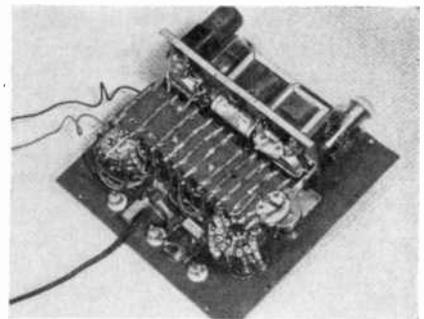
all scales linear and spread over a 100-degree arc. This meter cannot be damaged by wrong scale selection or by attempting measurements across a "live" resistor, etc. Maximum protection is provided against burn-out.

Ranges

The 27 measurement ranges include: six d-c voltage ranges of 0 to 6, 30, 150, 600, 1500, 6000; seven a-c ranges of 0 to 3, 6, 30, 150, 600, 1500, 6000; seven ohmmeter ranges of 0 to 1000, 10,000, 100,000 ohms and 1, 10, 100, 1000 megohms; seven capacity ranges of 0 to .001, .01, .1, 1, 10, 100, 2000 mfd.

The meter movement has guaranteed accuracy of 2% of full scale and all multiplier resistors are within 1%. For voltage ranges over 600 all insulation is

The Model 662 is an a-c and d-c electronic type instrument which provides 27 ranges in the functions required of the average multitester.



rated at 15,000 volts for complete safety.

The case is of welded-steel construction and, with the metal panel, provides thorough shielding. Overall dimensions are: 9¼ x 9¼ x 7¾ inches. Included are high-voltage test leads, signal tracing probe, tubes, pilot lamp and batteries.

PREPARE TO JUMP INTO A BETTER JOB

Nilson's MASTER COURSE IN RADIO COMMUNICATION

especially prepared for Home Study can help you get the increased knowledge you need. Every Nilson graduate to date has secured operator's license. Many got better jobs. SERVICEMEN—the Nilson Master Course prepares you for operating job.

TRAINING TAKES TIME — DON'T WAIT Go after increased technical knowledge NOW! SEND FOR CIRCULAR 3-S. Make this step toward a successful radio career today!



POLICE AIRCRAFT FORESTRY BROADCAST RADIO TELEGRAPH

SUCCESS DEPENDS ON TRAINING

NILSON RADIO SCHOOL
51 EAST 42nd STREET, NEW YORK, N. Y.

KEEP THINGS HANDY

By MARTIN FRANCIS

PAUL ZIRKLER, shown in front of his work bench at 216 Bridge Street, Austin, Minn., believes in having his equipment and stock handy. He has arranged his service department in such a way that his instruments are at eye level and his stock of replacement



Paul Zirkler, Minnesota Service Man, keeps a stock of tubes and parts near at hand over his service bench.

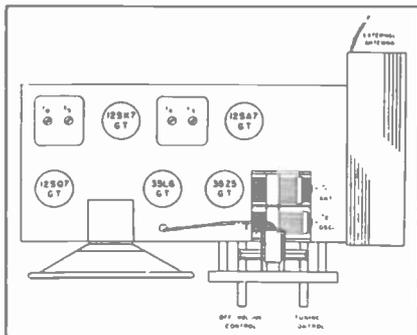
tubes and parts are kept directly above. Thus, once he is seated at his bench to make repairs, he need not leave it. This method of keeping things within easy reach saves him considerable time in moving jobs through his busy shop.

PHONO SWITCHING

SILVERTONE 7055

(See Front Cover)

THIS receiver appears the same as a standard a-c, d-c superheterodyne and would probably be so designated if it weren't for the a-c (only) phonograph motor. Rated at 105 to 125 volts, a-c, the receiver uses a



Silvertone 7055 is a transformerless a-c receiver that employs an automatic switch on the pickup arm.

5-inch p-m speaker and boasts 0.83-watts undistorted output. An unusual feature of the set is the automatic phonograph-radio switch which is attached to the pickup arm. The switch operates when

IT TAKES A LOT OF PARTS TO KEEP THE NATION'S EARS OPEN



Hungry for news—the nation depends on radio to keep it informed.

It is the responsibility of the radio industry to keep the receivers in American homes and automobiles in first-class condition. This is your responsibility and your contribution to the defense of the nation.

So that resources and materials important to Victory can be conserved, it is necessary to select radio parts carefully. Utah's part in the task of keeping communication at top efficiency is attested to by the fact that more than 7,000,000 Utah parts were used last year—many of them in national defense for the Army, Navy, Air Corps and important civilian communications.

This year, again, Utah engineering will keep abreast of industry developments. Again, Utah's policy of aggressive research and product development will be maintained.

To the trade, Utah products again will offer the same high quality and exceptional value. They will continue to be distributed through recognized channels

G. Hamilton Beasley,
President



Peter L. Jensen,
Vice-President



only. Requirements of Utah customers will be met as promptly and as quickly as possible. Utah Radio Products Co., 815 Orleans Street, Chicago, Illinois. Canadian Office: 560 King Street, West, Toronto. In Argentine: Ucoa Radio Products Co., S.R.L., Buenos Aires. Cable Address: Utaradio, Chicago.

In 1941, 7,014,701 Utah parts were furnished for use in defense and civilian communications.



UTAH RADIO PRODUCTS COMPANY

Speakers • Transformers • Vibrators • Utah-Carter Parts
816 ORLEANS STREET, CHICAGO, ILLINOIS

the pickup is removed from its rest and is placed on the record. It makes all the necessary connections to switch on the phonograph and squelch the radio signals. For radio operation the pickup arm must be replaced on its rest. (See front cover.)

The switch itself is a 3-circuit affair accomplishing the following: first, it applies a-c power to the phonograph motor; second, it switches the volume control from the detector circuits to phonograph pickup; third, it opens the B supply to the converter and i-f stages thereby removing all plate and screen

voltages from the tubes not used for phonograph amplification. Besides cutting out radio reception, the B voltage is materially raised, which permits greater power output and somewhat better power-supply filtering. The improved filtering is due to the reduction in load and consequent increased load impedance of the filter.

The B filter consists of a 35-ohm surge suppressor followed by a two-stage resistance-capacity conventional low-pass filter using 35-mfd condensers.

Buy United States Defense Bonds
and help beat Hitler.

SAFEGUARD YOUR SERVICE



With indications pointing to an early tapering-off of radio set manufacturing, the demand for servicing present equipment will naturally increase. Astatic Crystal Cartridges and other replacement parts for microphones and pickups are manufactured with exacting skill and precision to conform to established laboratory standards of operating efficiency. Astatic parts assure a more satisfactory and a more dependable job.

ASTATIC

THE ASTATIC CORPORATION

Licensed Under Brush
Development Co. Patents

YOUNGSTOWN, OHIO

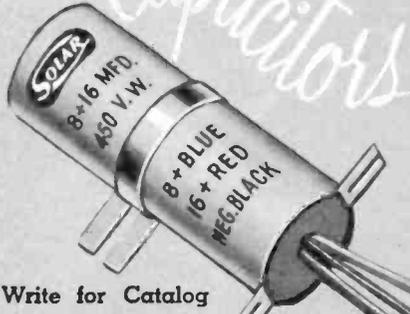
In Canada:
Canadian Astatic Ltd.
Toronto, Ontario

New, Handy



UNIVERSAL REPLACEMENT

Capacitors



Write for Catalog

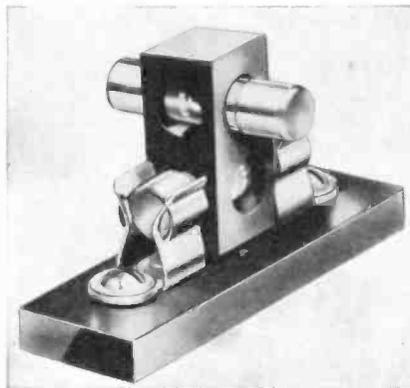
**SOLAR MFG. CORP.,
Bayonne, N. J.**

New Products...

Additional information and prices of the equipment described below may be obtained, without obligation, from the respective manufacturers.

LITTELFUSE QUICK CHANGE UNIT

A new convenience for changing fuses in close quarters is compactly embodied in a spare fuse holder and puller combined, announced by Littelfuse, Inc., 4797 Ravens-



wood Avenue, Chicago. The new devices are applicable to all 4AG and 5AG fuses. One end of the holder is painted red. Until a fuse change is necessary this red end is underneath, out of sight. Windows in the holder keep the elements of both fuses in view at all times.

WABASH BLACKOUT LAMP

Designed for blackout lighting in air raids, the Wabash blackout bulb, announced by the Wabash Appliance Corp.,



335 Carroll St., Brooklyn, N. Y., provides downlighting in a 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 filament glare and projects the light downward. A black silicate coating covers the bulb up to the extreme lighting end which is a deep blue. The new bulb consumes 25 watts.

News...

RCA AD SERIES

The third of the series of full page, two color RCA advertisements appeared in the Dec. 27, 1941 issue of Collier's. This ad, like its predecessors, was designed to acquaint the public with the necessity of relying on competent Service Men to keep radio receivers in efficient operation.

"Yes, Mrs. Smith, I'll make it sound like new. The oscillator is off a few thousand beats a second," the headline reads. The text develops the theme, explaining how maladjusted parts unknown to the set owner can seriously affect reception. The ad also urges replacement of worn tubes at regular intervals, and a routine service check-up every year or 18 months.

This ad completed the 1941 schedule of consumer advertising for the RCA Tube and Equipment Division, the heaviest, that has ever been run by the Division in consumer publications. The first of these ads ran in the Saturday Evening Post on March 29 at the time when radio stations changed their wave lengths. The second, third and fourth appeared in the October, November, and December issues of Collier's magazine.

RCA 97R2

80 Volts on the grid cap of the 6K8: The trouble was shorting of a lead under the push-button switch assembly, the positive potential thus being applied to the grid. *Willard Moody*

Remember Pearl Harbor. Buy U. S. Defense Bonds and Stamps.

Catalogs, Bulletins, etc. . . .

Copies of the catalogs and bulletins discussed below may be obtained directly from the respective manufacturers mentioned. Write for them today!

• • • • To assist taxpayers in the preparation of their income tax returns the Treasury Department has issued a folder entitled "How to File Your Income Tax Return the Simple Way." The folder contains a facsimile of the simplified form 1040A and illustrates the six steps required to prepare the return. Form 1040A may be used by persons who are required to file returns but who have gross incomes of not more than \$3,000 from salaries, wages, etc., only.

Copies of the folder may be secured from the nearest Collector of Internal Revenue.

• • • • A copyrighted book, "Phonograph Pickup Cartridge Replacement Manual," is published for the convenience of jobbers and Service Men by the Astatic Corp., Youngstown, Ohio. The manual is designed to enable selection of the proper pickup cartridge when replacement is required.

• • • • A Renewal Tube Characteristics Sheet has been released by the commercial engineering department of the Hygrade Sylvania Corp., 500 Fifth Ave., New York City. The 12-page booklet contains not only average tube characteristics but also panel lamp characteristics and tube base diagrams.

Although the booklet is available without charge it is requested that Service Men order for bare requirements only and give each copy the widest possible use.

• • • • A 16-page catalog, No. 18 listing over a thousand stock items in rheostats, resistors, tap switches, chokes and attenuators has been issued by the Ohmite



Manufacturing Co., Dept. 7M 4835 Flournoy St., Chicago. The catalog gives illustrations descriptions, ratings, prices and other helpful information on the wide range of Ohmite stock types and sizes.

CUT RADIO REPAIR TIME AND INCREASE SERVICING PROFIT

This new handbook shows you how!

RADIO

Troubleshooter's HANDBOOK

\$3.50

only

COMPLETE IN ONE BIG VOLUME

710 PAGES!

New revised and enlarged

A. A. GHIRARDI
AUTHOR

Probably the foremost authority on radio servicing in this country. The man prominent radio manufacturers and servicing organizations turn to for technical guidance. This new data book is a direct result of Ghirardi's long experience, the only handbook of its kind ever written to help servicemen work faster and make more money.

OTHER GHIRARDI BOOKS TO HELP YOU

RADIO PHYSICS COURSE
A complete home-study radio course so head-and-shoulders above any thing in the field that it is used as the basic text by thousands of students and schools. World's greatest collection of radio knowledge gathered together in one huge 972-page volume. Everything is explained clearly, and illustrated, and easy to understand for quick study and reference. Complete in one volume. **\$5.00**

MODERN RADIO SERVICING
A practical How-To-Do-It home-study course in radio service work. Easy to understand. Teaches you step by step all about test instruments, troubleshooting, testing and repair. Trains you at home in spare time for profitable radio servicing. By the expert, A. A. Ghirardi, who packs a lifetime of remarkable radio experience into its 1300 pages. For only **\$5.00**.

SPECIAL "COMBINATION" OFFER brings you two great books—**MODERN RADIO SERVICING** and the **RADIO TROUBLESHOOTER'S HANDBOOK** at the special money-saving "combination" price of **\$8.00**.

YOUR LOCAL DISTRIBUTOR should be able to supply you with **RADIO TROUBLESHOOTER'S HANDBOOK** and the other books in Ghirardi's modern radio "library." If he is out of stock, use this coupon to order direct.

FREE COLOR CODE CHART!

Send for your copy of Ghirardi's new Capacitor & Resistor Color Code Chart. Easy-to-read, it gives you all RMA coding arrangements at a glance. Check the coupon to get your FREE copy.

NEVER before in radio servicing have minutes meant money the way they do now! To speed up trouble-shooting, cut repair time on every service job . . . to make your working day pay you the biggest profit, send at once for Ghirardi's revised, enlarged on-the-job **RADIO TROUBLESHOOTER'S HANDBOOK**.

Here, boiled down to essentials for you, skillfully tabulated and indexed for split-second reference is everything you need on hand for 1942 servicing. Imagine having in one handy volume such working service data as: trouble and remedy Case Histories for 1,607 models of 196 makes of receivers and record changers . . . alignment instructions for more than 20,173 superhets . . . noise elimination charts for auto radios installed in all car models . . . complete servicing information with charts and tables—**66 BIG SECTIONS IN ALL**, each one as easy to refer to as a name in your phone book.

710 pages of "shirt sleeve" working data to help you save time and make more money at service work. Over 400 pages of vital new information never before published. And all of it factory-checked; none of it duplicating any data in existing servicing manuals. It's the quickest, surest, most economical way to increase your efficiency and earn a greater share of the profits in radio today! Get your copy at once. This revised and enlarged edition of the **RADIO TROUBLESHOOTER'S HANDBOOK**, complete, is still only **\$3.50**.

SEE FOR YOURSELF — 5 DAYS' TRIAL

Lyanna, USE the book at home and on the job for five days without obligation. See how much time it saves . . . how much easier it makes radio repair. Judge what it will be worth to you to have this book constantly at hand. If you do not agree it has already paid for itself, return the book at the end of the examination period and get your money back. See your local distributor or clip the coupon and mail it TODAY!

**RADIO & TECHNICAL PUBLISHING CO., Dept. 812,
45 Astor Place, New York, N. Y.**

Enclosed find payment for books I have checked (on 5-days' trial). I understand that if I am not fully satisfied, I may return the book(s) at the end of the trial period and receive my money back.

- (1) Radio Troubleshooter's Handbook \$3.50 (\$4 foreign)
- (2) Radio Physics Course \$5.00 (\$5.50 foreign)
- (3) Modern Radio Servicing \$5.00 (\$5.50 foreign)
- (1) and (3) combined in your special offer \$8 (\$9 foreign)
- Rush my FREE Color Code Chart. Send FREE literature on book (1), (2), (3).

NAME _____
ADDRESS _____
CITY _____ STATE _____

See Your Distributor or Mail This Coupon Now

Displays . . .

• • • • A new Sylvania radio tube display featuring Donald Duck and his little nephew is being distributed to service shops. It is made in two sizes, a large display 35" high for use in store windows and a miniature which is an exact duplicate reduced to 12" high for counters and small windows.

Uncle Donald is such a blithering quack of a model that his nephew in guttural desperation says, "If your radio sounds like Donald Duck . . . 'It's Time to Get New Tubes.'" This is followed by an action hook to get people into the store. "Do It Today for Good Listening Tomorrow."

STEWART-WARNER HUDSON SA40

Contact screw adjustment: Once properly set, the contact screw seldom requires readjustment. Improper adjustment may be identified by the symptoms indicated below:

Contact screw too far in: When a push-button key is depressed, the magnet will operate, but the cam operating bar may not be pushed through.

Contact screw too far out: This may permit the push-button key to exert too much pressure on the cam operating bar and cause it to stick.

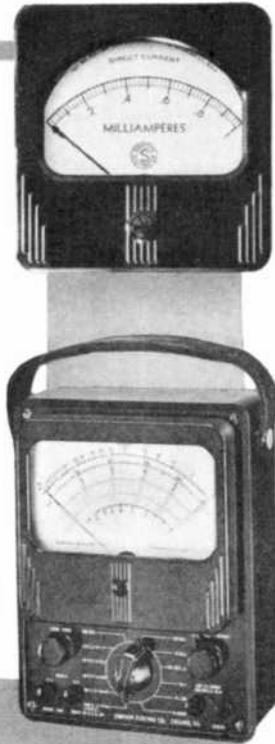
Chattering of the mechanism may be caused when the screw is either too far in or too far out. Adjust the screw until the unit operates properly when any one of the push-buttons is depressed. (See figure on next page.)

If your need for instruments is essential enough to give you the right to buy, it is essential enough to rate the best.

To those who have searched out the facts, best means *Simpson!*

SIMPSON ELECTRIC CO.
5208-18 Kinzie Street, Chicago, Ill.

Simpson
INSTRUMENTS THAT STAY ACCURATE



You bet. We're in step with progress—with better listening, and therefore with quicker sales and more sales. Take us on, you wide-awake dealers.

Ken-Rad Tube & Lamp Corporation
Owensboro, Kentucky

DEPENDABLE
Radio Tubes

KEN-RAD



SAVE \$1.00!!!

- The Group Subscription Plan for *Service* enables a group of service men, dealers or jobbers to subscribe at one-half the usual yearly rate.
- The regular individual rate is \$2.00 a year. In groups of 4 or more, the subscription rate is \$1.00 a year. (In foreign countries, \$2.00.)
- Each subscriber should print his name and address clearly and state his occupation—whether a dealer, jobber, independent service man, service organization, etc.

Remember this Group Plan when Your Subscription Expires

Personnel . . .

• • • • Walter L. Krahl has been named assistant chief engineer of the Hygrade Sylvania Corp., Radio Tube Division. Mr. Krahl was formerly division engineer of the Salem, Mass., tube plant of the company.

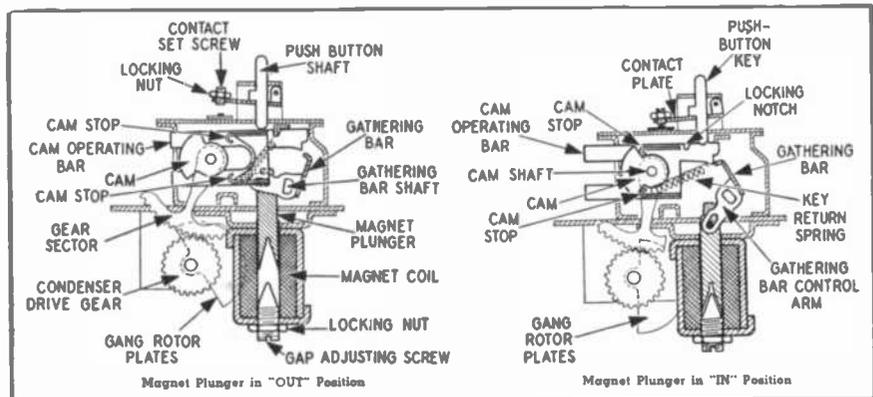
• • • • Milton Auster, of Dale Radio Co., has been appointed as business specialist on radio parts in the Emergency Management Office of the Office of Price Administration. He is devoting his full time to the government position.

• • • • William C. White has been appointed director of an electronics laboratory in which will be concentrated General Electric's advance development activities in the field of electronics. The new laboratory has been established as a division of the radio and television department of G. E. Mr. White was engineer in charge of the vacuum tube division. O. W. Pike succeeds Mr. White in this latter position.

• • • • The office of the New England representatives of the Turner Co., Henry P. Segel Co., is now located at 221 Columbus Ave., Boston, Mass.

STEWART-WARNER HUDSON SA40

Slipping clutch; backlash: A slipping clutch is indicated by excessive backlash during manual tuning. First check to see



Figs. 1 and 2. The Stewart-Warner Hudson SA40 employs a complicated tuning mechanism.

that the correct plunger return spring is used.

The correct type of spring may be determined from the following table which gives the dimensions of the three types of springs which have been used.

	Number of turns	Body length	Overall length	Out-side dia.
Correct spring	36	3/4 in.	1 1/8	7/32
Light spring	34 plus	5/8	1 1/4	3/16
Heavy spring	24	13/16	1 1/8	9/32

If the unit has the light or heavy spring, replace it with the correct one. When changing springs it is also desirable to replace the magnet assembly if it does not have the locking nut and gap adjusting screw shown in Fig. 1.

However, this is only necessary when

there is insufficient pull of the solenoid to operate the mechanism.

Next check the position of the cam on the end of the gathering bar shaft (copper plated shaft) with relation to the riser of the declutch arm while the plunger is out. The cam should be halfway up the curved portion of the riser as shown in Fig. 1.

If the cam is not halfway up the riser while the plunger is out, as shown in the illustration, loosen the two bristol set screws in the retaining collar on the other end of the gathering bar shaft and move the retaining collar on the shaft until the cam is properly positioned on the riser. A special set screw wrench is needed to fit the bristol set screws.

In all cases where slipping clutches are reported, check to see that there is no excessive friction in the gang condenser, dial or gang condenser drive gears.

INDUSTRIAL ELECTRONICS

(Continued from page 8)

tube finds many other applications in industry which do not involve phototubes at all. It can be actuated by mechanical or other electrical means. In the case of larger tubes, tiny voltages applied to the grid by any input device will control power in terms of kilowatts; or even a delicate switch connected in the grid circuit in such a way as to alter the applied bias, can accomplish this.

Another interesting possibility offered by this type of tube in a-c circuits is found in its adjustment to conduct current only during a small fraction of each cycle. When plate and grid are operated in normal phase relationship from an a-c source, the tube will be conductive during one half of each cycle. During the other half the anode will be negative and under this condition the tube cannot conduct. If means are provided in the form of resistance, capacity or inductance to alter the grid-anode phase relationship, the tube can be made conductive during a smaller fraction of a cycle. Thus the tube may not fire until the peak of the positive half cycle is reached, for instance.

Advantage is taken of this in the control of automatic welding, as one example. For certain welding operations it is necessary that the current be applied for only a very small fraction of one second. To accurately govern this period of application by mechanical means would be difficult, particularly as any switch employed would have to be of heavy construction to handle the high current involved in high-speed welding operations. It is readily accomplished by means of a suitable thyatron, however, with the tube itself functioning as both timer and relay, its anode circuit in some cases handling currents close to 100 amperes!

By suitable circuit arrangement, the phase relationship of grid and anode might be adjusted so that the tube fires just after the peak of the positive half cycle has been reached (for a 1/300-second weld). Conduction would then continue over only 1/5 of a cycle. When the tube is fired its anode circuit passes the necessary high current to the welder which is in series with it. At the same time it actuates another circuit which biases the tube to prevent firing during successive cycles. Thus a single impulse of current flows and is not repeated until a manually operated control switch is again pressed to initiate another weld.

It has been the purpose in the foregoing to provide a basic understanding of some of the general operating principles and characteristics of phototubes and thyratrons. It is perhaps unfortu-

THE STRANGE CASE OF SERVICEMAN WALDO MUDD

Dear Miss Barefacts:

I know that your column is entitled "Advice to the Loveless" and I am not loveless. As a matter of fact, I have more love than I know what to do with. That's why I am writing to you.

You see, Miss Barefacts, I am a radio service man. I make good money and I'm very happy. I mean I was happy until I met Arabella Blotts. She is one of my customers. In fact, she is my very best customer. That's the trouble.

Arabella has a very nice apartment with about eight radios in it. The first time she called me, I went over and fixed two of the radios in about half an hour. Then Arabella asked me to sit down and have a drink with her.

The correspondence course I took in radio servicing didn't say anything about what to do in a case like this. Besides, I don't drink anything but ginger ale. However, Arabella insisted, so I asked for ginger ale. It was very funny tasting ginger ale and I even felt funny after I drank it.

Then Arabella sat down beside me. She is a very big girl. Also, she is very determined. Every time I moved away from her, she shoved over closer to me. Finally, I was at the end of the davenport and couldn't move any farther. Also, I was at the end of my wits.

When I got back to my shop, I remembered she hadn't paid me for fixing the radio. Also, I was dizzy and didn't feel like working any more that day.

The next day, Arabella called and said both of the radios I had fixed were broken again and would I please come right over. Well, there wasn't anything to do but go over and fix them. So I did.



Then the same thing happened again, the very next day.

However, Miss Barefacts, I will not bore you by telling you any more of this sort of thing. Suffice to say, it was six months ago that Arabella first called me. Since then, she has called me almost every day. I have fixed all of her radios at least a half dozen times each and she still hasn't paid me for a single job. What's more, I am afraid to send her a bill. Arabella is funny that way. She might get mad and not call me any more. After all, she

is the best customer I have.

What shall I do?

Very truly yours,

WALDO MUDD,
Radio Service Man.

★ ★ ★

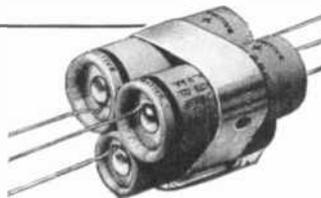
Dear Mr. Mudd:

Don't worry. Your problem should be an easy one to solve. My first suggestion is that you marry Arabella Blotts. Evidently that would please her. Then you can repair her radios in your spare time and spend the rest of your time at work for which you will be paid. My second suggestion is that, in the future, you use Sprague Condensers and Koolohm Resistors for every replacement. Once you install them you can forget them—and so can your customer. Then, the next time you meet a girl like Arabella, she will have to be more original in finding an excuse to invite you back again.

Sincerely yours,

GERTRUDE BAREFACTS,
Editor, "Advice to the Loveless Column."

● ATOMS are made in five different types, thus making them practically universal for any replacement job whether it calls for a single-section or multi-capacity unit, lug mounting, or a condenser with separate positive and negative leads.



Make up hard-to-get replacements by strapping individual Atoms together with ST Mounting Straps—supplied free! You'll find the combined Atoms actually smaller, often cheaper, and fully as reliable. You save time—money—space.

SPRAGUE PRODUCTS CO.

North Adams, Mass.

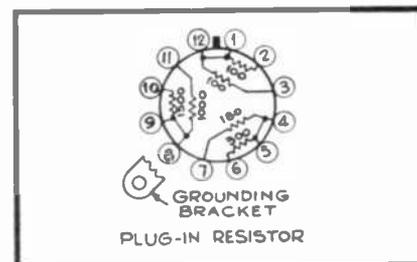
GOOD CONDENSERS—EXPERTLY ENGINEERED—COMPETENTLY PRODUCED

nate that space does not permit a discussion, in the present article at least, of some of the specific equipment in which phototubes and thyratrons are employed. In the next article of this series, however, such practical information will be presented in the form of circuits and circuit analysis.

RCA Q17, Q31, 5Q66

Ballast resistor connection: In the service data for the RCA Model Q17 the resistance between the terminals 6 and 7 of the ballast resistor should be 480 ohms instead of 550 ohms.

In the service data for the Model Q31 the resistance between terminals



6 and 7 of the ballast resistor should be 480 ohms instead of 580 ohms.

In the service data for the Model 5Q66 the connections inside the ballast resistor should be taken as shown in the accompanying illustration.

ASSOCIATIONS

Radio and Electrical Appliance Service Association, Inc.

At a meeting of the board of directors on Jan. 7, at Dale Radio, 1780 Broadway, New York City, it was decided to suspend the activities of the association for the duration. A refund will be made to all service shops of dues and fees paid to the association.

Robert G. Herzog, Secretary

Radio Servicemen's Ass'n of Luzerne County

A regular meeting of the Radio Servicemen's Association was held in the Chamber of Commerce Rooms, Miners National Bank, Wilkes-Barre, Pa., on Jan. 6. The main topic of discussion at this meeting was our relationship to the National Defense Program. The law requiring all aliens to surrender short-wave receivers was discussed, and we agreed that the method of removing the short-wave band from such a set before it is returned to the individual be standardized.

C. F. Bogdan, Secretary

RADIO SERVICEMEN OF AMERICA

Nominations for RSA Directors

This is the last call for nominations for directors of the following districts: District 5 (Iowa and Missouri); District 7 (Wisconsin, Minnesota, North Dakota, South Dakota, and the northern peninsula of Michigan); and District 9 (Michigan, excepting the northern peninsula, and the Province of Ontario, Canada).

Under our by-laws, nominations must be received at national headquarters by Feb. 15, 1942. Present directors are: District 5, Edward H. Gordon, LeClaire Hotel, Moline, Ill.; District 7, Fred Olson, 107 S. Madison St., Green Bay, Wis.; and District 9, S. W. Christie, 36 Miller, Pontiac, Mich.

Boston Chapter

Servicing "Hints and Kinks" have gone over big at every meeting. Nomination and election of officers and our annual banquet are scheduled for January.

Our associationship with the various broadcasters is going along as usual.

Hy Leve, Secretary

Chicago Chapter

As a step to help counteract the public's lack of confidence in Service Men, our Executive Board sent a bulletin with the heading: "You Have Been Challenged!" to every Service Man in this area.

To discover a solution the Chicago chapter invited all to the Stevens Hotel on Wednesday, Nov. 26, at 8:00 P. M.

The program on the 26th opened with the personal appearances of Globe Trotting Ulmer Turner and beautiful Betty Ames, who devoted themselves specifically to the problems of the radio Service Man.

Then Harold Cunningham took up briefly the question: "Can a Service Shop Make a Satisfactory Income for Its Owner in View of New Taxes, Material Shortages, and Other Problems Before Us?"

The climax of the meeting was a brief talk by Robert L. Schless, business and advertising executive of the Chicago Herald American. Mr. Schless showed us how we can best build a substantial income during the uncertain period ahead of us.

All in all, this meeting was a big success for the Chicago Chapter. We feel that adoption of Mr. Schless' plans and cooperation with the Chicago Herald American will be very beneficial to our Chapter. The Chicago Herald American staff are doing their best to promote RSA to the public.

Our "Blitz" is under way with a column of RSA ads in the Herald American radio program section, under the heading, "Don't just call a Radio Serviceman. Call an RSA man." The same radio section carries a question and answer feature, "Dr. RSA", in which common questions asked by radio owners are answered by our members.

The Blitz is on! Our message is reaching the public. United, we're on our way.

Hellmuth Junkel, Publicity

Cleveland Chapter

Cleveland Chapter is planning a re-organization scheduled to start at a dinner dance in January. We are starting the ball rolling which we hope will gather all the Service Men in Cleveland under the banners of RSA. We expect promising news in the near future.

Mervin L. Brechbiel, Vice-President

Danville Chapter

Our "Christmas Sets for the Needy" program was a great success. Station WDAN and the Danville Commercial News advertised for old receivers to be donated. We repaired those received. The public certainly did donate a bunch of "old junkers" this year. The RSA Hall looked like a junk yard. We wrecked a few old timers for parts and fixed up a lot of others.

Last meeting night we started another season of RSA Radio School. We enrolled twenty-five Sea Scouts, YMCA boys, and RSA associate members.

The service business is still good here. New merchandise is not selling so well, but we are behind in our service work.

Our annual RSA Christmas Party was held Dec. 20. RSA Hall was decorated with Christmas streamers, red, white and blue lights, a large Christmas tree, mica snow covering the platform, and Santa himself was there too, and . . . well, we can sure toss some whindinger, wild parties! !

Evard Welch, Secretary

Jamestown Chapter

Our December meeting was held at the Hotel Jamestown. The business meeting was followed by technicolor sound movies. Refreshments were served.

Norman W. Smith, Secretary

Lehigh Valley Chapter

At our last regular open meeting John Rider spoke on the formation and subsequent dissolution of various Service Men's associations because of inadequate support. Detailed discussion of the Reader's Digest story and its benefits to legitimate Service Men followed. The parts shortage; future outlook, etc.; the danger of Utilities competition and the procedure being used in New York City to offset this threat were also discussed.

Election of officers is scheduled for January. Our Fourth Annual Banquet is being planned. Bob Herzog, Editor of SERVICE Magazine has been invited as the guest speaker.

Ray E. P. Abbott, Secretary

Pittsburgh Chapter

Harold Sheets, service manager of the C. R. Rogers Co., Philco Distributor, addressed our December meeting with up-to-the-minute information on correctly servicing the newest Philco record changers.

Bill Irlam, Secretary

(Continued on page 33)

YESTERDAY
TODAY
TOMORROW

← SUPREME



Every instrument scientifically engineered and soundly built for dependable, accurate, profitable radio servicing. See your Jobber or write for new catalog.

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MISSISSIPPI**

WHEN YOU CHANGE YOUR ADDRESS

Be sure to notify the Subscription Department of SERVICE at 19 E. Forty-seventh St., New York City, giving the old as well as the new address, and do this at least four weeks in advance. The Post Office Department does not forward magazines unless you pay additional postage, and we cannot duplicate copies mailed to the old address. We ask your cooperation.

ASSOCIATIONS

(Continued from page 32)

LaPorte Chapter

Our December meeting was held at the Soldiers Memorial Park. Regular business included the distribution of rubber stamps and code charts, for use in chassis marking, to all members.

Our Christmas Party—one that all members will remember for a long time—followed. A sound film, plenty of eats, drinks, and entertainment added to the evening's enjoyment. Left-overs were auctioned off and brought some income to the chapter treasury.

RSA pins were given to all members as Christmas gifts from the chapter. We're very proud of them. The party didn't break up until the wee small hours of the next morning!

We wish to thank RSA and RCA Victor for making it possible for us to receive the RCA Victor Service Data sheets.
Stanley A. Kubit, Secretary

Interstate Chapter

The regular course of study was conducted by Dr. Harvalik at St. Ambrose College, before our December meeting. All of the old chapter officers were unanimously reelected for 1942 over their protests. The National Emergency was blamed for it! Reelected were: Edward H. Gordon, president; L. H. Moorhead, vice president; and Oscar W. Olson, secretary-treasurer. An auditing committee consisting of Paul Fassnacht, M. W. Berberet, and Ross Hughes was appointed by the president to go over the books for the year 1941. President Gordon, on behalf of the chapter, thanked Dr. Harvalik for the privilege of attending his lectures at the College.

RCA Victor service notes ordered from the National Office were distributed to the members.

Oscar W. Olson, Secretary

SER-CUITS

(Continued from page 14)

only prices but priorities. Nevertheless, as prices increase and national income rises, sets become more expensive and we may see more elaborate designs.

As another example, *Garod's Model BP310* is a 7-tube, 3-band portable with a 3-gang condenser, t-r-f stage, 35Z5 rectifier and 50L6 beam-power output tube on line operation. A phone jack is included, presumably as an aid to locating short-wave stations. It serves quite well for this purpose. Both broadcast and short-wave loops are provided. The external aerial post connects to the high side of the short-wave loop through a 0.00025-mfd condenser.

Buy U. S. Defense Bonds and Stamps each payday.

Sound News

Additional information and prices of the equipment described below may be obtained, without obligation, from the respective manufacturers.

SHURE CARDIOID MICROPHONE

A "Super-Cardioid", Series 556, has been introduced by Shure Brothers, 225 W. Huron St., Chicago. It is said that the new microphone has a cardioid pattern that is twice as unidirectional as the con-



ventional cardioid and that the axial polar pattern is symmetrical at all frequencies. A frequency range from 40 to 10,000 cycles is provided in a Uniphase single unit construction. Three types are offered for 35-50 ohm circuits; 200 to 250 ohm and for high impedance inputs.

KNIGHT P-A SYSTEM

Allied Radio Corp., 833 Jackson Blvd., Chicago, have added the Knight 30-watt "Jiffy" p-a system to their line. Speaker cases mount on fold-down tripod stands which may conveniently be placed for best



results. The stands can be extended from 46 to 78 inches and are provided with adjustable swivels. The complete system includes the 30-watt amplifier with phono top; two 12-inch Safused dynamic speakers; 1 Shure "Uniplex" microphone; 1 Takedown microphone stand and the 2 speaker stands described.

INTRODUCING

SYLVANIA SERVICEMAN SERVICE

by
FRANK FAX



YOU probably wonder who I am, writing you under that handle above. Well, I'm a Sylvania engineer assigned to the one task of helping you all I can with your problems and your selling.

I've quite a staff to help me, too — backed by the Sylvania engineering and promotion departments in full force.

Our purpose is to give you a **SERVICEMAN SERVICE**, the like of which the radio business has never seen.

Yes, a *personal* service for you individual radio experts — all set to answer any technical questions you send me, and to supply whatever promotion helps your own business needs.

What's it to us? Just this: the more we can help you do a better job, the more business you'll get and the more Sylvania tubes you'll need.

So come on with those questions that have been puzzling you. Send 'em to me today, and see how this new **SYLVANIA SERVICEMAN SERVICE** can help you in a big way. Address your queries to me personally: Frank Fax, Hygrade Sylvania Corporation, Emporium, Pa.

Our advice, of course, is absolutely **FREE**. So are some of the sales helps we can supply you — with all others available at substantial savings to you. Just take a look at the typical "helps" listed below:

- | | |
|---|--|
| 1. Window displays, dummy tube cartons, timely window streamers, etc. | 15. Service hints booklets |
| 2. Counter displays | 16. Technical manual |
| 3. Electric clock signs | 17. Tube base charts |
| 4. Electric window signs | 18. Price cards |
| 5. Outdoor metal signs | 19. Sylvania News |
| 6. Window cards | 20. Characteristics sheets |
| 7. Personalized postal cards | 21. Interchangeable tube charts |
| 8. Imprinted match books | 22. Tube complement books |
| 9. Imprinted tube stickers | 23. Floor model cabinet |
| 10. Business cards | 24. Large and small service carrying kits |
| 11. Doorknob hangers | 25. Customer card index files |
| 12. Newspaper mats | 26. Service garments |
| 13. Store stationery | 27. 3-in-1 business forms |
| 14. Billheads | 28. Job record cards (with customer receipt) |

SYLVANIA

SERVICE, JANUARY, 1942 • 33



SERVICEMEN

who are

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CORRECTION

R.C.P. adv. opposite page

Last paragraph of specifications should read:

Accurate measurements from .00005 to 2000 mfd.

7 Ranges: 0/.001/.01/.1/1/10/100/2000.

THE \$1.00 GROUP PLAN Is Still Available

OUR GROUP SUBSCRIPTION PLAN enables you and three or more of your co-workers to subscribe to SERVICE at one-half the regular yearly rate—only \$1.00 each for twelve issues. The Group Plan low rate only applies when 4 or more subscriptions are ordered at one time. (Foreign \$2.00.)

Speak to three or more of your friends . . . let them sign up with you and then you can remit for the whole group. (Renewals or extended subscriptions are acceptable as part of a group.)

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Please enter annual subscription (12 issues) for each of the undersigned for which payment is enclosed at the rate of \$1.00 each; foreign \$2.00. (This rate applies only on 4 or more subscriptions when occupations are given.)

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662**

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★ **NEW RCP ELECTRONIC MULTITESTER** ★

WAR telescopes the scientific developments of years into as many months. Here is one of the first benefits — this startling new RCP Electronic Multitester, the finest general purpose instrument you've ever seen. Now you can make essential measurements heretofore beyond your reach. Ideal for a wide range of laboratory and production tests. RCP Electronic Multitesters are now being used by Signal Corps Laboratory, U. S. Navy Yards, leading research laboratories, and leading government suppliers of precision products.

Compare these features and ranges with any other meter on the market:

DC VACUUM TUBE VOLTMETER — DIRECT READING
Sensitivity: 160 megohms (high ranges); 16 megohms (low ranges).
6 Ranges: 0/6/30/150/600/1500/6000.
Measures all voltages without affecting circuit constants.

AC VACUUM TUBE VOLTMETER — DIRECT READING
Input capacity only .00005 mfd., input resistance 160 megohms, high, and 16 megohms low.
7 Ranges: 0/3/6/30/150/600/1500/6000.
Measures signal and output voltages, etc.

VACUUM TUBE OHMMETER — DIRECT READING
From the lowest scale division .1 ohm to 1000 meg-ohms.
7 Ranges: 0/1000/10,000/100,000/1 meg./10 meg./100 meg./1000 meg.
No test leads to short. No resetting when changing ranges. No danger of shock on high measurements.

VACUUM TUBE CAPACITY METER—DIRECT READING
Accurate measurements from .00003 to 1000 mfd.
7 Ranges: 0/.001/.01/.1/1/10/100/1000.
No danger of shock on low capacity measurements. No test leads to short. No resetting when changing ranges.

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The perfect tester for AM, FM, Television, AVC, AFC, and laboratory measurements. Tests bias cells, oscillator grid voltages, resistance coupled plate voltages under actual operating condi-

tions without disturbing circuit constants. Tests high voltage AC power supply. Wide frequency range output meter. An instrument that puts you head and shoulders above your competitors!

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- High voltage test leads; r.f. lead; signal tracing probe, high frequency probe; resistance and capacity lead.
- 100° Scale on 4½" D'Arsonval Microammeter with guaranteed accuracy of 2% at full scale. Linear meter movement.
- Foolproof—maximum protection against meter burn out. Meter cannot be damaged by checking a live resistor or using too low a range for making a measurement.
- Has pilot light indicator.
- Matched pair multiplier Resistors accurate to 1%.
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- ★ 5 RCA Preferred Type, Low-Drain Tubes
- ★ Easily Convertible to Power-Line Operation
- ★ R.F. Stage for Extra Sensitivity
- ★ Approximately 850-Hour Combination "A & B" Battery Pack
- ★ Full A. V. C. Action—7 Tuned Circuits

IN FARM MARKETS, these great Radiola battery radios have always been real profit-makers for servicemen! And now there's a big *new* market—for in city and country alike, folks want an "emergency" radio... a radio independent of the power-line... a radio that stays *on* when the power goes *off*!

Through use of the RCA Model CV-42 Electrofier (available as an inexpensive accessory), the Radiola B-52 operates on house-current, without battery-drain... yet can be changed over to battery operation at a moment's notice if blackouts, air raids or other emergencies should make it necessary! Remember, too, that in many farm areas electrifica-

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 PM Speaker
- ★ 1000-Hour Battery Life



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