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RADIO WORLD

REG. U.S. PAT. OFF.

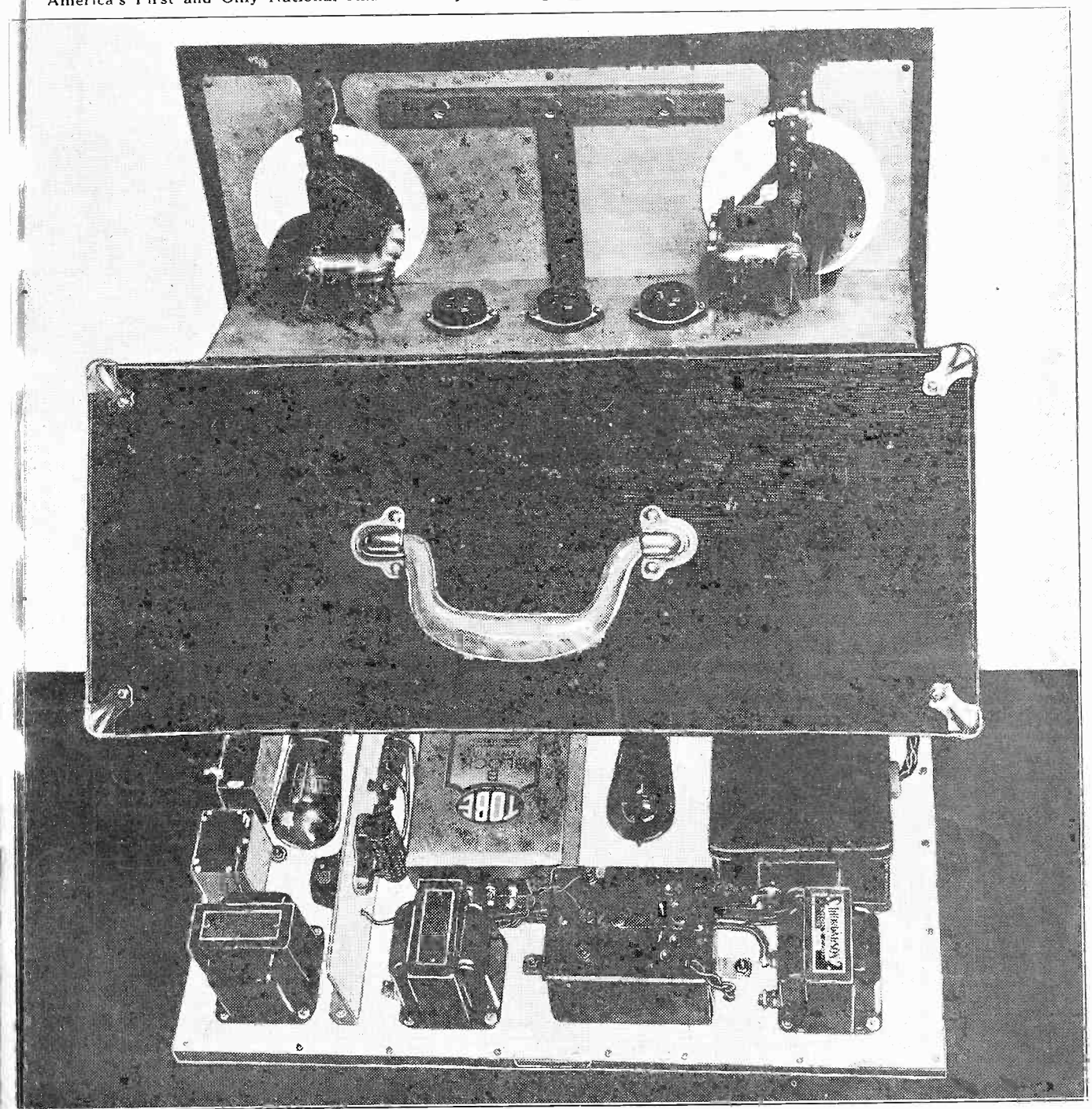
America's First and Only National Radio Weekly

The Lynch Five, All Aboard Deck

The 7-Tube Thompson

The Way of a 3-Foot Cone

Tone Quality Moves Up a Peg



LEO FENWAY'S MASTER CRAFTSMANSHIP IS OBVIOUS IN THIS, HIS NEWEST CREATION, A RECEIVER AND FULL AC POWER SUPPLY, ALL IN ONE CASE. SEE PAGE 3 FOR HIS ARTICLE.

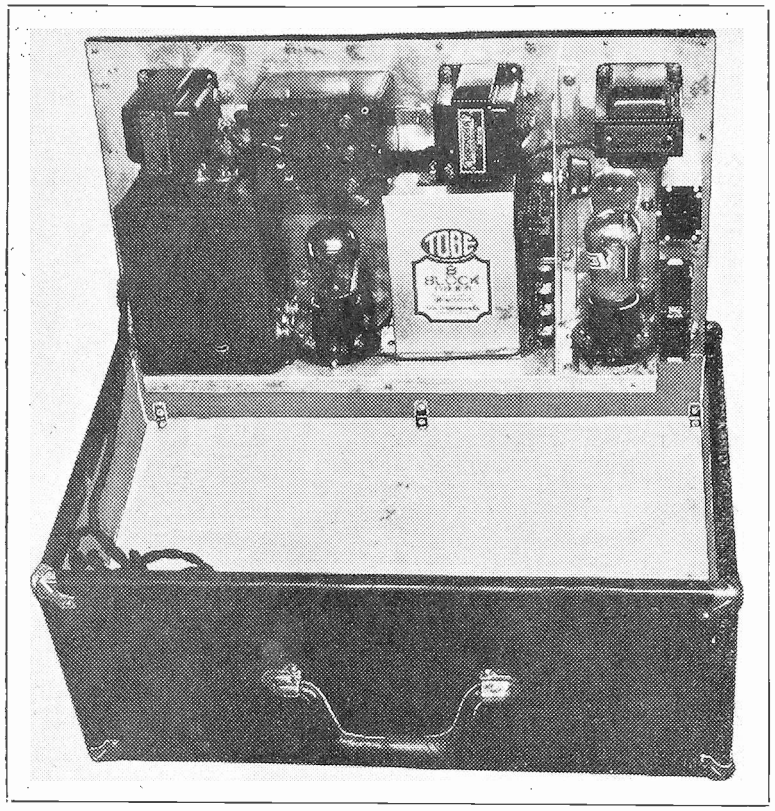


FIG. 2.

The kitchen table mechanic can buy radio parts now with the same confidence with which he buys his onions, and know them fully as well.

Can Select Good AC Tube

He may even select for his set an AC tube which has been established through years of outstanding service. This tube is the Kellogg, or more familiarly known as the McCullough. You may or may not know that a few years ago McCullough applied his inspired brain to the problem of AC tubes and solved it. He gave the world a type of tube which it had sought since the early days of radio, but, like the song of other days, after they (the world) got what they wanted they didn't want it. At least a large number of set builders picked up smatterings of half-baked opinions about the shortcomings of these AC tubes and decided to let them alone. The McCullough was almost forgotten. Still, the idea of the tube was so good that it has ever remained the same—to operate from the AC house lighting circuit through the use of a Concertrolastat, or similar step-down transformer, thereby eliminating the necessity of the A battery as a source of filament supply. And what is said of the operator of the McCullough tube applies to the Sovereign tube, which has the same requirements and the same characteristics.

The writer has been experimenting with these tubes since 1925. He firmly believes that they have outgrown the experimental laboratory stage and entered the phase of commercial utility.

The Thordarson Compact

Another example of craftsmanship in radio instruments is the Thordarson 171 power compact. This outfit consists of a plate transformer, two choke coils and necessary buffer condensers, and can be wired into the Concertrola in from one to two hours, with practically no radio knowledge nor engineering skill. The exact position for this compact is clearly emphasized in Fig. 2. Any deviation from the specified arrangement of this unit may result in a buzz or hum, after the set is completely wired.

Radio improves with age. So do audio transformers. Pages could be written about audio transformers. A simple expression, showing the amplification ratio of a tube and an audio transformer, settles the point as to the type of audio channel best suited to the Electric Concertrola.

The expression is this:

$$\frac{\mu NZ}{R+Z}$$

Where μ is the amplification factor of the tube, Z the primary impedance of the transformer (this applies to all forms of audio amplifiers), R the internal impedance of the tube, and N is the effective transformation ratio of the transformer. Now, then, if, at a given frequency, the tube impedance R equals the transformer impedance Z, the expression for amplification becomes $\frac{1}{2}\mu N$. On the other hand, the greater the transformer impedance Z the more nearly does the expression become equal to μN.

Transformer Choice

So, the professional set builder, at least, can gather that the greater the transformer impedance, the greater the amplification ratio, and to choose a transformer of lower impedance to match the impedance of the tube merely results in poor amplification. Therefore, in order to get the best results from the Concertrola we had to choose a transformer of very high impedance, and, seeing that transformer impedance varies with frequency while tube impedance is practically unaffected by frequency, we had to choose a transformer which has high amplification at low frequency, say 100, otherwise the deep, low tones, which are characteristic of the Concertrola, would have been reproduced unsatisfactorily.

Ferranti transformers, type AF3, were chosen because they answered all requirements. At 100 periods these transformers have an impedance of 50,000

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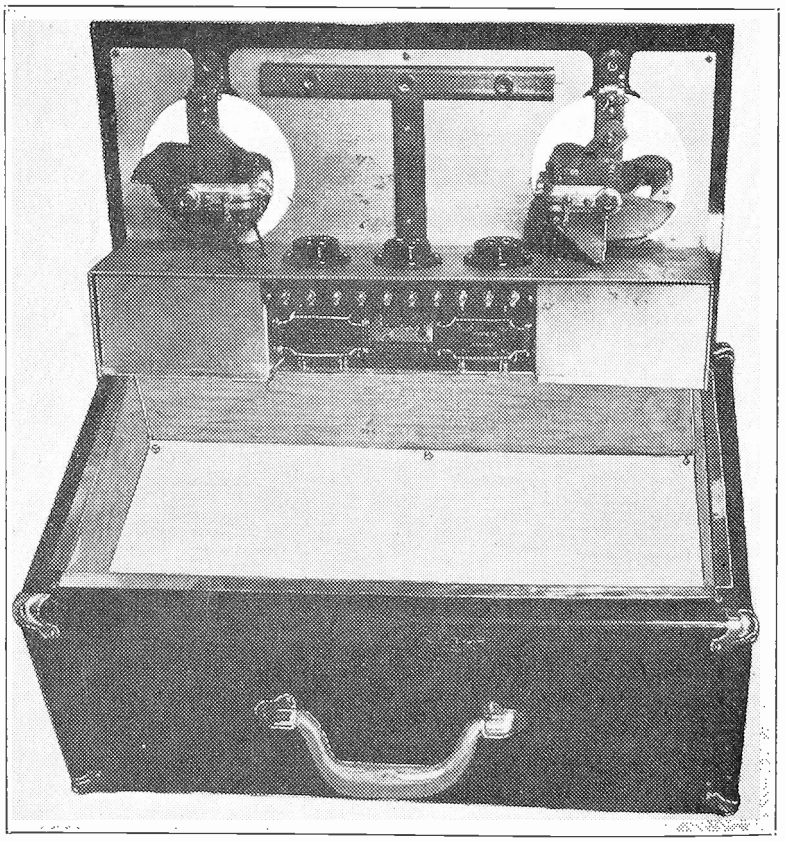


FIG. 3

Radio Builds New Mansions On Quality Street

By J. E. Anderson

Contributing Editor; Consulting Engineer

Attention Newly Directed to Effect of Phase Shift on Timbre, While Amplitude and Wave form Distortion Are Watched as Carefully as Ever

THERE are many factors in radio which affect the quality of the reproduced signal. Some of these factors are almost wholly within the control of the designer. Others are beyond his means at present. Those which cannot be controlled easily at present are those which work in opposition to each other. The best the engineers can do is to effect the best possible compromise between the opposing factors.

There are three main forms of distortion which must be minimized in designing broadcast equipment. These are (1) amplitude distortion; (2), wave form distortion; and (3), phase shift distortion

In amplitude distortion the signals of certain frequencies are brought out more strongly than others, and some are almost completely suppressed. In wave form distortion the signal as reproduced is not of the same harmonic composition as the original. In phase shift distortion the harmonic components of signal frequencies do not bear the same time relationship to each other in the reproduced signal as in the original.

Sources of Amplitude Distortion

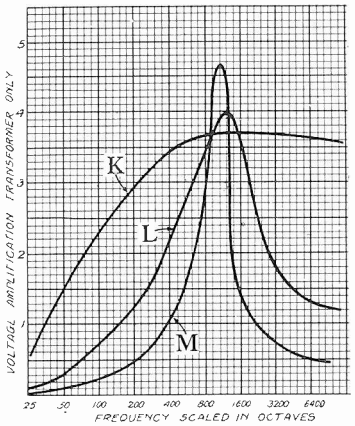
Amplitude distortion is introduced by inductive and capacitive reactances in the system. Wave form distortion is introduced by overloading of tubes and transformer cores. Phase shift distortion is introduced by reactances and resistances.

It is difficult to say which of the three is the most ruinous to quality but it would seem that wave form distortion is. The human ear is much more sensitive to timbre in music than to intensity. Amplitude distortion changes the intensity at different frequencies; wave form distortion changes the timbre. Phase shift distortion has been regarded as negligible but that is by no means certain. Relative phase shift between the fundamental and its harmonics is equivalent to a wave form distortion and if the circuit is such that the wave resulting from the phase shift is also distorted, the reproduced signal may be radically different from the original.

The first thing in a receiver that introduces amplitude distortion is the selectivity of the tuner. It favors the low notes and suppresses the high. In some of the more selective receivers this distortion is very serious. In moderately selective receivers it is negligible. The amplitude distortion from this cause is greater at the lower broadcast frequencies than at the higher.

The Detector's Effect

Another source of amplitude distortion is the detector, when the grid condenser and leak method is used. This also favors the lower notes better than the higher and in effect is like too high selectivity. The detector detects the low better than the high. This effect is not serious at broadcast frequencies unless the modulation frequency is comparable with the carrier frequency. With the ordinary



THESE CURVES ILLUSTRATE PHASE SHIFT AS RELATED TO AMPLIFICATION. AT OR VERY NEAR THE HIGHEST POINT ON EACH CURVE THE PHASE SHIFT IS ZERO. WHERE THE AMPLIFICATION IS DOWN THE PHASE SHIFT IS HIGH.

values of grid leak and condenser and an ordinary tube as detector the suppression of the high notes does not exceed 10% until the modulation frequency is about 5,000 cycles.

When we reach the audio amplifier there are many effects which alter the amplitude of the signal. A condenser, in series with the line, cuts down the low notes. A choke coil in shunt with the line does the same. A condenser in shunt with the line suppresses the high notes, and an inductance coil in series with the line has the same effect. In the plate circuit of the detector tube there are usually a radio frequency choke coil and a bypass condenser. Both of these are so placed that they cut down the amplification of the higher audio notes. In some cases the reduction at 10,000 cycles from this cause alone has been over 75%. When this is multiplied by a selectivity suppression of 75%, the relative transmission is only 6%, or the 10,000 cycle note is almost completely suppressed.

Complex Conditions

In transformer coupled amplifiers each transformer can be regarded as an inductance in shunt with the line and inductances in series with the line on either side of the shunt. There are also effective shunt condensers. From this equivalent we would expect that both the low notes and the high notes to be suppressed by a transformer and the middle notes brought out well. That is exactly the case. The criteria of a good transformer are that it does not appreciably suppress the low notes while they are above audibility, that it does not suppress the high notes while they are below audibility, and that the amplification in between is the same for all frequencies. This means that the equivalent shunt inductance should be large and that the effective shunt capacity should be small.

There are many regenerative and resonance effects which alter the transmission of a transformer coupled circuit. These introduce peaks into the amplification which often account for most of the noticeable distortion.

In a resistance coupled circuit the condensers in the grid circuit limit the amplification of the low notes.

Limiting Factors

The shunt condenser and the series choke used in the first plate circuit limit the high to a certain extent, but the greater limitation is introduced by the effective capacity of the grid circuit. This effective capacity is quite large in some cases and it depends on the small capacity between the grid and the plate of a given tube and on the resistance in the plate circuit of that tube.

If the grid condensers in a resistance coupled circuit are too small, particularly if the grid leak is also small, and if the plate resistance is too large, the characteristic of a resistance coupled amplifier is almost the same as that of a good transformer coupled circuit. The relative suppression of the highs and the lows is of the same order of magnitude in the two cases.

Wave form distortion is first introduced by the detector, particularly if the detector is of the grid condenser and leak type. The reason the detector works at all is that it distorts the wave form. It is only a matter how much distortion can be tolerated.

Some Remedies

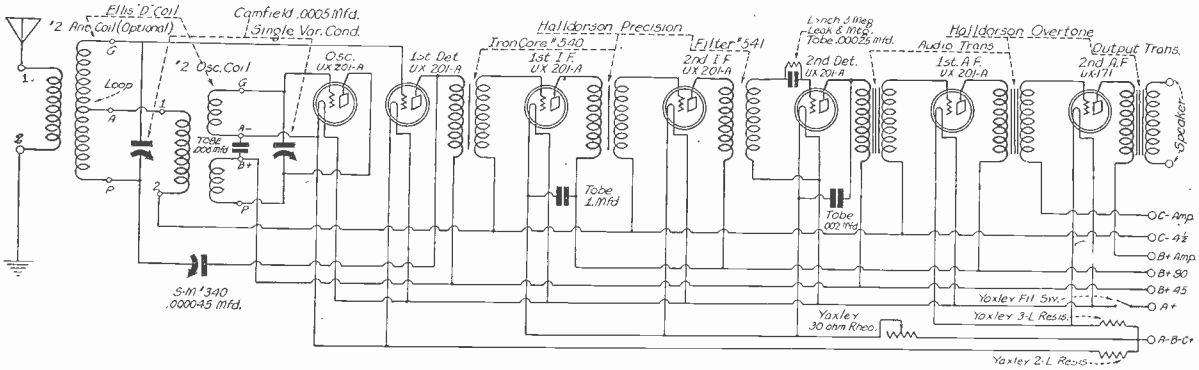
After the detector every iron core in transformer or choke and every amplifier tube introduces distortion in the wave form. The amount introduced by each one depends on how heavily the part is loaded. If the cores of transformers and chokes are too small considerable distortion will be introduced by them. This is minimized for any given transformer or choke by limiting the plate current either with increased C voltage or decreased B voltage. This can only be done to a certain extent before the tube will introduce more distortion of the same type than is avoided in the core.

The distortion introduced by the tube can be minimized by increasing the plate voltage and suitably adjusting the grid bias. Since this remedy is just the reverse of that for core distortion it is necessary to effect the best possible compromise.

The best way of avoiding wave form distortion is to use tubes large enough and give them high enough voltage and

(*Concluded on page 20*)

The 7-Tube Thompson



THE CIRCUIT DIAGRAM OF THE THOMPSON SUPER SEVEN.

By Herbert E. Hayden

THE excellence of Super-Heterodynes cannot be measured by the number of tubes used in it. Receivers of this type having up to 24 tubes have been constructed which did not and could not show the performance of a seven tube circuit properly built.

Neither can the excellence of a Super-Heterodyne be measured by the selectivity of the intermediate filter. Very often the weakest part of the entire receiver is the high degree of selectivity. Numerous examples could be cited to prove that point.

There are several factors which enter into the worth of a Super-Heterodyne. Some of these are: adequate selectivity; satisfactory transmission of side frequencies; freedom from interference from undesired signals and electric disturbances; quality of the audio frequency output; simplicity of control; adequate and suitable volume control; economy and compactness.

The Tally

How does the Thompson Super Seven score on these points?

Let us first look into the question of selectivity. It is so simple to get adequate selectivity, and so difficult not to exceed the highest permissible to retain quality, that it is best to see how a reasonable selectivity has been obtained in the Thompson Super Seven. In the first place there are two iron core intermediate transformers peaked at a suitable value to work harmoniously with the filter. These are broad, as they should be, and they are efficient. The third IF transformer is air cored and sharply tuned to a frequency which makes the iron core transformers work most effectively. The selectivity secured in this manner with two iron core intermediate transformers and one sharply tuned air core transformer is all that is necessary under the most severe conditions and it is not excessive for quality reception.

The reasonable selectivity employed in the IF amplifier insures that the side frequencies are transmitted with full volume. Thus quality is preserved as far as the IF amplifier is concerned and that without needless sacrificing selectivity.

Two Intermediate Stages

Only two stages of IF amplification are employed in this receiver. Only two stages are necessary when efficient IF transformers are used and when full advantage is taken of them and the tubes. One object of adding more amplifiers is to overcome losses introduced by faulty design. There is a certain limit to the sensitivity of a receiver beyond which it is useless to extend it. That limit depends on tube and battery noises as well as on noises originating outside. The limit can be reached just as well with a seven tube super of proper design as with a circuit of more tubes and supposedly of greater sensitivity. And what is more, the use of fewer tubes decreases the tube noises and thus effectively lowers the noise level and makes it possible to reach out farther with the seven tube set.

As soon as there is more than one broadcasting station in operation the intermediate selectivity is no safeguard against interference. Be the IF channel ever so selective if there is a station operating on a frequency which differs from the desired station by twice the value of the intermediate frequency, that station will interfere. The millions of birdies heard in the average Super-Heterodyne attest to the correctness of this.

Must Be Done at RF

The elimination of this type of interference can only be done in the radio frequency level. There are four things in the Thompson Super Seven which tend to depress interference to the vanishing point. First, a low loss tuned circuit is used in the modulator input. Second, the grid bias method of modulation is employed, and this renders the circuit more selective than if the grid bias and leak method were used. Third, radio frequency regeneration is used in the modulator, which greatly increases the selectivity in the RF level and helps to discriminate against the undesired signals. Fourth, the coupling between the pick-up coil and the oscillator is not made too close. Sensitivity is obtained by amplification after the modulator and not by overloading the modulator to get a high output.

While the circuit diagram shows that an antenna is used provision is also made for substituting a loop. Where interference is severe the loop should be used, otherwise the antenna will give satisfactory results. Greater sensitivity may be expected with the antenna than with the loop. It is not direct interference which must be guarded against, but only so-called "image" interference, to which only the Super-Heterodyne is subject.

Neither Condenser Grounded

It will be observed that neither the oscillator nor the modulator tuning condenser is grounded. This does not mean that the circuit is subject to body capacity. It would be if the old style construction were used. With the new method of shielding and drum dials this annoying trouble is eliminated completely. That makes possible the use of the most effective circuits both for the oscillator and for the modulator.

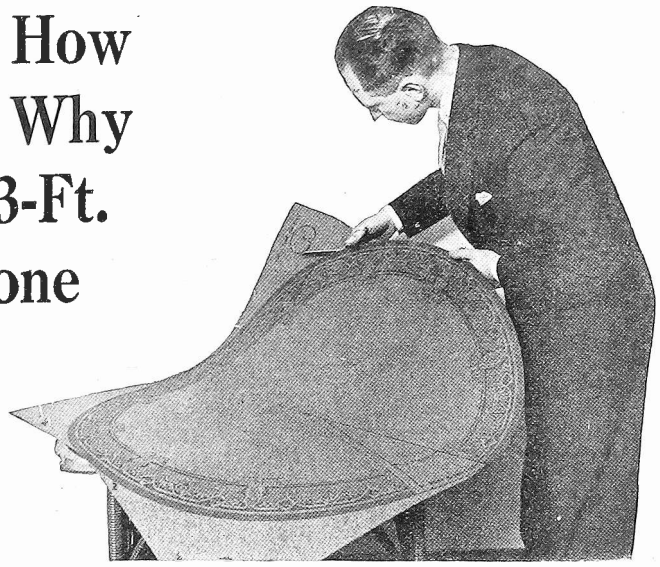
Quality of output is secured by transmitting the side frequencies and by introducing no frequency discrimination in the audio amplifier. First note that tubes capable of handling the volume required are used. Then observe that transformers having satisfactory characteristics are used in the amplifier. These selections go a long way toward making the quality of the output of the high order it is.

Now to clinch the quality argument take note of what has been omitted. There is no enormous choke in series with the line to cut down the higher audio frequencies. There is no series choke coil at all. There is no condenser in series with the line to stop the low frequencies. There is no shunt condenser larger than necessary so that the high frequencies are not by-passed. There is no shunt coil to by-pass the low audio frequencies. There is no means of tampering with the filament current in the audio amplifier, thus making it impossible to get bad quality by throttling down the tubes.

LIST OF PARTS

One Silver-Marshall No. 340 midget condenser
Six Silver-Marshall tube sockets
Two Silver-Marshall Drum type dials
One pair Silver-Marshall brackets
One Yaxley filament switch
Two Yaxley imp jacks
One Yaxley 2L resistance
One Yaxley 3L resistance
One Yaxley 30 ohm rheostat
One Tobe .006 mfd. condenser
One Tobe 1 mfd. condenser
One Tobe .002 mfd. condenser
One Tobe .00025 mfd. condenser
One Tobe .001 mfd. condenser
Two Halldorson Precision iron core No. 540 transformers
One Halldorson Precision No. 541 filter Transformer
Two Halldorson Overtone audio frequency transformers
One Halldorson Overtone output transformer
One 7x21 panel
One 9x20 subpanel
One 3 megohm grid leak
One grid leak mounting
Two Camfield .0005 mfd. tuning condensers
Ten XL spring binding posts
One Ellis oscillator coupler
One spring socket
One No. 2 Ellis antenna coupler (unless loop operation alone is desired)

The How and Why of 3-Ft. Cone



By James H. Carroll

Contributing Editor; Associate, Institute of Radio Engineers

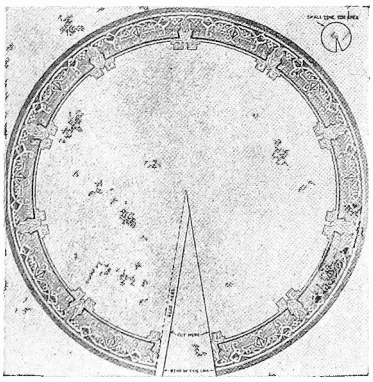


FIG. 1

FOR the past two years the goal most sought in radio reception has been tone quality. Set manufacturers have been improving the audio amplifying systems until today practically any of the manufactured sets will reproduce tones as low as 60 cycles without audible distortion. The home set builder using specially fine transformers or impedance or resistance coupling can reproduce tones much lower. A properly designed resistance coupled amplifier will reproduce frequencies as low as 25 cycles.

One problem has been to find a loudspeaker which would reproduce the tones delivered to it by the set. Laboratory tests have proved that one type of speaker which will faithfully reproduce all of the audible tones is the cone speaker three feet in diameter. With a three-foot speaker it is possible to reproduce all of the tones which a good audio amplifier delivers to the speaker. In the past year there have been many speakers of this type placed on the market.

The "Ensco" Kit, first put on the market about a year ago, has done much to popularize the three-foot cone.

The assembly requires no mechanical or radio knowledge whatever.

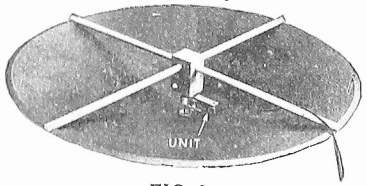


FIG. 2

LIST OF PARTS

One Ensco Unit completely assembled
One sheet of decorated and marked Alhambra Fon-O-Tex Paper
Two metal apexes.
One wall frame
One adjustment wrench
One extension pin

Fig. 1 shows the square piece of cone material ready for cutting. Full directions are plainly marked on the paper itself. This applies to either the twenty-four or thirty-six-inch size. Lay the sheet on a flat surface. Cut out the circle on the marked outer line. Then cut out the segment as shown. This leaves a flap for pasting in the cone in shape. When the cone is ready to paste, take a blunt instrument such as the back of a knife and score the line marked "Bend on this line." This allows the edge to be turned back when the cone is completed.

Now pull the cone gently into place so that the edge fits over the space marked "glue here." Spread a thin coating of glue. Be sure to pull the cone into shape with due regard to the style to be used. If a console type, the design must be on the inside or concave side of the cone. If the wall or pedestal type, the design should be on the outer or convex side of the cone. Turn the sheet with the design downward and proceed to paste by spreading glue on the blank side. Now paste the edges together by pressing gently on the same, starting at the inner apex and working outward. Allow cone to dry for a few minutes and then paste in the small cone which is cut from corner of sheet as shown in Fig. 1. This small cone goes on the inner apex when pedestal or wall cone is made and on the outer apex when console type is made. The small cone makes the large cone rigid. When cone is completed, lay it face down and bend back the edge on the scored line.

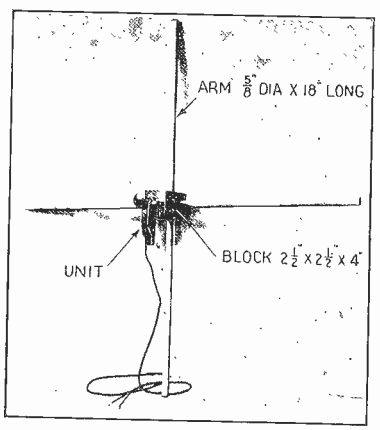


FIG. 3

The "Ensco" engineers maintain that the only advantage of the double cone is to make it rigid enough to ship a manufactured speaker. In all cones the music comes from the concave side. When two concave sides are placed together as is the case with double cones, there are bound to be muffled and distorted tones. The single cone offers no obstructions to the music and as the "Ensco" is a kit it is not necessary to consider the shipping feature. The single cone is far more simple to assemble than the double.

Fig. 2 shows the rear view of a completed wall type speaker. The "Ensco" kit contains a mounting frame consisting of four dowels matched to a block. Fig. 3 shows the detail of the frame. The four dowels are inserted in the block and glued in place so that each leg is the same length. By inserting the opposing sticks first and sighting through the other two holes the two can be brought to the exact center and glued. The other two will then match perfectly. The unit is mounted as shown and fastened by two screws through the mounting plate. For ceiling mounting a suspension cord is used. For wall mounting a cord is attached to two dowels about halfway to the center.

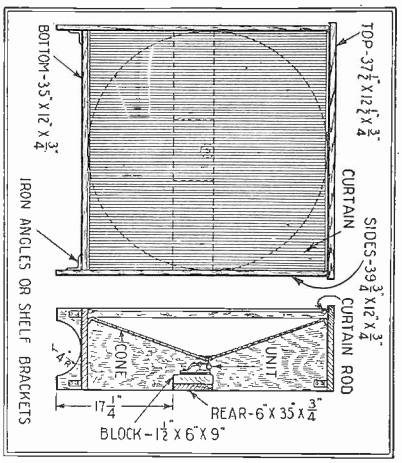


FIG. 4

When mounting the unit be sure that the drive pin is in line with the center of the cross stick. Next attach the drive pin extension and mount the cone. The cone is clamped to the drive pin extension with the two metal apexes and two nuts. One apex is placed on each side of the main cone apex. The cone should be mounted in such a way that the bent up flange rests lightly on the arms of the frame, without placing any strain or tension on the pin. The flange of the cone is now attached to the arms of the frame with four thumb tacks.

Even better results will be obtained

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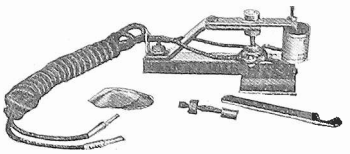
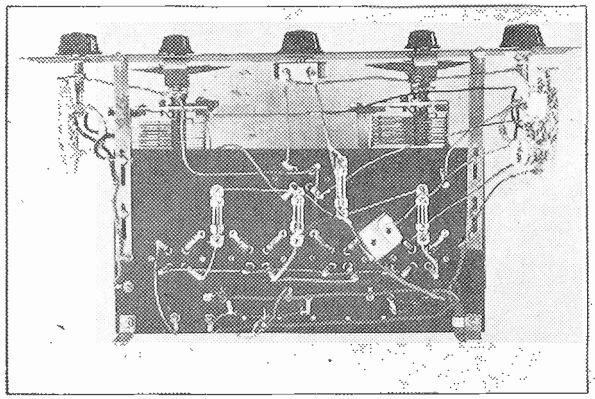
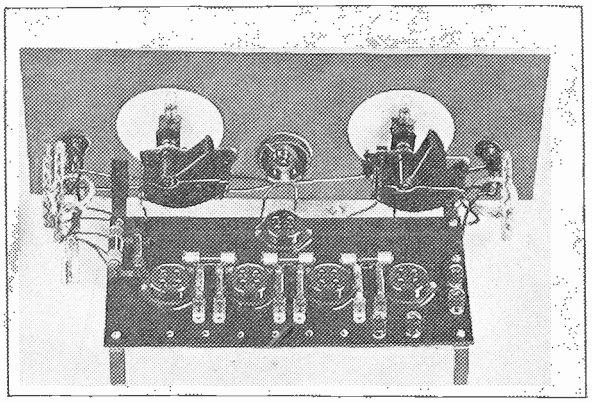


FIG. 5

The Lynch

Arthur H. Lynch, whose active intellect and enthusiastic pressure have left the whole radio field in his debt, now comes forward with the idea that many thousands of home constructors of radio sets would like to build inexpensive models, good sets but at low cost. Mr. Lynch is so well able to state his case that further introduction by us would be superfluous.—EDITOR.





"MUCH OBLIGED FOR THE SIMPLICITY OF LAYOUT" IS WHAT THE SET-CONSTRUCTING FRATERNITY WILL SAY ABOUT THE LYNCH FIVE, BOTTOM AND REAR VIEWS OF WHICH ARE EXHIBITED ABOVE

By Arthur H. Lynch

THE idea that a good radio receiver could be made of parts that cost between $25 and $35 always has been attractive to manufacturers, but they could not see how it could be done.

A few months ago we asked about two dozen of the leading parts manufacturers if they believed there would be any demand for a really fine receiver which could be assembled by the home constructor at a cost of $25 to $35. They were unanimous in the matter of a ready sale for such a receiver and nearly unanimous in proclaiming the task impossible. Some of them had been attempting to produce a circuit which could be used in a receiver employing parts which would list at something like $50, but $35 was entirely out of the question.

The Old Master Tackles Job

So we set to work. The receiver we were aiming at was not a cheap receiver but a good receiver at a modest price. We are rather proud of the receiver we have brought into being and believe it will enjoy more than ordinary popularity.

When you learn that the receiver has been enthusiastically indorsed not only by the technical editor of the N. Y. "Telegram," but also by Willis K. Wing, editor of "Radio Broadcast"; Volney Hurd, radio editor of the "Christian Science Monitor"; Laurence Cockaday, technical editor of "Popular Radio"; Frank Britton, radio editor of "Popular Mechanics"; Laurence Lesh, editor of "WCFL Radio Magazine"; William G. Many, editor of "Radio Review" and the technical staff of "The Citizens' Radio Call Book," you will realize that the receiver is more than an ordinary one.

Please do not misinterpret this statement, however. The receiver is not better than a good Super-Heterodyne, but it is better than many Supers. It is considerably better than most six-tube receivers, regardless of price, and is better than any five-tube receiver we have seen.

What's What

The receiver is a five-tube affair, employing a combination of tuned radio frequency, similar to the ever-popular Roberts circuit; a regenerative detector and three stages of resistance coupled audio frequency amplification.

The front panel is of attractively decorated metal and is fitted with two illuminated controls. The panel measures 7x18 inches and is the handiwork of the Wireless Radio Corporation. It is sold, with the dials already mounted, for $6. It is designed to carry any of the popular variable condensers now on the market. The panel is sold with a pair of brackets and back supports for use in mounting the deck.

The deck is a real innovation. It is a shelf of Westinghouse Micarta 6x12 inches. It is provided with five of the latest Eby de luxe sockets, made with special prongs which make direct contact with the special resistor and condenser clips which hold the component parts of the resistance amplifier in place.

Dorsey's Ingenuity

This new type of combination resistor and condenser clip was designed by Arthur Dorsey, best known for some of his important patents on vernier dials. The clips are made to grip the condenser and resistor caps in viselike fashion and, in addition to making a perfect contact, it is impossible for them to be jarred out of place.

A new type of fixed condenser has been designed for this deck, and it is similar in appearance to the resistor but slightly greater in diameter.

The condensers are finished in black, with nickel plated end caps to match the end caps of the special resistors with which the deck is provided. In fact, all of the metal parts are nickeled and make for beauty because the illumination contrast with the black Micarta.

The deck is arranged in a manner which not only reduces the cost to the home constructor but actually provides a method which keeps all the wiring beneath the deck and thus improves the appearance of the completed receiver.

Wiring Reduced

Without in any way limiting the scope of selecting various circuit arrangements which the constructor may desire to employ in wiring his filaments or plate and grid returns, the deck reduces the amount of wiring necessary to a minimum, as may be seen from the accompanying illustrations.

The deck is provided with mounting holes for ten binding posts, but the posts themselves are not provided because some constructors may wish to use a battery cable wired directly to the receiver.

In neutralization the grid suppressor method is very simple.

A non-inductive wire wound grid suppressor, which is similar in size and shape to the common grid leak, is placed in the grid circuit of the radio frequency tube, outside the tuning circuit.

Uses About 800 Ohms

The value of this resistance depends upon the voltage applied to the radio frequency tube, the type of tube employed, the coupling between the primary and secondary of the tuning units and certain other factors. The resistance of the grid suppressor for most of the coils now available is about 800 ohms.

The antenna coupler is provided with a rotary primary. Changing the position of this primary will compensate for aerials of various lengths and will also serve as a very satisfactory volume control. Some coil manufacturers, such as Sickles, have single hole mount antenna couplers in their lines. The Sickles coils were used by me in the model illustrated.

With such coils as the old-style ones, which have a tapped primary on the antenna coupler, the coil may be mounted directly on the deck and the hole in the panel used for mounting a single hole mount switch.

Sequence of Work

Where coils such as the National tuning units are employed, where the primary is fixed and untapped, a midget condenser may be used in the antenna circuit and mounted directly on the panel.

Our first job is the mounting of the condensers to the panel. This is a very simple thing to do, as the condenser brackets with which the panel is equipped are arranged to carry either single or triple mount condensers. The manner in which they are mounted is evident when the panel and condenser are observed.

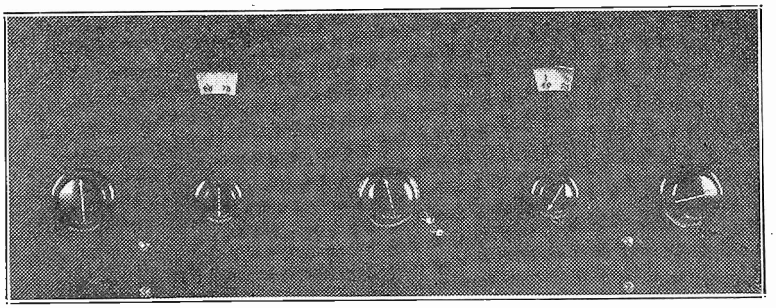
The next step is the mounting of the coils. They are of the single hole mount type and are placed in the two outside holes on the panel, as shown.

Next the grid suppressor clip is mounted on the deck.

The experienced constructor may now wish to complete all the wiring on the deck, then the wiring of the panel before assembling the two. For those less

Five

A Receiver So Designed That Parts Cost Between $25 and $35, Yet Worthwhile Results Are Easily Obtained.



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And here we may point out that the front brackets are made of metal and may be bent to any desired angle. In this way the receiver may be used in a cabinet with either a straight or sloping panel.

Acme Celatsite Does Trick

And now about the wiring. Almost any good grade of wire, of any of the approved kinds, may be employed. Bus wiring makes a ship-shape job, but it is pretty hard to beat a job done with Acme Celatsite.

It is well worth while doing a good soldering and wiring job. When the insulation is removed from the ends of each piece of wire you use give it a good scraping. Use a soldering iron that is hot and will stay hot. And use either good soldering flux or resin-core solder.

With your soldering completed your receiver is ready for the inserting of the tubes. And in this receiver much of the advantage over set employing similar circuits comes from the application of special purpose tubes.

CeCo Tubes Recommended

For instance, the radio frequency gain or amplification is improved by the use of the CeCo type K tube. This tube has a higher amplification constant than the ordinary one and increases the distance over which the receiver will pick up stations. It has the effect of increasing the volume from local stations also.

The detector tube is the CeCo type H special detector, which, like the type K, has a higher amplification factor than ordinary tubes. In addition to increasing the range and volume of the receiver, it also improves the tone quality. The reason for this latter improvement is rather involved.

The rectified current from the detector is fed into the audio frequency channel, which employs two CeCo type G tubes in the first two stages and a CeCo type F tube in the power stage. The type G tube is the high mu tube designed especially for use in resistance amplifier circuits. By using these tubes the amplification of a signal from a local station reaches the point where a reproduction from a good loud speaker can be made too great for comfort in the average living room.

Power Tubes

The receiver described here is for use with a B battery voltage of not more than 135 volts. The power tube for such a voltage is the CeCo type F. Where 180 volts of B battery is employed a tone filter, such as the National, should be connected to the output terminals of the receiver. It is a fairly safe rule to use a tone filter if the receiver is supplied by power from a B eliminator.

Whether the voltage source is batteries or a battery eliminator, it is better to use a CeCo type J71 power tube if the plate voltage is 180 or more. Of course, it is necessary to employ the proper grid bias for the particular type of power tube employed. The tubes are controlled by Equalizors, except that a rheostat is used additionally as a volume control on the RF tube.

And the Speaker

There is little use in our going to much trouble in the designing and building of a receiver which is capable of nearly perfect tone reproduction if we use it with an inferior loud speaker. A poor speaker can ruin the tone quality to a degree almost beyond belief.

The tone quality of our new receiver is almost perfect—much more natural and real than is true with the great majority of receivers now available. The use of a Western Electric cone with receivers employing this type of circuit has been furnishing real enjoyment to a great many folks in many parts of the country for the last two years. For a long time the Western Electric cone has been as good a speaker as one could buy.

During the last few months a new reproducer, employing a new principle, has been gaining great favor. It is known as the Lata Balsa Reproducer. It is significant in passing to mention that many engineers of the Western Electric Company are now using these reproducers.

The Summary

So, to sum up our story, our offering consists of a remarkably good receiver at a cost of little less than half the cost of a similar one made by the older home construction methods—a better performing, better appearing receiver, which is much easier to build. By following these instructions you are now able to purchase your receiver, speaker, tubes and batteries for just a little less than the price of other forms of receivers alone. We trust you will like it.

LIST OF PARTS

One 7x18 inch metal panel with glow dials and rheostat and mounting brackets.

One Lynch 5-tube de luxe deck, consisting of five Eby De Luxe sockets; three .1 meg. metallized resistors; three .5 meg. metallized resistors; one 2.5 meg. metallized resistor; three special cartridge type coupling condensers; one special cartridge type grid condenser; four sets of special mountings for resistors and condensers, all assembled and ready for wiring.

One Sickles antenna coupler.

One Sickles 3-circuit tuner.

Two .0005 variable condensers.

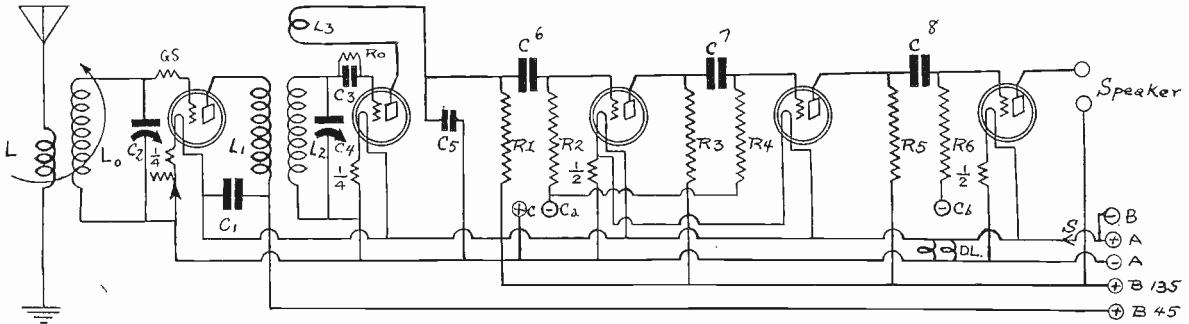
One 800-ohm grid suppressor.

Ten Eby marked binding posts.

One .002 mfd. Sangamo bypass condenser.

Two Lynch Equalizors, type 4.

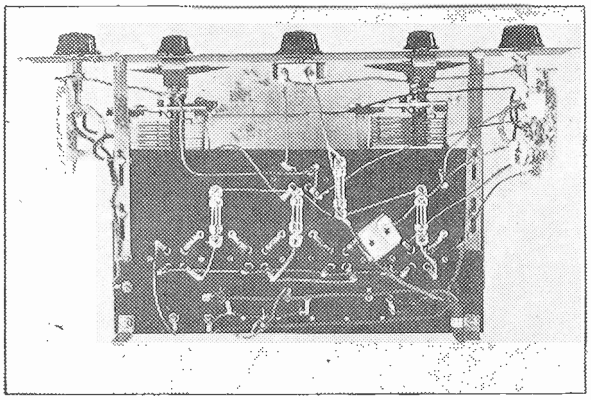
Two Lynch Equalizors, type 2.

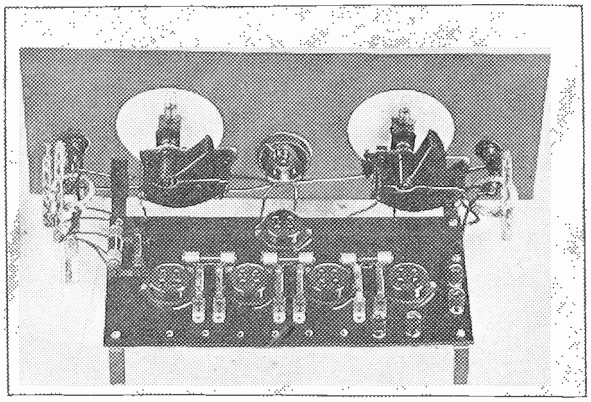


THE SCHEMATIC DIAGRAM OF THE CIRCUIT

The Lynch

Arthur H. Lynch, whose active intellect and enthusiastic pressure have left the whole radio field in his debt, now comes forward with the idea that many thousands of home constructors of radio sets would like to build inexpensive models, good sets but at low cost. Mr. Lynch is so well able to state his case that further introduction by us would be superfluous.—EDITOR.





"MUCH OBLIGED FOR THE SIMPLICITY OF LAYOUT" IS WHAT THE SET-CONSTRUCTING FRATERNITY WILL SAY ABOUT THE LYNCH FIVE, BOTTOM AND REAR VIEWS OF WHICH ARE EXHIBITED ABOVE

By Arthur H. Lynch

THE idea that a good radio receiver could be made of parts that cost between $25 and $35 always has been attractive to manufacturers, but they could not see how it could be done.

A few months ago we asked about two dozen of the leading parts manufacturers if they believed there would be any demand for a really fine receiver which could be assembled by the home constructor at a cost of $25 to $35. They were unanimous in the matter of a ready sale for such a receiver and nearly unanimous in proclaiming the task impossible. Some of them had been attempting to produce a circuit which could be used in a receiver employing parts which would list at something like $50, but $35 was entirely out of the question.

The Old Master Tackles Job

So we set to work. The receiver we were aiming at was not a cheap receiver but a good receiver at a modest price. We are rather proud of the receiver we have brought into being and believe it will enjoy more than ordinary popularity.

When you learn that the receiver has been enthusiastically indorsed not only by the technical editor of the N. Y. "Telegram," but also by Willis K. Wing, editor of "Radio Broadcast"; Volney Hurd, radio editor of the "Christian Science Monitor"; Laurence Cockaday, technical editor of "Popular Radio"; Frank Britton, radio editor of "Popular Mechanics"; Laurence Lesh, editor of "WCFL Radio Magazine"; William G. Many, editor of "Radio Review" and the technical staff of "The Citizens' Radio Call Book," you will realize that the receiver is more than an ordinary one.

Please do not misinterpret this statement, however. The receiver is not better than a good Super-Heterodyne, but it is better than many Supers. It is considerably better than most six-tube receivers, regardless of price, and is better than any five-tube receiver we have seen.

What's What

The receiver is a five-tube affair, employing a combination of tuned radio frequency, similar to the ever-popular Roberts circuit; a regenerative detector and three stages of resistance coupled audio frequency amplification.

The front panel is of attractively decorated metal and is fitted with two illuminated controls. The panel measures 7x18 inches and is the handiwork of the Wireless Radio Corporation. It is sold, with the dials already mounted, for $6. It is designed to carry any of the popular variable condensers now on the market. The panel is sold with a pair of brackets and back supports for use in mounting the deck.

The deck is a real innovation. It is a shelf of Westinghouse Micarta 6x12 inches. It is provided with five of the latest Eby de luxe sockets, made with special prongs which make direct contact with the special resistor and condenser clips which hold the component parts of the resistance amplifier in place.

Dorsey's Ingenuity

This new type of combination resistor and condenser clip was designed by Arthur Dorsey, best known for some of his important patents on vernier dials. The clips are made to grip the condenser and resistor caps in viselike fashion and, in addition to making a perfect contact, it is impossible for them to be jarred out of place.

A new type of fixed condenser has been designed for this deck, and it is similar in appearance to the resistor but slightly greater in diameter.

The condensers are finished in black, with nickel plated end caps to match the end caps of the special resistors with which the deck is provided. In fact, all of the metal parts are nickeled and make for beauty because the illumination contrast with the black Micarta.

The deck is arranged in a manner which not only reduces the cost to the home constructor but actually provides a method which keeps all the wiring beneath the deck and thus improves the appearance of the completed receiver.

Wiring Reduced

Without in any way limiting the scope of selecting various circuit arrangements which the constructor may desire to employ in wiring his filaments or plate and grid returns, the deck reduces the amount of wiring necessary to a minimum, as may be seen from the accompanying illustrations.

The deck is provided with mounting holes for ten binding posts, but the posts themselves are not provided because some constructors may wish to use a battery cable wired directly to the receiver.

In neutralization the grid suppressor method is very simple.

A non-inductive wire wound grid suppressor, which is similar in size and shape to the common grid leak, is placed in the grid circuit of the radio frequency tube, outside the tuning circuit.

Uses About 800 Ohms

The value of this resistance depends upon the voltage applied to the radio frequency tube, the type of tube employed, the coupling between the primary and secondary of the tuning units and certain other factors. The resistance of the grid suppressor for most of the coils now available is about 800 ohms.

The antenna coupler is provided with a rotary primary. Changing the position of this primary will compensate for aerials of various lengths and will also serve as a very satisfactory volume control. Some coil manufacturers, such as Sickles, have single hole mount antenna couplers in their lines. The Sickles coils were used by me in the model illustrated.

With such coils as the old-style ones, which have a tapped primary on the antenna coupler, the coil may be mounted directly on the deck and the hole in the panel used for mounting a single hole mount switch.

Sequence of Work

Where coils such as the National tuning units are employed, where the primary is fixed and untapped, a midget condenser may be used in the antenna circuit and mounted directly on the panel.

Our first job is the mounting of the condensers to the panel. This is a very simple thing to do, as the condenser brackets with which the panel is equipped are arranged to carry either single or triple mount condensers. The manner in which they are mounted is evident when the panel and condenser are observed.

The next step is the mounting of the coils. They are of the single hole mount type and are placed in the two outside holes on the panel, as shown.

Next the grid suppressor clip is mounted on the deck.

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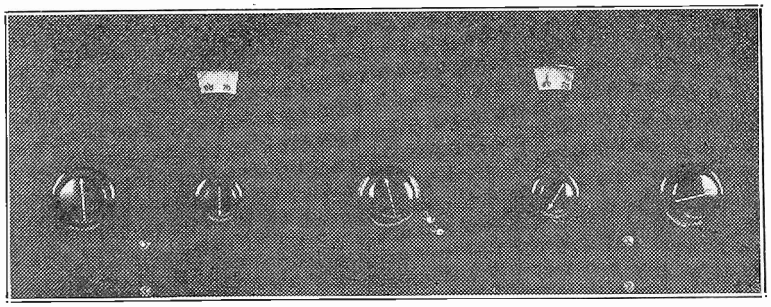

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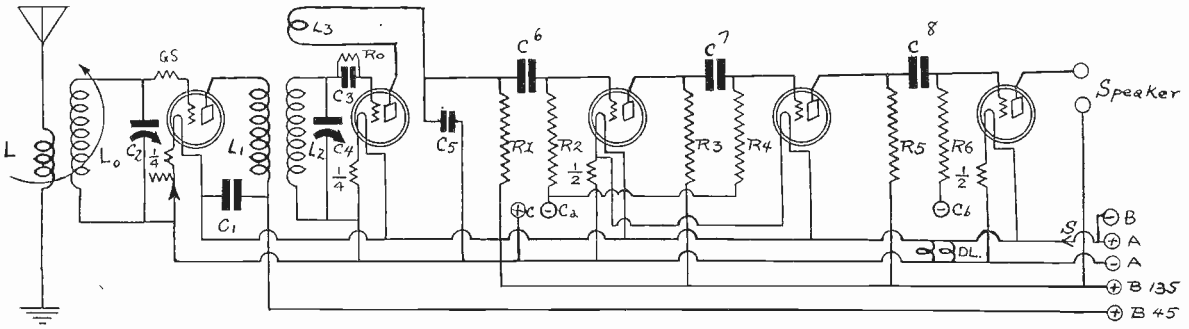


THE SCHEMATIC DIAGRAM OF THE CIRCUIT

Bouck Points the Way to Aero-7 Efficiency

By Zeh Bouck

THE fact that things go wrong in the very best of families may perhaps account for analogous eccentricities on the part of the very best of circuits. The Aero-Seven is as foolproof as it is practical to make an efficient receiver. But efficiency in a radio receiver is necessarily a concomitant of a certain degree of electric complexity. The more efficient we make a receiver, in the general sense, the greater is the possibility for the development of trouble.

It is difficult to make two receivers exactly alike even though they are the same type and model. This accounts for the impossibility of altogether eliminating trouble from any particular design of receiver. While all the Aero-Sevens built will be 90% alike, and, in this respect, reflecting the efficiency of design, will have eliminated many sources of trouble, a good 10% of individualities will exist which, in some cases, may work for phenomenal or freak efficiency, and in others result in various troubles and subtle difficulties of operation.

True Insight Simplifies Remedies

As long as the receiver is like the model from which it is copied, it will not fall below a very high average efficiency. In the points where it differs from the prototype it may even vary in a gloriously positive direction.

With these individual eccentricities in mind, it is obviously a difficult task to describe the various troubles into which the experimenter may run. It is better to consider only generalities with the idea that a fundamental knowledge of the characteristics of the receiver provides insight into these peculiarities—the sporadic instances of unsatisfactory operation.

Antenna and Condenser

A consideration of the proper adjustment of the receiver from antenna through to the output tube will probably clear up the majority of unsatisfactory symptoms.

Antenna:—The Aero-Seven will function efficiently from any sort of an antenna with the exception of a loop. The longest convenient indoor antenna or a fifty foot outdoor stretch is recommended. The antenna is coupled to the first tube through a resistor, eliminating the imposition of tuning discrepancies due to the antenna capacity.

Adjustment of the Amsco Condenser:—Lack of selectivity and sensitivity are indications of improper adjustment of the three-gang condenser, and is the only radio frequency detail requiring particular attention. Small compensating condensers are mounted on each side of the main capacitors. The condenser is shipped from the factory with these compensating condensers adjusted tightly. All adjustments should be made with a wooden screw-driver such as may be shaped from a dowel or similar stick.

Give each condenser 1½ turns backward and tune in a station—preferably a distant or weak local station. Move the dial with one hand, adjusting one condenser with the other, ¼ of a turn up and down, until the station comes in loudest. Repeat this operation with the other two sections. Stations over the entire tuning range should now tune in with a satisfactory degree of sharpness. If they do not, it is an indication that the exact wiring plan of the receiver has not been followed.

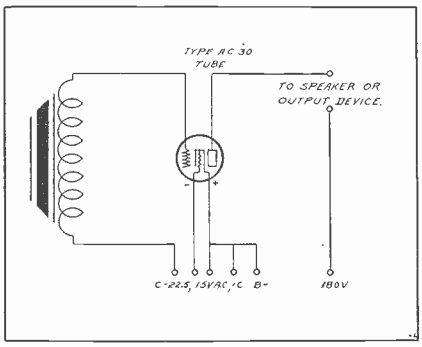


FIG. 1.
CONNECTION FOR AMPLIFIER TUBE IN AERO-SEVEN AC SET.

When the compensating condensers are correctly adjusted, the circuit will fall into oscillation with the potentiometer control knob further to the left than when the condensers are poorly compensated.

The AF Amplifier.—With some resistor couplers blocking may be experienced on loud signals. This can be eliminated by lowering the resistance of the last grid leak to ¼ megohm. When a B eliminator is used instability may be indicated, generally evident as motorboating. There are several methods of combating this.

The value of the coupling resistors in the first two resistor-couplers may be dropped from ¼ megohm to 100,000 ohms. Also, increasing the capacity of the coupling condenser in the second coupler to 1/10 mfd. is effective. As a last resort, connect a Mershon 80 mfd. electrolytic condenser across the 180 volt eliminator lead and minus B. This will generally be found quite effective.

Advocates Output Device

Overloading of the loudspeaker can be appreciably reduced by the inclusion of an output device, such as the Amsco Orthophone, between the last tube and the speaker.

The AC Set.—A fundamental idea of the operation of AC tubes is rather essential in shooting trouble with such circuits. However, the troubles to be expected with alternating current tubes are no more serious than those characterizing the battery type. There are three fundamental amplifying and detector circuits recommended for use with the Arcturus tubes—the bulbs for which the AC Aero-Seven model has been designed. A cut published Oct. 22 shows the detector. The line from lower side of the coil to cathode of the tube indicates the grid return when the detector circuit is shown by itself. When used in conjunction with the usual amplifiers, the detector grid return is automatically taken care of through the ground.

Heater Type Tubes

Arcturus tubes are all of the heater type. The heater terminals are brought out to the plugs connecting with the filament terminals on the standard socket. The cathode terminates in the plus filament prong. These tubes have a standard four prong base and fit into the UX socket without additional side or overhead wiring. Reference to the AC circuit published in the October 22 issue of Radio World will indicate that all amplifier grid returns excepting that of the power tube are grounded, and receive the minus 1½ volt bias by having this potential grounded while the plus side of the C battery is connected to a cathode circuit.

Hum Elimination.—No hum should be experienced when using Arcturus AC tubes. If a hum is heard when a B battery eliminator is employed, substitute batteries temporarily to determine whether the hum emanates from the eliminator. If the hum is caused by the tubes, slightly increase the plus D voltage to the detector grid.

Voltages and Resistances

Check the ground carefully, inspect filament wiring; see that all like filament terminals are wired together. Care should be taken to isolate all AC leads, transformers, etc., from AF and RF circuits. Keep the filament heater transformer at least two feet from the receiver proper.

Check the B, C and D voltages. A persistent case of hum can often be eliminated by reducing the resistance of the coupling resistors on the first two audio tubes to from 8,000 ohms to 10,000 ohms. It is possible to go down as far as 5,000 ohms on these resistors without more than a negligible loss in volume.

When using the B and C eliminator designed by the writer (see October 22 issue), various interactions of the C potential will be noted. For instance, varying the plate current by adjusting the C potential to the power tube will necessarily effect the low C potential to the RF tubes due to the change in the current passing through the biasing resistor. Adjustment of the first C potential for maximum signal is therefore impracticable.

Adjustment Pointers

The C bias to the power tube is adjusted with the plate milliammeter as described October 22. When the correct adjustment is obtained, the Amsco Duostat should not be touched again. The volume control should be turned on until the receiver oscillates. A slight hum should be discernible in the speaker. Adjust the 1½ volt bias control, varying the oscillation control at the same time, (always keeping the receiver just above the oscillating point), until an adjustment of the RF bias is secured at which the hum is at a minimum. However, it should not be increased beyond the point where adequate regeneration is easily obtained over the entire wavelength range.

If conditions are such as to suggest the eliminator is not behaving properly, the voltages may be checked with a high resistance voltmeter. If such is not conveniently available, one may be improvised by connecting a milliammeter in series with a resistor. A zero to 5 milliammeter is about the right size for the meter and the resistor should never be less than 100,000 ohms. The volts will always equal the current indicated by the milliammeter, times the ohmage of the resistor divided by 1,000.

How It Works Out

For instance, if you have a 0 to 5 milliammeter in series with a 100,000 ohm resistor, and when connected across the maximum post of the B eliminator it shows a deflection of 3 milliamperes,

$$3 \times \frac{100{,}000}{1{,}000} = 3 \times 100 = 300 \text{ volts.}$$

The functioning of the glow tube will always indicate that the high voltage is OK. Breakdown of resistor R, or a high ohmage in this resistor, will generally be indicated by the functioning of the glow tube only when the heaters of the receiving tubes are turned off.

The use of a high grade cone or Balsa speaker with the Aero-Seven is recommended by the author.

TERM 'PHASE' NOTHING TO BE WORRIED OVER

The connection of audio transformers may be such that the phase difference between the current in the first transformer primary and that in the second is zero. In that even the circuit might distort or even oscillate when only two tubes are used. The frequencies of maximum distortion, or of oscillation, will be different in the two cases. It is this trouble which accounts for some of the squealing often met with in audio amplifiers. One cure for it is the use of good and dependable transformers in the receiver.

What Phase Means

The term phase should not scare anybody. It is really simple conception. Nearly everybody knows what the term means as related to the moon. It means the aspect of the moon at any given time. Suppose we had two moons which moved around the earth at the same speed but in such a manner that one is full when the other is new. The two moons would be in opposite phase, or their phase difference would be 180 degrees. Alternating currents or voltages may be compared with the moons. The plate current in one tube may be compared with one and the plate current with that in the other. At a given frequency and at any given time their aspects are different, or there is a phase difference between them. The angular difference may have any value from zero to 360 degrees.

Even in the behavior of the radio frequency amplifier phase plays an important part. When the impedance of the load on one of the radio frequency tubes is highly inductive, that is, when the plate AC current lags behind the voltage, the tube breaks into oscillation as a result of feedback through the capacity between the grid and the plate.

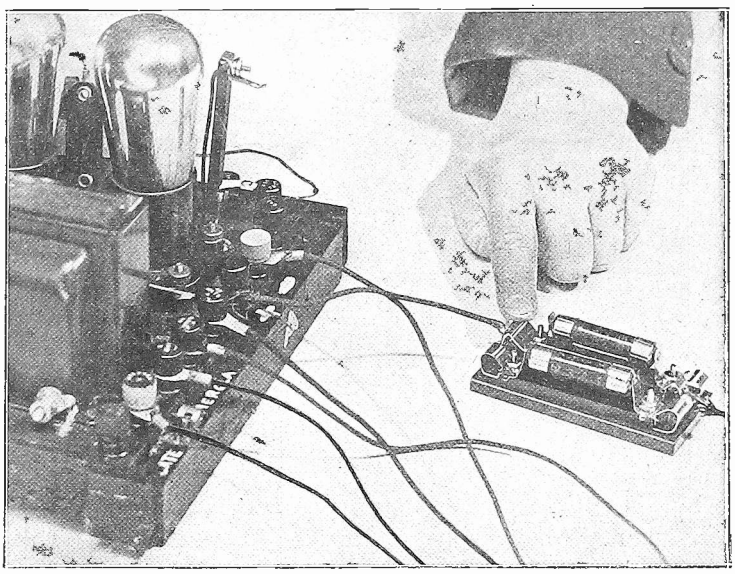
Good Heat Conductors Needed for Power Work

It is necessary that good conductors be used in connection with all radiators because if the heat cannot reach the radiating surfaces easily there will not be anything to radiate.

Perhaps the greatest amount of heat is carried away by convection. Or convection is the greatest aid to efficient radiation. Cool layers of air come in contact with the radiating surfaces and are heated both by radiation and conduction. Since the distance between the hot surface and the cool air is small, and since the temperature of the two differs widely, a great amount of heat is transferred. As soon as the air has received the heat it moves on by circulation and cooler air comes in contact with the hot radiating surface. To keep the eliminator cool there must be adequate circulation of air as well as good radiating surfaces which receive the heat by radiation and by conduction.

The heat generated in the resistors can be cut down by limiting the current flowing in them. This not only helps to limit the rise of temperature in the eliminator but it also decreases the drain on the supply line. The heat dissipated by the resistors serves no good purpose and is pure waste of energy. The current, and hence the temperature, can be limited by increasing the resistance in the voltage divider.

Adapter Reduces Number of Controls



(Hayden)

A RECEIVER EQUIPPED WITH RHEOSTATS FOR FILAMENT CONTROL CAN BE FILAMENT CONTROLLED INSTEAD BY AN AMPERITE ADAPTER (AT RIGHT). THIS DEVICE IS PUT IN THE NEGATIVE A BATTERY LEAD AND AMPERITE COMBINATIONS SUITABLE TO THE REQUIREMENTS INSERTED INTO THE CLIPS.

Resistor Should Resist, And That's About All

Strictly speaking when is a resistor not a resistor? The answer is: when it has any charactertistics other than resistance.

Resistors, particularly for radio work, should possess only one quality, that of resistance. In the radio frequency amplifier, for example, a unit possessing properties other than resistance will often after the operation of the circuit.

The fault most common to resistors are inductance and capacity. By capacity is meant the property of holding or storing energy as does the fixed condenser.

However, one type of resistor at least, the Vitrohm, under test was found to possess only the characteristic of resistance. The research laboratory of a well-known technical institute discovered both capacity and inductance were so low as to be difficult to measure even with laboratory instruments.

Teleplex Teaches Code

Every broadcast listener should be able to read code as well as every ham. The B. C. L. will derive more pleasure and ofttimes a lot of fun through being able to read code messages, on the high waves as well as on the low; many a thrill and tingle of romance constantly pulsing through the air to be caught on the fly. Learning the code is not so easy for some, unfortunately.

There is now an instrument on the market which simplifies code education and makes it available to everyone. This is a real, scientific apparatus which is used by leading schools and by many naval stations. It teaches sending as well as receiving and can be operated at as slow a speed as five words a minute up to as high a speed as is possible for any human ear to receive the signals. It is called the Teleplex. Full information may be had from the Teleplex Company, 76 Cortlandt Street, New York City.—J. H. C.

Independents Promise to Defend Dealers in Suits

The Radio Protective Association decided at a meeting at the recent Chicago radio show that the association should defend any dealer or jobber of a member who may be sued for patent infringement by the Radio Corporation of America or associated companies.

The association is only two months old. Following are the names of those on the board of directors of the association:

Harry G. Sparks—Sparks-Withington Company, Jackson, Mich.; Fred S. Armstrong—Vesta Battery Corporation, Chicago; R. W. Augustine—Joy-Kelsey Corporation, Chicago; H. R. Rose—Shamrock Manufacturing Co., Newark, N. J.; H. Chirelstein—Sonatron Tube Co., New York, N. Y.; Duane Wanamaker—Grigsby-Grunow-Hinds Co., Chicago; L. Mandel—Metro Electric Co., Chicago; J. Wiechers—Western Coil & Electrical Co., Racine, Wis.; Arthur D. Lord—DeForest Radio Co., Jersey City, N. J.; Alexander Weiss—Marti Electric Co., West Orange, N. J.; Ernest Kauer—C. E. Manufacturing Co., Providence, R. I.

Mr. Armstrong is treasurer of the association and Oswald F. Schuette, executive secretary is in charge of the headquarters at 134 South LaSalle Street, Chicago.

Sonora and Others Form Acoustic Products Co.

A new concern in the field of radio is the Acoustic Products Company. P. L. Deutsch, of Chicago, is president and Dr. Miller Reese Hutchinson heads its research and scientific laboratories.

The organizations taken over by the new corporation include the Sonora Phonograph Company, the Bidhamson Company, a patent holding corporation organized by John Hays Hammond, Lewis Kaufman, James J. Burden, E. F. Hutton, Harris Hammond and Anthony J. Drexel Biddle, Jr., and the Premier Laboratories, headed by Dr. Hutchinson.

FAMILIAR VOICE

GEORGE O'BRIEN, LEADING TENOR OF THE NATIONAL LIGHT OPERA COMPANY AND MEMBER OF THE QUARTET OF THE NATIONAL BROADCASTING COMPANY, A GUEST SOLOIST WITH THE NEW YORK SYMPHONY ORCHESTRA.

Butman Is Appointed Radio Board Secretary

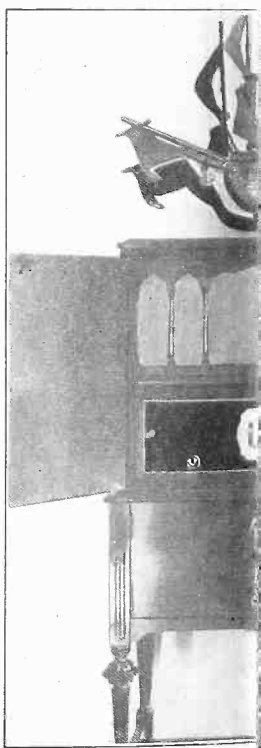
Carl Hawes Butman was chosen secretary of the Federal Radio Commission, succeeding Sam Pickard, who succeeded Henry A. Bellows as a member of the commission.

Versatility Required of Broadcasting Musicians

(Volpe Photo)

THE ALL-AMERICAN DANCE ORCHESTRA, WHICH BROADCASTS EVERY FRIDAY NIGHT FROM WGBS, the GIMBEL BROS. STATION, 6:30 TO 7:00 P. M., EXCEPTING FOR THE TIME TAKEN BY HERMAN BERNARD IN HIS WEEKLY TALK ON RADIO TOPICS, BEGINNING AT 6:40, UNDER IVA LANG'S DIRECTION.

Modern jazz dance music requires many instruments and musicians of great versatility. Each musician must be prepared to play more than one instrument and to change from one to the other at the wave of the leader's baton. In this All-American orchestra which broadcasts Friday nights from station WGBS, New York City, each player has at least two instruments. Each of those seated in the front row has one instrument in his hand and one on the floor. The leader has a piano behind him and a violin at his feet. The bass drummer has all the usual instruments for making the booms, the crashes, the rat-a-tats and the other noises which put the pulse in the music and the pep in the dancers' feet. The instruments producing the low notes are the hardest ones to reproduce on a radio set unless the output voltage is 400 or more and the output tube able to stand the strain, e.g., 210.



MODERN HOME CO
USUALLY PUT INTO
AND MADE ARTISTI
MELODY SHIP OF M
ADDS INTEREST

Board Suspends License of Eric Palmer's Son

At the request of Eric H. Palmer, radio editor of the Brooklyn "Daily Times" and publicity director of the Radio World's Fair, the amateur transmitting license of his young son, to operate station 2 ATZ, was suspended for ninety days by the Federal Radio Commission.

In a letter to the Commission Mr. Palmer stated that his son's extreme interest in radio resulted in him neglecting food and school, so that his health and his standing in school suffered and he had been dropped from two high schools.

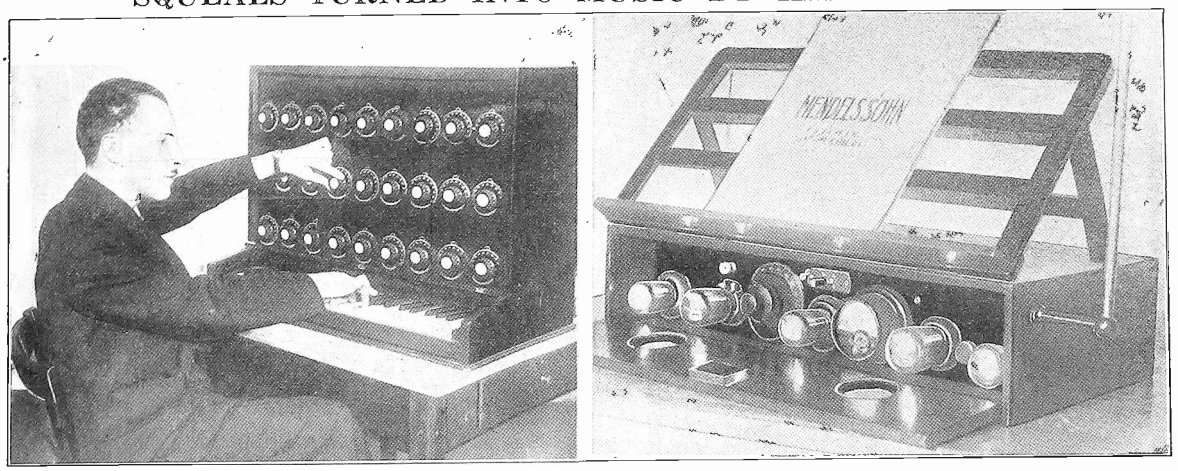
Accompanying the suspension was a letter written by Admiral Bullard, chairman of the commission:

"We believe with your father that you need a good rest, and when your license is restored, we hope you will resume your radio work with reasonable moderation.

"As you know, a radio is just in its infancy and great discoveries are just around the corner. We well understand your keen interest in this most marvelous invention with its great possibilities. Those of us who were pioneers will soon be forced to turn the reins of radio over to you boys, and we want you to be strong and healthy, as the burden will undoubtedly increase as new avenues for radio are opened up by you and your colleagues.

"This is a marvelous field for the American boy, and such enthusiasm as you have displayed should as a rule be commended rather than discouraged, but in order to develop into a big, strong, healthy boy you must have regular meals and your full quota of sleep."

SQUEALS TURNED INTO MUSIC BY HAND-WAVING

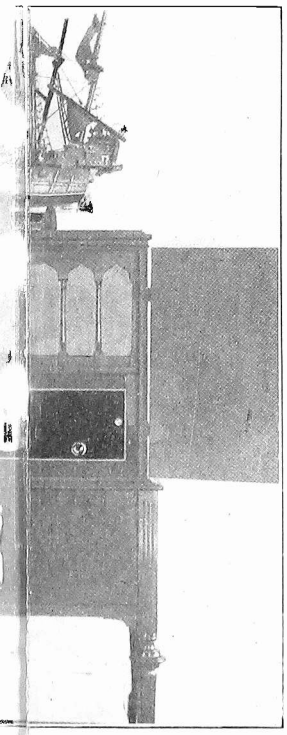


(Wide World)

PROFESSOR LEO THEREMIN OF THE PHYSICO-TECHNICAL INSTITUTE OF LENINGRAD, GIVING A DEMONSTRATION IN BERLIN OF AN INSTRUMENT BY MEANS OF WHICH HE CAN PRODUCE MUSIC OUT OF THE ETHER BY WAVING HIS HANDS. THE INSTRUMENT IS A MODIFIED RADIO TRANSMITTER AND THE PRINCIPLE OF MUSIC PRODUCTION RESTS ON THE WELL-KNOWN SQUEAL AND BODY CAPACITY IN RECEIVERS. AT RIGHT IS THE INSTRUMENT PERFECTED BY HIM. SKILLFUL CONTROL OF HETERODYNE SQUEALS MAKES IT A MUSICAL INSTRUMENT.

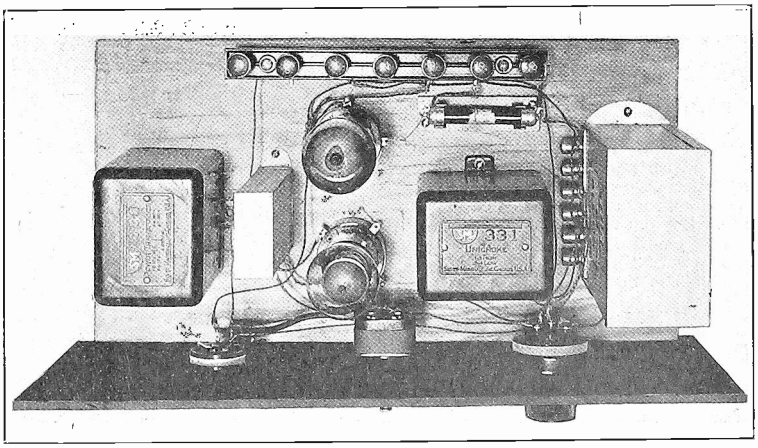
George Lewis Joins Arcturus Company

George Lewis, formerly president and general manager of Kenrad, radio executive and engineer of long experience, has been made vice-president of Arcturus Radio Company of Newark, New Jersey, manufacturers of AC tubes. The first commercial operator's license ever issued by the U. S. Government was made out to Lewis. His prominence in radio, attained as an American delegate to the First International Radio Conference at Geneva in 1913, has been maintained in subsequent activities. In 1923 Mr. Lewis joined Crosley as assistant to the president, going to Kenrad three years later. He has been a manager of the Institute of Radio Engineers, of which he is a member. He is chairman of the Vacuum Tube Committee of the R.M.A. and chairman of the National Electrical Manufacturers' Association, vacuum tube section.



NSRUCTED SETS ARE HNDSOME CONSOLES CALY DECORATIVE. A IISORIC SIGNIFICANCE O HE ENSEMBLE.

THE MODERN POWER IDEA



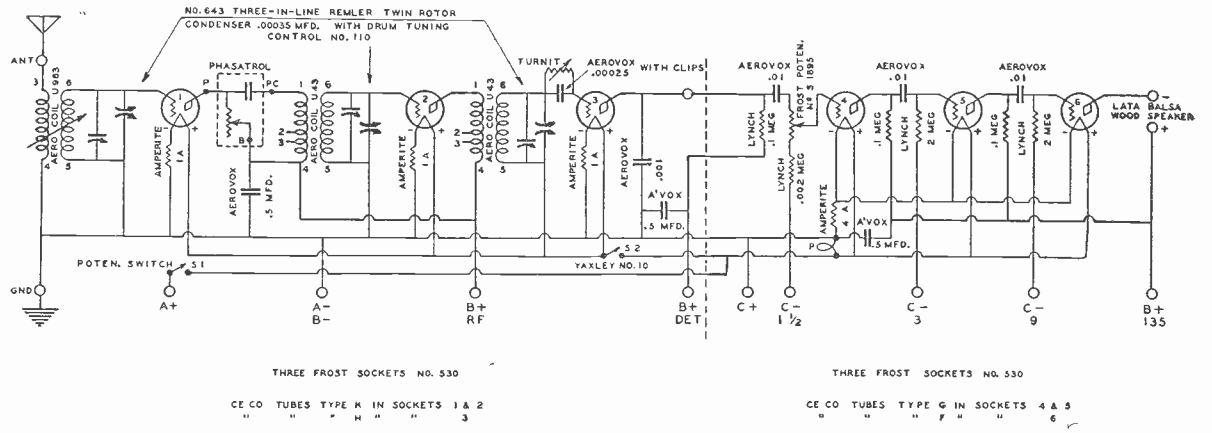
AN ELIMINATOR BUILT LIKE A RECEIVER

Battery eliminators usually are placed in compact metal boxes where the component parts are cramped. Such extreme compactness may be fine from the point of view of space conservation, but it is not so good when it comes to heat dissipation. Eliminators get hot, very hot at times. But only when they have been crowded into a small space and carefully shut up and heat insulated to prevent the escape of any heat.

The proper way of operating an eliminator is the cool way. Overheated, the eliminator will work no better than an overheated gasoline engine. Excessive heat may be equally disastrous in both cases.

One way of insuring an eliminator against overheating is to build it out in the open, just like the eliminator illustrated above. This has been built like a radio set in which stray couplings have been minimized. This is a splendid way of building an eliminator in which heat is continually liberated. The heat is disposed of just as rapidly as it is liberated.

The coils and transformers are built on generous lines. Consequently they will not heat up much when the compact is working full blast. Most of the heat will be generated in the two rectifier tubes. The designer kept this in mind when he built the compact and placed the tubes in the middle of the set as far from the other parts as possible.



YOU MAY HAVE AVERAGE SELECTIVITY, UNUSUAL SELECTIVITY OR ULTRA-SELECTVITY IN THE UNIFIED DIAMOND, AS CIRCUMSTANCES REQUIRE.

Why Selectivity Range Is An Asset to a Set

By the Laboratory Staff

In the Unified Diamond several methods of changing the selectivity are available to the fan operating the receiver. The first is the adjustable coupling between the antenna coil and the first tuning coil. When the coupling between these coils is close, the selectivity is lower, because the antenna resistance is reflected into the secondary. But the sensitivity of the circuit is correspondingly higher.

The second method of varying the selectivity of the circuit is the adjustable feature in two primaries of the Aero tuning coils subsequent to the first. If all the turns available in the primaries are used the selectivity is low, but again the sensitivity of the set is higher than when the coupling is loose.

The third method is the adjustment of the Electrad Phasatrol. If the adjuster is turned farther than is necessary to neutralize the circuit, the receiver becomes less selective. But the object of the Phasatrol, invented by John F. Rider, is not to control the selectivity of the circuit but to control the oscillation in the first tube.

Reasons for Changes

Now, is there any good reason for changing the selectivity of the receiver? There are very good reasons. If the set is super-selective, as it may be made, the quality will suffer somewhat. The upper side frequencies will be depressed in amplitude. Articulation will suffer as a result. Spoken signals will not be so easily understandable, and musical signals will not be so crisp and delightful. Thus we have a very strong reason for not making the set too selective.

Again, when the set is made super-selective, its sensitivity will be low. Distant stations cannot be received. It is, of course, desirable to receive DX occasionally. Hence for that reason we do not want to make the set to selective.

Is there any particular reason for increasing the selectivity in spite of the undesirable effects? Yes, in some places and at certain times. There may be an exceptionally strong signal which interferes with the clear reception of another and weaker signal. The only practical way to separate the two signals is to increase the selectivity. This can usually be done to an extent which will cut out the strong interfering station and still leave sensitivity enough to bring in the weak and desired station.

What reason is there for sacrificing selectivity and gaining sensitivity? At certain times local stations may have signed off and it is then desirable to try for a remote station. If there is no strictly local station operating there is no need for great selectivity because the tuning of the remote station will be quite sharp anyway, and the set can easily separate distant stations. This can be readily done even when the distant and desired station is much weaker than another DX station.

Tuning in DX

In tuning in distant stations the first requisite is sensitivity. This will bring in the stations. The second requisite is tone quality. This requirement is much greater on distant stations than on local. Usually the signals from the distant stations are very much attenuated on the higher notes. If the circuit is not broad on the local stations, it will be excessively sharp on the distant stations. If the circuit is very selective on the locals, it will so mutilate the programs from distant stations that they will not be worth listening to.

The Aero Universal super-sensitive coils are officially prescribed by Radio World's Laboratory Staff for the Unified Diamond. These coils are not only efficient but are so constructed that they may be placed reasonably close to one another without fear of trouble due to magnetic coupling.

The coil shown at left is the one used in the antenna input circuit. The primary is adjustable. After the adjustment is made for best all around results, it is left that way.

The primaries of the two other coils, illustrated at right, are fixed. These primaries are inside of the secondaries at a point where maximum coupling is obtained. The coils are versatile in that three ranges of inductances are available in the primary. Of course, for the secondary the inductance is always the same.

The coils used in the Unified Diamond are to be tuned with .00035 mfd. condensers. Aero coils are also made for .0005 mfd. tuning, but if the three-section condenser specified for the Unified Diamond is used, or any other condenser where each section is .00035, be sure that the right Aero coil is used. If you use a .0005 coil with a .00035 condenser you will not be able to tune above 495 meters or thereabouts.

LIST OF PARTS
for the Radio Frequency Fountain

Organic Kit

One Remler three-in-line .00035 mfd. condenser, No. 643 (includes pilot lamp P).
One Remler drum tuning control, No. 110.
One Aero Universal antenna coil, U-963.
Two Aero Universal wave trap unit coils, U-43.
One Frost 500,000-ohm potentiometer, with switch, No. S1895 (switch is S1 in diagram).
Three Frost sockets, No. 530.
One Electrad Phasatrol.
Three 1A Amperite with mountings.
One Aerovox .001 mfd. moulded condenser, No. 1450.
Two Aerovox .5 mfd. bypass condensers, No. 250.
One Aerovox .00025 mfd. moulded grid condenser with clips, No. 1475.
One Improved Turn-It. variable grid leak.
One Yaxley No. 10 switch (S2 in diagram).
Two extra Remler knobs, one for Yaxley switch, the other for Frost potentiometer-switch.

Inorganic Kit

One 2¾x20x¼-inch Bakelite socket strip (note ¼-inch thickness).
One 7x21x3-16-inch Bakelite front panel.
One pair of Bruno or Benjamin adustable brackets.
Six lengths of Acme Celatsite.

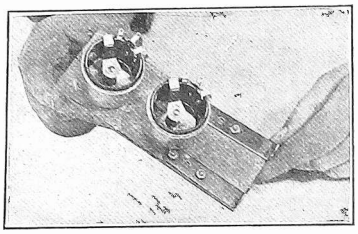
Accessories

Two CeCo type K tubes for sockets 1 and 2; one CeCo type H tube for socket 3.
One 7x21-inch Corbett sloping cabinet, model TS, 10 inches deep (genuine walnut or genuine mahogany; specify which).

Chicago Opera Program to Be on Air Weekly

Encouraged by the success of the Chicago Civic Opera Company broadcasts from the Autitorium Theatre last season, the National Broadcasting Company will send out over its large network of stations each week of the twelve weeks of this season acts from the most popular of operas as put on by the Chicago Civic Opera Company.

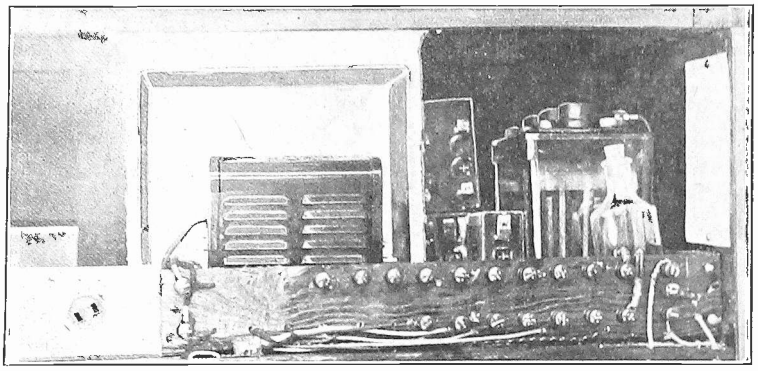
NICE MOUNTING



(Hayden)

HEAVY DUTY resistors employed in eliminators, even the compact variables shown, dissipate a great deal of heat. To aid in the heat disposal the resistors should be placed so that the air can circulate freely. Two Centralab heavy duty resistors are shown mounted on a heat resistant strip which in turn is to be mounted vertically on the sub-panel by means of the brass angles.

OPEN IN BACK IS NEW STYLE



(Hayden)

WHEN INSTALLING radio equipment in a console it is well to separate the various components as far as possible. The trickle charger, storage battery, and C battery can be placed in the top compartment. The lower compartment is suitable for the B eliminator and power amplifier. The back is left open to facilitate ventilation and heat disposal.

Rectify Full Wave And Reap Full Gain

By Truman C. Hawley

A certain fan was about to build himself a B battery eliminator and he was in a quandary as to what form of rectification to use, half wave or full wave.

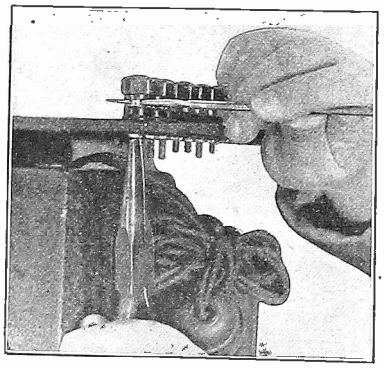
He put his problem up to a friend of his, a man reputed to be well versed in the ways of rectifiers.

"Why use half wave rectification," the expert asked, "when you can use full wave rectification? If half a thing is a good thing then the whole is just twice as good a thing."

That is logical enough, and should have met with an appreciative reception from the fan, but it did not. He built a single wave rectifier, because he had already decided to do so. In fact he had already bought the parts, and all he wanted from his friend was the approval of his judgment. Not getting the approval, he only formed another judgment of his friend's opinions which was far from complimentary.

There seems to be no good reason for employing half wave rectification. Every practical consideration is against it. Everything is in favor of full wave rectification. Surely, if half a wave is good, a whole wave is better.

POSTS ON RIGHT



(Hayden)

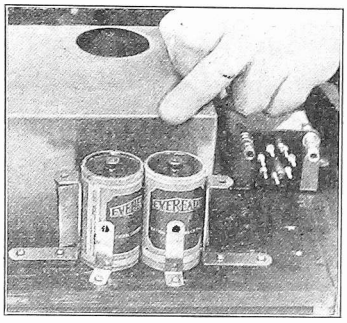
WHEN MOUNTING binding posts it is not easy to hold a post firmly while tightening the nut so that the hole in the stem will point in the desired direction. The photograph shows a simple solution. A sharp-pointed tool like a mechanic's scriber is inserted into the hole. The post is then held in the desired position while the nut is secured. A steel tool is preferred as any other will bend.

Hertzberg of "Radio News" Now Managing Editor

Robert Hertzberg, associate editor of "Radio News," has been appointed managing editor of that magazine by Hugo Gernsback, the editor-in-chief. Fred H. Canfield, formerly technical radio editor of the New York "Herald Tribune," was appointed technical editor of "Radio News."

Previous to his advent on "Radio News," Hertzberg was a free-lance radio writer and a former member of the staffs of several of the New York newspapers.

CELLS FOR BIAS



(Hayden)

SOME PREFER to use grid bias in Super-Heterodynes instead of the usual potentiometer. They can use a couple of Eveready cells in the manner illustrated. The cells are held in place on the subpanel by means of brass angles.

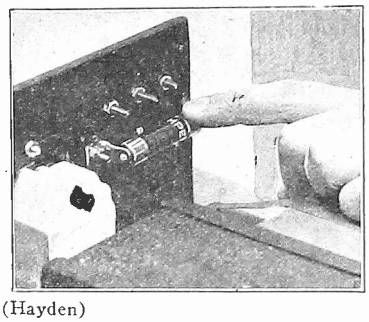
Maguire Opens Store

The many friends and customers of P. F. Maguire, who has sold parts and given advice to thousands of fans in New York's great radio retail center, will be glad to know that he has opened a radio store of his own under the name of Jersey Radio Co., at 78 Cortlandt Street, New York City. Here he has stocked the latest and most modern sets, parts, accessories, speakers and power supply devices of every type. Advice is freely and courteously given and the fans' problems are taken to heart with a true desire to serve.

Mail orders will be filled for the benefit of those who cannot get in to see him and satisfaction is guaranteed. However, those who have dealt with "Mac" in the past will not need this warranty.—J. H. C.

The Aero-Seven, a super-sensitive receiver, which can be operated from batteries or from the alternating current line, was described in lucid fashion by Zeh Bouck in the Oct. 8, 15 and 22 issues of Radio World. Send 45 cents for these three issues, or start your subscription with any one of them. RADIO WORLD, 145 West 45th St., New York City.

EASY TO REACH



(Hayden)

WHEN AN AMPERITE is installed on the baseboard for the power tube in the eliminator assembly it is usually inaccessible. But if it is mounted in back of the front panel near the top it is easy to get at.

A THOUGHT FOR THE WEEK

DON'T worry about the coming of that day when all the use any man will have for a radio set will be to sit down and turn a knob and get Kalamazoo or Kamchatka. That day isn't coming. Always there will be that spirit of adventure that made Columbus hunt for an unknown continent, Franklin explore the heavens with a kite and Lindbergh take his epoch-making flight. Thank God, we are not a nation of lollipop-sucking, unimaginative, mechanical dolls that speak when somebody punches us in the chest. We still dream, think, plan and dare to venture into unknown fields. And so experimental radio will continue to fascinate millions who are humans and not dummies.

SIXTH YEAR

RADIO WORLD

Title Reg. U. S. Pat. Off

The First and Only National Radio Weekly

Member, Radio Publishers Association

Radio World's Slogan: "A radio set for every home."

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MANAGING EDITOR, Herman Bernard
TECHNICAL EDITOR, Lewis Winner

CONTRIBUTING EDITORS:
J. E. Anderson, James H. Carroll, and
Capt. Peter V. O'Rourke

SUBSCRIPTION RATES

Fifteen cents a copy. $6.00 a year, $3.00 for six months. $1.50 for three months. Add $1.00 a year extra for foreign postage. Canada, 50 cents.

Receipt by new subscribers of the first copy of RADIO WORLD mailed to them after sending in their order is automatic acknowledgment of their subscription order. Changes of address should be received at this office two weeks before date of publication. Always give old address: also state whether subscription is new or a renewal.

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General Advertising

1 Page, 7¼"x11"	462 lines	$300.00
½ Page, 7¼"x5½"	231 lines	150.00
⅓ Page, 8¼" D. C.	231 lines	150 00
¼ Page, 4⅛" D. C.	115 lines	75.00
⅛ Page, 4⅛" S. C.	57 lines	37.50
1 Column, 2¼"x11"	154 lines	100.00
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52 consecutive issues	20%
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WEEKLY, dated each Saturday, published Wednesday. Advertising forms close Tuesday, eleven days in advance of date of issue.

CLASSIFIED ADVERTISEMENTS

Ten cents per word. Minimum 10 words Cash with order. Business Opportunities ten cents per word. $1.00 minimum.

Entered as second-class matter March 23, 1922, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

New York Entrants Chosen for Kent Test

At an audition recently conducted over WRNY in New York City, Elsie Wieber and W. N. Hain were selected from among twenty-five young artists to represent New York in the national Atwater Kent song contest for $17,500 in prizes and special tuition in vocal schools. A gathering of 400 music critics chose these artists.

Fiction Sole Authority for 5,000 Cycle Cut-Off

By Capt. Peter V. O'Rourke

Contributing Editor

Much has been written about the 5,000 cycle cut-off in radio broadcasting. Transmitting stations are supposed to cut off the transmission at 5,000 cycles on each side of the carrier frequency so that no frequency is radiated which represents an audio frequency higher than that fictitious cut-off. A German technician who visited this country a short time ago expressed surprise that the cut-off was so low in this country when in his homeland the cut-off is more than twice as high. No doubt the designers of our American broadcasting stations are equally surprised at the 5,000 cycle cut-off.

One argument for the 5,000 cycle cut-off is that the width of a broadcast channel as fixed by law is only 10,000 cycles and that a station cannot transmit a frequency higher than 5,000 cycles without interfering with the higher frequencies of the stations operating in the two adjacent channels.

One of the Reasons

The idea of a 5,000 cycle cut-off has been fostered by manufacturers of audio coupling devices and loudspeakers which cannot go any higher than 5,000 cycles.

But the argument that broadcasters cut off at 5,000 cycles is unsound. Anybody who has ever listened in on a radio program has heard frequencies up to and above 10,000 cycles. The higher frequencies can even be heard on the cheapest sets, and often they can be heard on super-selective Super-Heterodynes.

One reason for the persistence of the talk about the 5,000 cycle cut-off is that it is a hangover from old telephone practice. Before broadcasting telephony was a utility and it was not used for entertainment. Transmitted speech had to be intelligible, but it did not have to be perfect to bring in revenue. The telephone equipment had to be such as to be capable of transmitting and receiving intelligible speech with the greatest economy.

It was found that it was not necessary to transmit frequencies higher than 5,000 cycles to make the received signals intelligible. In fact, the cut-off could even be much lower without a great loss in the articulation. When putting the cut-off at a low value the telephone equipment could be greatly simplified and made very much less expensive. Hence in the interest of economy the cut-off was put as low as was allowable to retain understandable articulation.

Came the Music

When music was added to regular telephone communication the former low cut-off was found to be too low. It was raised to 5,000 cycles, with a noticeable improvement in fidelity. But the cry went up for perfect quality in radio. Radio receiving equipment was so improved that perfection was closely approached in some cases. Now was all this improvement due to the perfected receiving equipment? Indeed not! The receivers could not reproduce any better quality than the transmitters sent out. The transmitters had been improved as well as the receivers. As a matter of fact the transmitters of the better type had been perfected long before the public thought of improving the receivers. When the receiver designers started to work they already had high grade transmission to try to reproduce.

And the modern transmitters don't cut off at 5,000 cycles. They transmit 10,000 cycles and higher. A transmitting station does not have to economize on audio amplifiers and modulators when the cost of this equipment is less than one per cent of one per cent of the total cost of the station. It would be a queer sort of economy to save a few dollars on a transformer when the cost of the station may mount to half a million, and when the cheaper transformer would make the station worth thirty cents.

Up to 10,000 Cycles Sent Out

Audio frequencies at least up to 10,000 cycles are transmitted, but they are not always received, due to inferior audio amplifiers, super-selective circuits and inefficient reproducers.

Broadcast channels were put 10 kc apart to prevent direct heterodyning between the carriers of two adjacent channels, not to prevent clashing of the sidebands of the stations. The clashing of the sidebands would not be noticeable because the two beating frequencies would be weak and constantly varying. The two carriers would beat and produce a fairly steady howl because they are relatively strong and steady.

Two broadcast stations operating on frequencies 10 kc apart will produce a beat of that frequency, and this is audible. The reason we do not hear this high pitched squeal is that two stations operating 10 kc apart are always far removed so that the strength of the one carrier is vanishingly small in comparison with that of the other. Then again, a frequency of 10,000 cycles is not readily heard unless it is very intense.

Must Stay Within 500 Cycles

When two stations nominally 10 kc apart stray off their assigned frequencies and toward each other, the resulting beat will be lower, and that may be heard even if the two stations are located 3,000 miles apart. That is one reason why the Government is insistent that the stations shall not stray more than 500 cycles off their assigned frequencies. If both stations approach each other by this amount, the beat frequency will be 9,000 cycles, which is high and not easily heard unless it is intense. Hence as long as the stations stay on their assigned frequencies within the limits set by the Government there will not be any direct interference between stations. The 9,000 cycle beat is the worst case possible within the law.

Trans-Atlantic Programs Make a Step Forward

At a series of conferences between Captain P. P. Eckersley, chief engineer of the British Broadcasting Company, and Dr. Alfred N. Goldsmith, consulting engineer of the National Broadcasting Company, resulted in preliminary plans for special experiments to help develop trans-Atlantic broadcasting between England and America.

"We propose an intensive experimental and development program, but we are unable to give any present guarantees of service," both engineers stated. "The program will include the erection of a powerful short wave relay broadcasting transmitter and the installation of a special short wave relay broadcasting receiving station in England and the systematic utilization of similar facilities in the United States. We believe that ultimately short wave development is likely to permit inter-continental broadcasting."

The Radio Trade

List of Licensed Manufacturers of Sets and Power Devices

So that readers may be apprised of the set and power supply manufacturers licensed by the Radio Corporation of America and its associated companies, the list of licensees, revised up to the time of going to press, is given herewith:

SET MANUFACTURERS

(1)—Zenith Radio Corporation, 3620 Iron Street, Chicago, Ill.
(2)—All American Radio Corporation, 4201 Belmont Avenue, Chicago, Ill.
(3)—Splitdorf-Bethlehem Electrical Company, Newark, N. J.
(4)—Stromberg Carlson Telephone Manufacturing Company, 1060 University Ave., Rochester, N. Y.
(5)—The Crosley Radio Corporation, Cincinnati, Ohio.
(6)—Freed Eisemann Radio Corporation, Junius & Liberty Aves., Brooklyn, N. Y.
(7)—F. A. D. Andrea, Inc., 1581 Jerome Ave., New York, N. Y.
(8)—Federal Telephone Manufacturing Company, Buffalo, N. Y.
(9)—American Bosch Magneto Corporation, Springfield, Mass.
(10)—Charles Freshman, Incorporated, 240 West 40th St., N. Y. City, N. Y.
(11)—Howard Radio Company, 451 North Ohio St., Chicago, Ill.
(12)—Gilfillan Bros., Incorporated, 1815 Venice Boulevard, Los Angeles, Calif.
(13)—Wm. J. Murdock Company, 347 Washington Ave., Chelsea, Mass.
(14)—Bremer-Tully Manufacturing Company, 520 South Canal St., Chicago, Ill.
(15)—Steinite Radio Company, Atchison, Kan.
(16)—Day-Fan Electric Company, Dayton, O.
(17)—Mohawk Corporation of Illinois, Diversey at Logan Boulevard, Chicago, Ill.
(18)—King Manufacturing Company, Buffalo.
(19)—Atwater-Kent Manufacturing Company, 4700 Wissahickon Ave., Philadelphia, Pa.
(20)—United States Electric Corporation, Chicago, Ill.
(21)—Phanstiehl Radio Company, Waukegan, Ill.
(22)—Federal-Brandes Co., Inc., Newark, N. J.
(23)—A. H. Grebe and Company, Incorporated, Richmond Hill, N. Y.
(24)—Consolidated Radio Company, c/o Wells-Gardner and Co. Div., 1720 N. Robey St., Chicago, Ill.
(25)—Stewart-Warner Speedometer Corp., 1826 Diversey Blvd., Chicago, Ill.

POWER SUPPLY

(1)—Radio Receptor Company, Inc., 106 Seventh Ave., New York City, N. Y.
(2)—General Radio Company, 30 State St., Cambridge, Mass.
(3)—Martin-Copeland Co., Providence, R. I.
(4)—J. S. Timmons, Incorporated, 339 East Tulpehocken St., Philadelphia, Pa.
(5)—National Company, Inc., 61 Sherman St., Malden, Mass.
(6)—Farrand Manufacturing Company, Incorporated, Long Island City, N. Y.
(7)—Harold J. Power, Inc., Medford Hillside, Mass.
(8)—American Transformer Company, 174 Emmet St., Newark, N. J.
(9)—Zenith Radio Corporation, 3620 Iron St., Chicago, Ill.
(10)—William J. Murdock Company, 347 Washington Ave., Chelsea, Mass.
(11)—Mohawk Corporation of Illinois, Diversey at Logan Boulevard, Chicago, Ill.
(12)—Gilfillan Bros., Incorporated, 1815 Venice Boulevard, Los Angeles, Calif.
(13)—Howard Radio Company, 451 East Ohio St., Chicago, Ill.
(14)—Stromberg-Carlson Telephone Manufacturing Company, 1060 University Ave., Rochester, N. Y.
(15)—Steinite Radio Company, Atchison, Kan.
(16)—Federal Telephone Company of Buffalo, Buffalo, N. Y.
(17)—Bremer-Tully Manufacturing Company, 520 South Canal St., Chicago, Ill.
(18)—King Manufacturing Company, Buffalo, N. Y.
(19)—Phanstiehl Radio Corporation, Waukegan, Ill.
(20)—United States Electric Corporation, Chicago, Ill.
(21)—Crosley Radio Corporation, Cincinnati, O.
(22)—A. H. Grebe and Company, Incorporated, Richmond Hill, N. Y.
(23)—Consolidated Radio Company, c/o Wells-Gardner and Co. Div., 1720 N. Robey St., Chicago, Ill.
(24)—Stewart Warner Speedometer Corp., 1826 Diversey Blvd., Chicago, Ill.

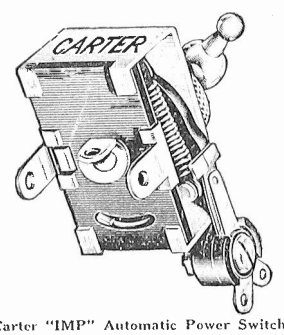
Radio Up-To-Date

Through a typographical error in the book review in a recent issue, the name of the firm handling the best radio book on the market at $2.00, was incorrectly spelt. The name of this firm is Heisten & Roberts, the address 116 West 39th street, New York City. The review also failed to cover the fact that this book covers all the modern discoveries in radio right down to date, even television being treated.

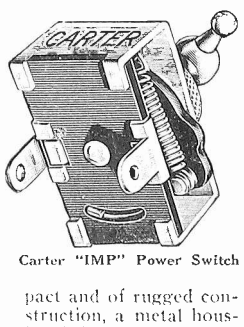
The book is a thorough education in radio for the experienced as well as for the layman; for trained engineers it is an indispensable reference book. Twelve of the greatest minds in the field of radio collaborated on this work and it was originally issued in four volumes; this edition being the four bound into one deluxe binding. Further information may be had from the above concern.—J. H. C.

New Carter Switches Announced

To their long list of excellently made products, the Carter Radio Company, 300 East Racine Avenue, Chicago, Ill., have added the "Imp" power switch and the "Imp" automatic power switch. The power switch is of the quarter turn double contact snap switch type, and can be used in either the 6-volt filament supply lead or in the 110 volt line lead. The automatic switch does the same job as a relay. That is, it turns the charger off, the B eliminator on, and closes the filament circuits, or turns the charger on, the B eliminator off and breaks the filament circuit.



Carter "IMP" Automatic Power Switch



Carter "IMP" Power Switch

Both devices are very small, compact and of rugged construction, a metal housing being used, with all parts insulated.

Literature Wanted

THE names and addresses of readers of RADIO WORLD who desire literature on parts and sets from radio manufacturers, jobbers, dealers and mail order houses are published in RADIO WORLD on request of the reader. The blank below may be used, or a post card or letter will do instead.

RADIO WORLD,
145 West 45th St., N. Y. City.

I desire to receive radio literature.

Name .....

Address .....

City or town .....

State .....

Joseph H. Nulty, Trenton, Ontario, Canada.
Frank K. Kertz, Jr., 10402 Lamontier Ave., Cleveland, O.
W. E. Jensen, 3201 Charles St., Seattle, Wash.
Donald M. Van Tassel, 35 Beers Building, Oil City, Pa.
Dr. John A. Gieselbrath, 274 Main St., Middletown, Conn.
C. L. Fulks, 1317 McDonough, Richmond, Va.
Percy J. Cox, 1282 3rd Ave., Watervliet, N. Y.
Harley Swift, 601 Valley Drive, Syracuse, N. Y.
L. A. Purdy, 309 California St., Oakland, Calif.
P. Bernier, Box 13, Station A, Boston, Mass.
Horace S. Kirchner, 512 Central Ave., Oak Lane, Philadelphia, Pa.
Leonard Leschnik, 1711 Montgomery Place, New York City, N. Y.
Ragnor Borg, 1411 79th Ave., W. Duluth, Minn.
Vincent Holmes, 11626 Moran, Hamtramck, Mich.
C. T. Russell, 1 North Scott St., Mobile, Ala.
C. Ryan, 719 1st St., New Orleans, La.

Tobe Has Condensers for Victoreen Device

One of the most interesting as well as essential parts in the Victoreen power supply unit, which was described in the October 15, 22 and 29 issues of Radio World, by J. E. Anderson, is the new Tobe 1,000 volt fixed condenser, manufactured by Tobe-Deutschmann Co., Cambridge, Mass., pioneer manufacturers of fixed condensers. Although made to stand the high voltage of 1,000, they are unusually compact, and yet electrically perfect.

Cardwell 1928 Condensers

The new Taper Plate Type "E" Cardwell condenser gives the ideal tuning curve midway between straight wavelength and straight frequency, with ample separation on all wavelengths. The type "E" is built to last under hard use and may be mounted entirely behind a 4 inch dial. It is made in five capacities, from .0005 to .000075. The Cardwell "Balancet" is a condenser for neutralizing, balancing, vernier or for any purpose a baby condenser will fill. These come in all needed capacities. The type "C" condenser is .00035 mfd. Full information on the Cardwell line may be had from the Allen D. Cardwell Co., 81 Prospect Street, Brooklyn, N. Y.—J. H. C.

NEW CORPORATIONS

Terminal Radio Stores, $15,000; N. Y. City. (Atty., M. Shapiro, 1440 Broadway, N. Y. City).
Byron Radio Corp., $20,000; N. Y. City. (Atty., S. C. Seltzer, 291 Broadway, N. Y. City).
Acme Apparatus Corporation, Cambridge, Mass., 25,000 shares at $10. (Incorporated under the laws of Massachusetts).
Hubert Radio Corp., $20,000; N. Y. City. (Atty., S. C. Seltzer, 291 Broadway, N. Y. City).

Radio University

A FREE Question and Answer Department conducted by RADIO WORLD for its yearly subscribers only, by its staff of Experts. Address Radio University, RADIO WORLD, 145 West 45th St., New York City.

When writing for information give your Radio University subscription number.

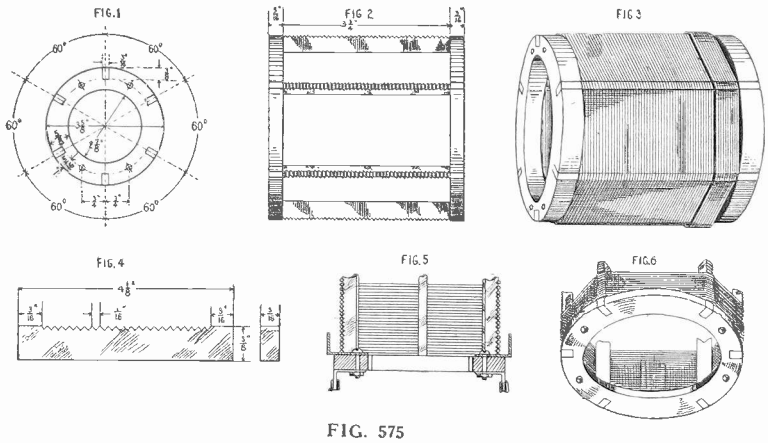


FIG. 575

How to make a tuned radio frequency coil.

I AM at present using 90 volts on the plates of my audio amplifier tubes. I wish to rewire this portion of the receiver, so that I can use a power tube such as the 112 in the last stage, but keep the —01A in the first audio stage. On the plate of the 112, I would like to use 135 volts.

(1) Could I use 135 volts on the plate of the first audio tube also, or should I keep the 90 volts on the first audio plate and just use 135 on the last audio plate?

(2) Using the separate B voltages, are separate C's necessary? What voltages? —RICHARD MAXWELL, Mount Vernon, New York.

(1) Use 90 volts on the first audio plate and 135 volts on the last plate.

(2) Use separate C batteries also. For the first audio tube, use a 4½ volt C battery, while for the last audio tube, use a 9 volt C battery. Don't use a common C battery.

* * *

I RECENTLY built a 3-tube set, using a regenerative detector, with a loop for pickup, and two stages of transformer coupled audio frequency amplification. A small microdenser is connected from the plate of the detector to the loop. This is used to control the oscillations. I use a two foot loop. I cannot get any volume. Do you think it is the loop? I have a three foot loop. Would that help?

(2) Would you suggest adding another stage of audio frequency amplification to this set? I have a two to one ratio transformer. The other two transformers are also of the two to one ratio type.—HENRY A. DOMINICK, Harrison, Pa.

(1) The three foot loop would increase the volume considerably.

(2) Yes, you can add another stage of audio, but you will have to provide some means of controlling the volume. Suggest you install a 200,000 ohm potentiometer in the secondary circuit of the first audio transformer. That is, connect the resistance terminals across the F and G posts. Then break the connection running from the G post of the transformer to the G post of the socket. To the G post on the socket, connect the arm of the potentiometer. Be sure you use the proper C bias on all the tubes.

* * *

I AM about to build a 6-tube receiver. In it, are two tuned radio-frequency stages, a non-regenerative detector and three stages of resistance coupled audio frequency amplification. Now I would like to build my own coils. The data on the print showing the circuit diagram of the set, states that any standard type of RF coil can be used. I would like to use .0005 mfd. variable condensers, the coils to be of the air-form type.—ROBERT L. MORTON, Salt Lake City, Utah.

The various steps in the making of such a coil are shown in Fig. 575. First, the heads are made. The dimensions for this are shown in Fig. 1 in the group of six diagrams. In Fig. 2, we see the side view of the form, with the dimensions of the strips as well as the width of the head. These strips as well as the head may be of hard rubber, or Bakelite. How the completed form looks is shown in Fig. 3. In Fig. 4, the dimensions for the notches on the strips are given. You will find that after notching the strips of wood, there will be 67 notches. Forty-five of these are to be used for the secondary winding. The winding of the secondary is not begun until six notches are skipped at the beginning. At the conclusion of the winding, six more notches are skipped, and then ten turns are put on for the primary. In winding, use No. 22 double cotton covered wire. To mount the coils, use angle brackets of the one inch bend type. How they should be mounted is shown in Fig. 5. Fig. 6 shows how the strips are fitted into the circular head. It is not necessary to apply any dope to hold the windings. If you have made the notches deep enough and the windings tight enough, you should experience no difficulty in making the windings stay in place.

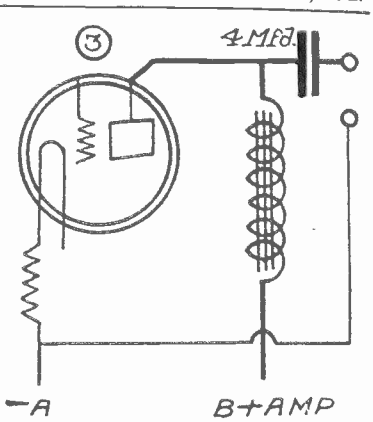


FIG. 574

The circuit illustrating how to install a choke coil and condenser, as requested by Wallace Merchow.

* * *

I HAVE built the five-tube circuit described by Tim Turkey in the August 27 issue of RADIO WORLD, and am experiencing some trouble with it.

(1) I cannot control the oscillation in the detector stage. I have tried reducing the number of turns on the tickler, but when the oscillations do stop, the signals grow weak. The same thing happens when the B voltage is reduced. I think the trouble is in the RF choke unit. That is, is it possible that the value of the fixed condensers shunted across the choke is too great? If so, what value would you suggest?

(2) If I use a power tube in the last stage, such as the 171, is it necessary that I use a choke coil and condenser in series with the plate of the tube? If so, please show how to hook it up and give values.—WALLACE MERCHOW, Atlanta, Ga.

(1) Try .00025 or .0001 mfd. fixed condensers.

(2) The choke coil and condenser will prevent the speaker windings from becoming damaged. How to connect it up is shown in Fig. 574. The choke coil can be of the 100 henry variety. The capacity of the fixed condenser is indicated.

* * *

IN BUILDING a shielded receiver, is it best to incorporate the coils and the condensers in separate shields or should one use a large can and place all the parts in it?

(2) I notice that in several descriptions of shielded receivers, the front portions of the can are left off. Wouldn't it be better to place them on?

(3) Must the cans be grounded?

(4) If so, does it matter whether the plus A or the minus A is also brought to the ground?—ABE MOSKOW, Brooklyn, New York.

(1) The separate shields should be used for best results. Using a common shield, does only one thing and that is, to

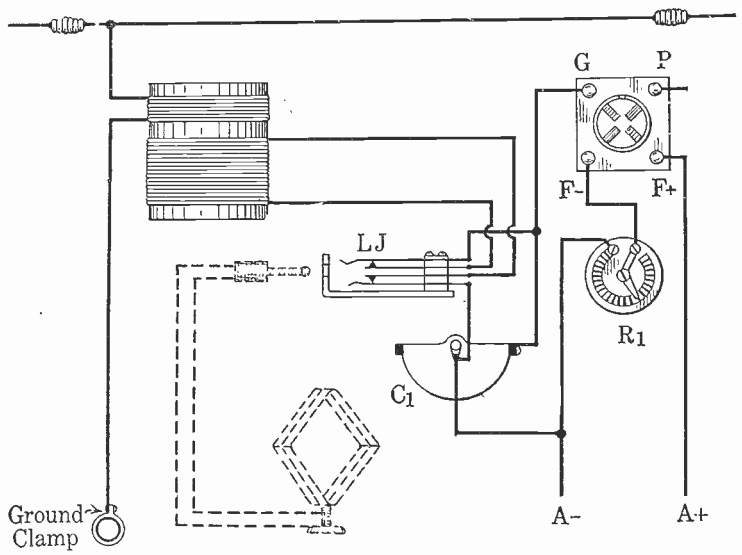


FIG. 576

How to hook in a loop via a double circuit jack.

prevent the coils from acting as miniature antennas, thus making the set a bit more selective. But, then again, the common feedback or interstage trouble is encountered. So what you gain, you really lose.

(2) Yes. The more the unit is shielded, the less tendency there is for interaction between coils.

(3) Yes. Without the ground, the shield is practically worthless.

(4) No. Either side can be grounded. Be sure to watch the grid returns. That is, if the shafts of the condensers are connected to the cans and you use a —01A tube as a detector, you will have a short, if you connect the grid return to the plus F since the grid returns of the RF tubes will be to minus. Instead, the grid return through the coil should go to the minus F, while the grid leak should be brought to the F plus. In this way the actual grid return is made plus for this tube.

* * *

I WOULD like to build a four-tube reflex, wherein the first radio frequency stage is reflexed, the detector is non-regenerative, while the next two tubes are hooked up in a straight transformer coupled circuit.

(1) Could I use a radio frequency choke coil? If so, would a 65 millihenry type work?

(2) In connecting up, is this coil placed in series with the plate of the detector tube and the P post of the audio transformer in the reflexed stage? Also, is a .0005 mfd. fixed condenser connected from the plate post of the detector socket to the minus F post of the same socket?

(3) How many rheostats would you recommend using and of what values?

(4) If I use 90 volts on the plates of the audio tubes, should I still use separate 4½ volt C's in both grid circuits?

(5) Would it be advisable to use regeneration in either the radio frequency or detector stages?

(6) Is it necessary to use by pass condensers in this type of set? If so, how many should be used, what value and where?—PHILIP J. DARLING, Kensico, New York.

(1) Yes.

(2) Yes. Be sure that you bring one terminal of the radio frequency choke to the P post on the proper audio transformer.

(3) It is only necessary to use a rheostat in the RF filament circuit. This should have a value of twenty ohms, and be inserted in series with the negative leg of the filament. The filaments of the other tubes should be controlled by Amperites, the type depending upon what tubes are used. They should also be placed in the negative leg of the filament.

(4) Yes, that is good practice.

(5) No, the tuning would become too erratic.

(6) Yes, bypass condensers can always be used to advantage. Each of the plate voltages should be bypassed to the minus A. via 1 mfd. fixed condensers. That is, each one is connected from the B plus post to the minus A post.

* * *

PLEASE SHOW how to hook up a double circuit jack in the radio-frequency portion of a tuned RF set, so that a loop may be used.—FRANK ARMOR, Kansas City, Mo.

This is shown in Fig. 576.

* * *

I WISH to construct the Winner receiver, which was described in the October 1, 8, 15, 22 and 29 issues of RADIO WORLD, and therefore desire to have some information, before I go ahead.

(1) Could the set be built to work successfully without incorporating the shields?

(2) Must a power tube be used in the last stage of audio frequency amplification?

(3) I am confused as to the correct ohmage rheostat to use in the radio frequency amplifier filament circuit. Will you please set me straight on this matter?

(4) Shouldn't the coils be placed at right angles to each other? I notice that they are parallel.

(5) Are the binding posts A and B necessary?

(6) Is it necessary to use a variable grid leak?

(7) Is the detector stage wired up for a soft tube such as the -00A, or a hard tube such as the -01A?

(8) I have three .0001 mfd. fixed condensers. One, I desire to use as a grid condenser, while the other two, I would like to use in the special radio frequency choke balancing system. Could they be used?—CHICK COMINS, N. Y. C., New York.

(1) No. These shields are very important. They prevent interstage coupling, which causes uncontrollable squeals. They also aid in making the set more selective, since the coils act as energy transferers and not as small antennas.

(2) Yes, in order to get the flawless reproduction that this receiver is capable of delivering.

(3) Use a twenty ohm rheostat for best results.

(4) It is not necessary to place the coils at right angles, since they are enclosed in shields, which cuts off the field reaction relationship between the two. In other words, the coils are really isolated from each other because of the shields. The angle method is only necessary, when the coils are in the open.

(5) No, these posts are not necessary. They were only installed so that it would be simple to use an AC for the filament of the last AF tube. By breaking the two leads running from the filament posts of this socket to the A battery, you will have the same effect.

(6) No. This is not necessary since the detector stage is not critical.

(7) The detector stage is wired up for the —00A type of tube. If you should desire to use the —01A type of tube, it will be necessary to make a slight change. Instead of running the grid leak across the grid condenser, it should be connected from the G post of the socket to the plus F post on the same socket.

(8) Yes, you can use these condensers.

* * *

MY SUPER-HETERODYNE is extremely selective yet it does not cut out all interference. It heterodynes with certain stations. What can I do to remedy this condition?

(2).—The receiver was built of the very best parts throughout but still I do not like the quality. The signals are muffled and throaty. What is the reason?

ATHELBERT DODGE,
South Bend, Indiana.

(1).—The cause of the interference is lack of selectivity in the radio frequency level. Another tuner and radio frequency amplifier will remedy this condition.

(2).—The cause of the muffled or throaty signals is too great selectivity in the intermediate frequency filter.

HOW COMPROMISE GOVERNS DESIGN

(*Concluded from page* 5)

then choose transformers which will carry the load without core saturation.

Designer's Job

It is the job of the designer to set a low maximum wave form distortion and then choose his circuit components so that at no time the distortion will exceed that limit. It is usual to set the limit so that the second harmonic in the last tube is about 5% of the fundamental. That is not noticeable and can be neglected. In the earlier tubes the per cent second harmonic should be much less, and it is a simple matter to keep it at a lower value.

It should be pointed out that constants which will reduce the wave form distortion will increase the amplitude distortion. For example, the higher the plate resistance in a resistance coupled amplifier the lower will be the wave form distortion, but the greater will be the suppression of the higher frequencies, because the effective grid input capacity increases with the plate coupling resistance. Similar effects are active in transformer coupled amplifiers. The designer of a receiver of good quality must take this into consideration when he selects his values. He picks on the best possible compromise.

Phase shift distortion, it was stated above, is caused by reactances and resistances. But if the circuit were purely non-reactive or purely resistive, there would be no phase shift, or the phase shift would be the same for all frequencies. Still, the resistance cannot be dissociated from the reactance in determining the phase shift.

How Phase Shift Arises

The phase shift by any one impedance depends on its reactance at some frequency divided by the resistance. For example, if the inductance of a coil is 1 henry and its resistance is 100 ohms, the reactance of the coil at 16 cycles per second is 100 ohms, and the ratio of the reactance to the resistance is unity. The impedance is 141 ohms and the phase shift is 45 degrees. At 32 cycles per second, which is the second harmonic frequency of 16 cycles, the impedance is 224 ohms and the phase shift is 63.5 degrees. The relative phase shift between the fundamental and the second harmonic is then 18.5 degrees when the difference ought to be zero.

The impedance for the third harmonic is 316 ohms and the phase shift is 71.6 degrees and the relative phase difference between it and the fundamental is 26.6 degrees. The 18.5 degree phase difference means that two events which should happen simultaneously happen .0032 second apart. That is not a long time but it is an appreciable part of a complete cycle, which is only .0625 second long.

Phase shift distortion means that the harmonics happen before or after the fundamental when true reproduction demands that they should happen together.

Direct Drive Favored for Three-Foot Cone

(*Continued from page* 5)

with the console speaker which is illustrated in Figure 4. With the single reversed cone (concave side out), and the unit mounted on the heavy back board of the cabinet, ideal acoustical conditions prevail. By placing the batteries and other accessories on the lower shelf behind the cone, and the set on top, the speaker serves a dual purpose, taking the place of a radio table. Silk curtains to harmonize with the room furnishings hide the big cone and add to the appearance. Simply follow the dimensions shown in Fig. 4.

Fig. 5 shows the "Ensco" unit, the only direct drive unit which will operate a three-foot cone. The single magnet of the "Ensco" unit is made of the highest grade of tungsten steel, powerfully magnetized. There are no transmission arms or levers to reduce the motion of the armature and no distortion in the unit itself is negligible. The air gap of the unit is located at the center of the coil, where it should be. Magnetic leakage is thereby reduced with a consequent increase in efficiency.

The only adjustment necessary is to regulate the air gap. If the cone chatters, the gap is too small. A slight turn of the nut in a clockwise direction facing the back of the speaker will open it. If the gap is too wide the volume will be low. The nut is then turned about 1/8 turn in the opposite direction.

The "Ensco" speaker will operate on any set using 90 volts of "B" battery or more with or without a power tube. It may be used with any of the modern receiving tubes of the following types, 201-A, 112, 171 or 210. Voltages up to 180 may be safely applied without fear of damaging the well-insulated coil. On higher voltages use an output filter or transformer.

Chain of Harmonics Used in Lincoln Set

The Best Lincoln Radio Company of 30 Euclid Arcade, Cleveland, Ohio, manufactures coils used in a Super-Heterodyne known as the Lincoln Nine. The coils for this receiver comprise intermediate transformers and oscillator coupler.

The arrangement contains unusual features. One of these is that the successive intermediate stages operate at different multiples or harmonics of the original frequency, a system which makes the intermediate amplifier its own filter. Air core transformers are used.

VESTA HAS 180-VOLT UNIT

Included in the complete line of radio power units made by the Vesta Battery Corporation, Chicago, is a B power 180-volt unit.

FOR COMPLETE DATA on the the winner, a 4-tube set of excellence, see the Oct. 1, 8, 15, 22 and 29 issues of RADIO WORLD.

HERMAN BERNARD, managing editor of *Radio World*, discusses radio topics of popular interest every Friday at 6:40 P. M. from WGBS, 348.6 meters, the Gimbel Bros. station in New York City. Listen in.

Fenway Himself Gives Outline of Concertrola

(*Continued from page* 4)

ohms, and at 500 periods they have an impedance of 410,000 ohms. Working with a 17 tube in the last stage, Ferranti transformers greatly assist in driving home the thought that the Concertrola means quality and economy. And speaking of the 171 tube—it should provide ample power for anybody who has some regard for the feelings and rights of others.

Right now we are passing through the era of the too-loud loudspeaker. The power amplifier nuisance is becoming more acute than ever. Apparently the sole object of the owners of a power amplifying outfit seems to be to force as much sound out of their instrument as is humanly possible. It doesn't seem to matter whether it is distorted or howling so long as it is LOUD.

Use a 171 Tube

When you build your Concertrola you will certainly use a 171 tube, unless you intend to join the mob who have passed up sweet sounds for an indecipherable "mush" augmented by many unearthly noises which no piano or any other orchestral instrument has ever produced. Of course, it would sweeten things up a bit by saying that not all power amplifiers are alike. Perhaps they're not. I've heard one that was exceptionally fine—but it was removed two city blocks.

I don't think that the set builder can merely glance at the Hammarlund condensers, shown in Fig. 3, and turn away. He is likely to perceive that they are of a very small capacity, which means that the Concertrola coils have a very high inductance, resulting in a strong signal right from the start. The fact that the condensers are small in capacity doesn't necessarily mean that selectivity suffers. On the contrary, the selectivity of the set is not entirely dependent upon the condensers, but also on the Concertrola coils, which have been designed especially

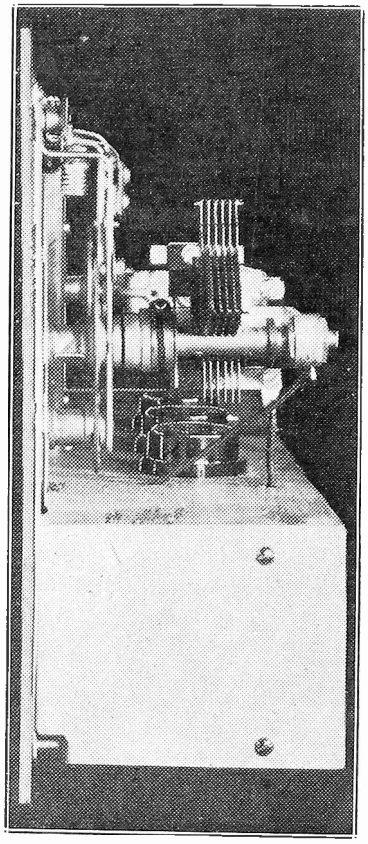


FIG. 4

Radio World's CLASSIFIED ADS *for Quick Action*

10 Cents a Word—10 Words Minimum—Cash With Order

so. Instead of saying that these coils are mounted at the extreme ends of the set, the illustration in Fig. 3 shows their position exactly. They are in the small oblong shields. A phonograph pickup will be desired, of course. The new Pacent may be used with the Concertrola to advantage.

You need not be discouraged because you once failed in the construction of a set. Failure may be due to circumstances for which you were not responsible, to faults in the circuit diagrams, or simply to the fact that you may have undertaken something for which yeu were not fitted. Still, it helps a lot to know that thousands of home constructors have built thousands of sets which were wonderfully successful; these set builders, for the most part, knew little or nothing of the technicalities of radio.

Without doubt 90 per cent. of the set builders who construct this new-type outfit will be pleased with their work, the instructions they receive will be of permanent value to them, and they will have learned how to build a satisfactory electric receiver.

The Tobe condensers specified for the Concertrola are so thoroughly established that set builders will have no substitutes. The Electrad "Truvolt," the Thordarson voltage divider and the Yaxley No. 64 switch, although more or less new to the set builder, are stable instruments, which should give continuous service over many years.

Marco Illuminated Controls have excellent scales, are attractive, are made mechanically strong and should perform their function with little or no attention during the life of the set.

The front panel is Bakelite, that sturdy insulator that makes a radio set look like a radio set.

And the rectifying tube is of course, Q.R.S. We use the 85 mil type.

And so, in search of the new we go back to the old—the old reliable parts manufacturers. Of course there are other instruments made which might work out in this new-type radio receiver. But no set builder can know all radio instruments, nor can he incorporate in one set all the parts which the market affords. This much, however, is certain: the amateur and professional set builder who perseveres with the instructions given in these articles (there are three more articles to come), who uses the exact instruments specified and who builds his set completely shielded as shown, will learn how to assemble a very desirable combination radio receiver and phonograph amplifier.

But within the set builder is the power, or the knack, or the skill, or the talent, or the genius that will enable him to build such an instrument.

[*Next week Mr. Fenway will explain the circuit, the electrical harness, which he is sure will carry his new vehicle over the top.*]

EVERY FRIDAY evening, beginning at 6:40 P. M., a ten-minute talk on radio topics is delivered by Herman Bernard, managing editor of *Radio World*, from WGBS, the Gimbel Bros. station, New York City. Wavelength 348.6 meters; frequency 860 kilocycles. Listen in.

THE R IS MADE STRAIGHT LINE!

IN electricity in all its forms, including radio, "R" stands for resistance. Any resistor that is variable should vary directly in proportion to the adjustment. In variable grid leaks this asset of "straight line R" has been missing. But now it is supplied—efficiently, perfectly—in

The New De Luxe Model

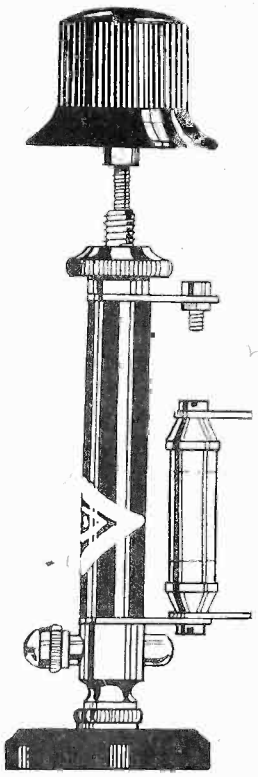
BRETWOOD

Variable Grid Leak

The improvements made in the new model—imported from England and released for the first time—are:

(1) Constant readings, (2) even distribution of the resistance element, (3) support provided for optional baseboard mountings.

By using the Bretwood Variable Grid Leak you improve tone quality, by avoiding detector tube overloading, achieved by correct leak setting. Thereafter the leak may be varied for extremely distant stations, or may be left at the original setting.



The DE LUXE MODEL
with Condenser Attached

The De Luxe Model Bretwood Variable Grid Leak specified by Herman Bernard for Radio World's Four-Tube Universal Receiver.

1. The knob is hard rubber.
2. The shaft is durable brass, and can not jam or stick.
3. The brass lock nut, with milled edge, enables single hole panel mount.
4. The barrel is of hard rubber and houses the the resistnace element and plunger.
5. The lugs are adjustable to any position within the sweep of a circle.
6. The grid condenser is securely fastened to the lower lug and requires no extra room, as it is within the projection of the lugs.
7. The syphon container distributes a constant supply of resistance element, making the reading straight line resistance, and preventing uneven distribution of the resistance element.
8. The hard rubber pedestal affords the option of perpendicular mounting, as on a baseboard.

Each Bretwood Variable Grid Leak and Bretwood Bullet Condenser is guaranteed against mechanical or electrical imperfections and is sold on an absolute five-day money-back guarantee.

If you're not delighted with results, then we're not even satisfied!

North American Bretwood Co., 145 West 45th St., N. Y. City.

Gentlemen: Enclosed find $1.75. Send me at once one De Luxe Model Bretwood Variable Grid Leak on 5-day money-back guarantee. (Or $2.25 for leak with grid condenser attached.)

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