



**A C**  
**RADIO**  
**MANUAL**

by  
*Merle Dutton*

FOR  
**SERVICE MEN**  
AND  
**SET BUILDERS**

**CONTENTS**  
245 Push-Pull Amplifier  
Public Address Systems  
Commercial Set Hook-ups  
Vacuum Tube Characteristics  
Care and Operation of A. C. Sets  
Service Data





## DONGAN POWER TRANSFORMERS AND CHOKE UNITS

Dongan transformers are built to last. A pack constructed with these transformers will give years of continuous service. These transformers owe their superiority to the best of engineering design and to efficient manufacturing methods. Dongan power transformers were well known by the amateur constructor years before the inception of broadcasting. They have been the standard of comparison for the last ten years. **When in need of transformers insist on Dongan.**

### START THE RADIO SEASON WITH A REAL POWER AMPLIFIER

Dynamic speakers require more power than can be had from the single 171 tube, without loading this tube to its full capacity. You can bring your present battery operated or electric set up to date by adding a 245 push-pull power amplifier built from Dongan parts.

#### POWER TRANSFORMER FOR 245 TUBES



Designed for use with UX-280 or similar rectifier tube to supply A, B and C power for A. C. tubes of the 2½ volt type in addition to two UX-245 power tubes. Use one No. 5554 double choke in filter circuit. Approximate D. C. output 300 volts, 100 ma. Secondary voltages 350-350 volts 125 ma. 5V amps. C. T. 2½V 3 amps. C. T. 2½V 10½ amps. C. T.

....The transformer shown above can be used for making up a 245 push-pull power amplifier and "B" eliminator, or for the construction of a phonograph amplifier, public address system, or power unit for a complete electric set. The extra 2½ volt tap has sufficient capacity to run four or five 227 or 224 type tubes. Spec. No. 1951.

#### OUT-PUT TRANSFORMER FOR 245 TUBES



This Dongan output transformer should be used as an output device for a pack using 245 tubes. It is constructed with two secondary windings, one of which can be used with a dynamic speaker. The other winding has the proper impedance for a magnetic speaker. You cannot get the full benefit of the exceptional tone quality possible with 245 tubes without using a high grade output transformer of this type.

This transformer can be had in two different styles. One of these can be used with 2-245 tubes in push-pull, and the other can be used with a single 245 tube.



#### DONGAN DOUBLE CHOKE UNITS FOR 245 POWER PACK

This double choke unit can be used with either the 171, or 245 push-pull power amplifier. These choke coils are mounted in a very attractive black can and will match the other transformers necessary to build up a complete pack. Spec. No. 7512.

DONGAN PUSH-PULL AND AUDIO TRANSFORMERS ARE LISTED ON INSIDE BACK COVER



**Dongan Electric Manufacturing Co.**

2987-3001 Franklin Street  
DETROIT, MICHIGAN



# A. C. RADIO MANUAL

BY

MERLE DUSTON

Drawings by Karl Seebers

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### FOREWORD

*This book will be found to be of interest to both the amateur radio constructor, and the man doing radio service work.*

*The author has written twenty different radio books, of which over one million copies have been sold. During the past year, he has had charge of an organization which serviced more than five thousand radio sets. The information given in this book is based upon practical experience derived from this service work.*

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PAGE ONE

# ROYAL "B" AND "C" BATTERIES



As Good as the Best  
So  
Why Pay More

Royal "B" and "C" batteries are made especially for The S. S. Kresge Co. by one of the worlds largest battery manufacturers. Due to the fact that Kresge stores sell such a large number of Royal batteries, you are always assured of getting fresh stock.

	Prices
45 volt Heavy Duty.....	<b>\$2.25</b>
45 volt Standard Size.....	<b>\$1.50</b>
22½ volt Small "B" or "C".....	<b>\$0.89</b>
4½ volt "C".....	<b>\$0.25</b>
Dry Cells .....	<b>\$0.25</b>

FOR SALE AT  
**S. S. KRESGE**  
25c to \$1.00 Green Front Stores

## STOP THAT RADIO INTERFERENCE

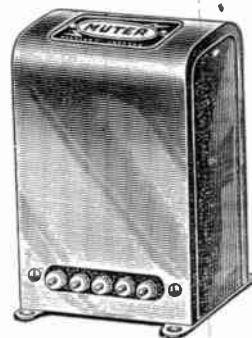
USE  
"Accurate Brand" Interference Filters



**JUNIOR SIZE**

This size filter should be used between the radio set and the house line and for filtering small electrical devices which are causing interference. Price complete with cord and plug ..... **\$2.25**

Accurate brand interference filters are sold complete with cord and plug receptacle. This will enable the user to connect either type between the radio set and the house line or between the interfering electrical apparatus and the source of electric supply.



**SENIOR SIZE**

This size filter should be used in very bad cases of interference, or for filtering large motors, sign flashers, etc. Price complete with cord and plug ..... **\$4.25**

FOR SALE AT ALL  
**S. S. KRESGE**  
25c to \$1.00 Green Front Stores



# Care and Operation of A. C. Sets

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## HOW A. C. IS USED IN ELECTRIC SETS

A. C. stands for alternating current, meaning that the electric current alternates or changes its direction of flow at regular intervals. The rate of change back and forth is known as cycles. A 60 cycle current changes its direction sixty times per second, a 25 cycle current, twenty-five times per second. These two types of current are standard in the U. S. and Canada, and, of the two sixty cycle is used more than twenty-five cycle.

It is necessary to have some type of direct current for the successful operation of a radio set using vacuum tubes. This is why all A. C. electric sets have some means of changing A. C. to direct current. The filament of an A. C. tube, can be heated from alternating current, but the plate or "B" supply must be rectified. In most cases, rectifying tubes, are used for changing from alternating to direct current. Tubes most commonly used for this purpose, are known as the 280's, 281's and the Gaseous B. H. or B. A. tube popularized by Raytheon.

These rectifier tubes must at all times be in good condition or the plate potential will drop. Whenever an A. C. set gives weak, or mushy signals, the "B" and "C" voltage should be tested to see if the rectifier tube is working properly.

Many different types of tubes are used in A. C. sets. For the last stage of audio, tubes can be used similar to those developed for battery operated sets. For the detector and R. F. part of the circuit, new tubes have been designed. The difference between D. C. and A. C. tubes, is in the construction of the filament or cathode. The heating element is so constructed that it gets hot and cools off slowly, so the electron flow is not affected by the rise and fall of the A. C.

Sets using twenty-five and sixty cycle current differ only in the construction of the filament and plate transformer. A twenty-five

cycle set can be used on sixty cycle current, but if a sixty cycle set is connected to a twenty-five cycle line, the transformer is apt to get warm. The twenty-five cycle set may hum when connected to a sixty cycle line, but no harm will be done to the set.

**Always be careful not to connect an A. C. electric set to a D. C. line, as this will blow out a fuse, or burn out the transformer.**

---

## D. C. ELECTRIC SETS

D. C., or direct electric current is used in the congested districts of larger cities and in some apartment houses and hotels that have their own electric light plants.

As a general rule D. C. sets do not give the efficient operation to be had from an A. C. set. From what has been said under the previous heading the opposite would seem to be true, but this is not the case.

D. C. electric sets are inefficient due to the fact that high plate or "B" potential cannot be had. With A. C. the voltage can be raised or lowered with transformers, but with D. C., the highest voltages obtainable is that put out by the generator, and in most cases is only 120 volts. As power tubes require voltages from 135 to 450 for efficient operation it readily can be seen why exceptional operation cannot be had with a D. C. electric set.

Several of the larger set manufacturers are making D. C. sets, and when no other current is available, these will give fairly good results. They will however, require servicing at regular intervals, or the customer will have trouble with the tubes burning out.

Where high efficiency and great volume is required, it is better to install an A. C. set, or power amplifier and then convert the direct to alternating current through the use of a motor generator.

# Care and Operation of A. C. Sets

## INSTALLATION OF A. C. SETS

Many A. C. sets are working efficiently, without using an aerial in any way. In these cases a good ground wire is generally connected to the aerial post. When good results are obtained from a condition of this kind, signals are being picked up through the A. C. light line. The above of course, applies to sets which are constructed for aerial and ground use, and not for those made for use with a loop.

If a set is located in a neighborhood where there is electrical interference, it is not a good plan to depend on the electric light line for pick-up.

One of the most efficient outside aerials for A. C. sets, is shown below. We would not recommend this aerial too highly for battery operated sets, particularly if a straight wire aerial can be run, but with the added pick-up of A. C. sets, it will give good results, and pick-up signals from the broadcast stations without a great amount of electrical interference from neighboring light and trolley wires.

This aerial can be assembled in the shop and will not take more than an hour to install. The mast can be be a ten foot length of one half inch gas pipe, or electric conduit. This can be fastened to the roof by driving a ten penny nail in any convenient location. The pipe should be set over this nail, and fastened down by the four guy wires, as shown in the drawing. These guy wires, which are a part of the aerial, should be from fifteen to eighteen feet long and can be fastened to the roof with nails or screw eyes. The guy wires are fastened to the top of the mast by driving a wooden plug in the upper end. The lead-in should be soldered to all four wires, and then be run by the most direct method to the receiving set. This lead-in should be supported by screw eye insulators, or other types of stand-off brackets.

Some aerial constructors, do not put insulators at the bottom of the guy wires, but depend upon the insulating properties of the roof material. This is a poor plan and we would advise the use of small glass insulators, at both top and bottom of the wires.

Electric sets should have a good ground connection and where possible, the ground wire should be connected to a water pipe by using a ground clamp.

Do not install an electric set close to a stove hot air, or steam radiator, as excessive heat weakens the condensers in the power pack, and they will then soon become shorted.

## VOLTAGE CONTROL OF ELECTRIC SETS

The tubes of an electric set must have the right voltage for lighting the filament, or trouble will be experienced. An ideal condition is hard to get, due to the fact that line voltages vary in different cities, and in different localities of the same city at different times of the day.

Changing voltages are caused by the varying loads connected to the line at different times of the day. In outlying districts, the line may be over loaded at all times.

Most A. C. set transformers are wound for 110 volt operation, although some have a high-low switch, which can be used for 110 to 120 volts. If a set does not have one of these adjustments, a voltage regulator, can be used. This will cut down the current so that the tubes will not burn out, or become deteriorated due to high voltage. These voltage regulators will drop the voltages, at the tubes, from one quarter to one half volts. A. C. tubes should never be used at over the rated voltages, which are shown elsewhere in this book, but in most cases, satisfactory results can be had if they are operated slightly under these voltages.

If a voltage regulator is used on a large set having one or more power or rectifier tubes, be sure to purchase a heavy duty line regulator, so that it will carry the current drawn by this set.

When a low line voltage condition is present the trouble is more difficult to rectify. Some high priced voltage regulators will either lower or raise the input voltage to the set. Most of the medium priced ones, will only cut it down. In certain localities, the voltage is so low, that an additional transformer is necessary. Fortunately these conditions are rare, and will only be encountered in small towns, or rural districts.

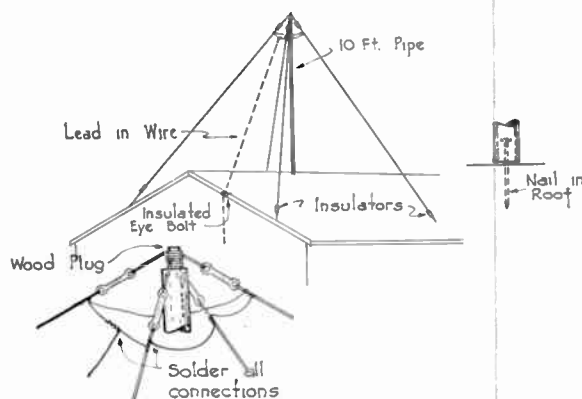


Fig. 1—Umbrella aerial assembly

# Care and Operation of A. C. Sets

## INTERFERENCE ELIMINATION

### RADIO INTERFERENCE

In certain localities good radio reception is next to impossible due to interference caused by electrical apparatus either in the building where the set is located, or in the immediate vicinity. This outside electrical interference can only be eliminated by the co-operated effort of the user of the radio set and of the owner of the electrical device causing the trouble.

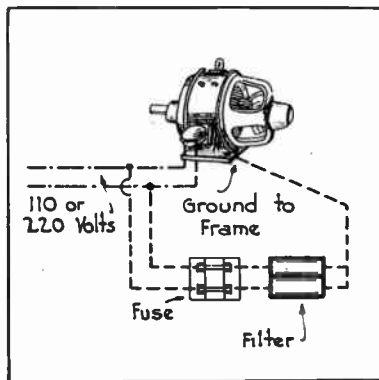


Fig. 2—Filtering two wire electric motor

The Department of Commerce Bureau of Standards, have recently sent out a bulletin which covers different phases of electrical interference. This is known as "Letter Circular 182." We are reprinting two paragraphs of this letter which seems to sum up the whole problem in a brief and comprehensive manner.

"Much of the work in mitigation of electrical interference results in an improvement in the operation of the electrical devices or supply lines and is thus a double gain. There are, however, some electrical devices which, even when in perfect working order, cause disturbances which result in interference with radio reception. In many cases it is possible to provide filters, shields, chokes, etc., either at the source of disturbance or at the receiving set, which do much to relieve the difficulties.

"Part of the disturbance from electrical devices is practically inevitable and must be regarded, like atmospheric disturbances, as part of the inherent limitation of radio reception. In other words, the limitation upon radio reception is not only the distance and

## Interference Elimination (Continued)

the power of the transmitting stations and the sensitiveness of the receiving set, but also the omnipresent background of slight electrical disturbances which drown out signals below a certain intensity. This background of electrical disturbances is the underlying reason why reception from local station is inherently superior to reception from distant stations."

When a service man is called upon to clear up trouble thought to be a case of interference he should first test the set thoroughly to see if the noises are not originating in the set. One quick method of doing this, is to disconnect the aerial and ground, or loop connections, and note if the noise stops, or is materially decreased. If the noise continues after this test the set should be checked for defects.

If the electrical interference is originating on the premises of the set owner and he is willing to spend the money for the necessary condensers and the labor for installing, nine times out of ten, the trouble can be eliminated, or so materially decreased that it will not interfere with good reception.

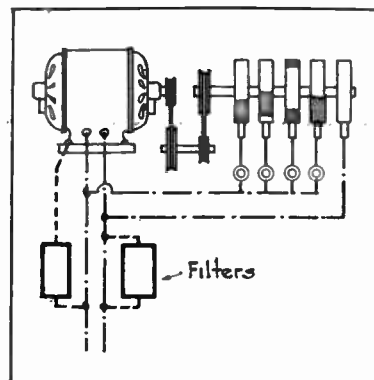


Fig. 3—Filtering sign flasher

If the trouble is found to be outside interference, the service man is limited in what he can do. In the case of an A. C. set, a filter condenser, or the filter and choke unit can be connected between the set and house wiring. This will materially decrease the noises caused by outside interference, particularly if they are being introduced to the set through the light lines.

# Care and Operation of A. C. Sets

## Interference Elimination (Continued)

When the interference has a pronounced 60 cycle hum, it may be caused by inductance between the high lines and the aerial. Frequently this can be eliminated by changing the aerial, or putting up a vertical aerial of the umbrella type.

Interference caused by defective apparatus belonging to the power company, should be reported direct to their service department. In most cases they are only too glad to have this brought to their attention as power leaks and defective equipment result in the loss to the company. The company also loses the revenue from the operation of the set if conditions are so bad, that the user cannot operate his receiver.

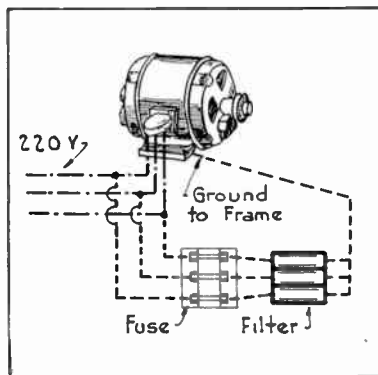


Fig. 4—Filtering three wire motor

In cases where the interference is caused by small electrical apparatus, the trouble may be eliminated by using junior filter condensers, as shown in figure 5. These units consist of by-pass condensers with a center tap which may be connected to the ground. This ground connection is not always necessary as one side of the light line is always grounded.

For large motors, sign flashers, or heavy duty electrical devices causing interference, somewhat larger filter condensers and additional choke coils will be necessary. Illustrations given will show how these should be connected. No hard and fast rule regarding the number and size of the condensers can be given due to the fact that conditions will vary and only experimenting will show how elaborate the installation must be to eliminate the trouble.

One point cannot be stressed too strongly, be sure that the filter condensers which you

## Interference Elimination (Continued)

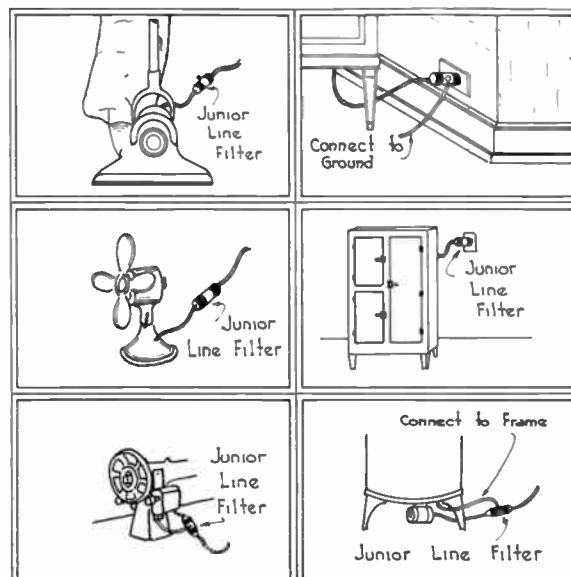


Fig. 5—Different methods of using small filtering units

are using have high enough insulation to withstand continuous service at the voltages to which they are connected. Also remember that D. C. ratings do not apply to A. C. current. Use only condensers made by reputable manufacturers and guaranteed by them to stand up under continuous use. A condenser which is across a 110 volt A. C. line, should have a D. C. rating of at least 300 volts. Do not get this size of condenser across the two outside wires of a three wire system. Connect two of them in series and ground the centre tap. As an additional precaution a fuse block may be installed in series with the condensers, and if small fuses are placed in this block, they will eliminate all fire hazards.

When filtering motor generator sets, try placing condensers both across the input and output circuits. In conclusion we wish to state that there is a big field for a service man in radio interference work, and, as is true with other branches of radio service, experience is the best teacher. It is our opinion that it will be only a short time, before all city and state legislators will pass laws making the owners of electrical apparatus responsible for the installation of proper filtering devices if their apparatus interferes with radio reception. Some states now have laws of this kind, and the concentrated effort on the part of set owners, dealers and service men will force the issue in other states.



# Servicing A. C. Sets and Power Packs

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## Interference Elimination (Continued)

Most manufacturers of electric ice boxes and oil burners are now including filter units as a part of their equipment. This has only been a recent development, and many users of oil burners are having trouble in receiving programmes while the burner is in operation. Sell all of the interference eliminators that you can, as it will add to your income and build up good will.

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## BALANCING R. F. STAGES

Many different methods have been devised for balancing the R. F. stages in an electric set. Some of these are so complicated that the set must be hooked up in a laboratory, where an R. F. oscillator is available, or instructions cannot be followed.

There is a much simpler and also much better method of getting satisfactory results. We believe that if the set is balanced in the home of the user after the service man has found out how much of a DX fan the customer is, a much better all around job can be done. The first thing to do, is to balance the variable condensers, by tuning in a local or distant station which can be received near the center of the dial. Next balance each R. F. stage separately, first setting the balancing condenser at a point where the tube will oscillate, and then back it off slightly before going to the next stage. Next try tuning in stations on both the upper and lower bands, and if the customer is a DX fan, have the set oscillate slightly on the lower wave length stations. Special instructions on balancing different commercial sets, will be found elsewhere in this book.

## TESTING AND REPLACING R. F. TRANSFORMERS

A radio set should be checked for an open R. F. coil when it is found that there is no plate "B", or "C" voltage on just one of the R. F. stages. If more than one of the R. F. stages show no plate voltage on an A. C. set, the power pack should be tested for shorted condensers, or a grounded choke.

Before taking the R. F. coil out of the circuit, unsolder one end of the primary and secondary and run a continuity test and see if the coil tests open. If this test shows the coil to be good, check over balance of this circuit for an open connection.

If there is just one break in the wire of the R. F. coil, this can sometimes be picked up and resoldered, thus saving the replacing or re-winding of the coil.

If you are re-winding a coil, count the number of turns, as you take the wire off, and rewind in the same manner, using as nearly as possible the same size wire as was on the coil originally.

It is not a good policy to try to substitute a coil of another make, as the inductance of the two coils may not be the same, and this will throw the set out of balance.

A shorted coil, is somewhat harder to locate, as the plate and "C" voltages will check at the tube. The set will generally play on local stations even when one R. F. coil is shorted out of the circuit. One easy way to find out if you are having trouble with an R. F. stage, is to tune in a station and then place your hand around each one of the R. F. coils, noting whether the signals increase or decrease. If no change is noticeable, check the set for trouble in that particular stage.

In making voltage tests, no plate voltage shows an opening in the primary of the coil ahead, and no "C." or grid voltage means an open in the secondary of the following coil.

As stated previously, these tests only apply when voltages do not show up on one tube, but are O. K. on the rest of the tubes. Before making any of these tests, be sure tubes are all O. K.

# Servicing A. C. Sets and Power Packs

## ELIMINATING A. C. HUM

Some types of electric sets, have what is known as a hum regulator. This consists of a low ohmage potentiometer, shunted across the transformer filament windings. The center tap of this potentiometer is connected to the ground, or to the grid return leads. Other sets use a filament transformer, with a center tap, instead of the variable potentiometer. Still other sets use a fixed resistance tapped in the center.

Anyone of these methods are satisfactory, if the center tap is held at the exact electrical center of the transformer. If they are off center even a slight amount, the grids of the tubes, will respond to the alternating current impulses, and a hum can be heard through the speaker.

When encountering a set which has a bad hum, look for a hum eliminator. If one is not found, test both sides of the filament transformer to ground with a good low scale A. C. voltmeter and try disconnecting the center tap of the resistance or transformer and insert a variable potentiometer and see whether adjusting this rectifies the trouble. If so, install either a variable or fixed center tap resistance which is known to be right.

If the set is equipped with a dynamic speaker, the hum may be caused by this unit. The best way to test this, is to try a magnetic speaker on the set, and see if the hum disappears.

Dynamic speakers of the six volt type, can be filtered by the use of a high capacity, low voltage condenser. Several manufacturers make condenser blocks especially for this purpose.

A six volt dynamic speaker, is one using this voltage across the field coil. A transformer is used to cut down the A. C. voltage and dry rectifier units are used for filtering purposes. If this filter is defective, a bad A. C. hum will result, and can be eliminated by the method spoken of above.

Many times A. C. hum will result from a poor 227 detector tube, or from having the speaker, or power pack close to this tube. When a hum develops in a set which previously worked satisfactorily, try inserting a new 227 tube.

If a set suddenly develops a very loud A. C. hum, the wiring to the dial light, and to the filaments of the tubes, should be checked to see if one side is shorted on the metal chassis.

## TESTING FOR OPENS AND SHORT CIRCUITS

If a difficult case of trouble is encountered and same cannot be located through the convenient method of testing voltages at the sockets, various continuity tests should be tried. A convenient method for making continuity tests, is shown in the accompanying drawing. A high resistance voltmeter is connected in series with a dry battery. When the two probes are connected, the voltmeter will read the full voltage of the battery. When these are connected across the primaries or secondaries of audio transformers, or across resistances in the circuit, some drop in voltage should be noted. This drop in voltage will not occur when checking an R. F. coil, due to the fact that the resistances of this coil is very low. This method of testing should be used for checking small by-pass condensers in the set, and for tracing out the circuit if the same is not known.

If the service man has a hook-up of the set he is working on, continuity tests will be easy to make. If no hook-up is available it is best to make a rough sketch as you go along so that the check-up can be made in a systematic manner.

Often times noises in the set will be caused by high resistance joint, or a very small leak across one of the by-pass condensers.

One very difficult piece of trouble which was brought into our laboratory, was found to be caused by a defective .001 condenser connected between the plate of the detector tube and the ground. This condenser had developed a high resistance leak and the detector plate voltage would leak across this condenser, causing the first audio transformer to pass an intermittent current to the grid of the first audio tube.

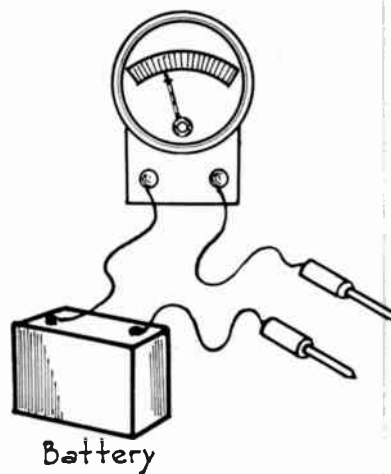


Fig. 6—Simple tester for opens and shorts

# Servicing A. C. Sets

## REPAIRING POWER PACKS

Electric sets have one inherent weakness which help to keep all radio service men busy. With an A. C. receiver it is necessary to rectify the alternating current for "B" supply. A part of this rectifying unit consists of filter condensers. Most of these condensers are made by winding tinfoil and paper together, and no matter how carefully these are made, some of them will develop a high resistance leak between the foil windings. This leak will increase as the set is used and in time will develop into a dead short. It sometimes takes several years for this to happen so some sets will be discarded with the original condensers intact. Enough of them will break down during the life of the set to make the replacing of filter condensers a major service problem.

### Rebuilding Condenser Blocks

When the condensers of the set break down the "B" voltage is eliminated at some, or all of the tubes. If the condenser which is defective is across either the input, center tap, or output of the chokes, all of the high tension "B" voltage is shorted. This will cause the rectifier tube to have a very blue glow. A slight blue glow will show up at times when the set is O. K., but when the tube is completely filled with this color, it shows either a defective tube, a blown condenser, or both. If the set shows excessive high voltage on the plates of some of the tubes, and no voltage on others, the condensers across the voltage divider should be tested.

The easiest, but not the cheapest method of fixing a set with broken down condensers, is to replace with a condenser can which can be purchased from the manufacturer of the set. The disadvantage of this method, is that replacement blocks are not always available, and the user will not want to wait several weeks while one of these is received from the factory. Again the manufacturer of the set may be out of business and replacement parts are not available. The best method is for the service man to keep on hand at all times unmounted condensers of various voltage ratings, so that he can replace one or all of the condensers in any service job which he may run across.

Buy these condensers in one microfarad sections having a voltage rating of 200 volts, 300 volts, 600 volts and 1000 volts. The 1000 volt condensers may be purchased in  $\frac{1}{2}$  microfarad sections, rather than one microfarad sec-

### Rebuilding Condenser Blocks (Continued)

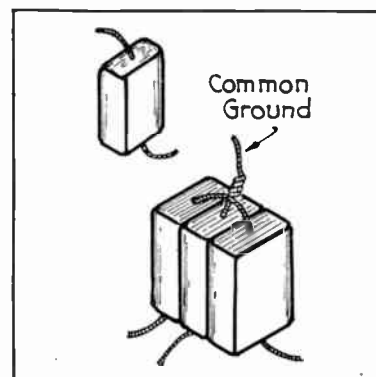


Fig. 7—Proper method of connecting replacement condensers

tions. Of these different types, you will find more use for 200 and 300 volt units, than for units having a rating of 600 and 1000 volts.

Several manufacturers are distributing these condensers complete with leads, and impregnated in black sealing compound, so that they will not absorb moisture. If using condensers which have only a coating of paraffin, buy some of the black sealing compound from a condenser manufacturer. The author will be glad to furnish names of companies where this compound may be secured.

The equipment necessary for changing condensers can consist of a blow torch, gas or electric stove, D. C. voltmeter and voltage supply, several pans, and if a great deal of work is to be done, a megohmmeter calibrated so as to read below 50 megohms.

# Servicing A. C. Sets

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## Rebuilding Condenser Blocks (Continued)

When a set needing condensers is brought into the shop, study the circuit before disconnecting the wires to the condenser block. Mark all the leads so that you will know how to reconnect the replacement block. Next heat up the condenser can with a blow torch, getting this just warm enough for the condensers to slip out of the can, and then check up the condenser to see which is shorted, and if you have a megger, check balance of the condensers, to see if they have a resistance of more than 50 megohms for each one microfarad section. If these condensers are right, they may be left in the pack, and only the defective or broken down condensers should be replaced.

If you do not have a megohmmeter, it is best to replace the complete block, as experience has shown that when one condenser developed a dead short, other condensers in the assembly would show such a bad leakage, they would soon break down if left in the set.

Make up and connect the new condenser blocks before installing them in the can. Bind the condensers with string or rubber bands. If it is found that you cannot get the same amount of condensers back in the can that came out, leave one or more one microfarad sections out of the assembly. These condensers should be left out of that part of the block having the greatest number of condensers in shunt, for instance, if four microfarad are used ahead of the choke, it is very seldom that any difference can be noticed if this is cut down to three microfarads. When soldering the leads at the condensers together, care must be taken not to get the ends of the condenser too hot, as this will break down the insulation.

If you study the condenser sections which were taken out of the can you can tell how many are connected to each wire. Most manufacturers put the condensers up in one microfarad sections. If in doubt about the voltage rating, tear down one of the defective condensers, and count the number of papers between tinfoil windings. Ordinarily a two paper condenser has a rating of 200 volts, a three paper 300 volts, a four paper 600 volts, and a five paper 1000 volts. This is not a hard and fast rule, as the thickness and quality of the paper have a bearing on the breakdown rating.

When the service man is using replacement condensers which have been impregnated in black wax at the factory, he need not fill the can with sealing compound. He should however, heat up a small amount of compound, and run this around the condensers where the wires are connected. Sufficient compound for this operation can be salvaged from the old condenser block. When using paraffin condensers the condenser can should be completely filled with sealing compound. This should first be heated until it will run freely and then allowed to cool until it has the consistency of heavy motor oil. If the compound is poured in the can while too hot, it may break down the paraffin insulation of the condensers. After the cover of the can is replaced, condensers should again be tested for short circuits and leakage. Be sure and get the leads from the different sections of the condenser block, coming through the same holes as they were originally, so there will be no mistake in making connections to the set.

The first two or three jobs will seem rather difficult, but after experience has been acquired no difficulty will be encountered in changing the condensers of any radio set.

# Replacing Audio Transformer

## REPLACING AUDIO FREQUENCY TRANSFORMERS

Should one of the audio tubes fail to show plate or grid voltage, it is a good plan to check the transformers to see if the primary or the secondary windings are open. Some sets will produce weak signals even with a defective transformer, but a test will show if this part is causing the trouble. An open speaker, shorted condenser in the power pack, or an open connection in the wiring will also be indicated by a no volt reading.

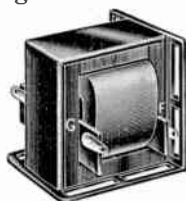


Fig. 8— Replacement audio transformer

It is very probable that more audio transformers have had to be replaced than any single part of a radio set. This has been due to the fact that transformers are wound with very fine wire, and in the process of manufacturing wire and coils, the small strands have become broken and have had to be soldered or brazed together. If this job is not very carefully done, the soldered joint is subject to corrosion and in time will become open. Corrosion also occurs where large coil leads are connected to small coil wires, or where the leads are fastened to the terminals of the transformer. Sometimes it is possible to pick up and resolder these broken connections, but in most cases, it will pay to replace the defective transformer with a new one.

Several manufacturers are putting out special transformers for this purpose. The one shown above is manufactured by the Dongan Electric Company, and is arranged so that it will mount in any position, and can be fastened with the same screws that were used for the old transformer.

When replacement transformers are to be installed, be sure to check the circuit carefully and see which leads are fastened to the primary and secondary windings. Many commercial sets do not have markings on the transformers so care must be exercised to see that the replacement transformer is connected properly. Many times the tone quality of an old set can be improved by putting in an entirely new set of replacement transformers. Marked improvement has been made in transformer design, and the replacement transformers made today should be much better than the one put in a set several years ago.

# Replacing Resistances

## REPLACING RESISTANCES IN ELECTRIC SETS

Of the different types of trouble which are encountered in an electric set, none of them are more perplexing than a burnt out resistance, if the value of the resistance is not known. We cannot understand why manufacturers do not mark the size on the resistance, or use a uniform color code so the service man could easily get a replacement part. Even with a service manual at hand a wrong value



Fig. 9— Type of metallized resistor without leads is apt to be installed, due to the fact that manufacturers often change the size of the resistance without changing the design in any other way. It may be they are trying to keep the repair business for their authorized dealers. If this is the case, they are doing themselves more harm than good, as the dealer's service man is as much at a loss as the independent radio repairman. Most sets include a great many different resistances, and it is next to impossible to keep on hand at all times repair parts for any model set that may come into the shop.

We have written to several resistance and set manufacturers trying to get authorized data which would apply to most of the A. C. sets. From the replies to these letters, we could see that no uniform policy was in force, so one service man's guess would be as good as another.

In the hook-ups of commercial set given in this book, we have given resistance sizes when this information was available. If the service man has manual of other sets he may be able to get resistance values from them. When a burnt out resistance is found and no information is available regarding its value, study the



Fig. 9B— Replacement metallized resistor with leads circuit carefully, and ascertain the approximate size that would be used in its place, and then keep trying different values close to this, until voltages of the set are as near right as it is possible to get them. It will help if you will study circuit diagrams of sets using similar design, and on which resistance values are given.

When replacing resistances, be sure the new ones have sufficient carrying capacity. For any but heavy duty power pack, work, the two watt size should handle the load.

The International Resistance Company of Philadelphia, make resistance in all sizes and the two models shown should cover most replacement requirements.



# Types and Characteristics of Vacuum Tubes

The Material Given Below is Furnished by Courtesy of the Makers of Volutron Tubes

## TYPE 245 AC Power Amplifier

When this tube is operated according to the following instructions, and not subjected to excess filament voltage, it is guaranteed to give satisfactory service.

### USES

This tube is designed for use as a last stage audio amplifier. Its undistorted power output is between that of the 171-A and 250. It is intended to be used primarily in AC operated sets and for this service a very rugged and long life filament has been constructed into it.

### MOUNTING

This tube is equipped with a standard base such as used on our regular 201-A tube. The plate, grid and filament connections on this tube are the same as those made use of on the standard 201-A type.

### FILAMENT

The filament of this tube is designed to be operated from a 2.5 volt supply, which is the same as that used for the 227 tube. When used in AC operated sets this voltage may be furnished by the secondary winding of a step down transformer. The filament used in this tube is of the oxide coated type and consumes 1.5 amperes. This filament cannot be rejuvenated.

### CONNECTIONS

A negative grid bias should always be used with this tube to prevent overloading and distortion. The table under operating potentials give a very close approximation of the biases necessary with various plate voltages.

It is customary, when using a tube of this type which operates its filaments on AC, to connect a potentiometer across the filament terminals and connect the plate and grid returns to the movable arm of this potentiometer. After the potentiometer has been adjusted for zero hum, no further change is necessary and is perfectly satisfactory to the average user to mount the potentiometer inside the set, without an adjusting knob available.

### OPERATING POTENTIALS

#### Filament 2.5 Volts

Plate Voltage (Volts)	Grid Bias (Volts)
180	-34.5
250	-51.5

In order to obtain the full benefit of the power of this tube is capable of delivering, we recommend not to use a plate voltage much less than 180. If only a lower voltage is available, we suggest the use of our 171-A type tube.

### CAUTION

Do not attempt to insert this tube in a socket which has been wired for any other type power tube, as the filament will either burn out or be permanently injured.

If the plate of this tube, in operation, acquires a visible red a plate voltage is being used which is too high or the grid bias is insufficient. Do not attempt to read total emission or to rejuvenate the filament of this tube.

## 112A AMPLIFIER TUBE

### USES

The 112A tube is designed for use as a last stage audio amplifier where filament current consumption of a low value is desired. Its undistorted output is greater than that obtained from a standard 201-A type tube and it will replace the type 112.

### FILAMENT

The filament of this tube is designed to be operated from a 5 volt supply. This may be furnished by a storage battery or in case of AC operated sets by the secondary winding of a step down transformer. This filament is of the oxide coated type and consumes .25 amperes which is just half of that consumed by the type 112. This filament cannot be rejuvenated by the processes normally used for tubes having thoriated tungsten filament.

### CONNECTIONS

A negative grid bias should always be used with this tube to prevent overloading and distortion. The table under operating potentials gives a very close approximation of the biases necessary with various plate voltages.

### OPERATING POTENTIALS

#### Filament 5 Volts

Filament Plate Voltage	5 Volts Grid Bias
90 volts	-4.5 volts
135 volts	-9.0 volts
157 volts	-10.5 volts
180 volts (max.)	-13.5 volts

The lowest value of plate voltage which will satisfy the volume requirements should be used. This will increase the life of the tube and is recommended where the maximum output of the tube is not essential.

### CAUTION

It is a common failing of many radio fans to attempt replacing a 201-A type with this power tube without changing the plate voltages or the grid biases. Attempting to use this tube in this manner will generally give a lesser volume and poorer quality than was obtained with the 201-A. In order to get the most out of this tube, therefore, it is necessary to use the grid bias most suitable for the particular plate voltage being used. Do not attempt to read total emission on this tube or rejuvenate it.

## TYPE UX171-A AC or DC Power Amplifier

### USES

This tube is designed for use as a last stage audio amplifier. Its undistorted output is greater than that obtained from a standard 201-A type tube. It is especially adaptable for use in sets where a low filament current is desirable and where a comparatively low impedance loud speaker or output transformer is made use of. It will replace the UX-171 tube.

### MOUNTING

This tube is equipped with a standard base, such as is used on our regular 201-A tube. The plate, grid and filament connections on this tube are the same as those made use of on the standard 201-A type.

### FILAMENT

The filament of this tube is designed to be operated from a 5 volt supply. This may be furnished by a storage battery or in case of AC operated sets by the secondary winding of a step down transformer. The filament used in this tube is of the oxide coated type and consumes .25 amperes which is just half of that used by the 171 tube. This filament cannot be rejuvenated.

### CONNECTIONS

A negative grid bias should always be used with this tube to prevent overloading and distortion. The table under operating potentials gives a very close approximation of the biases necessary with various plate voltages. Perfect reproduction and greater volume may be obtained by making provision in the connections for adjusting this bias potential to the most satisfactory value.

It is customary, when using a tube of this type which operates its filament on AC, to connect a potentiometer across the filament terminals and connect the plate and grid returns to the movable arm of this potentiometer. After the potentiometer has been adjusted for zero hum no further change is necessary and it is perfectly satisfactory to the average user to mount the potentiometer inside the set without an adjust knob available.

### OPERATING POTENTIALS

#### Filament 5 Volts

Plate Voltage (Volts)	Grid Bias (Volts)
90	-16.5
135	-27.0
157	-33.0
180	-40.5

The lowest value of plate voltage which will satisfy the volume requirements should be used. This will increase the life of the tube and is recommended if the maximum output of the tube is not essential.

If the plate of this tube, in operation, becomes so hot that it acquires a visible red a plate voltage is being used which is too high or the grid bias is insufficient. Do not attempt to read total emission or to rejuvenate the filament of this tube.

# Types and Characteristics of Vacuum Tubes

The Material Given Below is Furnished by Courtesy of the Makers of Volutron Tubes

## TYPE UX201A

### DC General Purpose Detector and Amplifier

#### USES

This tube was designed for use as a general purpose tube on radio receiving sets making use of storage batteries as a source of energy for burning the filaments. On such sets it may be used as a radio frequency amplifier, a detector or an audio frequency amplifier. For greater volume and minimum distortion a power tube should be used as a last stage audio amplifier and for extremely weak signals and for sets without sensitivity a 200-A vapor filled detector is recommended.

#### MOUNTING

This tube is equipped with a standard base with the plate, grid and filament connections arranged in accordance with standard practice to fit the sockets on standard types of receiving sets. It is preferable to mount the tube in a vertical position with the base down.

#### FILAMENT

The filament of this tube is designed to be operated on 5 volts. It is of the thoriated tungsten type and cannot be burned out unless excessive potentials are applied. Excessive potentials may not burn the tube out but will cause it to lose its emission. This tube of course can be rejuvenated by applying a slight over-voltage to the filament without any plate potential, but the frequent necessity for rejuvenation indicates that excessive voltages are made use of in some part of the receiving set.

#### CONNECTIONS

When used as a detector practically any voltage between 22½ and 67½ volts may be applied to the plate and the detector socket should be cushioned in order to minimize microphonism. When used as a radio frequency amplifier it is usual practice to use 90 volts applied to the plate without a bias battery. This results in very good amplification properties but is wasteful of current and it is better to always use a bias which corresponds to the plate voltage being made use of. This will result in minimum plate current, maximum volume, less distortion and longest life. When used as an audio frequency amplifier the voltages given under operating potentials will give best service.

#### OPERATING POTENTIALS

##### Filament 5 Volts

Plate Voltage (Volts)	Grid Bias (Volts)
45	-1.5
67.5	-3
90	-4.5
135	-9

The lowest value of plate voltage which will satisfy the volume requirements should be used. This will increase the life of the tube and is recommended if the maximum output of the tube is not essential.

Excessive voltages on either the filament or plate of this tube will destroy its emission. Some of the so-called emission tests sets on the market apply an excessive voltage to the grid of the tube which is injurious to it. An emission reading bears no relation to the operating properties or life of this tube and should be avoided.

## TYPE UV OR UX199

### DC Dry Battery Detector and Amplifier

#### USES

This tube was designed for use in dry battery operated sets. In such a set it may be classed as a general purpose tube, serving as a radio frequency amplifier, a detector or an audio frequency amplifier. For greater volume and less distortion it is recommended that a type 120 tube be used with its proper plate voltage and grid bias as a last stage audio frequency amplifier.

#### MOUNTING

It is preferable to mount this tube in a vertical position with the base down.

## FILAMENT

The filament of this tube is of the thoriated tungsten type designed to be operated with a potential of 3.3 volts maximum. Higher voltages than this will either produce inactivity of the filament or a burned out filament.

## CONNECTIONS

For use as a detector the usual circuits may be employed and the grid return should be connected to the positive side of the filament. When used as an amplifier it is desirable to place the filament rheostat in the negative side of the circuit and make use of the drop across the rheostat for biasing the grid.

## OPERATING POTENTIALS

### Filament 3.3 Volts

Plate Voltage (Volts)	Negative Grid Bias (Volts)
45	.5-1.5
67½	1.5-3.0
90	4.5

The lowest value of plate voltage which will satisfy the volume requirements should be used. This will increase the life of the tube and is recommended if the maximum output of the tube is not essential.

## TESTING

No test which makes use of potentials other than normal, on any part of this tube, will be of any value whatsoever to the average user of the tube, hence in testing this tube be sure that normal filament, plate and grid voltages are made use of; other tests will probably damage the tube.

To prevent using an overcharge on the filament of this tube it is highly recommended that a volt meter be purchased and connected permanently to the filament circuit of the set. It may save many tubes. If the higher values of plate voltages are used without corresponding grid bias the life of the tube will be greatly reduced.

## TYPE UX226

### AC General Purpose Amplifier

#### USES

This tube was designed for use as an amplifier using alternating current on the filament. It is not recommended for use as a detector, or as a last audio stage power amplifier, although it may be used as such.

#### MOUNTING

This tube is equipped with a standard base, such as is used on our regular 201-A tube. A socket should be used which offers a minimum of resistance to the filament circuits, since this tube uses a comparatively high current.

#### FILAMENT

The filament of this tube is designed for use on alternating current and operates at a dull red heat. It should be supplied with 1.5 volts potential from a small power transformer and the plate and grid returns should be connected to the movable arm of a potentiometer which is shunted across the filament terminals. All of the filaments of tubes of this type should be connected in parallel and one potentiometer will take care of the plate and grid returns of all such tubes in the set.

#### AMPLIFIER

When this tube is used as an amplifier, either in radio or audio frequency circuits, a negative grid bias should be used. Transformer coupling is recommended for the audio frequency stages.

#### OPERATING POTENTIALS

Filament, 1.5 Volts AC.  
Plate, 90 Volts to 180 Volts DC.

The following table will give the proper grid biases to be used with this tube:

Plate Volts	R. F. (Volts)	Negative Grid Bias	
		First A. F. (Volts)	Last A. F. (Volts)
90	4.5-6	4.5-6	.....
135	9-12	9-12	9-12
180	.....	13.5	13.5

# Types and Characteristics of Vacuum Tubes

The Material Given Below is Furnished by Courtesy of the Makers of Volutron Tubes

## OPERATION

Sets operated entirely from light socket power are more susceptible to fluctuations in line voltage than sets making use of only B eliminators connected to the light socket, for the simple reason that if the line voltage drops a trifle it reduces both the filament voltage and the plate potential supplied to the tubes. For this reason, on sets of this type, the removal of an electric appliance from a fairly heavy loaded circuit will often raise the potential on the set a sufficient amount to produce distortion and howling. The converse is true if an electric appliance is connected to the lighting circuit while the radio set, supplied from the same line, is in operation; the decrease in voltage produced by the appliance may decrease the loudness of the signal received.

## CAUTION

The filament of this tube is designed for 1.5 volts alternating current and it will be burned out instantly if an attempt is made to connect it direct to a house-lighting circuit without a step down transformer to supply 1.5 volts to the tube.

## TYPE UY227

### AC Heater Detector and Amplifier

#### USES

This tube is designed to be used as a radio and audio frequency amplifier and as a detector in sets operating on raw AC current. For the last audio stage of amplification a Power Amplifier tube is recommended.

#### MOUNTING

This tube makes use of a five prong base and requires a socket designed for this base. It is best to operate the tube in a vertical position and to make use of a socket which makes a large surface contact to the heater prongs to eliminate voltage drops at these points.

#### HEATER

The heater of this tube should be supplied with 2.5 volts across its terminals and if more than one tube of this type is used in a set, the heaters of the various tubes should be connected in parallel.

Since a comparatively heavy current flows through the heater circuit, it is advisable to turn the receiver off before removing this tube from its socket as its removal will raise the voltage impressed on the other tubes which remain in the set.

Sometimes biasing the heater circuit, with reference to the cathode, will improve reception.

#### DETECTION

Either grid bias or grid leak detection may be made use of with this tube. For most stable operation, and for quality at high volume where the input to the detector is great, a plate potential of 90 volts should be used with the corresponding grid leak.

When this tube is used as an amplifier, either in radio or audio frequency circuits, a negative grid bias should be used. Transformer coupling is recommended for the audio frequency stages.

Heater.....	2.5	Volts AC		
Plate.....	45	Volts to 180	Volts DC with grid biases indicated in the following table:	
Plate Volts	45	90	135	180
Megs.....	2-9	.25-1	(Leak Detection)	
Volts.....	4.5	9	(Bias Detection)	
R. F.....	4.5-6	9		13.5
First A. F.....	4.5-6	9		13.5
Last A. F.....	4.5-6	9		13.5

#### TIME LAG

This tube unlike the original 227 type tube requires only from 10 to 15 seconds, according to the filament voltage transformer used, from the time the current is turned on until the tube operates.

## CAUTION

The heater of this tube is designed for 2.5 volts alternating current and it will be burned out instantly if an attempt is made to connect it direct to a house-lighting circuit without a step down transformer to supply 2.5 volts to the tube.

## TYPE UX281

### AC Half Wave Rectifier

#### USES

This tube was designed for use as a half-wave rectifying tube in B battery eliminators and AC receiving sets, and is a successor to the tube formerly known as the type 216-B.

#### MOUNTING

This tube is equipped with a standard base, such as is used on our regular 201-A type. A socket should be used which offers a minimum of resistance to the filament circuit, since this tube uses a comparatively high current.

#### FILAMENT

The filament of this tube is designed for use on alternating current, which should be supplied with a 7½ volt potential from a small power transformer and the plate return connected to the mid-point of the filament winding. This filament is of the oxide coated type and consumes 1.25 amperes. It cannot be rejuvenated.

#### OPERATING POTENTIALS

Filament, 7.5 Volts AC—1.25 Amperes.  
Plate, 750 Volts AC, maximum.  
Output, 110 Milliamperes DC, maximum.

#### BLUE HAZE

When this tube is new it may throw out a slight amount of blue haze in the bulb, when it is first turned on. This is characteristic of the tube and does not bear any relation to the tube's operating qualities or life.

This tube will be burned out immediately if it is connected to a houselighting circuit without a transformer to step down the filament voltage to its rated value. It cannot be used in a circuit which is designed for the 280 or the 213 types.

## TYPE UX280

### AC Full Wave Rectifier

#### USES

This tube was designed for use as a full-wave rectifying tube in B battery eliminators and AC receiving sets, and is a successor to the tube formerly known as the 213.

#### MOUNTING

This tube is equipped with a standard base, such as is used on our regular 201-A type. A socket should be used which offers a minimum of resistance to the filament circuit, since this tube uses a comparatively high current.

#### FILAMENT

The filament of this tube is designed for use on alternating current, which should be supplied with a five volt potential from a small power transformer and the plate return connected to the mid-point of the filament winding. The filament is of the oxide coated type and consumes 2.0 amperes. It cannot be rejuvenated.

#### OPERATING POTENTIALS

Filament, 5 Volts AC, 2 Amperes.  
Plate, 300 Volts AC per plate, maximum.  
Output, 125 Milliamperes DC, maximum,  
or 350 A. C. at 110 mills.

#### BLUE HAZE

When this tube is new it may throw out a slight amount of blue haze in the bulb, when it is first turned on. This is a characteristic of the tube and does not bear any relation to the tube's operating qualities or life.

#### GUARANTEE

This tube is guaranteed to operate satisfactory in any set which is designed and properly equipped to make use of a tube of this type.

This tube will be burned out immediately if it is connected to a houselighting circuit without a transformer to step down the filament voltage to its rated value. It cannot be used in a circuit which is designed for the 281 or the 216-B types.

# Complete Vacuum Tube Data

TUBES LISTED BELOW ARE USED IN R. F. DET. AND A. F. SOCKETS

Model	USE	"A" Supply	Fil. Term. E.M.F.	Fil. I. Amp.	Grid Leak Meg.	Det. B. Bat. E.M.F.	Det. Plate I. Mills	Amp. B. Bat. E.M.F.	Amp. C. Bat. Volt	Amp. Plate I. Mills	A. C. Plate Res. Ohms	Mut. Cond. Micr.	Volt Amp. Fact.	Max. Undis. Output
WX12	Detector or Amplifier	Dry Cell 1½ V. Storage 2 V.	1.1	.25	3 to 5	22½ to 45	1.5	90 135	4½ 10½	2.5 3.5	15,500 15,500	425 440	6.6 6.6	7 35
UX112-A	Detector or Amplifier	Storage 6 V.	5.0	.25	3 to 5	45	1.5	90 135	4½ 9	5.5 7	5,300 5,000	1500 1600	8 8	30 120
UV199			SAME AS BELOW EXCEPT FOR BASE WHICH IS OLD UV TYPE.											
UX199	Detector—Amplifier	Stor. Cell 4 V. Dry Cell 4½ V.	3.0 3.3	.060 .063	2 to 9	45	1	90	4.5	2.5	15,000	425	6.6	7
UX200-A	Detector	Storage 6 V.	5.0	.25	2 to 3	45	1.5	Following 200 data apply to Det. only			30,000	666	2.0	
UX201-A	Detector or Amplifier	Storage 6 V.	5.0	.25	2 to 9	45	1.5	90 135	4½ 9	2.5 3	11,000 10,000	725 800	8 8	15 55
UX222	Radio Frequency Amplifier	Dry Cell 4½ V. Storage 6 V.	3.3	.132				135	1½	1.5	350,000	350	300-A	
UX222	Audio Frequency Amplifier	Dry Cell 4½ V. Storage 6 V.	3.3	.132				180	1½	.3	150,000	400	60	
UX226	Amplifier A. C. Filament Type	Transf. 1½ V.	1.5	1.05				90 135 180	6 9 13.5	5.5 6 7.5	9,400 7,400 7,000	875 1100 1170	8.2 8.2 8.2	20 70 160
UX240	Detector or Amplifier	Storage 6 V.	5.0	.25	2-5	135 180	.3 .4	135 180	1½ 3	.2 .2	150,000 150,000	200 200	30 30	
UY227	Detector A. C. Heater Type	Transf. 2.5 V.	2.5	1.75	2-9 ¼-1	45 90	2 7	Fol. UY Data apply to Det. only			10,000 8,000	800 1000	8 8	
UY224	R.F. Amplifier	Transf. 2.5 V.	2.5	1.75		180		180	1.5	4	400,000	1,050	420	
									SG 75+					
UY227	Amplifier Only	Transf. 2.5 V.	2.5	1.75				135 180	9 13½	5 6	9,000 9,000	1000 1000	9 9	65 140

# Complete Vacuum Tube Data

TUBES LISTED BELOW ARE USED IN LAST STAGE AUDIO AND RECTIFIER SOCKETS

Model	USE	"A" Supply	Fil. Term. E.M.F.	Fil. "I" Amp.	Grid Leak Meg.	Detector "B" Bat. E.M.F.	Detector Plate "I" Mills	Amp. "B"	Amp. "C" Bat. Voltage	Amp. Plate "I" Mills	A.C. Plate Res. Ohms	Mutual Cond. Microm.	Voltage Amp. Factor	Max. Undist. Output
UX112-A	Power Amplifier	Storage 6 V. Transf. 5 V.	5.0	.25				135 157½	9 10½	7 9.5	5000 4700	1600 1700	8 8	120 195
UX120	Power Amplifier	Dry Cell 4½ V. Storage 4 V.	3.0 3.3	.125 .132				135	22.5	6.5	6300	525	3.3	10
UX171	Power Amplifier	Storage 6 V. Transf. 5 V.	5.0	.25				90 135 180	16.5 27 40.5	10 16 20	2500 2200 2000	1200 1360 1500	3.0 3.0 3.0	130 330 700
UX210	Power Amplifier	Transf. 7.5 V.	7.5	.125				250 300 350 400 425	18 22.5 27 35 35	10 13 16 18 18	6000 5600 5150 5000 5000	1330 1450 1550 1600 1600	8 8 8 8 8	340 600 925 1325 1540
UX250	Power Amplifier	Transf. 7.5 V.	7.5	.125				250 300 350 400 450	45 54 63 70 84	28 35 45 55 55	2100 2000 1900 1800 1800	1800 1900 2000 2100 2100	3.8 3.8 3.8 3.8 3.8	900 1500 2350 3250 4650
UX245	Power Amplifier	Transf. 2.5 V.	2.5	1.5				180 250	34.5 51.5	26 32	1950 1900	1800 1850	3.5 3.5	750 1600

SPECIAL PURPOSE TUBES

Model	USE	Circuit Requirements	Purpose	RMS		Max. D. C. Output Current Both Plates	D. C. Output at Max. as applied to Filter of Typical Circuit	Recommended Max.
UX280	Full Wave Rectifier	Full Wave Circuits	Rectification in Eliminators	Filament Terminal Volts	2V	125 M. A.	260V	750V
				Filament Current	2A			
				A. C. Plate Volts (Max per plate)	300			
UX281	Half Wave Rectifier	Half or Full Wave Circuit	Rectification in Eliminators	Filament Terminal Volts	7.5V	A.C. Plate Volts	650V	750V
				Filament Current	125A	D.C. Output Current	65M.A.	110M.A.
				A. C. Plate Volts (Maximum)	750V	D.C. Output Voltage as applied to Typical Filter	650V	650V



# Why Screen Grid Tubes

## WHY SCREEN GRID TUBES

Although this is the first season that any number of commercial built sets have been adapted for use with screen grid tubes, these tubes have been in process for development for a number of years. This type of tube was originally designed for a purpose entirely different from radio reception. It was during the summer of 1924 when Dr. Hull of the General Electric Company, and Professor Williams of the U. of M. made some of these tubes in the G. E. laboratory to help them in their research work in connection with the electron theory. They were checking up on the developments of Professor Milliken, and found that they would need a tube that would give them tremendous amplification without oscillation. The introduction of the extra grid was tried out, and now after five years, this type tube has been perfected to the point where it can be used for radio reception.

Tube manufacturers experienced trouble in making an A.C. tube incorporating the screen grid principle. When used in the set the tubes should be shielded, and it was found that unless provision was made for ventilation, the life of the tube would be very short. At the time this is being written, manufacturers are still trying to develop screen grid tubes that will last as long as other types of A. C. tubes.

Screen grid tubes are generally used as R. F. amplifiers, but at times they are connected as a space charge detector. The two types of screen grid tubes are similar in appearance, except that the A. C. 224 has five prongs, and the 222 has four. Connection to the control grid comes out the top of the bulb, and the grid post of the socket connects to the screen grid.

A comparison between the two types of tubes follows:

	UY-224	UX-222
Plate current .....	4 mils.	1.5 mils.
Screen current not over 1/3 of plate current		
Plate resistance .....	400,000 ohms	850,000 ohms
Amplification factor..	420	300
Mutual conductance, microhms .....	1050	350

This article has not as yet answered the question. "Why the Screen Grid Tube." These tubes are used because of their immense amplification factor, or the power gain per stage. This feature is brought about, due to the fact that the extra grid keep the tubes from oscillating allowing it to give tremendous amplification without spilling over. Comparing the



Fig. 10— Type UY 224 screen grid tube

amplification factor of the 224 A. C. tube with that of the 226 A. C. tube, we find that the 226 has a voltage amplification of eight, whereas the screen grid tubes has an approximate amplification of 400. In actual practice, we get a gain per stage of R. F. using a 226 tube of 10 to 1, where with the 224, we get approximately 40 to 1. Let us now see what this means with three stages of radio frequency amplification. The gain per stage is squared, so with the 226 we have;

$$10 \times 10 = 100 \times 10 = 1,000$$

Overall gain for three stages.

With the screen grid we have;

$$40 \times 40 = 1,600 \times 40 = 64,000$$

Overall gain for three stages

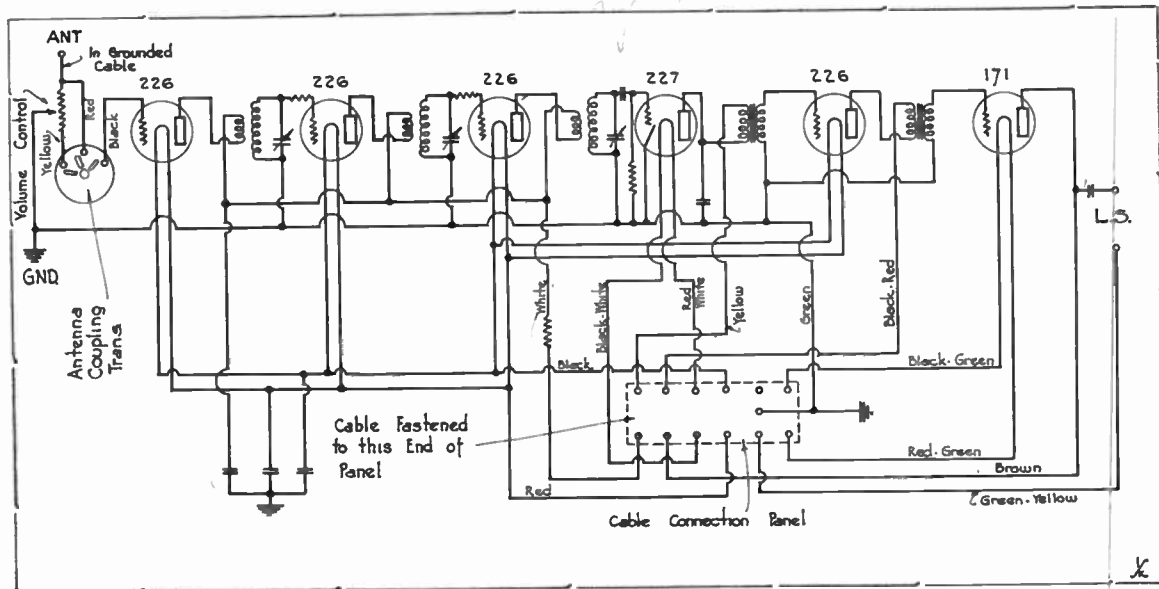
From the above calculation any layman can see why a set efficiently designed and using screen grid tubes will give stronger signals on distant stations than one using 226's.

In order to eliminate feed-back external to the tube it is necessary that all coils, condensers and tubes be thoroughly shielded. If this shielding is not scientifically done most of the huge gain, of which the tube is possible, is lost.

# Servicing A. C. Sets

## COMMERCIAL SETS

### ATWATER KENT MODEL 40



Atwater Kent 40-42-32

Fig. 11— Hook-up for model 40 Atwater Kent set

#### ATWATER KENT MODEL 40

The chassis and power packs of all 40 models are enclosed complete in a metal cabinet.

The volume control resistance is connected across a section of the antenna transformer. This control will at times have to be replaced, particularly if the set has been subject to a lightning discharge.

When replacing the volume control, the chassis must first be removed from the cabinet. The volume control can then be disconnected by loosening the two screws which fasten it to the metal frame. The three terminals connected to this, should be on the right hand side, when looking at the chassis from the front. The yellow lead connects to the top of the three terminals, the red lead to the bottom, and the green lead to the centre.

At times the volume control can be repaired, but if it is convenient a new one should be installed. The slider arm should be cleaned at

both the slider end and the contact end. It is not necessary to replace the complete volume control assembly, just change the resistance unit. The slider arm should always be bent, so that it will make a good connection with the resistance wire.

The same as with other Atwater Kent models, the condenser and coil assembly should be changed in group, never try to change just one of each. If changing the condenser group, use the original pulleys and belts.

If the set shows no plate voltage on the R. F. tubes, check the small plate by-pass condensers, and the small plate resistance mounted on the bottom of the chassis.

At times the grid resistances will have to be replaced. These resistances will be found mounted between the variable condensers and the sockets. If one of the R. F. tubes shows no "C" bias, check this resistance first.

The general set characteristics are given on following page:

# Servicing A. C. Sets

## COMMERCIAL SETS

### ATWATER KENT MODEL 36 AND 37

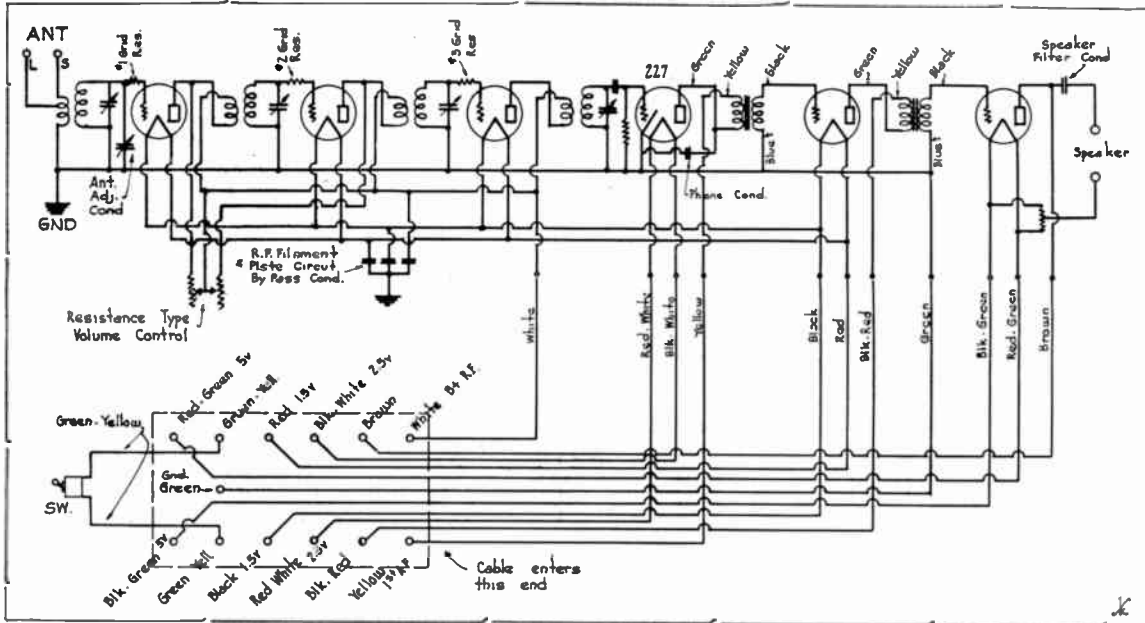


Fig. 12— Hook-up for models 36 and 37 Atwater Kent sets

#### ATWATER KENT MODELS 36 and 37

Models 36 and 37 are similar in design. The above hook-up can be used for checking either type. If it is found that the power pack is causing trouble, same should be returned to

distributor or factory. A very reasonable exchange price is given and this will be cheaper than trying to replace condenser block yourself. Only the power pack will have to be sent back.

General set characteristics for Models 40, 42, 44 and 52:

Tube No.	Type	Position in Set	A Volts	B Volts	Tube in Tester			Normal Plate M. A.	
					A Volts	B Volts	C Volts	Plate M. A.	Grid
1	226	1st R. F.	1.3	173	1.25	165	10	4.8	8.4
2	226	2nd R. F.	1.3	173	1.25	165	10	4.8	8.4
3	226	3rd R. F.	1.3	173	1.25	165	10	4.8	8.4
4	227	Detector	2.25	80	2.0	22.5		2.2	2.2
5	226	1st A. F.	1.3	173	1.25	165	10	4.8	8.4
6	171	2nd A. F.	4.6	192	4.3	180	36	18.0	19.5
7	280	Rectifier			4.3			20.0	

General set characteristics for Model 37, Serial No. 1,265,001 to 1,385,000:

Tube No. In Order	Type of Tube	Position of Tube	A Volt	B Volt	Tube in Tester			Normal Plate M. A.	Plate M. A. Grid
					A Volt	B Volt	C Volt		
1	226	1st. R. F.	1.3	145	1.25	138	10	4.8	8.4
2	226	2nd. R. F.	1.3	145	1.25	138	10	4.8	8.4
3	226	3rd. R. F.	1.3	145	1.25	138	10	4.8	8.0
4	227	Detector	2.25	157	2.0	40		2.2	2.2
5	226	1st. A. F.	1.3	172	1.25	130	8	3.8	7.6
6	171A	2nd. A. F.	4.2	210	4.1	148	32	14.4	15.4
7	280	Rectifier			4.5			16.5	

# Servicing A. C. Sets

## COMMERCIAL SETS

### ATWATER KENT SCREEN GRID—MODEL 55

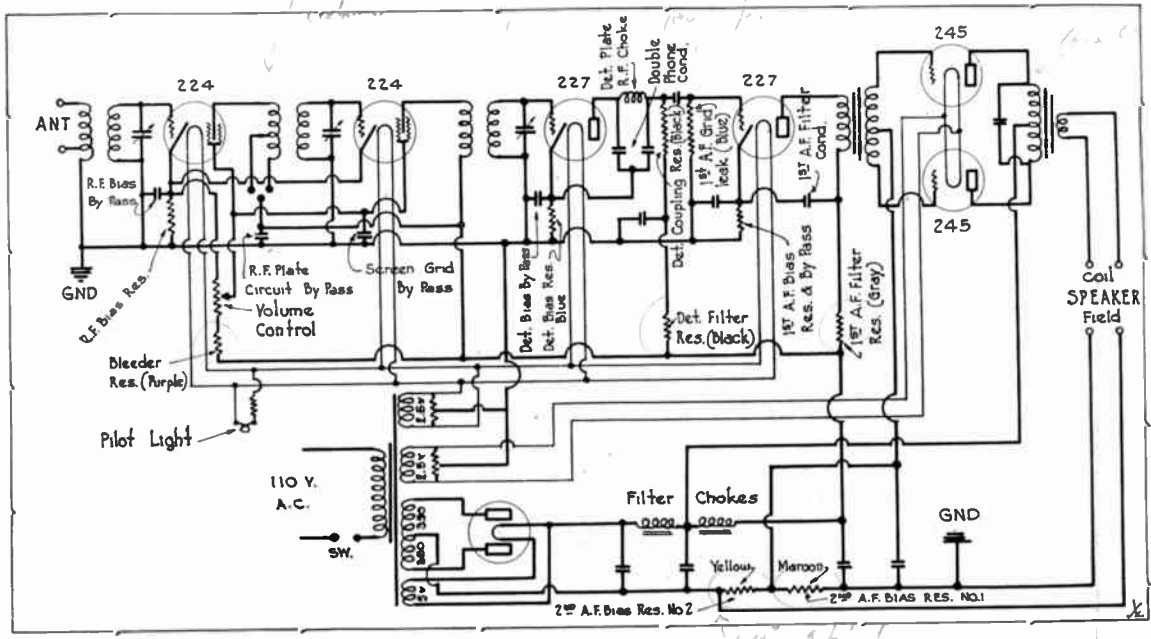


Fig. 13— Hook-up for model 55 Atwater Kent screen grid set

#### ATWATER KENT MODEL 55

The model 55 is one of the latest brought out by the Atwater Kent Manufacturing Company. It uses two stages of screen grid R. F. amplification—a 227 power detector, one stage of A. F. amplification with a 227 tube, and two 245 power tubes in push pull. Previous Atwater Kent sets had all of the power pack in one unit. This set has been designed with separate units so that they can be replaced individually.

If one of the R. F. transformers is found to be defective, all three of them should be replaced as they are tested and balanced in sets. The same holds true of the variable condensers. If one of these is bad, all three should be replaced.

As is the case with all good screen grid sets, this one is very sensitive and does not require a long antenna. In most localities good results can be obtained with a short inside aerial if this is fastened to the "S. A." post.

General set characteristics are as follows:

Tube No. In Order	Type of Tube	Position in Set	A Volts	B Volts	C Volts	Screen Grid	Normal Plate M. A.
1	224	1st. R. F.	2.4	175	3	85	
2	224	2nd. R. F.	2.4	175	3	85	
3	227	Detector	2.4	70	12		
4	227	1st. Audio	2.4	105	2		
5	245	Audio push-pull	2.4	235	42		
6	245	Audio push-pull	2.4	235	42		
7							

\*Rectifier tube should have a filament reading of 4.9 with a M. A. from 30 to 40.

The manufacturer of this set advises the use of a good ground, **but do not recommend connecting the ground wire to the antenna post.**

If a hum is heard in the speaker try a matched pair of 245 tubes. If the characteristics of the two tubes vary, a pronounced hum will result. The long distance switch should be placed on the local position when receiving strong stations. If this is not done, the detector tube may become overloaded and poor reception will result.

The manufacturer recommends that this set be used with the F4, or F4C type dynamic speaker. They do not recommend its use with any other model A. K. speaker.

The condensers of the model 55, should be synchronized with the top shielding plate in place. In order to adjust the number one condenser, a hole should be cut in the top shield over the rotor of this condenser. Number two condenser rotor may be adjusted by turning the control knob, and number three rotor may be reached from the right hand side of the set.



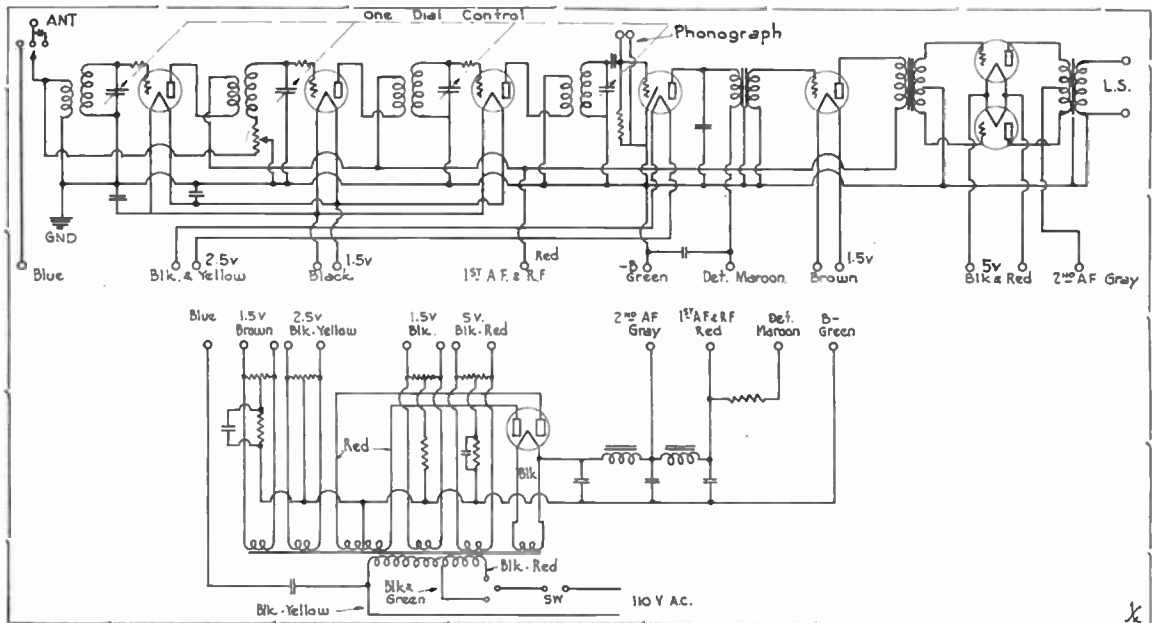




# Servicing A. C. Sets

## COMMERCIAL SETS

### STEWART-WARNER MODEL 801



Stewart-Warner

Fig. 16— Hook-up for Stewart-Warner Model 801

#### STEWART-WARNER MODEL 801

The Stewart-Warner Model 801 set uses a conventional tuned radio frequency hook-up with 226 type A. C. tubes. The last stage of audio incorporates 212's in push-pull.

The neutralization is accomplished by using grid biasing resistances. If having trouble with the set humming try using a new 280 tube, or replacing the detector tube. A hum can also be caused by an open center tap resistor, open by-pass condenser or a defective power unit.

If the set is distorted check for a defective speaker unit, defective transformer, or a de-

fective grid leak. Distortion is also caused by unbalanced or defective power tubes.

If excessive oscillation is noticeable, check for defective grid resistors, short circuited grid resistors, or an open in the aerial or ground circuit. Oscillation can also be caused by open by-pass condensers, exceptionally lively R. F. tubes, or a poor ground connection.

If no signal is noticeable, check for a grounded aerial broken lead-in strip, speaker leads not inserted properly, or a defective speaker. If the output transformer is defective, tubes do not make contact in socket, or if the condensers are shorted, no signal will be the result.

General set characteristics are as follows:

#### STEWART-WARNER MODEL 801

Tube No.	Type	Position in Set	A Volts	B Volts	Tube in Tester			Normal Plate M. A.	Plate M. A. Grid
					A Volts	B Volts	C Volts		
1	226	1st R. F.	1.46	157	1.33	155	14.8	2.9	9.7
2	226	2nd R. F.	1.46	158	1.33	156	14.8	2.3	9.2
3	226	3rd R. F.	1.48	158	1.32	156	14.8	1.9	9.5
4	227	Detector	2.40	132	1.98	25	0	1.4	1.45
5	226	1st A. F.	1.62	175	1.42	146	12.5	3.3	4.1
6	112A	2nd A. F.	5.1	175	4.93	158	12.0	9.9	14.9
7	112A	2nd A. F.	5.1	175	4.95	158	12.0	9.3	14.2
8	280	Rectifier	6.7		4.78				

# Servicing A. C. Sets

## COMMERCIAL SETS

### CROSLY MODEL 704B

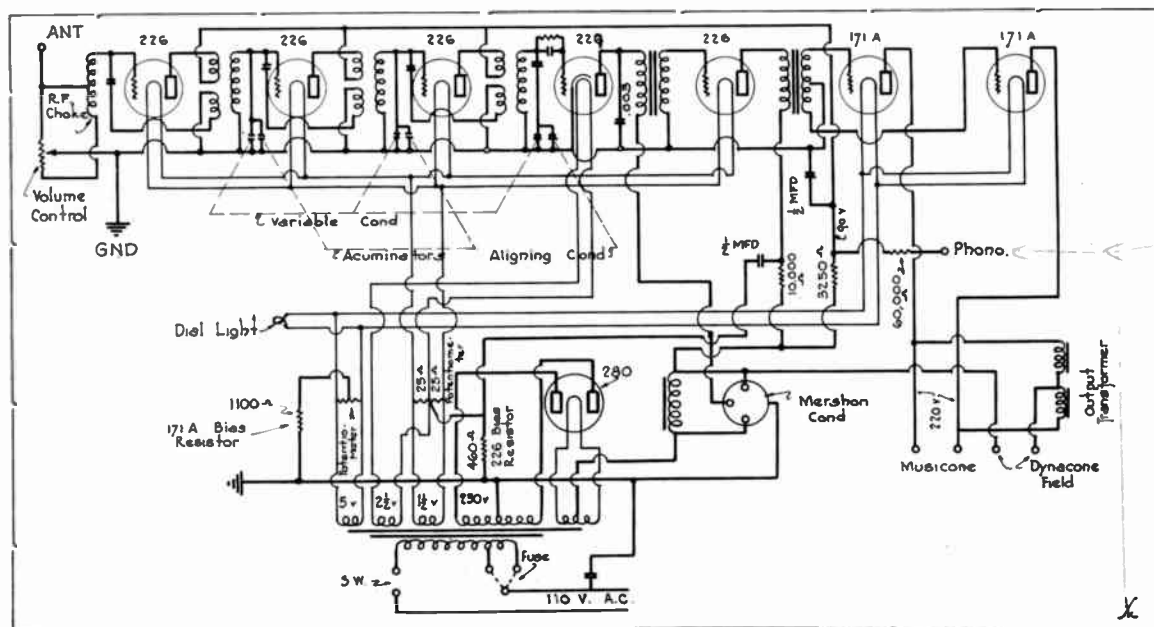


Fig. 17— Hook-up for model 704B Crosley

### CROSLY MODEL 704B SET

The Crosley Model 704B set has been one of the most popular of the Crosley line. The set uses the Hazeltine method of oscillation control, and when it is properly balanced very good reception can be had.

The output of this set, is arranged so that either a magnetic or dynamic speaker can be used. When a dynamic speaker is used, the field can be excited from the set. Another feature of the set, is the Mershon condenser. This type of condenser is self-healing, so

trouble from over-loading is cut down to a minimum.

The most common trouble experienced by us in sets of this type, has been from loose socket springs, and broken connections.

Occasionally a condenser or resistance lets go, but we have had few cases of this kind. In one case the set had to be rebalanced after a new set of tubes were installed, due to the fact that the set had been brought up close to the oscillation point, when the inefficient tubes were in the sockets.

The general set characteristics are as follows:

### General Set Characteristics

Tube No. In Order	Type of Tube	Position of Tube	A Volt	B Volt	Tube in Tester			Normal Plate M. A.	Plate M. A. Grid
					A Volt	B Volt	C Volt		
1	226	1st. R. F.	1.6	160	1.5	150	11.0	6.5	12.0
2	226	2nd. R. F.	1.6	160	1.5	150	11.0	6.5	13.4
3	226	3rd. R. F.	1.6	160	1.5	150	11.0	6.5	13.4
4	227	Detector	2.50	150	2.25	30	0.0	2.2	2.75
5	226	1st. A. F.	1.6	220	1.5	120	9.0	6.2	8.0
6	171A	2nd. A. F.	5.3	185	5.0	170	37.5	20.0	23.0
7	171A	2nd. A. F.	5.3	185	5.0	170	37.5	20.0	23.0
8	280	Rectifier	5.3		4.9				

# Servicing A. C. Sets

## COMMERCIAL SETS

### CROSLY MODEL 705 D. C. ELECTRIC

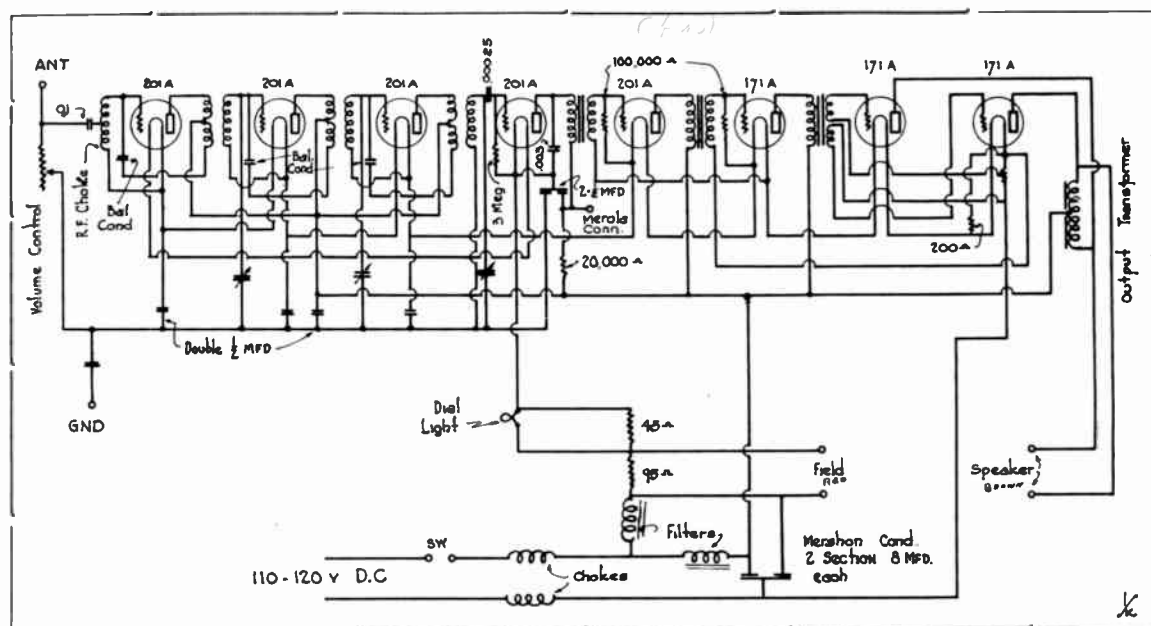


Fig. 18— Hook-up for 705 D.C. Crosley electric

### CROSLY D. C. ELECTRIC SET MODEL 705

As stated previously in this book, most D. C. electric sets are a continual source of trouble. We will modify this statement somewhat by saying that all of these sets with which we have come in contact have been a source of trouble. This statement does not apply to the Crosley set, hook-up of which is shown above, any more than it does to all other electric D. C. sets. The trouble is caused by D. C. line voltage fluctuations, and by the changing of the resistance of the filaments of the tubes after they have been in use for some time. Another disadvantage of a D. C. set, is that only 110 to 120 volts is available for a "B" supply whereas power tubes require from 135 to 450 volts for effective operation.

The Crosley D. C. set shown above uses five 201A tubes and two 171 power tubes in push-pull. Due to the fact that these tubes are connected in series none of them will light if one tube is burned out. Sometimes the filament of a tube will short, and this will throw an excessive voltage on the rest of the tubes, causing them to become paralyzed. Many times a service call is made and the only trouble found is that the plug to the D. C. house line, has

been reversed. Instructions accompanying the set, tell the customer how to insert this plug, but evidently these instructions are not always read.

The most common trouble will be found to be poor tubes. These should at all times be kept uniform. It will be better to have the line voltage too low, rather than high, so that a slight fluctuation will not paralyze the tubes. The voltage can be lowered by using a line resistance, or by inserting the proper light bulb in place of fuse in the input socket. If the line voltage is too low, the set will not be efficient. We have had one or two service cases where a new volume control was necessary and several other cases where the resistance strip had to be changed.

If the tubes are tested with a plug-in-type tube tester be sure to turn off the set when taking the tube out of either the tester or the set.

An official testing chart was not available on the Crosley D. C. set but our service records show most sets have a tube filament voltage of from 4.5 to 5.5. This voltage will vary with different tubes in the same set. The plate voltage on the R. F. tube is about 90, and on the 171, about 105 with 10 to 15 volts of "C" bias. These voltage readings were made on a set connected to line voltage of 118.

# Servicing A. C. Sets

## COMMERCIAL SETS

### MAJESTIC MODEL 70

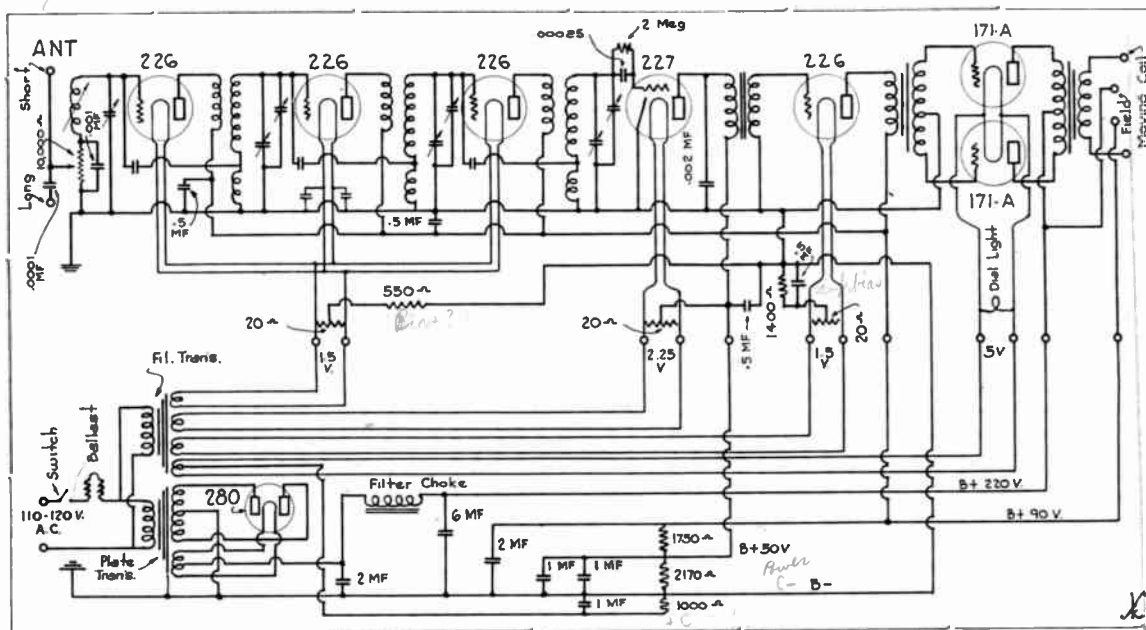


Fig. 19— Hook-up for model 70 Majestic

### MAJESTIC MODEL 70 SERIES

A great many model 70 Majestic sets have been sold, so the service man is quite often called upon to repair sets of this type. In most cases it will be found that the trouble is caused by defective tubes, but at other times the set will have to be pulled, and major repairs made.

The set comes in two separate units and connections are made through a flexible cable. At the pack end of this cable, will be found a terminal block fastened down by thumb nuts. If your preliminary tests show no voltage at some of the sockets, check these nuts to see if they are making good contact. If the set makes a scratching noise, when the volume control is moved, this should next be checked to see if it is defective.

If no filament or plate voltage is shown on some tubes, and other check O. K., the chassis should be taken to the shop and the small condensers in the set checked for a short. Also check the filter condensers in the pack to see if these are blown.

We have found that the two small by-pass condensers on the side of the metal frame, cause the most trouble.

The continuity of the different circuits can readily be checked from the terminal strip.

The set is balanced by inserting a tool through the holes in the top of the metal frame and adjusting the small condensers. A special tool is made for this purpose, which may be purchased from a Majestic distributor, or direct from the factory. As a substitute, a short piece of fiber or bakelite tubing, slotted at the end may be used. It always is best to balance the set in the home of user. Tune in a strong station, 300 to 500 miles away, and which comes in near the center or upper part of the dial. Before doing this try to find out from the customer how much of a DX fan he is, and then balance the set accordingly. Some users will want strong signals on outside stations, even if the set oscillates freely on high frequency stations. Other users will not want the set to oscillate at any frequency. In addition to the balancing condensers, the trimmer condenser should be adjusted. Use the same tool as used for the balancing condenser, and insert through holes in back of condenser shield.

General characteristics are given on the next page:

# Servicing A. C. Sets

## COMMERCIAL SETS

### KOLSTER MODELS K20-22-25-27

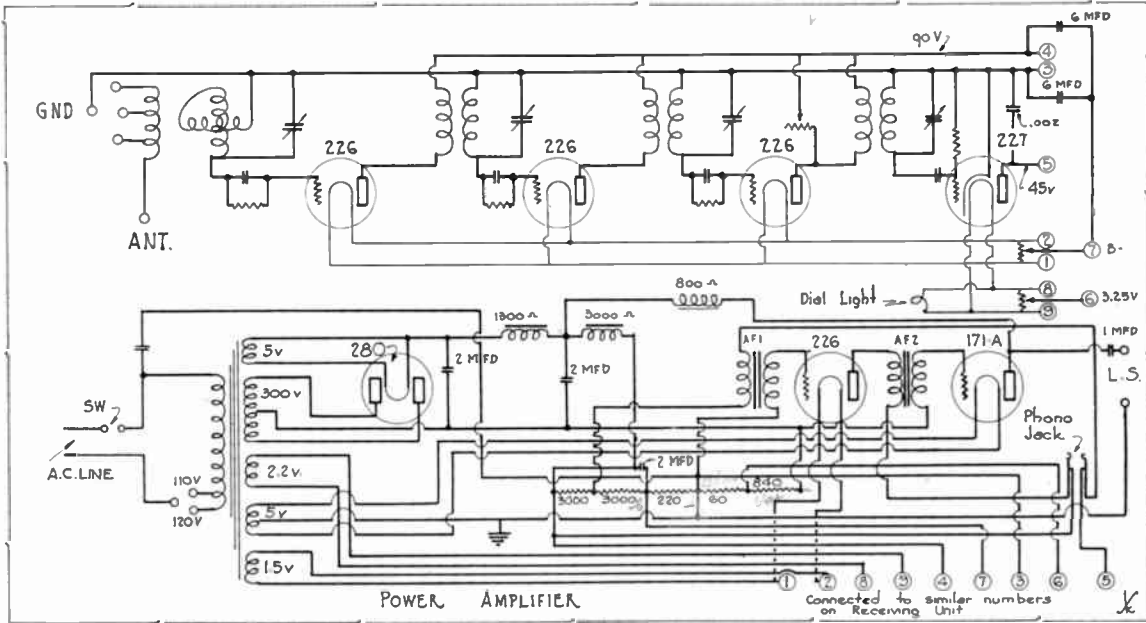


Fig. 20—Hook-up for models 20-22-25 and 27 Kolster

### KOLSTER MODELS 22-25-27-37

General Set Characteristics are as follows:

Tube No.	Type	Position	Tube out of Tester			Tube in Tester			Normal Plate M. A.	Plate M. A. Grid
			A Volts	B Volts	C Volts	A Volts	B Volts	C Volts		
1	226	1st R. F.	1.43	95	1.35	89	6.0	3.25	6.5	
2	226	2nd R. F.	1.43	95	1.35	89	6.0	3.40	6.6	
3	226	3rd R. F.	1.43	95	1.35	89	6.0	3.40	6.6	
4	227	Detector	2.30	50	2.00	42	5.0	3.10	3.1	
5	226	1st A. F.	1.56	92	1.45	86	5.5	3.60	6.5	
6	171	2nd A. F.	5.50	246	5.00	184	41.0	17.50	9.5	
7	280	Rectifier			5.00			22.00		

### Model 70 Majestic Set Characteristics

In Order Tube No.	Type of Tube	Position of Tube	Tube out of Tester		Tube in Tester		C Volts	Normal Plate M. A.	Plate M. A. Grid
			A Volts	B Volts	A Volts	B Volts			
1	226	1st. R. F.	1.5	102	1.4	96	5	3.5	8.5
2	226	2nd. R. F.	1.5	102	1.4	96	5	3.5	8.5
3	226	3rd. R. F.	1.5	102	1.4	96	5	3.5	8.5
4	227	Detector	2.4	100	2.2	40	0	3.0	3.0
5	226	1st. A. F.	1.5	100	1.4	83	4	3.5	8.0
6	171A	2nd. A. F.	5.0	192	4.8	180	40	20.0	23.0
7	171A	2nd. A. F.	5.0	192	4.8	180	40	20.0	23.0
8	280	Rectifier			4.8			20.0	

# Servicing A. C. Sets

## COMMERCIAL SETS

### FRESHMAN Q15

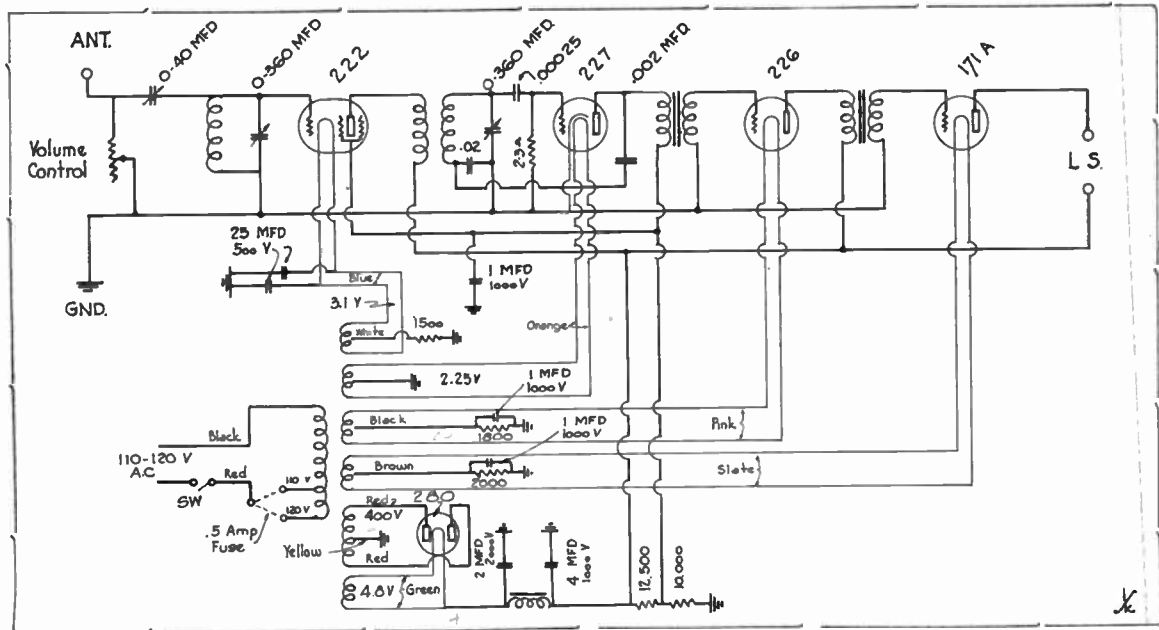


Fig. 21— Hook-up for Q15 Freshman

### FRESHMAN MODEL Q15 SCREEN GRID SET

The hook-up shown above, was one of the first A. C. screened grid sets put out by a commercial set manufacturer. It will be noticed that the type 222 tube is used where the new A. C. screen grid sets are using type 224.

This set employs only one stage of screen grid R. F. amplification with a 227 detector, a 226 first audio and a 171 for the last audio. Many of the later model screen grid sets, employ more than one of these tubes, but very efficient results can be obtained in the R. F.

circuit, that is, if the tube is functioning properly. Type 222 tubes are very critical in operation, and must have the proper grid and plate voltages.

Many inferior screen grid tubes have been placed on the market and if a service call is received from a set of this kind, be sure and try out a good tube, and see if this is not causing the trouble.

The most common case of trouble outside of the tube, would be defective resistances or blown condensers. Also check the set for loose or high resistance joints.

General set characteristics are as follows:

Tube No. In Order	Type of Tube	Position of Tube	A Volts	B Volts	C Bias	Milliamp.
1	171	Last audio	4.8	140	35	20
2	226	First audio	1.4	170	12	4
3	227	Detector	2.25	50	0	2
4	222	First R. F.	3.1	170	2.5	2

Screen grid bias should be plus 50 volts.

# Servicing A. C. Sets

## COMMERCIAL SETS

### FRESHMAN MODEL G

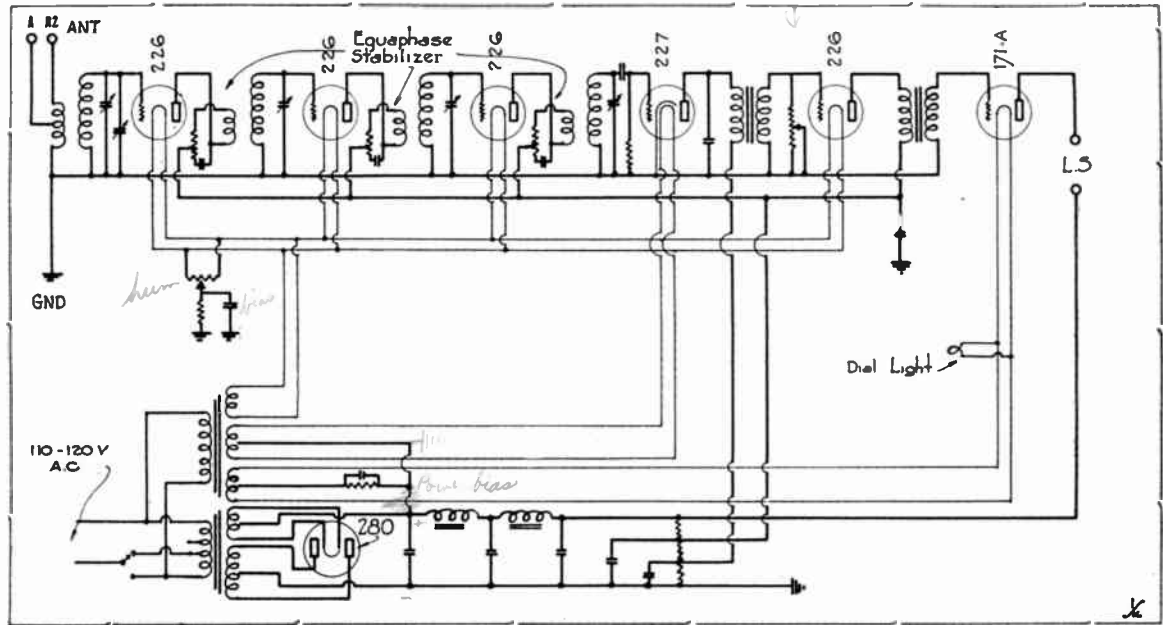


Fig. 22— Hook-up for model G Freshman

### FRESHMAN MODEL G SET

Although this set is out of production, many of them are still in use, so we are including the hook-up in this manual.

This set uses four 226 tubes, one 227, and a 171 power tube. As can be seen from the drawing, no output transformer, or output filter is included in the set, so one of these, should be installed between the set and speaker, that is, if the speaker does not already have one.

The set is balanced by the small condensers

shunted around the R. F. primaries. Care must be used in adjusting the screws, or the nuts will come off. When sets of this kind come to our shop, the nuts are soldered to the bottom leaf of the condenser, and adjustments can then be made without trouble.

Most of our service troubles with this set, have been with these balancing condensers, and with the filter condensers in the pack. The volume control also causes occasional trouble. If it becomes noisy, it should be disconnected from the secondary of the transformer, and checked with a voltmeter and battery.

### General Set Characteristics

Tube No. In Order	Type of Tube	Position of Tube	Tube out of Tester A Volts	Tube out of Tester B Volts	Tube in Tester A Volts	Tube in Tester B Volts	C Volts	Cath. Volts M. A.	Nor. Plate M. A.	Plate M. A. Grid Test
1	226	1st. R. F.	1.45	140	1.35	135	9	5		9
2	226	2nd. R. F.	1.45	140	1.35	135	9	5		9
3	226	3rd. R. F.	1.45	140	1.35	135	9	5		9
4	227	Detector	2.3	140	2.00	50	0	3		3.1
5	226	1st. A. F.	1.45	140	1.35	135	9	5		9
6	171A	2nd. A. F.	5.5	200	5.10	175	37	16		18
7	280	Rectifier			5.10				20	



# Servicing A. C. Sets

## COMMERCIAL SETS

*Testing  
for all  
Picks  
F. L. change*

### REGENT SET

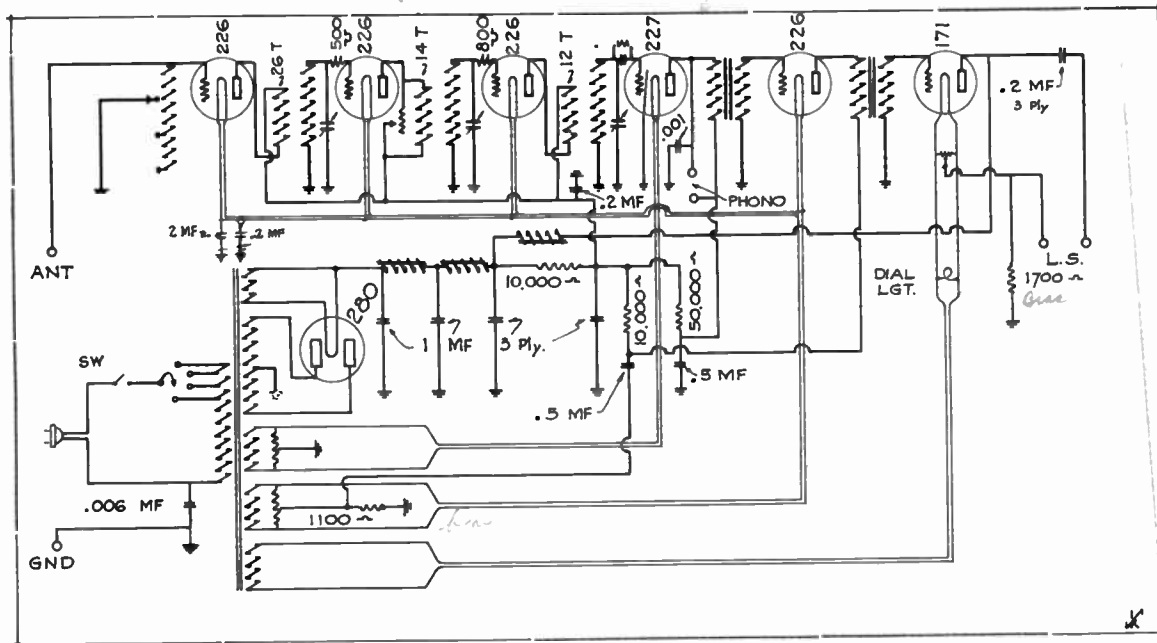


Fig. 23—Hook-up of Regent A. C. set

### THE REGENT SET

The Regent set is made by one of the well known set manufacturers especially for a large chain store syndicate. This set uses four 226 tubes, a 227, detector and a single 171 amplifier tube. The set uses grid resistance for stabilization. The manufacturers recommend that the set be used with an aerial 75 to 100 feet long, if either a too long or too short aerial is used, the antenna coupling switch will not work properly on either the high or low wave stations. To tell if the antenna is right for this particular set tune in a weak station near the center of the broadcast band (about 350 meters) and see if good volume is to be had on one of the center taps. If the loudest signal, comes in when the switch is at either the extreme end points, the aerial is either too long, or too short as the case may be. An umbrella aerial such as described on page four of this manual will give satisfactory pick-up with this set, providing the lead-in is not too long. Voltage of the set can be checked by using a set tester, or A. C. and D. C. meters equipped with test probes. The voltage given below should be right when the pack is connected to the set and all tubes are in place. The aerial should also be connected when making voltage readings. If this is not done, the first R. F. tube may oscillate, causing it to draw abnormal current from the power pack.

The power pack is provided with four taps for regulating the line voltage to the power transformer. These are rated 90-100-110 and 120. This should be adjusted so that the filaments of the 226 tubes have a voltage of 1.2, and the 171, 4.5 A. C. Take these readings when all tubes in the set are in place.

The power pack may be tested when disconnected from the set chassis, but of course the voltages will be high. The pack should not be left connected to the line any longer than necessary for testing purposes, or the condensers may break down. This test should show at least 250 volts across the high "B" tap,

If the set is not properly balanced a weak station should be tuned in at the center of the dial and the compensating condensers adjusted by inserting a screw driver through the opening in the condenser shield, moving the compensator plates until the loudest signals can be had.

General set characteristics are as follows:

Tube No.	Type of Tube	Position of Tube	A Volts	B Volts	C Volts
1	227	Det.	2.05	38	
2	226	3 R. F.	1.16	135	11
3	226	1 A. F.	1.18	120	10
4	226	2 R. F.	1.20	135	11
5	171	2 A. F.	4.5	165	33
6	226	1 R. F.	1.25	135	11

*Pick up*

*... show reading*



# Servicing A. C. Sets

## COMMERCIAL SETS

### ZENITH MODEL 39

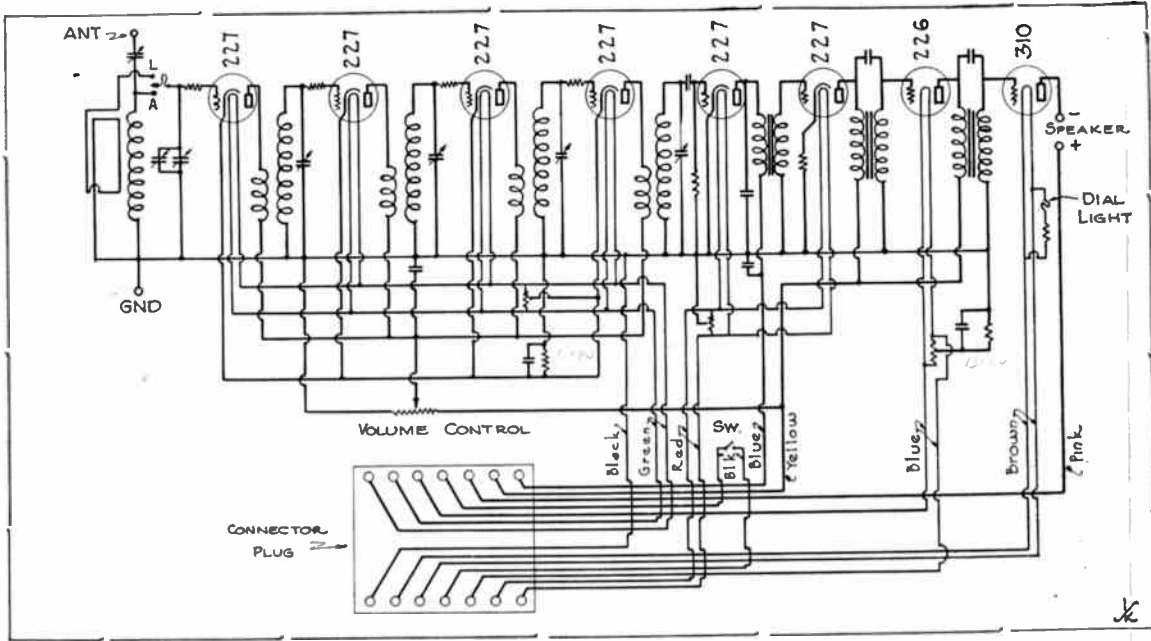
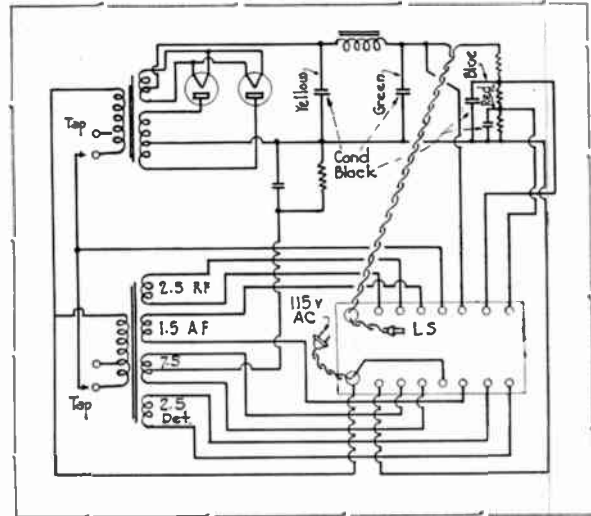


Fig. 25— Hook-up of model 39 Zenith

### ZENITH MODEL 39 SERIES

The above wiring diagram shows the hook-up for the Zenith Model 39 Series. The connection plug fits into one end of the transformer unit. The condenser and filter, are contained in a separate can, and connections made with flexible cords equipped with plugs. It is impossible to get these connections wrong as the plugs are made in different shapes. One mistake that can occur however, is connecting the plug shown in the drawing to the power unit. These are supposed to fit only one way, but by forcing the plugs in the sockets, they can be connected wrong. Care must be taken in making this connection to see that this is inserted in the right manner.

When trouble occurs with the set, it generally will be found to be in the filter pack. This pack can either be exchanged at the Zenith distributor, or new condensers can be



Zenith Power Supply

Tube No. In Order	Type of Tube	Position of Tube	A Volts	B Volts	C Volts	Normal Plate M. A.	Plate M. A. Grid Test
1	227	1st. R. F.	2.0	170	12	5.0	10.0
2	227	2nd. R. F.	2.0	170	12	5.0	10.0
3	227	3rd. R. F.	2.0	170	12	5.0	10.0
4	227	4th. R. F.	2.0	170	12	5.0	10.0
5	227	Detector	1.9	35	0	3.0	3.2
6	227	1st. A. F.	1.95	170	12	5.0	7.0
7	227	2nd. A. F.	1.4	170	12	5.5	7.0
8	210	3rd. A. F.	7.45	450	36	21.0	23.0
9	281		7.25			50.0	
10	281		7.25			50.0	

# Servicing A. C. Sets

## COMMERCIAL SETS

### SPARTON

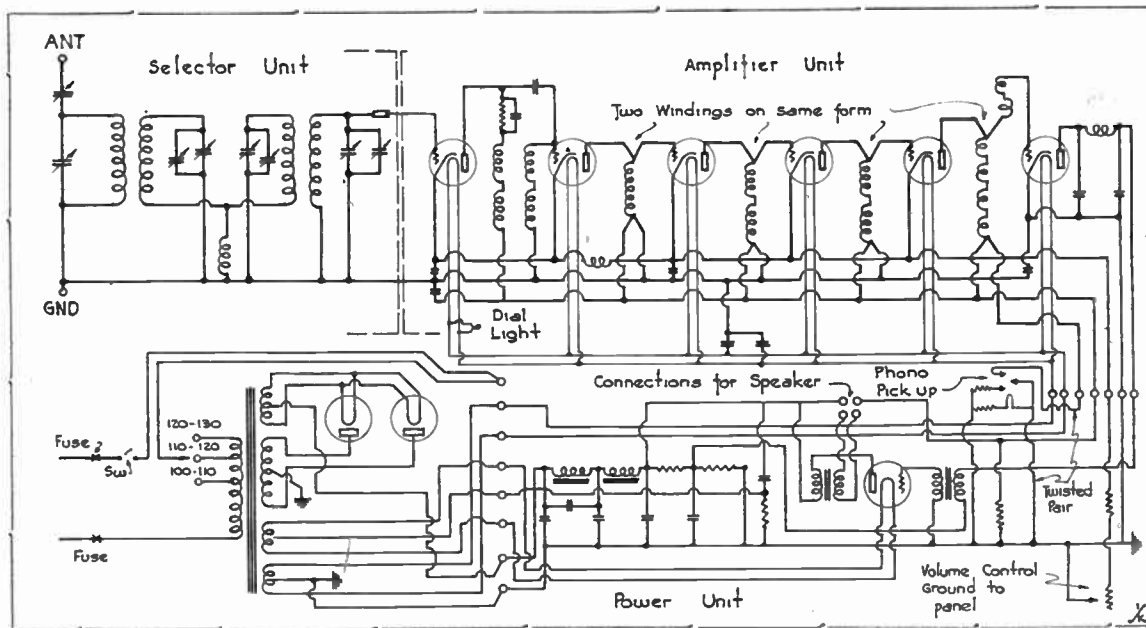


Fig. 26— Hook-up for model 89 Sparton

installed as per instructions given elsewhere in this book.

The 39 series include several different types of phonograph combinations and single console sets. Due to the fact that six 227 tubes are used, some trouble is experienced in the flickering or noises originating in these tubes. Standard manufacturers of 227 tubes, have corrected this fault, but if experiencing trouble with a set fading, or with a growling noise, when the antenna or loop is disconnected, take the covers off the cans and watch the 227 tubes. If some of these are flickering, same should be replaced, and the noises will probably disappear.

### SPARTON MODEL 89A

The Sparton set shown above uses the famous by-pass filter tuning unit. The R. F. part of the circuit is made up of several untuned stages using a special three volt tube. Many times servicemen make a mistake and replace these tubes with 2½ volt type 227. They will work after a fashion, but much better results will be obtained if using a regular Sparton tube.

The tubes in the amplifier part of the circuit are also especially constructed but are similar to the type 281's and type 250's.

#### SPARTON MODEL 89-A

Tube No.	Type	Position in Set	Tube in Tester			Normal Plate M. A.	Plate M. A.	Grid	
			A Volts	B Volts	C Volts				
1	C-484	1st R. F.	3.1	145	3	120	9	6.7	10.7
2	C-484	2nd R. F.	3.1	145	3	140	9	7.5	12.5
3	C-484	3rd R. F.	3.1	145	3	138	9	8	13.3
4	C-484	4th R. F.	3.1	145	3	138	9	6.5	12.2
5	C-484	5th R. F.	3.1	145	3	138	9	7.6	13.
6	C-484	Detector	3.1	260	3	240	25	1.5	7.2
7	585	Audio	7.7	535	7.4	380	62	52	108
8	281	Rectifier	7.7		7.4			58	

# Power Amplifiers

## 245 Push-Pull Amplifiers

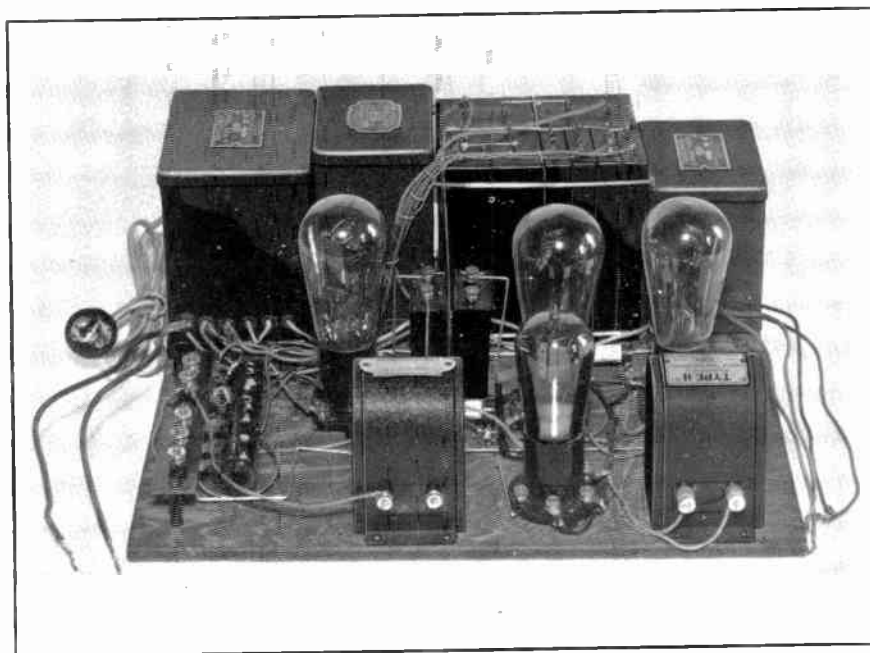


Fig. 27— A 245 Push-pull power amplifier

### 245 POWER AMPLIFIER

This 245 push-pull amplifier was designed so that it could be used in many different ways. It will make an ideal power amplifier to be used with any battery operated, or electric set. It may be used as an independent amplifier for phonograph record work, and with the addition of one more stage and microphone transformer, can be used for a speech or public address power unit. It can be adapted for use as power supply for the Screen Grid R. F. chassis shown in figure 41.

If the amplifier is used with a battery operated set, all tubes from the detector on can be eliminated. This cuts down the draw from the "A" battery. No "B" or "C" batteries, or "B" eliminator will be necessary as the "B" and "C" supply for all tubes can be furnished from this unit. The unit can also be used for converting battery operated sets for A. C. operation, that is, if 227 tubes are used for both R. F. and detector stages.

The amplifier is not too large for home use, and it still has sufficient surplus capacity to fill a fairly large hall or theater.

### SPECIAL FEATURES

The new 245 has been a remarkable improvement over any of the previous amplifier tubes brought out. As can be seen from the tube charts given elsewhere in this book, it has an undistorted output of 1600 milliwatts at 250 volts, where the 210 tube gives only 1540 at 425 volts, and the 250, 1500 at 300 volts. Of course, the 250 will give 4650 milliwatts at 450 volts and these tubes should always be used where a very strong signal is needed. For any ordinary purpose the 245 can be used to the best advantage. The cost for tubes, transformers and condensers is only about half that of the 210 job, and only about one third that of the 250 amplifier. Where a 210 or 250 requires the high priced 281 rectifier tubes, 245 push-pull tubes can be supplied with just one of the 280 type. Where a 210 or 250 push-pull require filter condensers rated at 1000 volts D. C., the 245 can be filtered with condensers having a 600 volt rating and still have a large margin of safety.

# Power Amplifiers

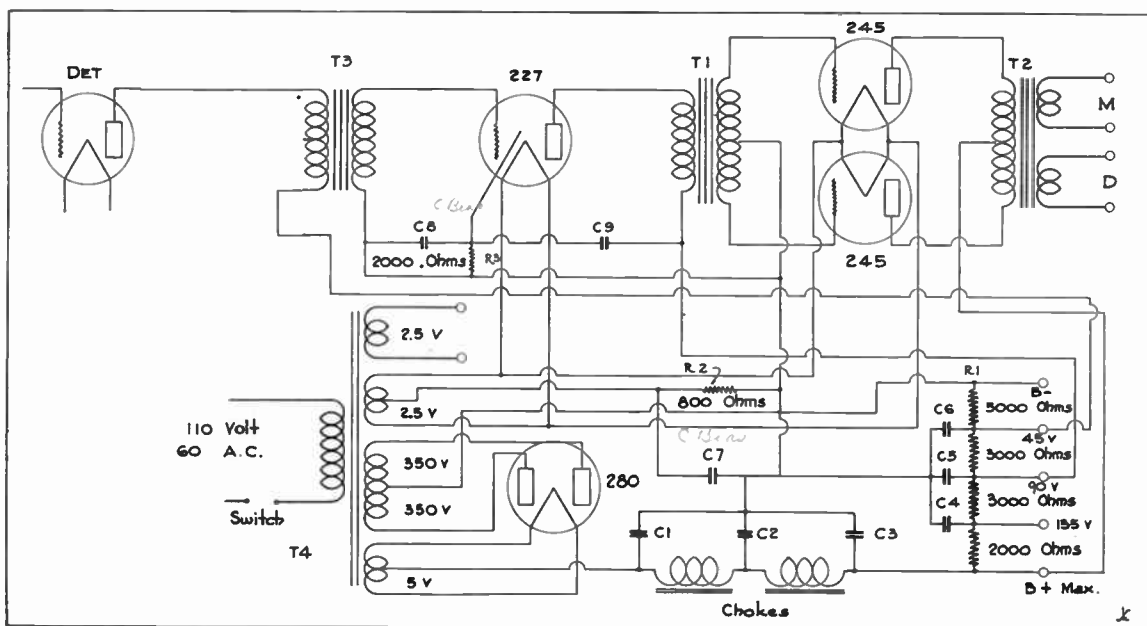


Fig. 28— Schematic drawing of 245 push-pull power amplifier

All of these advantages have been taken into consideration by the manufacturers of the new commercial sets. At least 75% of the new sets being placed on the market this Fall, have 245 tubes in the output part of the circuit.

This power pack is not designed to give maximum plate and grid voltages to the 245 tubes, but sufficient voltage is applied for all ordinary purposes.

The output transformer of the power pack was designed to be used with either a magnetic or dynamic speaker. The "M" winding is of high impedance and should be used with a magnetic speaker, and "D" winding is of low impedance and should be used with dynamic speaker. If the dynamic speaker already has a matching transformer, the speaker should be connected to the "M" windings.

Many power packs have been designed which connect to the first audio stage, rather than to the detector tube. The 227 first stage was incorporated in this design for two reasons. First, it would make a complete pack which could be used separately from the radio set, and second, the impedance of the input transformer will match the 227 tube better than it would a 201A, 226 or UX112.

The power transformer is constructed with one primary and four secondary windings, three of them are used in the pack, and the extra two and half volt winding can be used to light the filaments of four or five 224, or 227 tubes. The extra winding will be connected when the pack is used in connection with a R. F. chassis similar to that shown on pages 44 to 46, or when the pack is used for converting a battery operated set for electric operation. When the pack is used in connection with a complete electric set, or as a separate phonograph amplifier the extra winding should be left open.

## OTHER METHODS OF CONSTRUCTION

Figure 30 shows other methods of constructing a 245 power unit. The upper drawing gives details of the power supply unit and the two lower drawings show how to connect two 245 in push-pull and a single stage using a 245 tube. The power supply unit should be constructed as shown if the amplifier tubes are to be built in as part of the set.

# Power Amplifiers

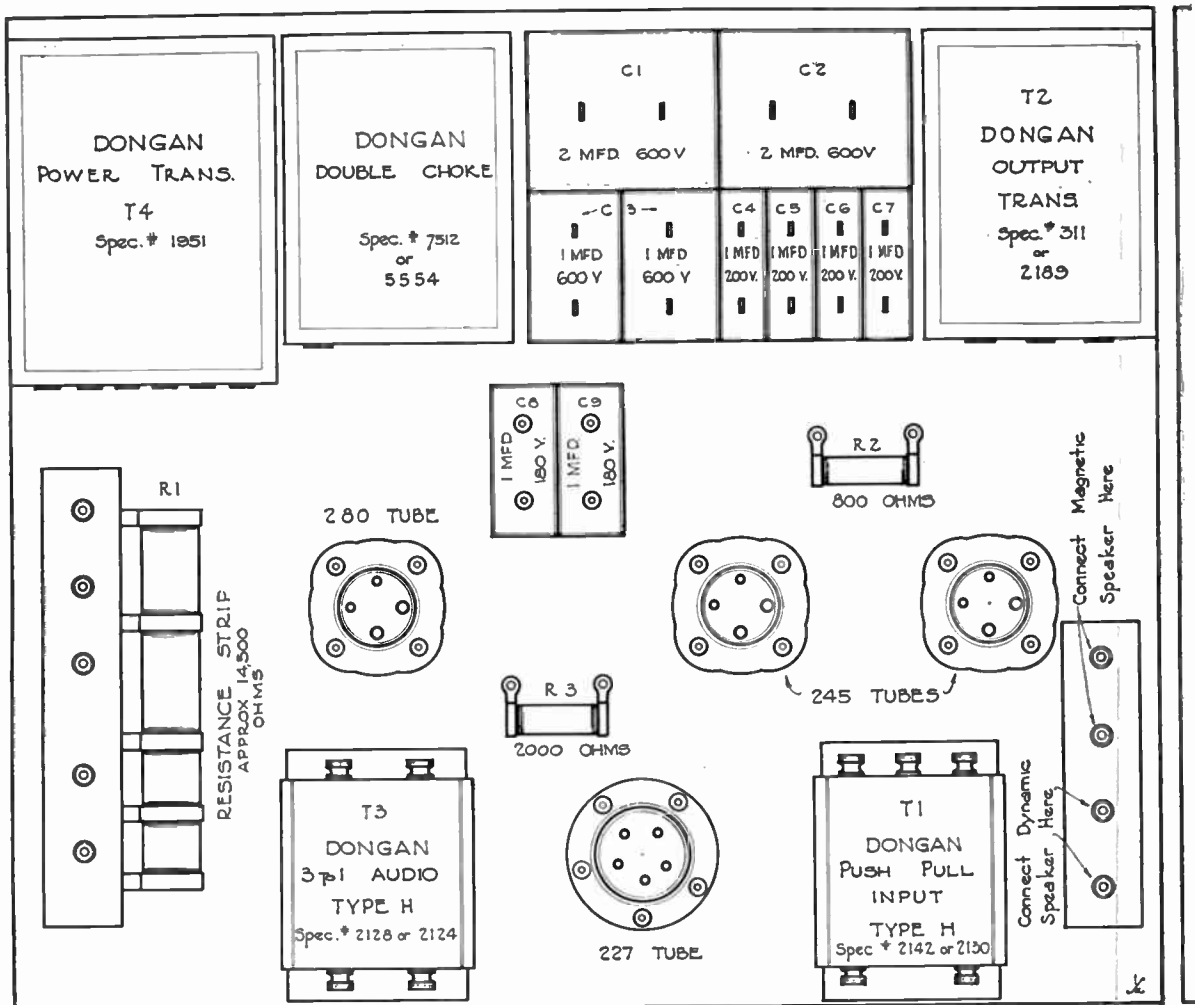


Fig. 29— Lay out of parts for 245 push-pull power amplifier

## LIST OF PARTS

- T4— 1—Dongan Power Transformers Spec. No. 1951 or 994  
 1—Dongan Double Choke Spec. No. 7512 or 5554
- T3— 1—Dongan Type "H" Audio Spec. No. 2128 or 2124
- T2 1—Dongan Out-put Transformer Spec. No. 3111 or 2189  
 Note 3111 is shown in Fig. 29 as 311. This is wrong.
- T1— 1—Dongan input Transformer Spec. No. 2142 or 2130
- R1— 1—Resistance and Binding Post strip about 14,500 ohms.
- R2— 1—Grid Bias Resistance, 800 ohms.
- R3— 1—Grid Bias Resistance, 2000 ohms
- C1—C2—C3— 3—"Accurate Brand" 2 mfd. condensers or  
 6—"Accurate Brand" 1 mfd. condenser 600 D. C. working volts
- C4—C5—C6—C7 4—"Accurate Brand" 1 mfd. condensers, 200 D. C. working volts
- C8—C9— 2—Small mfd. condensers for grid biases, "Accurate Brand" or Pilot
- 1—5 prong sockets  
 3—4 prong sockets  
 1—Binding post strip  
 1—Baseboard 13"x15"

# Power Amplifiers

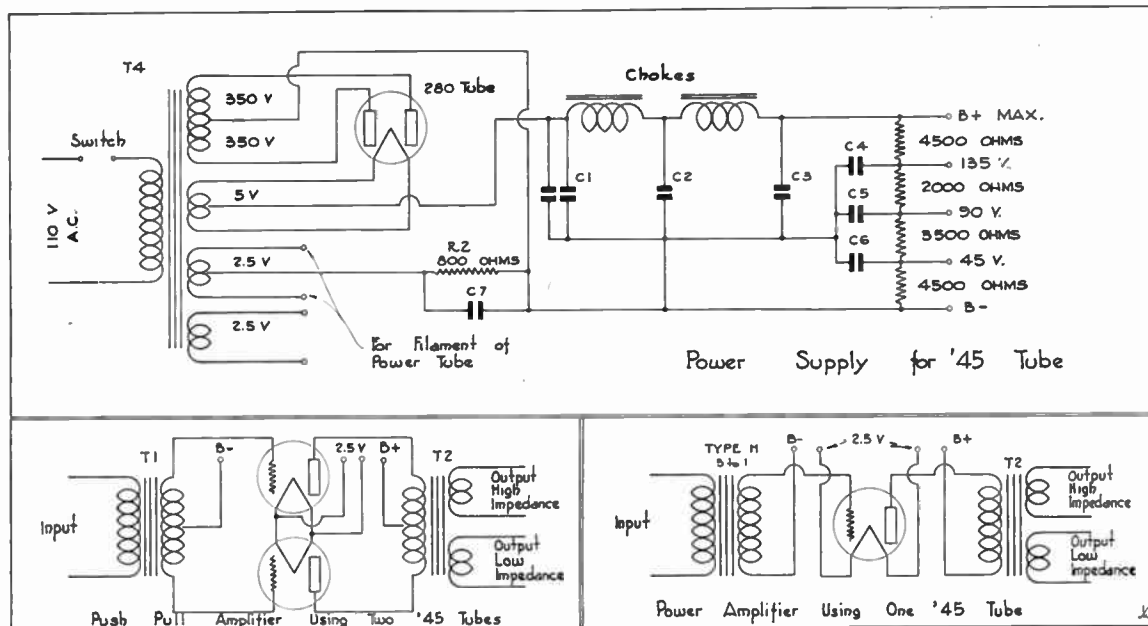


Fig. 30—Different methods of connecting amplifier using 245 tube. Upper drawing power supply unit only, left hand lower drawing push-pull circuit, lower right hand drawing single 245.

## CONSTRUCTION DETAILS

The laboratory sample of this amplifier picture of which is shown in figure 27, was constructed on a 13"x15" baseboard. Combination buss and flexible wiring was used. All the "B" negative, or grid return wires were run with buss wire, and flexible wire was used for the balance of the leads.

A combination resistance and binding post strip was used, and an extra binding post strip was made up for connections to the output transformer. It will be noted that two 2 microfarad condensers and two 1 microfarad sections were used instead of three 2 microfarad cans. This was done because of the convenience in mounting these sizes. The two 2 microfarad, the two 1 microfarad and the four 1 microfarad 200 volt condensers make a complete square block which is easy to mount on the sub-base. "Accurate Brand" condensers were used in the laboratory model. The constructor may be able to buy all of these condensers mounted in one can, hav-

ing a common ground wire, and wires for the sections brought out individually. Condenser C8 and C9, are shown mounted separately from this block.

As can be seen from the drawing all of the transformers used were manufactured by the Dongan Company, and the condensers and resistances carried the "Accurate Brand."

Some constructors may wish to use this pack with a dynamic speaker having a 90 volt field coil. This can be done by taking out a section of the voltage divider, and inserting in its place the field coil of the speaker. The amount of resistance taken out should equal the resistance of the field coil, and should be checked carefully to see that the coil is not getting a voltage either too high or too low.

It will be a good plan to add a three ampere fuse to the input circuit of this pack, although this is not shown on the drawing. A small flash-light bulb can also be put in series with the "B" negative line next to the rectifier tube, as shown in figure 39, page 42.

*Field coil*  
*flash light bulb*



# Phonograph Amplifier

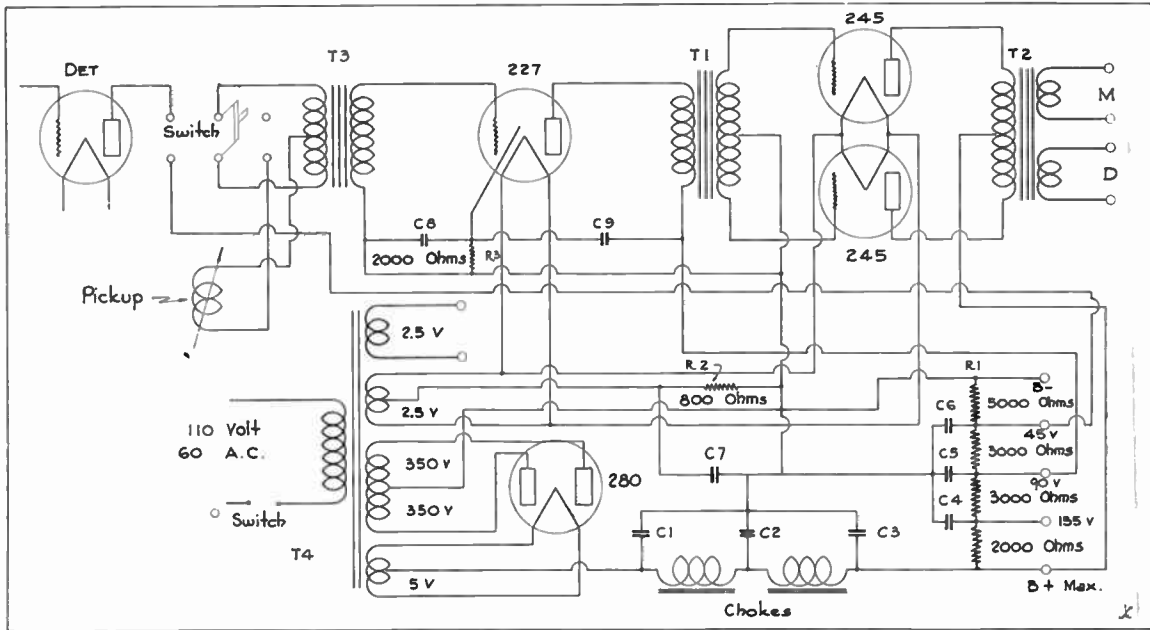


Fig. 31— Schematic drawing of 245 push-pull phonograph amplifier

## PHONOGRAPH AMPLIFIER

The hook-up shown above is the same as that described on the previous pages, except that provision is made for connecting a phonograph pick-up unit. If a pick-up is connected direct to the primary of an ordinary input transformer, the impedance will not match, and poor reproduction will result. The Donagan Company have designed a special input transformer which has a centre tap and the pick-up can be connected to this centre tap and one side of the primary.

If the unit is to be used in connection with a radio set the pack should also include the double pole, double throw switch. This switch is used for changing from phonograph to radio without interference between the two units.

Several efficient pick-up units are now being manufactured. Be sure to get one that has a counter balanced arm so the pick-up will not

bear too heavily on the record. If buying a unit without the arm, adjust the counter balance on the phonograph so that the proper weight will be applied to the needle.

Any old phonograph can be used as a turn table for the record. If the phonograph is equipped with electric motor installed before the electric pick-ups were developed, some interference will be noticeable. This can be eliminated by the use of filter condensers.

When purchasing motors especially for this work, be sure to get an inductive type made especially for phonograph radio combinations.

When building a phonograph amplifier for continuous duty two different motors and pick-ups should be installed on the same table. Records can then be replaced without interrupting the programme. Only one amplifier will be necessary and the pick-ups can be connected in series or changed over by the use of a double pole, double throw switch.

# Public Address Systems

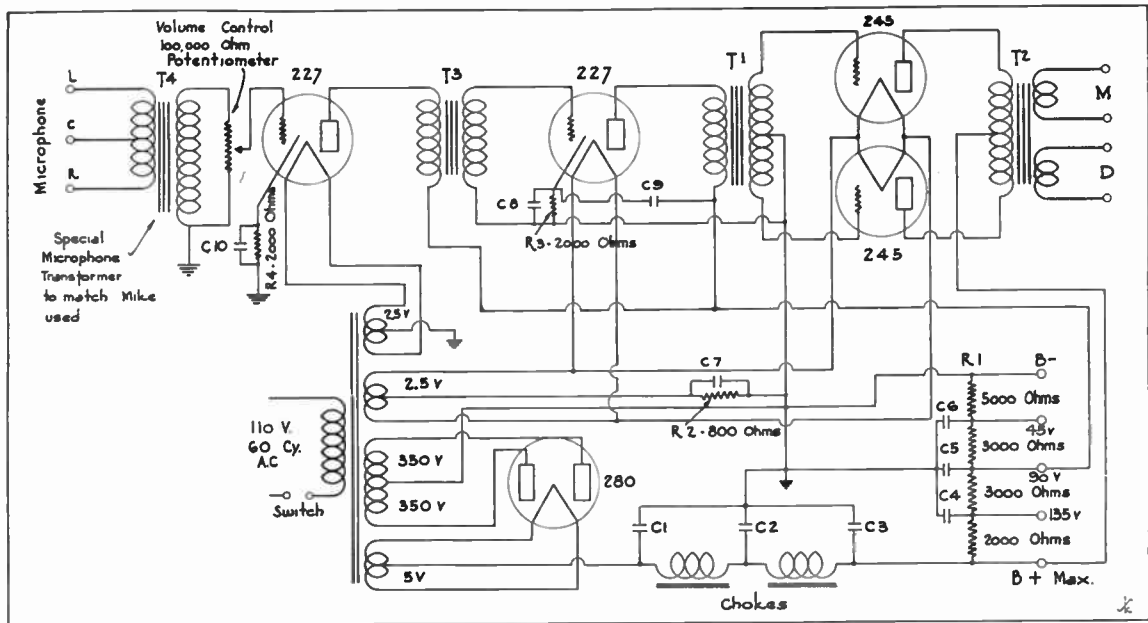


Fig. 32— Schematic drawing of 245 public address system

## PUBLIC ADDRESS SYSTEMS

### General Uses

Many uses can be found for a public address system. The service man or dealer who will study this phase of the radio business, will find many opportunities to increase his income. Every dance hall owner is a prospective customer, even if he has a good full time orchestra. If he is the owner of a large ball room, he has experienced trouble in having his orchestra heard in the farthest corner of the room. By installing a public address system with a microphone, and with speakers conveniently located, the music will be as audible in the back of the hall as it is immediately in front of the orchestra. If conditions will permit, loud speakers can also be placed in front of his place of business, and will be of as much advertising value as his sign. He can also use the system for making announcements, or for playing phonograph records, when no orchestra is available.

What holds true with dance halls, will also apply to restaurants, or road-houses. The latter can use the amplifying system, in connection with a phonograph, or radio set, and furnish entertainment at any time during the day or night. These places can also use the system for making announcements, and drawing attention to their place of business, by installing outside speakers. Some wayside inns

place the speakers, together with the sign on the main traveled highway, a sufficient distance from the entrance so that prospective customers will have a chance to bring their cars to a stop, and turn in for the necessary refreshments. It is surprising how much additional business can be brought in by advertising of this kind. Of course, this type of hook-up will be limited to rural or suburban districts, but there are many prospects that a well informed radio man can sell.

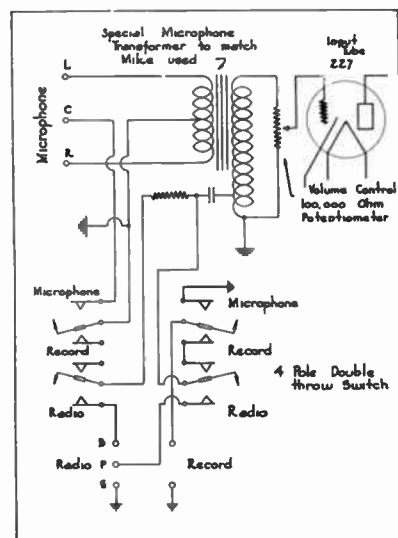


Fig. 33— Switching arrangement for a P. A. system

# Public Address Systems

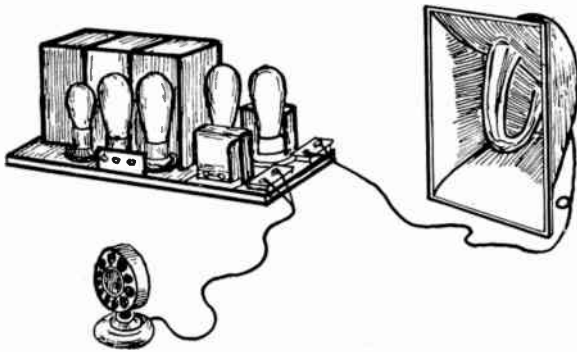


Fig. 34—P. A. power pack connected to microphone and speaker

The writer personally installed a P. A. system at a taxicab headquarters and service station. This is used for locating cab drivers in the assembly hall, and for making announcements, which can be heard by all employees either on the lot, or around the building. A low priced Frost carbon microphone is used, with an amplifier consisting of two stages with 112 tubes and two 171 tubes in push-pull. This amplifier was installed in a D. C. district, and very good results are being obtained by using the 220 D. C. current for "B" and "C" voltages. Anyone can secure a hook-up of this amplifier by writing to the author.

Considering the results obtained with this and other amplifiers, with which we have come in contact, we believe that the 245 push-pull job, will give sufficient volume, for all ordinary purposes. When a large outside area, a large theater or hall is to be covered, it is best to construct a P. A. system using two or four 250 tubes.

Medium sized exponential horns, or large dynamic cones can be used for small halls, but for a larger area, the combined dynamic speaker and horn is best. Several manufacturers are making speaker assemblies, especially for this purpose. We recommend the ones made by Wright DeCosta, or Amplion.

As stated above, a common carbon hand microphone can be used for speech amplification, but if an orchestra, or band is to be picked up, one of the higher priced broadcasting microphones should be purchased. These will range in price from \$75.00 to \$350.00.

Be sure the impedance of the input transformers matches the impedance of the microphone, and also the input tube. Information about input transformers can be had by writing the engineering department of the Dongan

Electric Co., 2987 Franklin Street, Detroit, Michigan.

The hook-up shown above is the same as used for a phonograph amplifier, or for use with a set, except that one more input stage has been added, and the output transformer has been changed. If the amplifiers is also to be used with a radio set, and phonograph, a three way switching device, similar to the one shown in figure 33, should be installed. The construction of the output transformer, will depend on the number of speakers to be connected. Figure 35 shows proper method of connecting five of these to separate windings, so that any or all or them can be used without materially changing the impedance of the circuit.

Information about special output transformers may also be obtained from the engineering department of the Dongan Company. Before writing them be sure to decide upon the style and make, and if possible, find the impedance characteristics of the speakers to be used.

We have not as yet definitely determined the maximum number of speakers that can be used with a 245 push-pull power pack, but as a rough guess, would say that six dynamics, or 12 magnetics could be connected at one time without overloading.

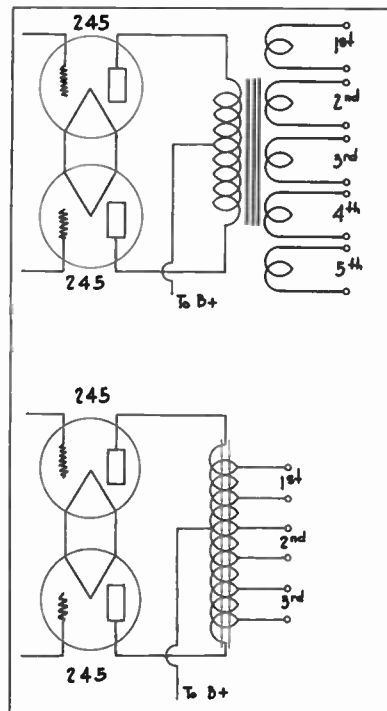


Fig. 35— Output arrangements for P. A. system

# A 250 Push-Pull Amplifier

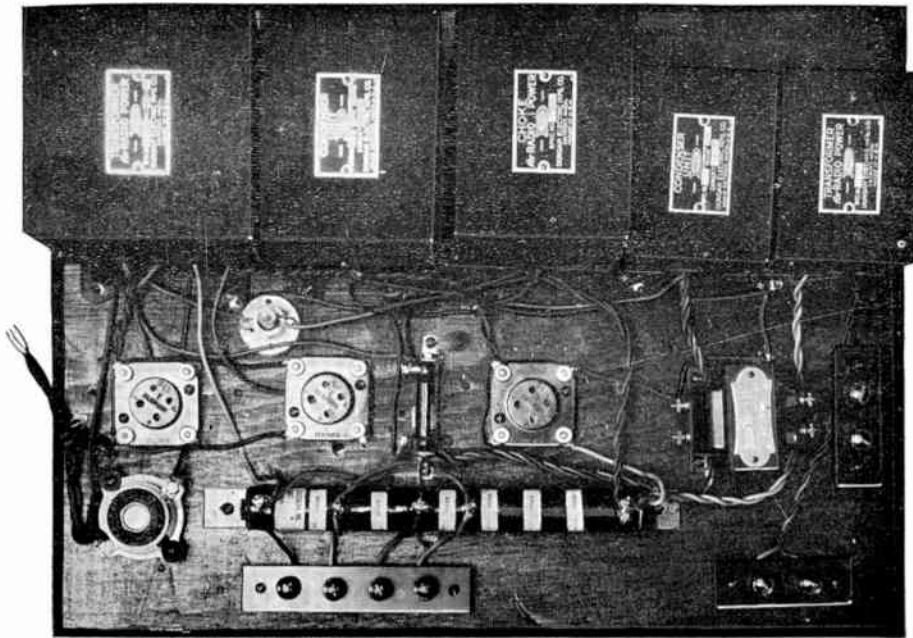


Fig. 36—Picture showing layout of parts for 250 push-pull amplifier

## 250 AMPLIFIER SYSTEMS

As stated in the article on the 245 amplifier, 250 type tubes should be used when very large halls or outside areas are to be covered. Parts and tubes cost more than for a 245 amplifier, so as a general rule, the 250 pack should not be recommended for ordinary home use when only one speaker is connected to the set.

This article contains hook-ups for four different arrangements. The first two drawings show an amplifier with a single 250 tube, figure 38A shows a 250 push-pull amplifier, and figure 39 gives the system to use when 250 tubes are to be used for public address work. Either one of the first two amplifiers, can be connected to the first audio tube of a battery or electric set. When a battery set is used the "B"

### LIST OF PARTS

T1 Dongan Transformer No. 7568  
T2 Dongan Output Transformer No. 1177  
T3 Dongan Type H Audio Transformer  
Ratio  $3\frac{1}{2}$ -1  
L1 Dongan Double Choke Unit No. 6551  
C1 Dongan Condenser Unit No. D-600  
C2 Dongan Condenser Unit No. D-307  
R1 Ward Leonard Resistor No. 507-6  
R2 Ward Leonard Resistor No. 507-55

2 UX-281 or Cunningham CX-381  
1 UX-250 or Cunningham CX-350  
3 Four Hole Sockets  
1 Porcelain Socket for Fuse  
1 3 Amp. Fuse  
8 Binding Posts  
B Flashlight Bulb and Socket  
1 25-ft. hookup wire  
Baseboard Wood Screws, Bakelite Strips

# A 250 Push-Pull Amplifier

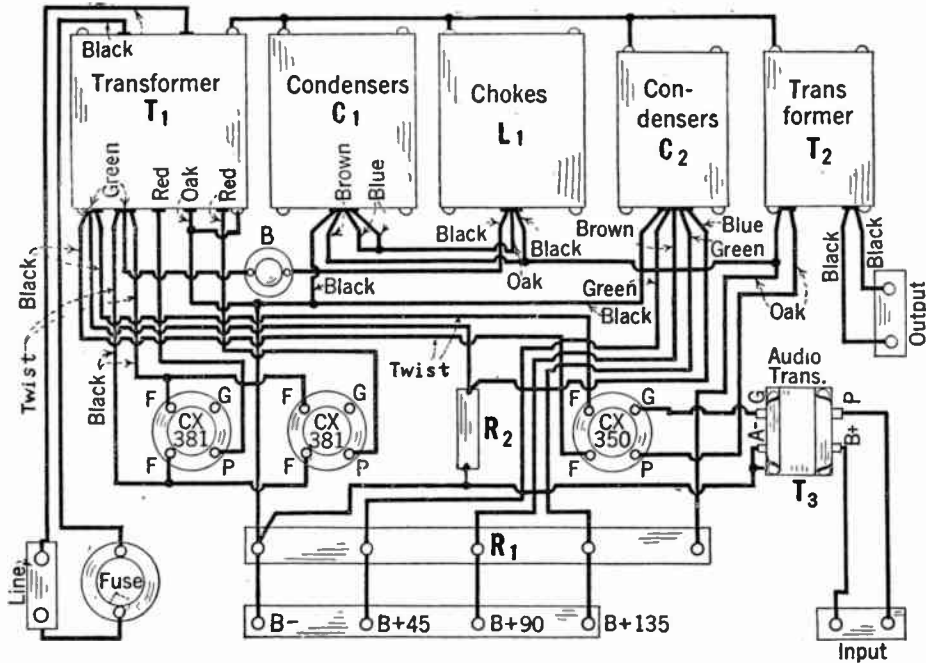


FIG. 2

Fig. 37—Outline drawing for single 250 power amplifier

supply for the set can be taken from the pack.

The hook-ups (figures 37 and 38) incorporate several features different from those ordinarily used. Most amplifiers use filter condenser ahead of the double chokes, as well as

across the center tap and next to the resistance. Eliminating this first condenser, tends to reduce the current draw of the rectifier tubes which gives them much longer filament life. Another feature of this pack, is the small

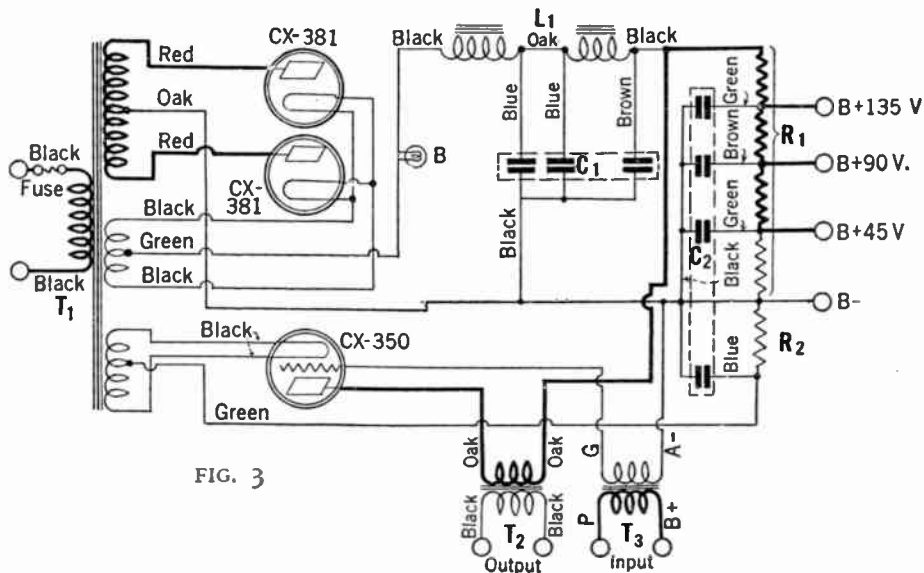


FIG. 3

Fig. 38—Schematic drawing of single 250 power amplifier

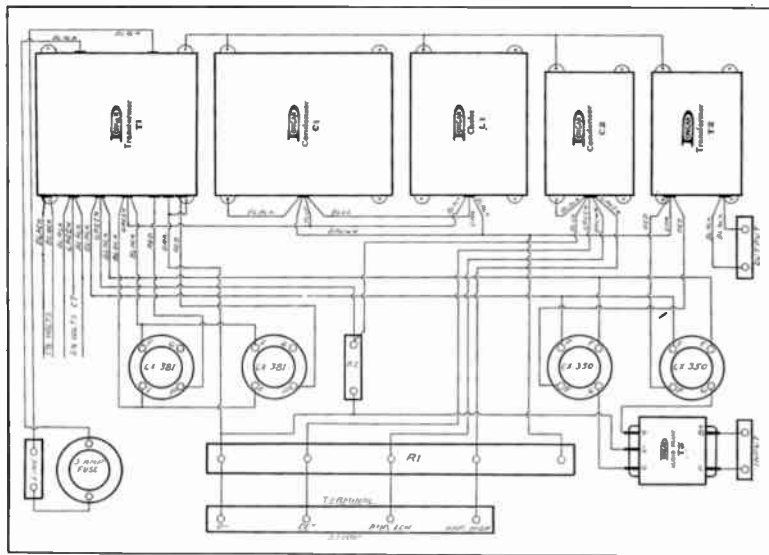


Fig. 38A— Outline drawing of 250 push-pull amplifier

flash-light bulb placed in series with the rectifier output. This bulb acts as a fuse, and protects the tubes and transformers in case a condenser breaks down, or an accidental short occurs.

Care must be exercised in installing these units. They should be placed so the operator cannot come in accidental contact with the wiring of the pack while the set is in operation. The user should be instructed to turn off the pack when making any adjustments or replacing tubes. The output voltage delivered by this pack is necessarily high and contact with the wires will cause burnt fingers and dangerous electrical shocks. The output voltage of the plate transformers is approximately six times that of the home lighting service.

The type of output transformer to be used with a P. A. system will depend upon the number of speakers to be handled, and the input transformer will have to match the im-

pedance of the microphone.

The hook-up of the push-pull power pack does not show the small flash light socket and bulb. This however, should be installed in the filter output circuit, the same as shown in figure 38.

Metal cases of all transformer cans and condensers should be connected to the "B"-line, and this should be grounded. If the amplifier is used in connection with a radio set, the "B-" of the amplifier should be connected to the "B-" terminal of the receiving set.

Figure 39 shows a condenser connected ahead of the choke coil, as stated before this may be disconnected, especially if the plate voltage of the 250 tube is too high. The transformer T1, figure 39 has two extra secondary windings which may be used for lighting the filament of the tubes of an R. F. chassis or for adding one or more tubes to the amplifier.

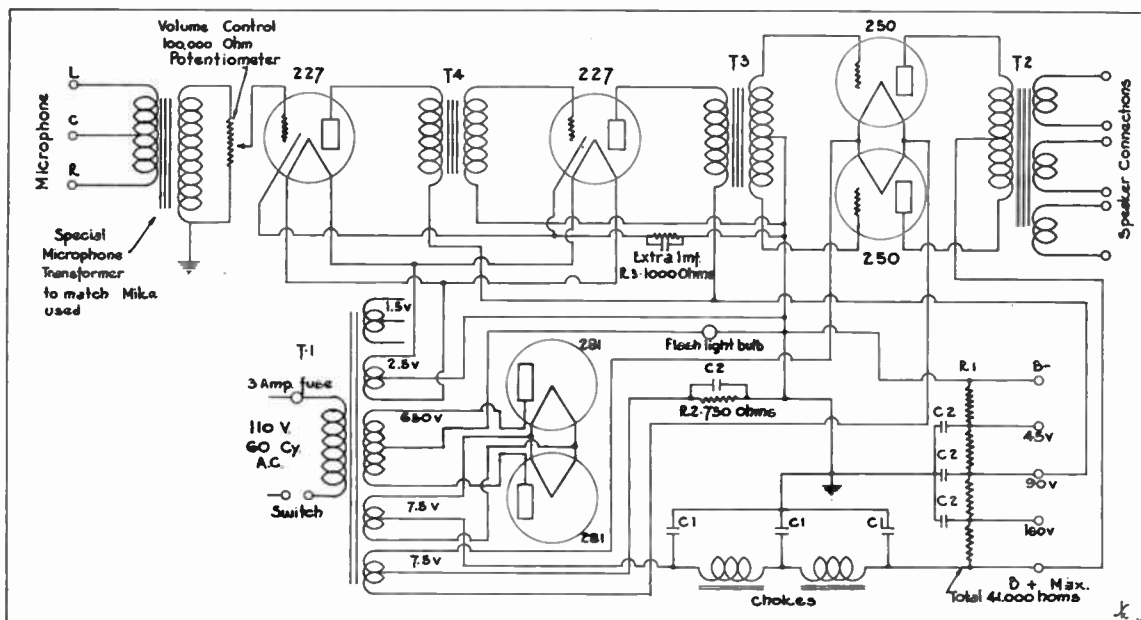


Fig. 39— Public address system complete with input and output transformer

# Screened Grid R. F. Unit

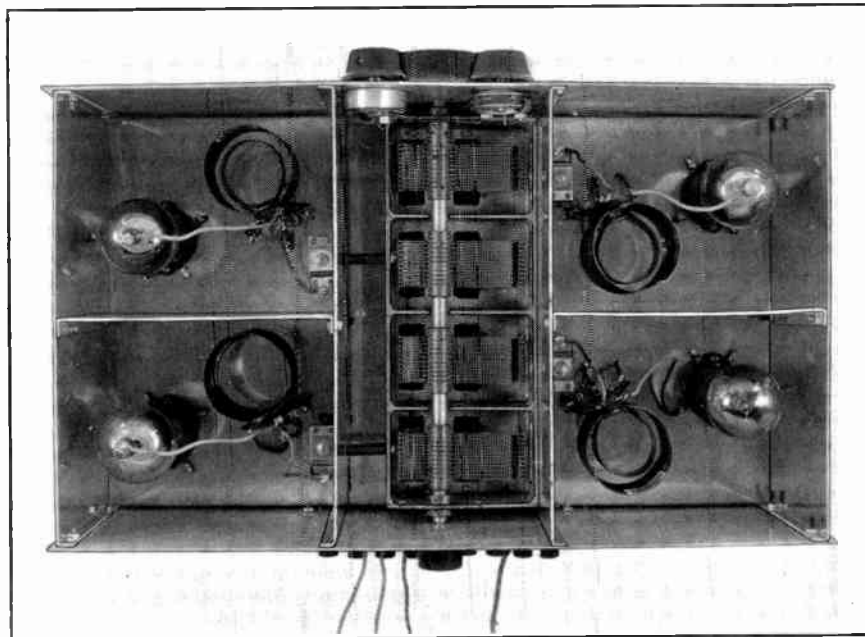


Fig. 40— Picture showing screen grid R. F. chassis

## SCREEN GRID R. F. CHASSIS

This screen grid R. F. chassis was designed to be used with the 245 push-pull power pack shown on pages 34 to 37. It will make an ideal experimental model for anyone interested in finding out the possibilities of the A. C. screen grid tube. Due to the fact that this unit introduces several novel features not found in commercial sets, some constructors may be skeptical about its successful operation. The main changes from the accepted standard, are the use of the variable grid bias for the detector tube, and the variable control for the 224 grids. These variables have been added to the hook-up to compensate for any variations which would occur with different constructors. These two variables should be mounted on a panel and can be used for tuning. The fifty thousand ohm variable resistance for screen grid bias shown on the bottom of the hook-up may be added to the circuit. If this is not done, the taps on the voltage divided of the power pack may not deliver proper biases to these tubes.

An optional output arrangement is shown. The original drawing shows the plate connected directly to the primary of the audio transformer in the pack. The alternate output circuit is shown in the small drawing below. The choke coils and condensers will tend to stabilize the circuit so that the wire running between the plate of the detector tube and the power pack is not susceptible to capacity effect. If experiencing trouble with the capacity coupling to this wire, use a shielded cable between pack and set, and ground the shield. You can buy shielded automobile cable in most any garage.

Most of the parts used in this set were manufactured by the Hammerlund Company. The antenna coupling coil carries specification AC 17. The coil used for coupling between the screen grid tubes, is known as SG 17.

The variable condenser was one of the Hammerlund four gang battle ship type, connected with four Hammerlund Midget balancing condensers. As can be seen from the picture figure 40, these balancing condensers are mounted on the metal shield in the compartment with the tube and coil. It may be best to drill holes in the metal cover, immediately

# Screened Grid R. F. Unit

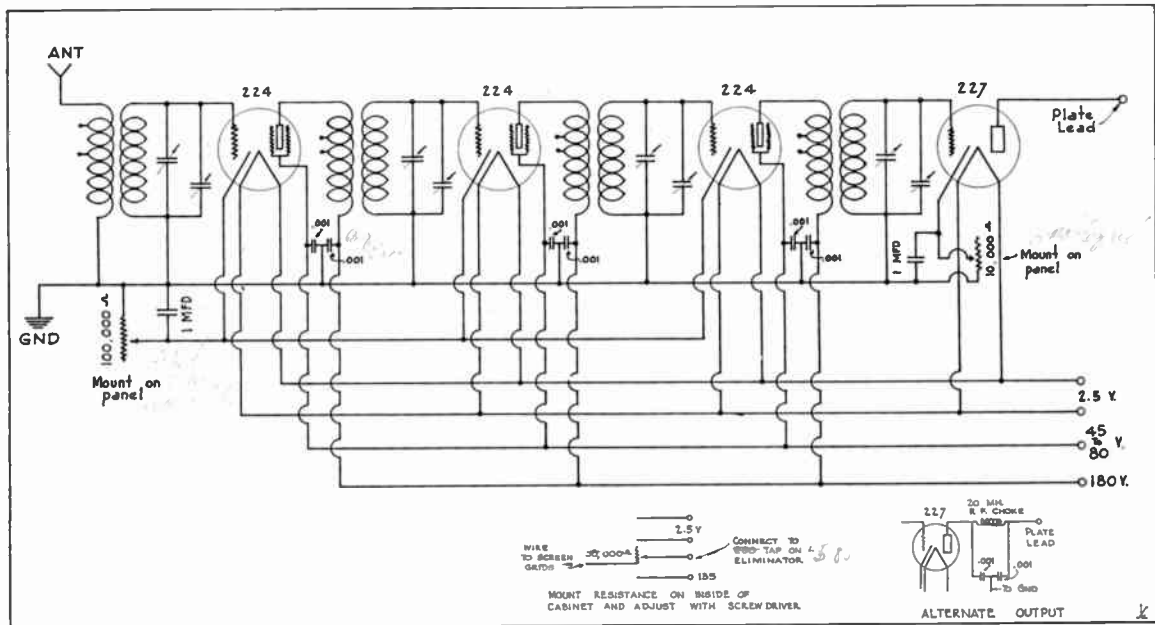


Fig. 41— Schematic drawing of screen grid R. F. chassis

above these midgits, as they should be adjusted with the shielding in place. This adjustment should be made with a fibre or wood screwdriver.

It was impossible for us to purchase shields ideally suited for the construction of this set, so we purchased some sheet aluminum and had these bent by a tinsmith. The completed unit is very compact and may be mounted either in a console or table model cabinet. It can also be used as an individual unit without any cabinet. The picture of this set, figure 40, shows the dial mounted directly on the shaft and the two variable resistances mounted through the shield in the condenser compartment. These resistances may be put in either of the two front tube compartments.

All of the filament leads should be run with number 18 wire, or larger, and each circuit should be run to the terminal block and connections made from this block to the power pack with number 14 wire. If this is not done a noticeable drop in voltage will result.

All of the wiring of the set can be done with rubber covered wire, but be sure to ream out the holes where the wires go through the metal shield, or the leads may become shorted. Most of the wiring can be run on the bottom of the sub-base. Keep all leads as short as possible, particularly the ones going from the coil to the control grid on the top of the screen grid tube. This set does not use grid condenser and leak, but grid bias detection, which is controlled by the 10,000 ohm variable resistance. It may be found that the set will oscillate when first hooked up, but after the adjustments are properly made, they may remain fixed for all ordinary purposes. If extreme efficiency is needed, they may be adjusted to bring in a louder signal. Our laboratory tests show this set can not be used with an extremely long aerial, and generally the only aerial necessary will be a short piece of wire placed around the room. In testing this set, we found we could bring in Chicago and Cincinnati with about ten feet of wire lay-



# Screened Grid R. F. Unit

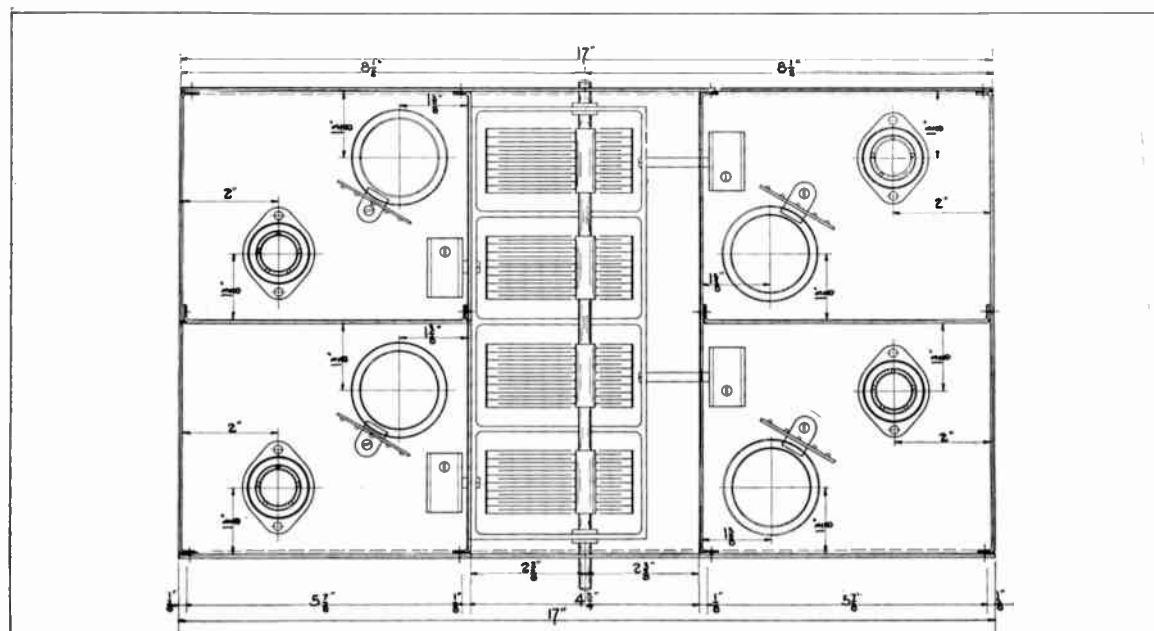


Fig. 42— Layout of parts for screen grid R. F. chassis

ing on the floor in a steel constructed building in down-town Detroit.

This set is very critical in operation, and care must be used in tuning, or you will pass by many stations. If set is hooked to a long

outside antenna, some cross talk will ~~not~~ be noticeable from nearby stations. The only correction for this, would be to design a band-pass filter as shown on the Silver-Marshall set, hook-up of which will be found on page 31.

## LIST OF PARTS FOR SCREEN GRID SET

- 1 Hammerlund 4 gang condenser
- 4 Hammerlund balancing condenser
- 3 Hammerlund S. G. 17 R. F. coils
- 1 Hammerlund A. C. 17 antenna coupler
- 4 5 volt sockets
- 1 Variable resistor 1,000 ohms
- 1 Variable resistor 10,000 ohms
- 2 1 Mfd. by-pass condensers
- 6 .001 Tinymold condensers
- 1 Terminal strip with binding posts
- Aluminum shields, as shown in Figure 43.
- Miscellaneous wire, bolts, nuts, etc.

# Screened Grid R. F. Unit

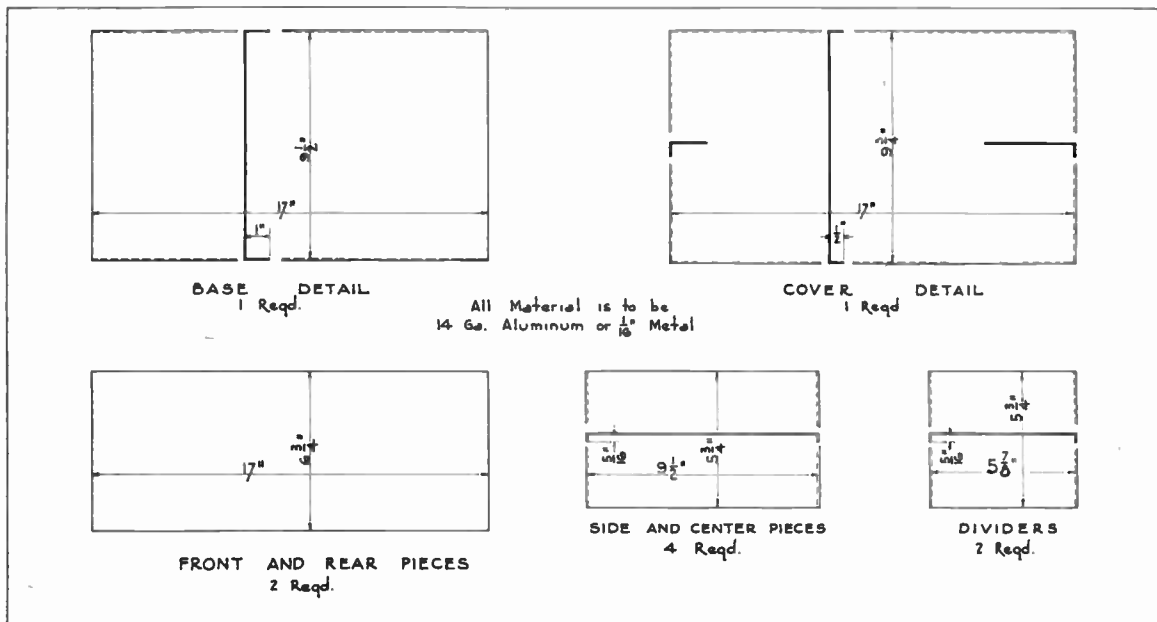


Fig. 43— Layout of shields for R. F. chassis

## SCREEN GRID R. F. UNIT

The shaft for the variable condenser will extend through both sides of the shield. When mounting this set in a console cabinet, a bakelite, or wood panel should be used. This panel should be large enough to cover up the cut-out in the front of the cabinet. If the cabinet in which the set is to be mounted is equipped with a front panel which does not already have the cut-out made, the only operation necessary will be the drilling of the holes for the condenser shaft and variable resistances.

Either one of two different types of dials can be used. If there is room in the cabinet to set the set away from the front panel, a pilot light dial put out by the Pilot Company, can be used. If the set must set up flush with the back of the cabinet, the shaft from the condenser should extend through the panel and be controlled by some type of Vernier panel dial. Several of these are available in either black or walnut finish.

If a wooden panel is used, it may be found necessary to mount the variable resistances outside of the metal cabinet and make connections with flexible leads. This will necessitate the running of a ground wire to one side of these resistances as well as the leads of the cathodes to the tubes. When these variables are mounted through the metal chassis, the ground connection is automatically taken care of.

The hook-up, figure 41, does not show a cut-off switch. This switch can either be inserted in the flexible cord, leading to the 245 power pack, or one side of this cord may be opened and additional connections made to an A. C. switch mounted on the panel, or the side of the cabinet. If using the set in a metal container without the use of a cabinet, or extra panel, it will be best to use the cut-off switch in the cord.

The leads from the set to the 245 power pack can be made through a four or five wire cable, although it is our advice to keep the plate lead from the detector tube, separate from the power leads. As stated previously, this lead should be run in armored cable, and the armor grounded.

With the ordinary console cabinet, room will be found in the speaker compartment for the 245 power pack. This may necessitate a different arrangement of parts than that shown in the directions for building this pack. Our laboratory sample which was sold to an executive of a broadcasting station and was installed in a cabinet with a speaker compartment, 21 1/2 inches wide, by 11 inches deep. A dynamic speaker was mounted in the center of this baseboard, and the transformers, sockets and condensers, were arranged around the outside edge. This made a very complete power pack and speaker unit.

# Dynamic Speakers

## ACCURATE DYNAMIC SPEAKERS

Among men who know the new Accurate Dynamic speaker, it is considered to be one of the best. The makers of this speaker have recently brought out a dynamic unit especially designed for replacement purposes, or for mounting in a console cabinet with a new set.

This speaker uses a 280 bulb, for rectifier, instead of the usual dry type unit. Bulb rectifiers have many advantages over dry units. Absolutely quiet operation and elimination of A. C. hum is possible as well as uniform response at all frequencies. A dry unit gradually loses its rectifying properties, and the speaker fails to produce uniform quality after it has been in use for some time. When a bulb type rectifier is used, uniform response is assured for practical the entire life of the tube. Servicemen and speaker owners sometimes experience difficulty in getting replacement dry rectifier units, where a 280 rectifier bulb is always available.

In addition to having proper design Accurate dynamic speakers are very carefully made. While visiting the Chicago Radio Show last June, the writer had the pleasure of visiting the Accurate factory. We were very favorably impressed with the exacting methods used for assembling and testing dynamic speaker units. All of these units are subject to intense sound and voltage break down tests, and final inspection includes actual comparison with a master unit which is at all times kept in perfect condition.

Different methods of connecting dynamic speakers to a radio set are shown in a little booklet put out by the Accurate Electric Company. Information given in this book will be of assistance to anyone who wishes to try out different arrangements to see which hook-up will give the best results.

The drawings specify 171-210 and 250 amplifiers tubes, the same arrangements can be applied if 245 tubes are used. The data given will apply to most makes of dynamic speakers. The following reprint is from the Accurate booklet.

### Baffles

In order to obtain satisfactory performance all Dynamic Speakers must be used with a suitable baffleboard. In the case of the Accurate table models and Console cabinet models, this baffle is automatically provided, however, when the unit only is to be used it must be mounted with a baffleboard.

A good baffleboard should be at least two feet square, and made of wood or wall board not less than  $\frac{3}{8}$  of an inch thick. The baffleboard should be of non-resonant material so that it will not vibrate and radiate sound when the unit is being operated. The opening in the baffleboard must be 9" in diameter. The unit should be mounted behind the baffleboard with the felt ring

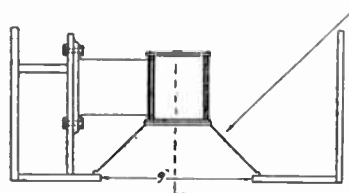


Fig. 44

# Dynamic Speakers

on the front of the cone housing pressed evenly and tightly against the board. The unit should be held in this position by screwing down the base to a shelf provided for that purpose as illustrated in Figure 44. It is not necessary or desirable to screw the cone housing itself to the baffleboard.

When the Accurate Speaker is installed in a Console cabinet, care must be taken to insure that it is properly baffled. When the grill opening is larger than 9", a baffleboard with a 9" hole should be placed behind the grill and the speaker unit mounted tightly against it.

Generally speaking, the larger the baffleboard the better the results obtainable. In any event the distance X, as illustrated in Figure 44, should be at least 2 ft.

## Input Connections

In any Dynamic Speaker the moving coil, or voice coil as it is commonly called, consists of a comparatively few turns of fine wire. The electrical characteristics of this coil are such that satisfactory results cannot be obtained by connecting it directly into the plate

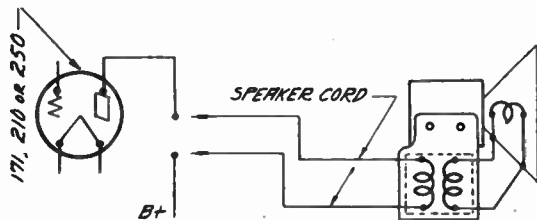


Fig. 45

circuit of the amplifier tube. For this reason a special input or impedance matching transformer must be used with all Dynamic Speakers.

In the case of all Accurate Speakers this transformer is provided as a part of the unit. It is sealed in a can and located directly under the field magnet. The trans-

former that we provide is so designed that it will give satisfactory results when the speaker is used with an amplifier system having a single 171, 210, or a 250 type tube in the last stage. When used under these conditions, connections should be made as illustrated in Figure 45.

Many radio sets now in use provide an output transformer in the plate circuit of the last audio tube for the purpose of matching the impedance of the average magnetic type speaker. When the speaker cord of an Accurate Dynamic is connected to the output terminals of a radio set providing such a transformer, the resulting circuit is that shown in Figure 46. In this case the voice current is going through two transformers between the plate circuit of the last audio tube, and the moving coil of the speaker unit. This arrangement may

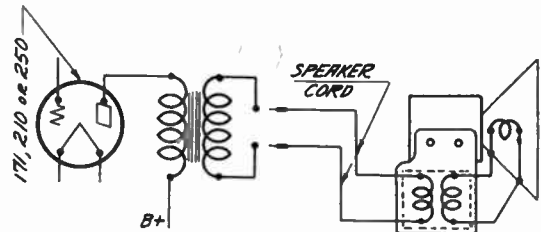


Fig. 46

or may not work well, depending on the characteristics of the output transformer provided in the set. In cases where satisfactory results are not obtained with a hook-up of this kind we recommend that the output transformer in the set be disconnected and the speaker cord tips connected directly into the plate circuit of the last tube, thus making the resultant circuit similar to that illustrated in Figure 45.

When the speaker is to be used with a push-pull audio frequency amplifier system, several different hook-ups are possible. Figure 47 illustrates the connection of the Accurate Speaker to a push-pull amplifier system provided with the usual type of push-pull output transformer. As in the case of the single tube provided with

# Dynamic Speakers

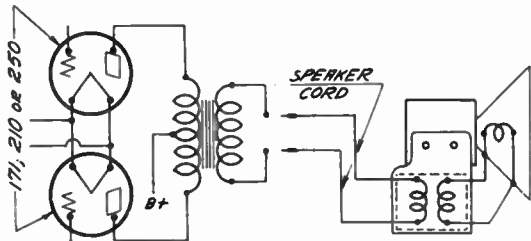


Fig. 47

an output transformer, this arrangement may or may not give satisfactory results, depending on the electrical characteristics of the transformer. In cases of this kind where satisfactory results are not obtained we recommend one of two alternatives.

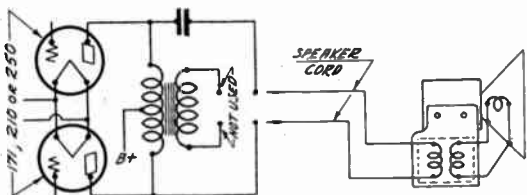


Fig. 48

The first is to neglect the secondary of the push-pull output transformer and use the primary as a push-pull output impedance as illustrated in Figure 48. The second alternative is to disconnect the speaker output transformer provided in the base of the speaker unit and to remove the output transformer in the audio amplifier and substitute for it a special Dynamic Speaker push-pull transformer. The connections for this arrangement are illustrated in Figure 49. Several manufacturers make push-pull transformers designed to work directly into the moving coil of a Dynamic Speaker. These can easily be obtained from most any dealer in radio parts. In ordering same, care should be taken

to specify the type of tubes to be used in the push-pull stage of the audio amplifier.

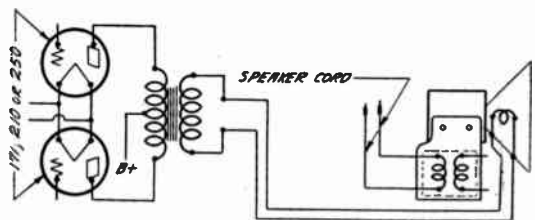


Fig. 49

The simplest and one of the most satisfactory arrangements for connecting an Accurate Speaker to a push-pull amplifier is to use an output impedance circuit. This is accomplished by means of a center tapped impedance unit and a 4 Mf. condenser as illustrated in Figure 50. This circuit is substantially the same as that shown in Figure 48, except that a special center tapped plate impedance is used instead of the primary of an ordinary push-pull audio transformer.

If the user has any doubt about which of the above mentioned circuits to use, or of the changes necessary in a radio set to obtain best results with a dynamic Speaker, a competent service man should be consulted. it.

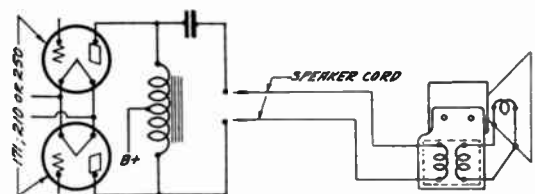


Fig. 50

# Choice and Operation of Radio Speakers

## CHOICE AND OPERATION OF RADIO SPEAKERS

Radio speakers in use today can be divided under three general headings, electro-magnetic, electro-static and electro-dynamic. Of the three, the electro-dynamic is the most popular at present, with the electro-magnetic as second. The electro-static speaker is just coming into use, but will become more and more popular as improvements are made, and the sets are adapted for their installation. At this point, we might say that the electro-static speaker, provides the most direct method known for converting electrical energy into sound. Its use is limited, due to the fact, that it has a peculiar design which requires a set or pack giving high potential between the plates of the speaker.

The electro-magnetic is one having permanent magnets. These use the same general principal of design as was first used in radio head-sets. They depend upon a permanent magnet for stress on the diaphragm or cone, and as it is true with all permanent horseshoe magnets, they lose their magnetism as time goes on and the speaker becomes weak and reproduction distorted.

The electro-dynamic speaker has a magnet which is energized by using a field coil connected to some outside source of current. The six volt type use either a storage battery, or a rectifying device similar to that used for charging batteries. The 90 volt type use either a special rectifying tube, or introduce the field coil as part of the filter circuit of the set.



Fig. 51— Magnetic type chassis

Information on the elimination of hum of the six volt type of speaker was given on page 8 of this book. A defective dynamic speaker is a hard piece of apparatus to repair, especially if the movable coil is scraping on the magnet. The clearance is measured in thousandth of an inch, and unless the proper tools are available for readjusting the cone, it is next to impossible for the service man to repair one of these which is out of line. If the movable coil shows an open circuit, this can sometimes be picked up and resoldered, but if the cone has become

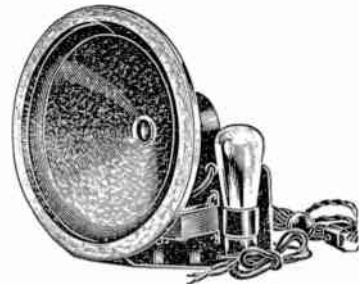


Fig. 52— Dynamic type chassis

bent, or otherwise warped, the speaker should be sent back to the factory for repair. There is one exception to the above statement, several dynamic speakers are designed so that the cone is centered by a bolt inserted in the magnet. When these get out of adjustment, a new cone assembly can be installed by the serviceman.

The choice of a radio speaker depends a great deal upon the set. The impedance of the speaker should match the output impedance of the set, and many times a magnetic speaker will sound better than a dynamic speaker, especially on a battery set, or on a electric set, having a single 171 output tube.

Another fact enters into the choice of a speaker, there is as much difference in the way different people hear, as there is in the way they see. Many times reception will sound good to one person, and it will upset the nervous system of another, so the service man, or salesman should demonstrate different types of speakers and sets, and sell the customer the one which appeals to his individual taste, even though he is convinced that the tone quality of another speaker is better.

# Push-Pull Power Amplifier Using 171 Type Tubes

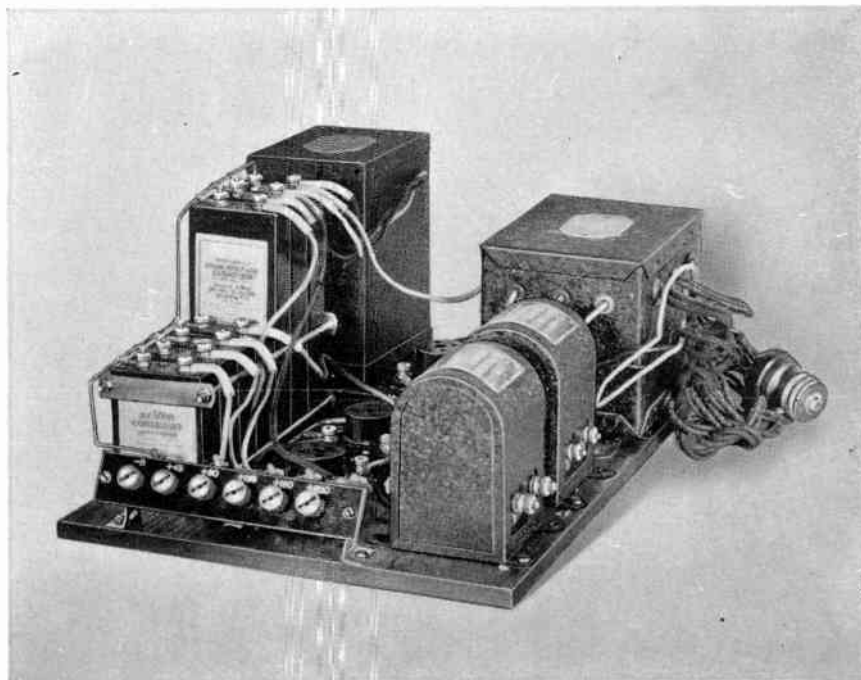


Fig. 53— Picture showing 171 Push-Pull power amplifier and "B" eliminator

The power pack shown above can be used in many different ways. It is an ideal unit for converting battery sets for A. C. operation, and can be used as an ABC pack for an all-electric set. The following pages of this book give directions for connecting this pack to various type of sets.

## DIRECTIONS FOR ASSEMBLY

Fig. 54 shows the location of the parts of the baseboard. When starting to build the pack, fasten all of the parts except the condenser block to the baseboard. Connections can then be made to the transformers and sockets without interference.

Before the transformers and choke coils are mounted, scrape or file the paint from one leg of each unit. A soldering lug should be placed under the wood screw which fastens this leg to the baseboard. These lugs can then be used for grounding these units to the negative "B" line.

After all the parts except the condensers are mounted, run a bus wire between all of these lugs and the negative ("B"—) end of the resistance strip; also fasten one side of the 1000

Ohm fixed resistance and the center tap of the high voltage transformer, to this wire.

It will be found best to use flexible leads for balance of wiring. These leads can be cut to length and soldering lugs attached before installation. Any necessary connections between flexible leads can be made under transformer, condenser or socket terminals.

All of the wiring to the 280 tube socket, the push-pull transformers and the 171 sockets can be made before condenser block is mounted. After the condensers have been fastened to the baseboard, complete wiring of the pack. Be sure to connect one side of all condensers to the GND., ("B"—) wire. Care must be taken not to short the leads from the other side of the condensers to the can containers. As can be seen from the laboratory model shown in Fig. 53, a short piece of rubber tubing can be used to avoid this trouble. If rubber tubing is not available, use large spaghetti or friction tape.

## TESTING

When pack is completely wired, insert a 280 tube in the socket and place a short piece of wire between "B"— and various "B"+ posts,

# Push-Pull Power Amplifier Using 171 Type Tubes

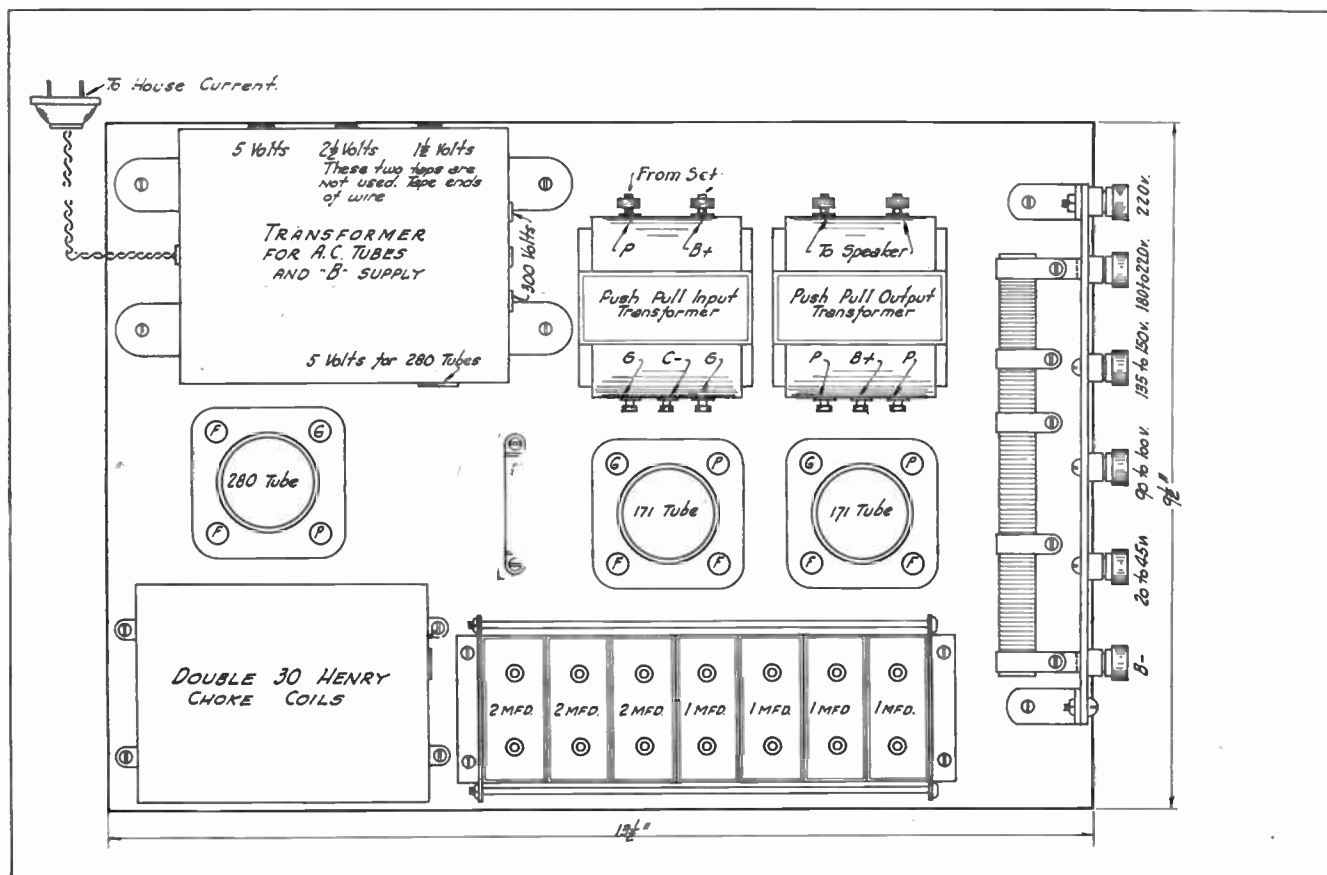


Fig. 54— Showing location of parts. Note size of base board

testing each one separately. A spark should result from this short circuit connection, getting larger as the voltage increases. Make only a momentary connection when making this test. If tube does not light or spark is not noticeable on all posts, something is wrong with the wiring, the resistance unit or a condenser is open or shorted.

## USE OF POWER PACK

The following pages of this book show different methods of using the 171 power pack.

## LIST OF PARTS

- 1—Dongan In-put Push-Pull Transformer.
- 1—Dongan Out-put Push-Pull Transformer.
- 1—Dongan ABC Transformer.
- 1—Dongan Double Choke Unit.
- 3—UX 4 Prong Sockets.

It can be used as a "B" eliminator, with the push-pull transformers or tubes or as a complete power amplifier in place of the last audio stage with any make or type of radio set.

Either 171, 112 or 210 tubes can be used in the push-pull sockets without changes in wiring. The 112 or 210 tubes will give louder signals due to the higher amplification constant. The  $1\frac{1}{2}$  and the  $2\frac{1}{2}$  volt tap on the ABC transformer will only be used when the pack is connected to a set using 226 or 227 type tubes.

- 1—Resistance and Binding Post Strip. Total ohms about 12,000 tapped for various "B" voltages.
- 3—2Mfd. Condensers 300 or 400 D. C. working volts.
- 4—1 Mfd. Condensers 180 to 200 D. C. working volts.
- 1—Fixed Resistance 1000 ohms.
- 1—Set Condenser Brackets (optional). Condensers can be mounted by several different methods.
- 1—Baseboard  $9\frac{1}{2}$  x  $13\frac{1}{2}$  inches.



# SPECIAL BLUE PRINT AND RADIO ENGINEERING SERVICE

*Merle Duston and Associated Radio Technicians maintain a thoroughly equipped testing and engineering laboratory, and can render any type of radio engineering service. Anyone wishing information regarding the design of any particular type of radio installation or apparatus, is invited to consult us regarding their problems. Prices of detailed drawings with special instructions will be quoted upon application.*

---

## BLUE PRINT SERVICE

We have on file, hook-ups of most commercial sets manufactured today, or which have been made in the past. Blue print copies from our laboratory tracings may be purchased for any of these hook-ups. We also have large size drawings of all hook-ups shown in this manual, as well as those given in the eight editions of our Radio Construction Book, and the two previous A. C. Manuals. Price of blue prints of any of these drawings are,

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Radio service is rendered on any type of receiving set. These may either be sent or brought into our laboratory, and will be repaired, or rebuilt. If requested, we will quote price before work is started.

Anyone wishing engineering service on the construction of sets shown in this book, or other custom built sets are invited to write us. Price for this service will be fifty cents per our typewritten page. Be sure to give all details regarding condition of tubes, batteries and installation.

**MERLE DUSTON**

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**Associated Radio Technicians**

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**Detroit, Mich.**

# Push-Pull Power Amplifier Using 171 Type Tubes

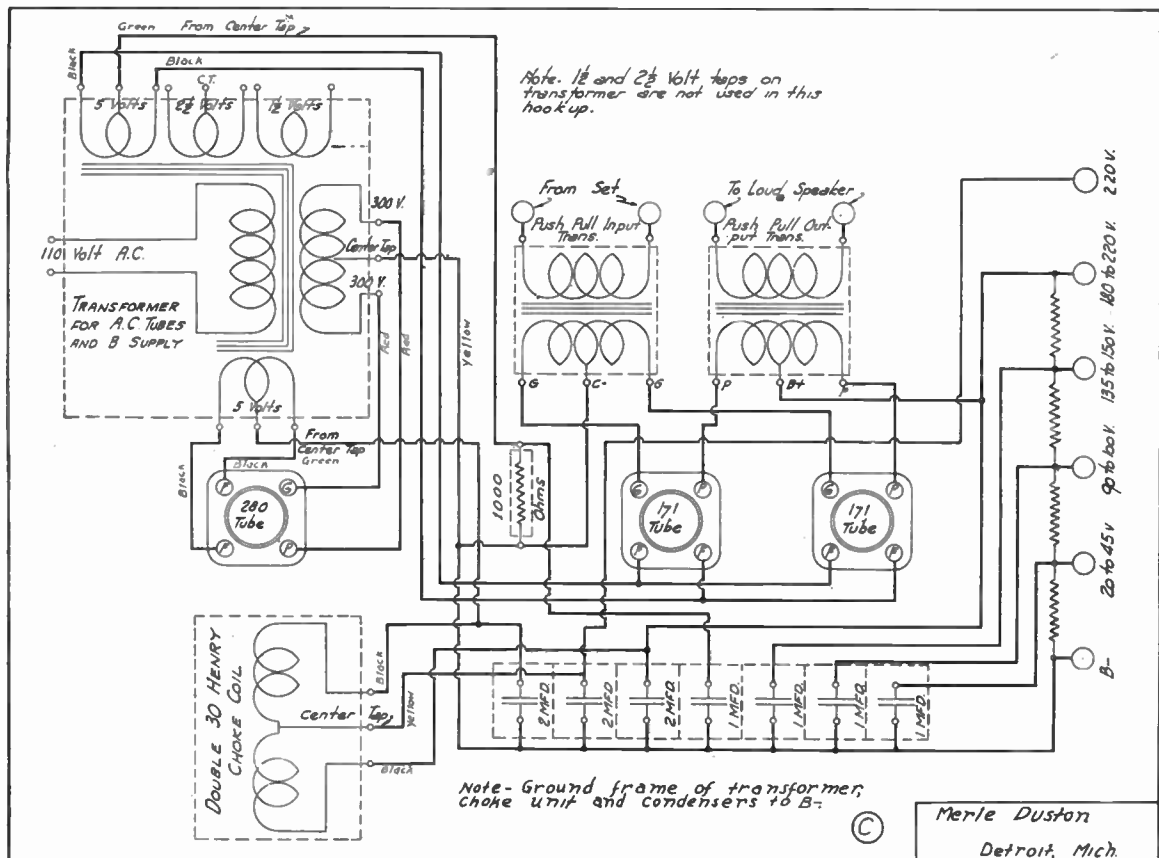


Fig. 55— Outline drawing of 171 push-pull amplifier

## Converting Battery Sets Using 171 Power Pack

As stated previously, the power pack shown on pages 52 and 53, is an ideal unit to use for converting battery sets for A. C. operation.

A very small percentage of sets cannot be changed over. For instance, it is hard to change over any type of reflex set or a shielded set where the wiring is inaccessible.

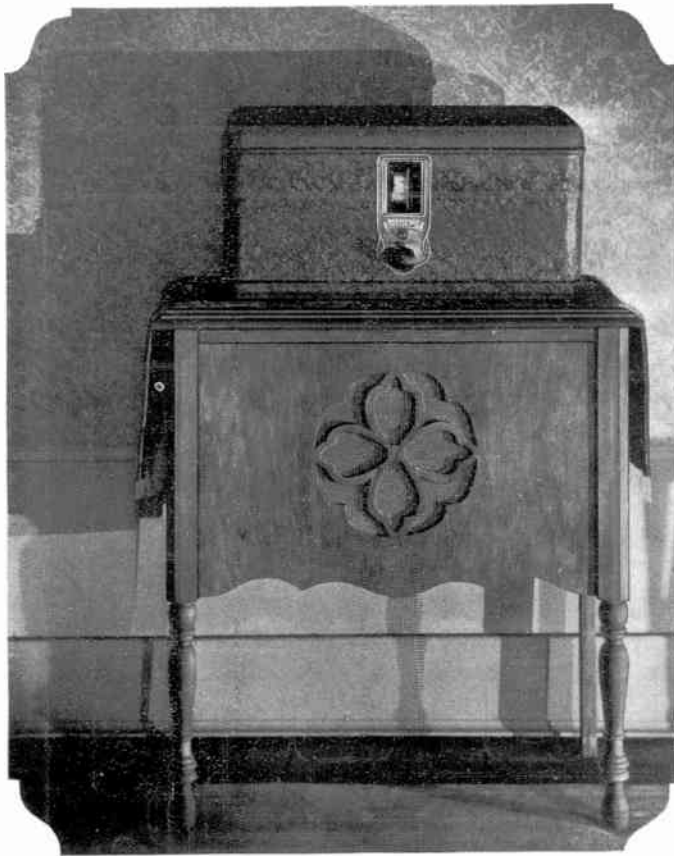
### DIRECTIONS FOR RE-WIRING AND CONNECTING TO SET

The method herewith described, has been used successfully with any number of four, five

and six tube radio frequency sets and with four and five tube Browning-Drake or Diamond of the Air receivers. The three tube three circuit regenerative receiver has also been successfully electrified by this method.

The hook-up shown in Fig. 56, gives a four tube T. R. F. circuit, showing filament connections to the tubes. This hook-up can be followed for sets using four to six tubes, with or without regeneration. The last audio stage is always omitted.

Before starting to rewire set, be sure to study the wiring as many leads can remain just as they are.



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This cabinet is made of selected gum wood, highly finished in dark walnut which will match the furniture of the average home. The console is 38 in. high, 24½ in. wide, and 15½ in. deep. The set compartment is arranged to fit ninety per cent of the sets on the market.

Equal in value to most cabinets selling for twice of the price asked for them in the Kresge stores.

## Set and Speaker Table

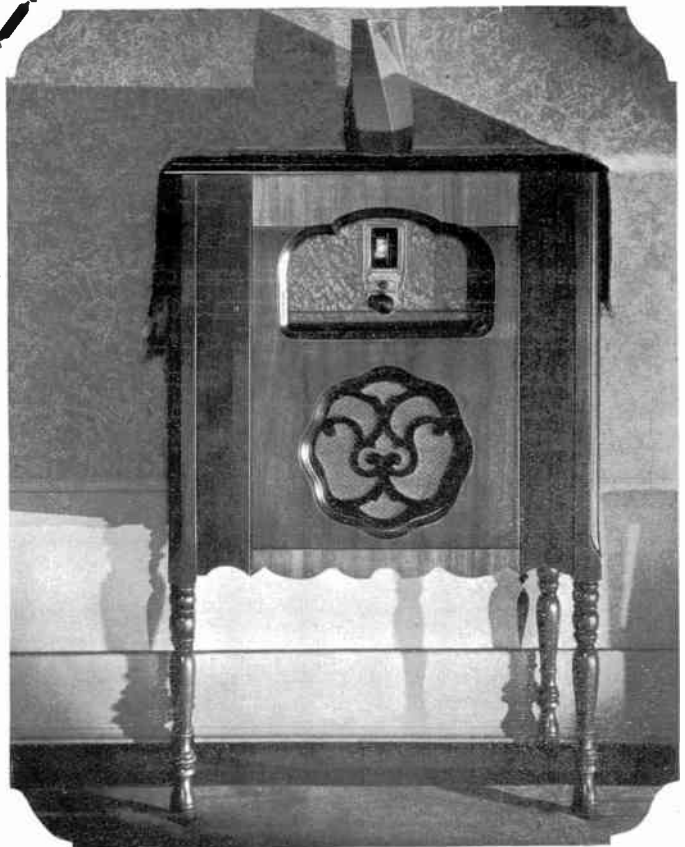
This radio table is made of selected gum wood and has dark walnut finish. It is sold knocked down, and can be assembled by anyone in two minutes time. Very sturdy in construction for a table of this type. Has speaker and battery compartment, so can be used with either a battery or electric table model set.

The size is 27½ in. high, 24½ in. wide, and 15½ in. deep.

**PRICE  
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LESS SET AND SPEAKER

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# Push-Pull Power Amplifier Using 171 Type Tubes

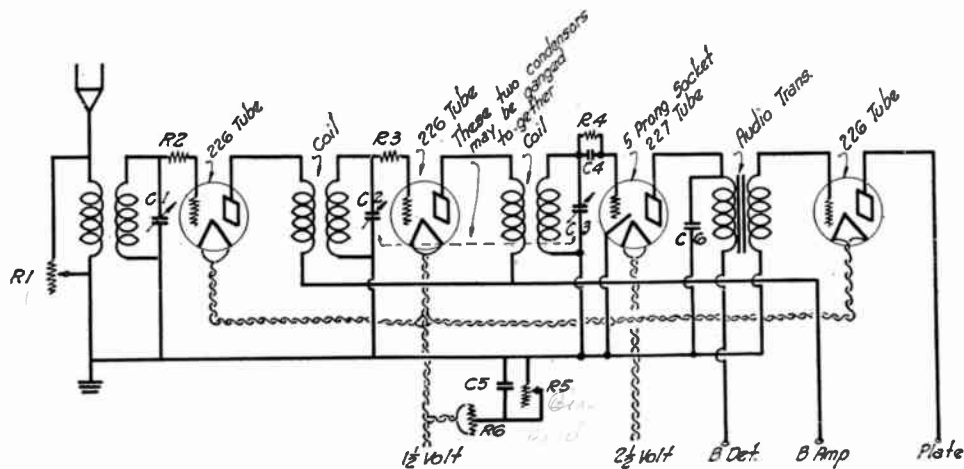


Fig. 56— Schematic drawing showing changes in wiring of set

Next disconnect all filament wiring. Mount five-hole detector socket in place of the present detector socket. Connect the "B" Neg. ("B"—) battery post to the ground and see that the rotors of all variable tuning condensers are connected to the same wire. Take out all "C" battery wiring and then connect the A— posts on the audio transformers to the B— ground wire. Next wire in the filaments as shown in Fig. 56. Use No. 16 rubber-covered wire similar to lamp cord for all of the filament leads. The leads can be connected to the binding posts or run direct to the leads of the power transformer which is a part of the

power pack.

The method of using the "C" basis on the 226 tubes, is by a drop of "B" voltage through the resistance R5. This resistance, as well as the resistance R1, should be mounted on the panel in place of the filament rheostats. They will serve as a voltage and oscillation controls.

If the set and the power pack are to be disconnected from the 110 volt line by a switch on the panel of the set, cut this in series with the cord to transformer. Be sure to use an approved A. C. switch for this purpose and use regular lamp cord for all 110 volt wiring. A

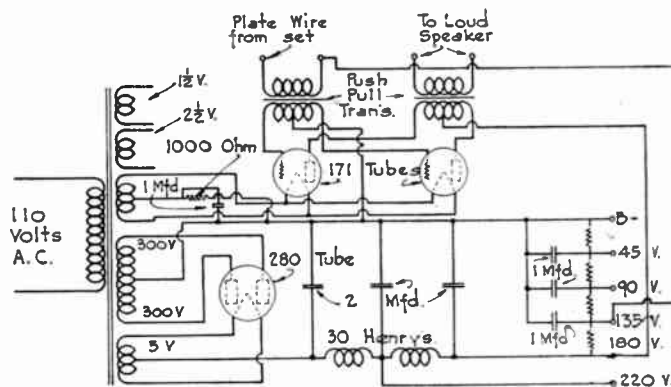


Fig. 57—Schematic Drawing of 171 Push-Pull Power Pack

# METALLIZED RESISTORS and POWER UNITS

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Each succeeding year, more and more of the important manufacturers of radio receivers; professional radio mechanics and engineers; and the radio fans who build their own sets, are standardizing on Metallized, the resistances which are recognized for their dependability, accuracy of rating and long period of uninterrupted service.

Anyone can cut his factory costs by a fraction in cutting the costs of resistances, but the difference is so small that you may as well have Metallized. They are cheap insurance against imperfect performance and dissatisfaction. That is why all radio departments of S. S. Kresge carry Metallized Resistors.

**International Resistance Co.**  
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*Metallized Resistors and Power Units are available for every practical resistance purpose in radio and television circuits, 500 to 200,000 ohms in power types; 1 to 100 Megohms in resistor types; ratings for all limited power requirements; standard, pigtail or special tips.*

# Push-Pull Power Amplifier Using 171 Type Tubes

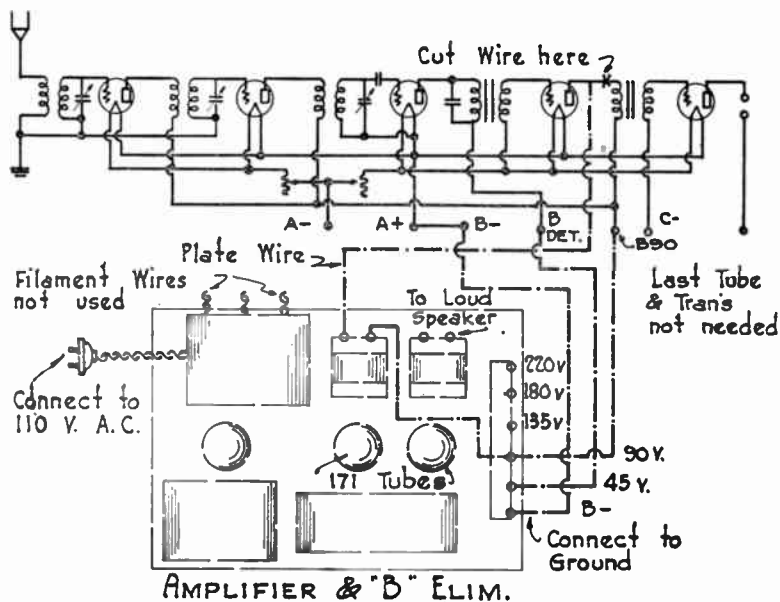


Fig. 58— Connecting set to power pack

simpler method is to insert a cut-off switch in series on one side of the cord fastened to the power pack, or the power pack can be discontinued at the 110 volt socket. If the set being rewired has proper balancing arrangements, the resistances R2 and R3 will not be necessary. They should always be installed if other methods of oscillation control fail to produce the right results.

Do not install the power pack more than four feet from the set proper.

Always use twisted rubber-covered wire for filament wiring in the set and for connecting filament leads between power pack and set.

The center tap resistance R6 may be either fixed or variable. If one of the small fixed type is used it should be mounted across the

filament terminals of one of the 226 tube socket. If a variable resistance is used, mount through the sub-base. A variable resistance will have to be adjusted to the point where the A. C. hum is least noticeable. It can then remain fixed.

Any type of good aerial or ground can be used. In certain locations it was found that the set would work best with the ground alone, connected to the aerial binding post. In fact, the first experimental model built up received KFI, Los Angeles, from Detroit, with no other connection than the ground wire. If the set tunes broad, try inserting a .00025 condenser in series with the aerial wire. Also try using a short antenna and different size grid leaks 1/10 to 2 Megohm.

## LIST OF EXTRA PARTS

Additional parts necessary for rewiring a set are:

R5 1-2000 ohm variable resistance.

R1 1-1000 ohm variable resistance.

C5 1-2mf. 300 volt fixed condenser.

R6 1-30 or 50 ohm center tapped resistance.

1-5-hole socket for 227 tube.

R2 and R3 2-1000 ohm grid resistance.

Necessary bolts, nuts, wire, etc.

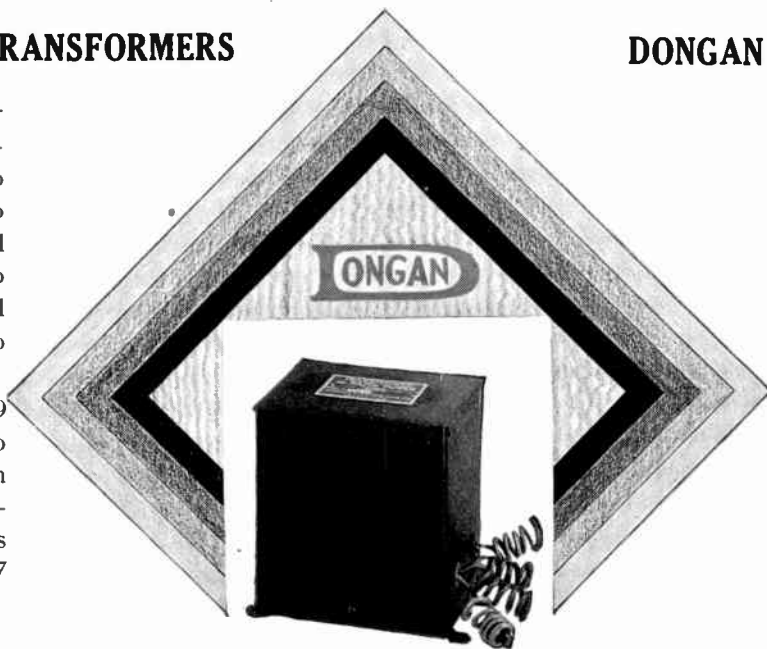
# WHEN YOU NEED POWER

BUILD A 250 AMPLIFIER WITH DONGAN PARTS

## DONGAN TRANSFORMERS

No. 7568 for full wave rectifier using two—281 tubes to supply "B" and "C" power to receiver and power for two—250 tubes.

Spec. No. 8529 similar to above but with two low voltage windings for 226 and 227 tubes.



## DONGAN PARTS

Spec. No. 6551 double choke unit.

Spec. No. D600 power amplifier condenser unit.

Spec. No. D307. A condenser used in connection with D600.

Spec. No. 1177 Straight output transformer.

Spec. No. 1176 Same as above but of push-pull type.

## DONGAN ELECTRIC MANUFACTURING COMPANY

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**TRANSFORMERS of MERIT for FIFTEEN YEARS**

# YANKEE TEST METERS



### PLUG-IN TYPE

Plug-in type test meters may be purchased in the following sizes:

0 to 300 volts D. C.

0 to 8 volts A. C.

0 to 150 volts A. C.

5 prong adaptor for either of the first two meters.

FOR SERVICE MAN

OR

SET OWNER

A SIZE FOR EVERY

PURPOSE

FOR SALE BY



### POCKET TYPE

Pocket type Yankee meters may be purchased in the following sizes:

0-50 Ammeter 5-50 Voltmeter.

0-50 Voltmeter.

**S. S. Kresge 25c to \$1.00 Green Front Stores**

# Using 171 Push-Pull Power Amplifier with Battery Operated Set

*Fig 58*

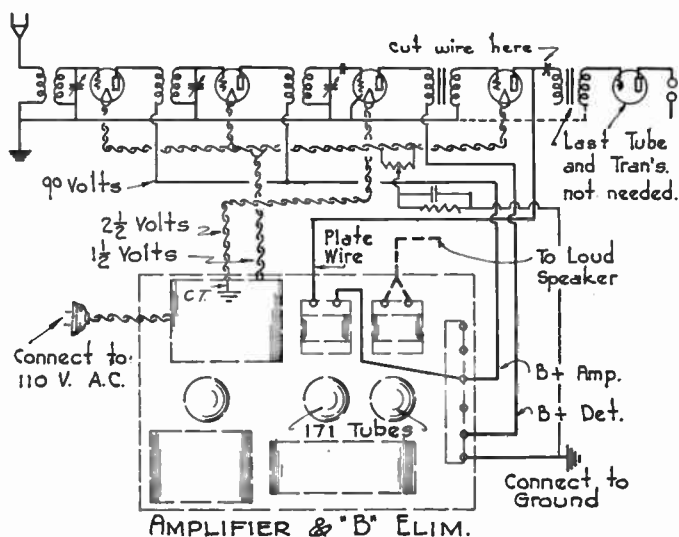


Fig. 59— Proper method of connecting power pack to battery set

*see page 57*

Many times a set owner will have a battery operated receiver which will give him distance and selectivity but not the quality which can be had with the newer type of A. C. sets.

The power pack described on pages 52 and 53 can be used with this type of battery operated set without changing the wiring in any way except to run a lead from the plate terminal of the first audio tube to the input transformer on the power pack.

The regular standard "A" battery and storage battery tubes should be used but the "B" supply will be furnished by the power pack.

When this combination is used, new A. C. tubes will not have to be purchased and if the set owner has two 112 or two 171 power tubes, these may be used in the push-pull sockets of the pack.

If the "B" load of the set is not over 15 Mils, the power pack will deliver over 200 volts to the push-pull tubes. Filaments of these tubes will be connected direct to the A.C. transformer.

Wonderful quality can be expected of this combination when connected to a good speaker.

The power pack will eliminate "B" and "C" batteries, as well as the last tube in the set. This will mean that in the case of a five tube set only four will be using current from the "A" battery. The 1 1/2 and 2 1/2 volt taps on the transformer will not be used and these wires should be taped separately.

When through using the set, be sure to disconnect power pack from 110 volt house current. A regular automatic control switch can be used for this purpose, or it can be disconnected at the socket.



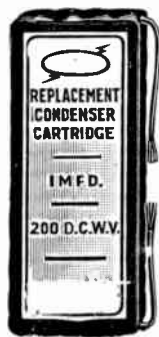
# ACCURATE BRAND RADIO PRODUCTS

"ACCURATE BRAND" Radio Products are made especially for the S. S. Kresge Company by one of the largest parts manufacturers in the country, they are thoroughly guaranteed in every way and are used by hundred of thousands of radio set builders and servicemen.

"ACCURATE BRAND" condensers are made by the latest manufacturing methods and their stamped rated voltage is more conservative than that used by most manufacturers. This means that you can depend on these condensers to stand up if used on voltages which do not exceed their rated capacity.

## Replacement Condenser Cartridges

For Repairing Condenser Blocks



Accurate Brand Condenser Cartridges are simply regular Filter and By-Pass Condenser Windings with 6" flexible rubber covered leads and doubly sealed in a special compound instead of being placed in cans. Their use makes it unnecessary for the service man to replace a complete condenser block or return to the factory for repairs. Very often it is not even necessary to remove the blown-out cartridge, but just disconnect it and connect a Muter cartridge in its place. A small investment in these Condenser Cartridges enables the service man to repair almost any condenser block in an A-C Set or a B Eliminator, or to assemble a complete new block if necessary.

ables the service man to repair almost any condenser block in an A-C Set or a B Eliminator, or to assemble a complete new block if necessary.

CAN BE HAD IN FOLLOWING SIZES

- 1 MFD—200 DC Working Volts
- 1 MFD—400 DC Working Volts
- 1 MFD—600 DC Working Volts

## CONDENSERS



Accurate Paper Condensers are produced in accordance with the highest standards of equipment and supervision that it is possible to obtain. They are of the externally wound non-inductive type which are most efficient. The very finest quality of linen condenser tissue and foil is used. The windings are vacuum dried and vacuum impregnated in paraffin. While the winding and im-pregnating methods we employ are the most expensive to follow, the finished condenser has a longer life and is capable of successfully withstanding higher voltages than the conservative ratings given below.

SOLD IN FOLLOWING SIZES

- 1 MF—200 Volt—2 MF. 200 Volt.
- 1 MF—400 Volt—2 MF. 400 Volt.
- 1 MF—600 Volt.

## DEPENDABLE B POWER UNITS



Fixed controls are used with separate fixed voltage taps, giving ample range as well as enabling the consumer to definitely know the voltage he is getting.

A wire wound fixed resistance unit supplies ample taps to meet all conditions giving a definite, permanent constant voltage at each tap.

**Specifications**—Size 6½ in. wide, 7 in. high, 8½ in. long. Highly finished enameled metal case with Bakelite front panel and insulated binding posts.

## Accurate Tinymold Condenser



Made of mica and foil electrodes, completely encased in a Bakelite mould 1¼" long, ¾" wide, ¼" thick. Flexible soldering lugs with 6/32 clearance holes are embedded in the Bakelite mould, the distance from center to center being 1⅞". Capacities are plainly stamped on the soldering lugs.

CAN BE HAD IN FOLLOWING SIZES

- 1/10-¼-½-1-2-3-4-5-10 Megohms.

FOR SALE BY ALL

**S. S. KRESGE**

**25c to \$1.00 Green Front Stores**

# A. C. "B" Eliminators

Hook-ups for two different types of "B" Eliminators are shown on this page. One of these eliminators is constructed so as to use the 280 rectifier tube and the other to use a gaseous tube of the 85 or 125 Mil type.

The general lay-out of parts can be the same for either hook-up. The only change in the list of parts will be the addition of the 2 1/10 Mfd. buffer condensers which are added to the 85 Mil eliminator. The high voltage transformer can be the same in either case, except that the 5 volt secondary winding is not used with the B-H tube. Fig. 61 gives a Schematic drawing of the 280 "B" eliminator.

Either one of these "B" eliminators should furnish sufficient voltage for five to seven tubes. The 220 volt tap will only be used when the eliminator is connected to an A. C. set, or to a battery operated set where the grid bias for 171 tube is taken from the eliminator.

When used in this way, connect the "B" negative terminal on the set to the 45 volt binding post, the detector to the 90 volt tap, the 135 volt, and the power tap to the 220 volt. Then connect the "A" minus post on the last audio transformer to the "B" negative post of the eliminator.

## LIST OF PARTS

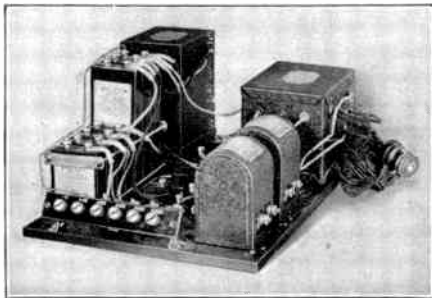


Fig. 60— Drawing of "B" eliminator using 280 tube

- 1—Dongan "B" Transformer.
- 1—Dongan Double Choke Unit.
- 3—2 Mfd. Condensers 180 to 200 D. C. Working volts.
- 3—1 Mfd. Condensers 180 to 300 D. C. working volts.
- 1—Set of Condenser Brackets (optional).
- 1—Tapped Resistance and Binding Strip (total resistance not to be under 12,000 Ohms).
- 1—UX Socket.
- 1—Wood Sub Board 6 1/2 x 13 inch.
- Miscellaneous lugs, wire, etc.
- 2—1/10 Mfd. Condenser. (For Fig. 26 only.)

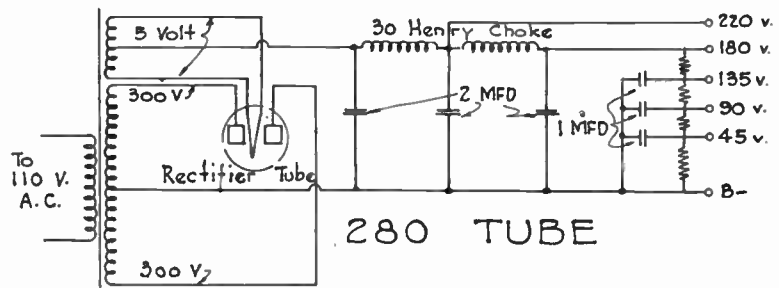


Fig. 61— Schematic drawing of 280 type "B" eliminator

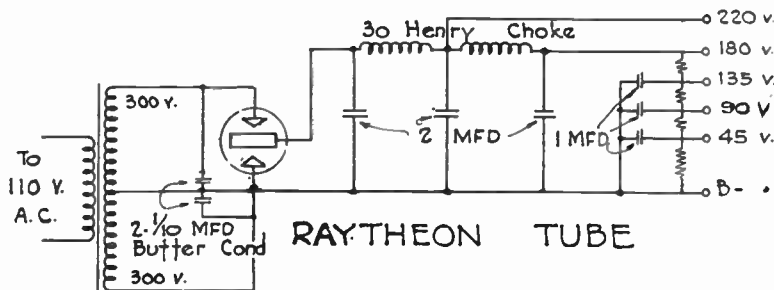


Fig. 62— Drawing showing 85 Mil B-H tube

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A. C. and D. C. Types  
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## S. S. KRESGE STORES

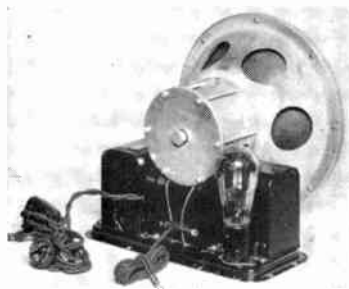
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*That Old Magnetic Speaker or That Out-Dated Dynamic  
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# ACCURATE



Accurate presents the new idea for old sets—a replacement speaker which brings your set up-to-date, and gives it a marvelous, rich tone. You will be amazed at its quiet, humless operation, its freedom from excessive “drumming” on low notes, and its live, natural tone.

You can have the Accurate, as shown at the left, to place in your cabinet, or to mount in either of the cabinets advertised elsewhere in this book. Prices are remarkably low for this outstanding speaker.

A. C. or D. C. MODELS FOR SALE AT  
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CHICAGO, ILL.



## AUDIO AND PUSH-PULL TRANSFORMERS

Dongan transformers are not only accepted as the standard by radio set builders, and servicemen, but they are also being used by many large manufacturers of commercially built radio receivers. Dongan transformers are properly engineered and made from the finest materials procurable. When in need of anything of the transformer line, insist on Dongan.

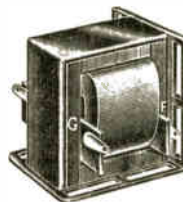
### DONGAN DIATONIK



THE SUPER  
AUDIO  
TRANSFORMER

It is no exaggeration to designate Dongan Diatonik as a Super Audio Transformer. Embodying every feature of the latest approved design and built to the highest quality standard, both volume and tone purity reach their maximum in receivers built up with these transformers. A moisture-proof sealed case is an additional feature of this transformer. Can be had in in-put and out-put combinations as well as straight 3 to 1 audio. Spec. Nos. 2128, 2129, 2130, and 2131.

### DONGAN REPLACEMENT TRANSFORMER



COMPACT IN DESIGN  
HIGH QUALITY  
PERFORMANCE  
LOW IN PRICE

The transformer shown above was designed especially for replacement purposes. The unique mounting bracket is arranged so that it can be held in place by the mounting screws used for the defective transformer which it is to replace. Next time you need a replacement transformer, insist on one made by Dongan. Spec. No. 3177.

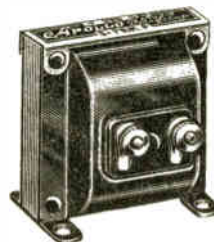
### DONGAN SUPREME A. F. TRANSFORMERS



THE BEST  
IN THE  
MEDIUM PRICE  
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The Dongan Supreme Audio Transformer has an exceptional tonal fidelity, and is a fit companion for its larger brother the Diatonik. This transformer has the same general appearance as the Diatonik, except that it is smaller in size. It uses a somewhat lighter coil and core, but makes an exceptional buy for the medium transformer that it is.

### DONGAN APOLLO A. F. TRANSFORMERS



JUST THE THING  
FOR THAT  
INEXPENSIVE  
SET

One of the most constant performers in the Dongan line, the Apollo is a sturdy, inexpensive transformer.

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