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1927

RADIO WORLD

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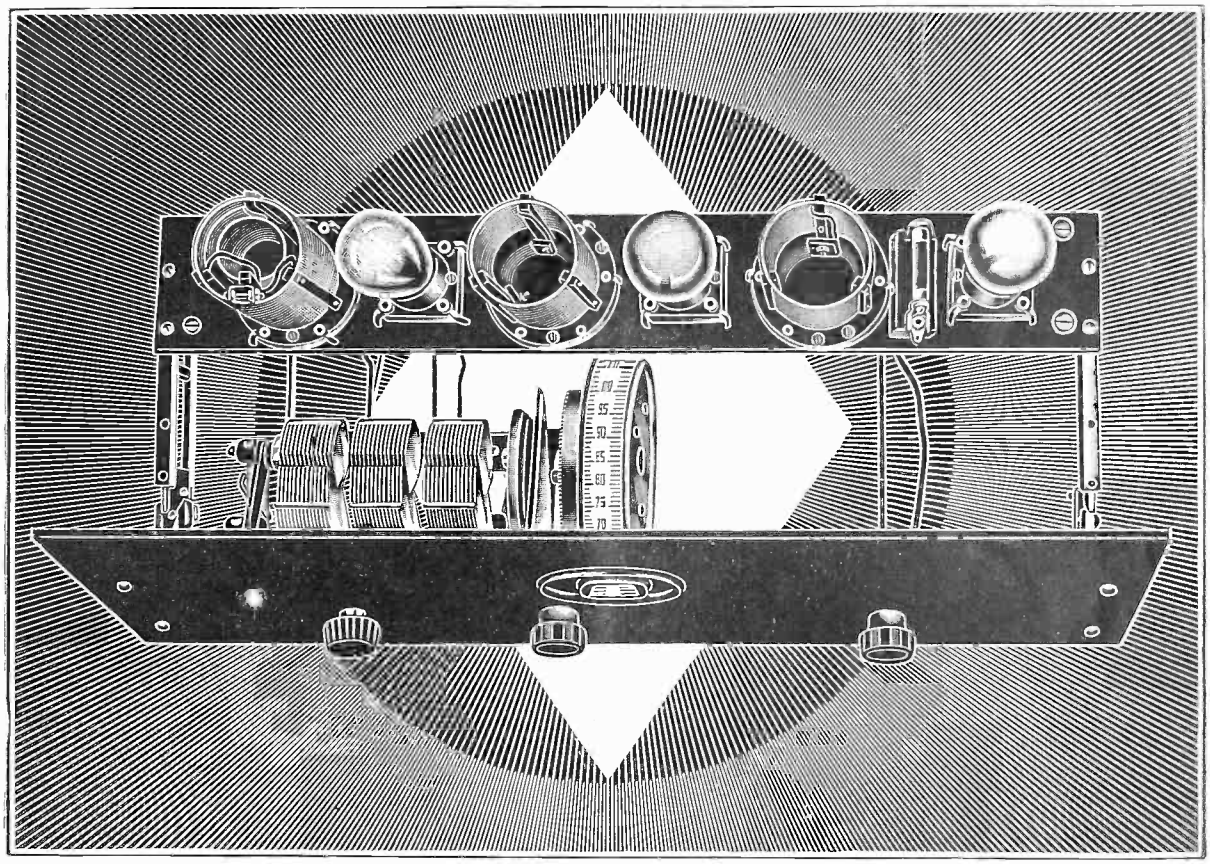
No-1

America's First and Only National Radio Weekly

THE RADIO FREQUENCY FOUNTAIN



THE RF FOUNTAIN OF THE NEW UNIFIED DIAMOND (shown above) feeds into an Audio Basin and Power Geyser. See Page 3 for the constructional Article on the Fountain.

IN THIS ISSUE ALSO—

An Audio Amplifier That Delighted Everybody, by John F. Rider; The Tuning of the Knickerbocker 4, by Herbert E. Hayden; The Strobodyne, by Brunsten Brunn; The Victoreen, by Capt. Peter V. O'Rourke.

Unified DIAMOND

Technical Excellence Starts Paying Big Dividends At Once!

WHATEVER you buy, only somebody's best opinion is being capitalized—perhaps your own. You hope that what you buy will live up to your expectations in every respect.

Amid a wide choice of kits from which to build a radio receiver you may be puzzled which one to choose. You welcome expert advice.

The Unified Diamond was built, tested, and perfected in Radio World's own laboratories by its staff of experts, with the sole object of achieving an outstanding receiver. All that exists of technical excellence went into that six-tube design.

Build the new Unified Diamond and have your expectations exceeded! Use the officially prescribed parts, the same ones chosen by those experts in whom you have so much confidence. Then, the moment you turn on the switch after completion of the set, you will know how wisely they—and you—have chosen.

For, right away, you begin collecting dividends of joy and delight. Selectivity, tone, volume, beauty, simplicity, newness, economy—these and more are qualities of the Unified Diamond.

The Radio Frequency Fountain

of the Unified Diamond consists of two radio stages and detector, a single drum tuning all, and the necessary switching and volume control.

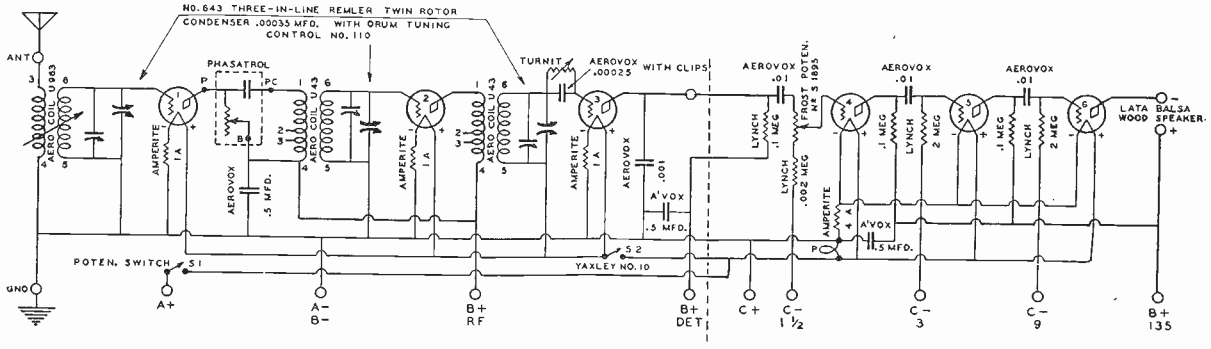
The Audio Frequency Basin

of the Unified Diamond consists of three resistance coupled stages of amplification, using two high mu tubes and one power tube.

Remler—Frost—Aero Products—Electrad
Amperite — Aerovox — Yaxley — Lynch
CeCo — Balsa — Bruno — Turn-it
Acme Wire — Corbett — Eby

The Unified Diamond Group

145 West 45th Street, New York



THREE FROST SOCKETS NO. 530

CE CO TUBES TYPE K IN SOCKETS 1 & 2
" " " H " " 3

THREE FROST SOCKETS NO. 530

CE CO TUBES TYPE G IN SOCKETS 4 & 5
" " " F " " 6

SIXTH YEAR

RADIO WORLD

REG. U.S. PAT. OFF.

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No. 1

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The Radio Frequency Fountain

of the Unified Diamond

By the Laboratory Staff

[*The approach to the constructional series on the unified Diamond, fully illustrated, was published last week, issue of September 17.*]

THE two component parts of the Unified Diamond, consisting of the Radio Frequency Fountain and the Audio Frequency Basin, afford a variety of choice which should enable almost any home constructor to select any plan of construction he prefers.

The Fountain is built the same no matter what else is done. This Fountain consists of two stages of tuned radio frequency amplification and a tuned detector imput, a Remler three-in-line condenser controlling all.

The volume control is not a part of the Fountain but of the Basin. However, as it must be accessible it is placed on the front panel, and lends itself to whatever selection the constructor may make in regard to the Basin.

The choice follows:

(a)—The Radio Frequency Fountain may be constructed so that it alone is placed inside of the cabinet, and the audio channel is separately constructed and placed in a console compartment.

(b)—The Audio Frequency Basin may be constructed on a separate sub-panel 8½ by 6 inches, or thereabouts, and placed inside the 7 x 21 inch cabinet, along with the Fountain.

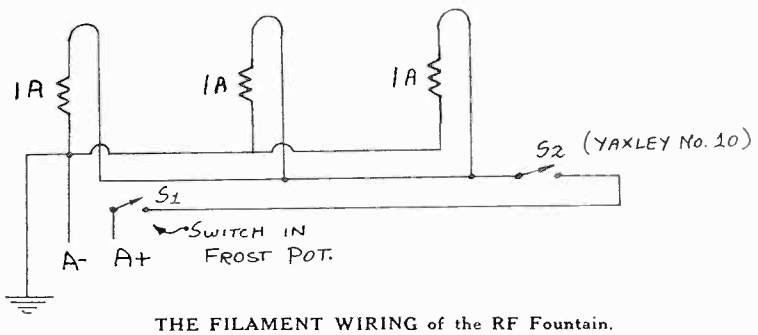
Two extra Eby binding posts are placed behind the second radio frequency socket and thus the conventional contents of the cabinet are provided. That is, the six-tube receiver is complete.

Furniture Often Deciding

What choice the constructor will make depends upon his furniture equipment. If he has a console or a radio table, he will most likely desire to build only the radio frequency part of the circuit in the 7 x 21-inch cabinet, and will carry the leads from the detector tube downward to an audio channel in the console compartment. If neither console or table is available, then the complete receiver will be wired for the 7 by 21-inch cabinet, and this is very easily accomplished.

Naturally those persons who have a longing for an extra power stage of audio feeding 310 output tubes must have or get suitable table or console provision, and will most likely decide to sink the entire audio into the console, including the power stage.

Actual operation is unchanged, no matter what the choice may be, and personal preference should prevail.



THE FILAMENT WIRING of the RF Fountain.

The front panel is 7 x 21 by 3-16-inch bakelite and is drilled for volume control at right and switch at left. The holes for the volume control and switch are 3½ inches from the bottom and 5 inches from left and right respectively, while the Remler drum is mounted with the knob (not the window) 2¼ inches up and 11⅝ inches from the right.

A round hole about 1⅜ inches is drilled with center 4 inches up from the bottom and 10½ inches from left and right. The only other provision on the front panel is for securing the brackets. If the Bruno adjustable brackets are used the holes are 3 inches from top and 1¼ inches from bottom, being ¾ inches in from left and right respectively.

Socket Placement

It is assumed that a sloping panel will be used, and the description will embody this idea because if a straight panel is employed no precaution need be taken which would not be necessary for a sloping panel.

The socket shelf is 20 by 3 inches. It has two holes in it for securing to the brackets and these holes may be determined by actual measurement upon the brackets. The binding posts are placed 1 inch in from left and right respectively and 2 inches away from each other, measured in a front and back direction.

The sockets are mounted with centers as follows when one is looking at the back of the receiver:

The first socket is centered on the shelf 5¾ inch from right, and the second socket has the same alignment 11¼ inches from right. The detector socket is centered 2⅜ inches from left.

Coil centers from left to right are: 3, 8½, 14¼ inches. This disposition of parts allows for a Lynch single mounting between the detector input coil and the detector socket, so that the variable grid leak is accessible.

The grid condenser may be mounted on top of the socket shelf and the leak put between the clips. The other system contemplates the use of the grid condenser below the socket shelf, the clips being there merely for emergency purposes.

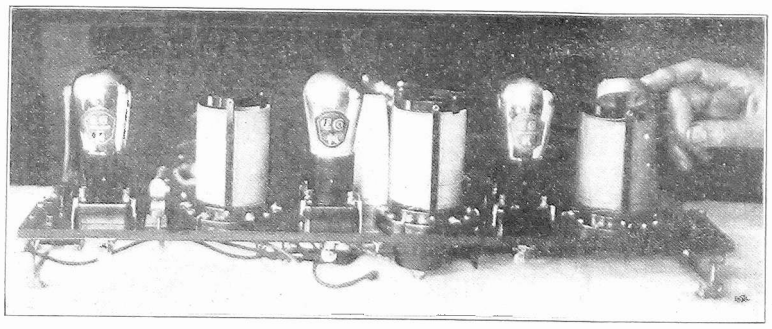
Simplified Wiring

The wiring of the Remler three-in-one condenser is simplified by the fact that both sections are insulated from the frame and from each other, and are rotors. Hence the grid connections may be made to the lugs on the Remler condenser that are nearest the socket shelf while the low potentials are connected to the lugs that are nearest the front panel.

The condenser used in the Unified Diamond has a left-hand extension so that the space to the left of the drum is occupied by the condenser, leaving space on the right for an audio channel, if it is decided to put the channel in this compartment.

Naturally the filament leads that go to the volume control are brought down perpendicularly through the special sub-panel of the basin and then back to the top of the shelf.

The coils have their terminals engraved on the bakelite bases, so that the numbered connections can be followed very readily.



THE TUBES AND COILS are evenly distributed along the socket shelf. The antenna-ground posts are at right.

Refer the diagram published last week on page 8, and which also will be found on page 2 of this week's issue. Holes are drilled right close to the coil terminals so that the wire may be passed down through these drill holes.

Phasatrol's Place

The Phasatrol is located under the socket shelf and directly under the second RF coil, that is, the coil feeding the second RF stage. Hence it is centered 8½ inches from right.

The bypass condenser of .5 mfd. is placed under the detector input coil. When the wiring is done it will be found that B plus RF extends right close by, and one side of the bypass condenser connects to this. The other side, to A-minus, which is also close at hand.

The .001 bypass condenser goes from the plate of the detector tube to A minus and is located at the left-hand side as a socket shelf underneath.

Likewise the three 1A amperites are put underneath the socket shelf, the holes for the mounting being centered and the distances being 5¾ inches from right, 11¼ inches from right and 2¼ inches from left, considering only the socket shelf as seen from the ruler.

If the layout of parts is established as explained, the holes for the sockets will locate themselves. The wiring is carried out in orthodox fashion.

The Binding Posts

As for the binding posts, there is one post for antenna and one for ground, and so marked. At the opposite end of the shelf only one post is necessary, so that a lead may be carried from the plate to the detector tube down to the Audio Basin. If this is not desired, the lead may be carried to the audio channel within the 7 x 21 inch cabinet, as previously explained. No binding posting is necessary for B plus detector, as this connection may be always made to the B battery at one end of the detector plate resistor. Nevertheless, for appearances sake, and to provide for any contingencies, it is just as well to have two posts, one plus and the other minus, and then if you are deciding to build a basin in the 7 x 21 inch cabinet along with the fountain, two more posts should be provided. These would be respectively 7¾ inches from left and 10½ inches from right, and would be close to the P and G posts of the second RF tube.

In case the output is to be taken in this fashion it is suggested that instead of having all the sockets on a center line that they be moved so that the center is 1 inch from one long edge of the strip instead of 1½ inches in, thereby preserving the alignment for the sockets and leaving ample room for the output binding posts.

[Balancing the Radio Frequency Fountain of the Unified Diamond will be discussed next week, issue of October 1. Balancing is very important. Follow this phase closely.]

LIST OF PARTS

for the Audio Frequency Basin

Organic Kit, with List Prices

Three Lynch .1 meg. metallized resistors	$2.25
Three Lynch 2 meg. metallized resistors	1.50
One Lynch .002 meg. (2,000 ohms) metallized resistor	1.00
Three Lynch double mountings	1.50
Three Frost sockets, No. 530	1.20
Three Aerovox .01 mfd. moulded condensers, No. 1450	2.70
One Aerovox .5 mfd. bypass condenser, No. 250	.90
One 4A Amperite	1.00
One Amperite mounting	.10
Two, Eby binding posts (speaker +, speaker —):	.30

Inorganic Kit

One 7x4x3-16 inch Bakelite base.
Five feet for base.
Six lengths of Acme flexible Celatsite.

Accessories

Two CeCo type G tubes for sockets 4 and 5; one CeCo type F for socket 6.
One Lata Balsa Wood Reproducer.
One Pacent Phonovox.

LISTS OF PARTS

For the Radio Frequency Fountain

Organic Kit, with List Prices

One Remler three-in-line .00035 mfd. condenser, No. 643	$15.00
One Remler drum tuning control, No. 110 (including pilot lamp P)	4.50
One Aero Universal antenna coil, U-963	4.50
Two Aero Universal wave trap unit coils, U-43	8.00
One Frost 500,000 ohm potentiometer, with switch, No. S1895 (switch is S1 in diagram)	2.10
Three Frost sockets, No. 530	1.20
One Electrad Phasatrol	2.75
Three 1A Amperites	3.00
Three Amperite mountings	.30
One Aerovox .001 mfd. moulded condenser, No. 1450	.40
Two Aerovox .5 mfd. moulded condensers, No. 250	1.80
One Aerovox .00025 mfd. moulded grid condenser with clips, No. 1475	.40
One Improved Turn-It variable grid leak	1.00
One Yaxley No. 10 switch (S2 in diagram)	.50
Two extra Remler knobs, one for Yaxley switch, the other for the Frost potentiometer switch	.50
Four Eby binding posts (Ant., Gnd., +, —)	.60

Inorganic Kit

One 2¾x20x¼-inch Bakelite socket strip (note ¼-inch thickness).
One 7x21x3-16-inch Bakelite front panel.
One Lynch single mounting (optional).
One pair of Bruno or Benjamin adjustable 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)
One Brach antenna kit.
One Acme 5-wire cable.

Transient Voltages Often Are Startling

Transient voltages in a radio receiver are sometimes ruinous to the component parts. Choke coil and transformer windings may be burned out or the insulation punctured by them. By-pass and stopping condensers may be broken down by the surges. Coupling resistors may be permanently damaged.

The sources of the voltage transients are legion. Some are man-made and others are natural. They more frequently enter the receiver at radio frequency than at audio frequency. They cannot be tuned out because they occur at all frequencies. They are induced in the tuned circuits by shock excitation and for that reason they build up for any frequency to which the circuit may be tuned.

As an example of man-made static which ruined by-pass condensers may be mentioned the sparking of an elevator motor. The voltages induced in a five-tube Neutrodyne of well-known make were so strong as to break down the by-pass condenser across the B battery just as fast as it was put in.

Affect Windings, Too

This case was more severe as to its effect on reception than static ever gets, but it was not necessarily as violent as static sometimes becomes. A static crash due to lightning occurs now and then which is strong enough to break down condensers much more thoroughly insulated than the condenser used in the Neutrodyne in question. Now, if it is true that static and man-made voltage transients can break down condensers they can also break down transformer windings. The voltage waves constituting the transients are very irregular, and they have very steep gradients. That is, if the voltages were represented by curves these would have high peaks and very steep slopes. Under such conditions the induced voltages will be very high in the last stage of the amplifier. The elastic electric stresses set up in the windings may be too great for the insulation, and a burn-out is the result.

It would seem that stopping condensers in the grid circuits of direct coupled amplifiers would be exempt from the ravages of transient voltages, but not so.

What the Voltage Is

The voltage across the stopping condenser is the sum of the grid and plate voltages applied to a given coupler between two tubes. When violent surges occur these voltages are changed very greatly.

Even the grid resistors in a direct coupled circuit are subject to break-down as a result of voltage surges. When violent crashes of static or other similar voltage surges occur, the grid goes positive and as a result a heavy grid current flows. This may be more than the leak has been intended for, and consequently it cannot be expected to stand up.

First It Must Last

The Requisites for an Inexpensive, Simple, Strong Aerial Mast

By Elliott H. Sharp

WHEN the infant industry, radio, put on its baby pair of shoes 'way back in the dim, dark ages ten years ago, some of its most enthusiastic supporters were the grade and high school boys of America. Together with this army of interested amateurs were a few of the older generation who had the time to devote to rigging up their own sets. Unlike most industries, radio was developed largely as a result of the widespread interest shown in it by such ardent amateur fans as these, who built up receiving sets as best they could, using bedsprings for an aerial and the register for ground. Thanks to them, the huge demand for adequate receiving sets was created.

Now the tired business man, who at first had time only to sit by and watch his son play with a thirty-six cent set, comes home, turns a couple of dials and listens in on music and talks from any part of the country. Radio has discarded its baby shoes and donned short trousers.

One of the important factors in radio is the aerial. While not always essential, the outside aerial is of great advantage to practically any receiving set. When radio was being conceived in the minds of inventors, the boys of the country were being satisfied with their amateur telegraph or, more especially, wireless sets. For these they had erected aerials of one sort or another. These they ultimately transferred to their radio set-ups.

More and More Aerials

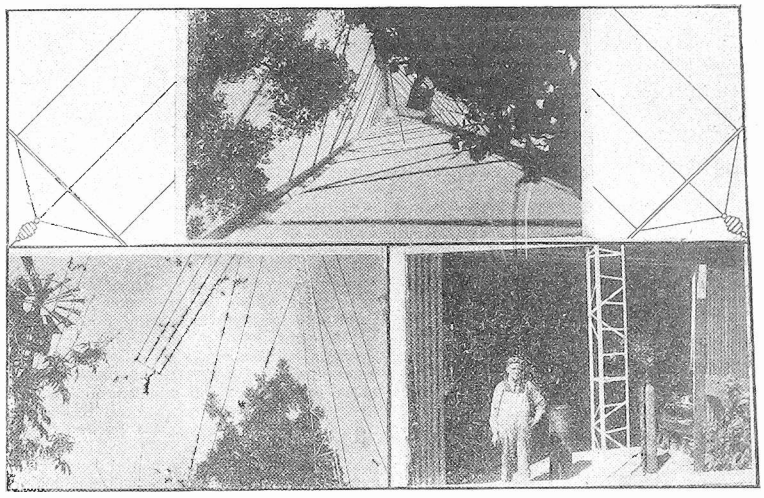
As radio got out of the baby talk stage and began to speak without the stuttering which at first characterized it, more and more aerials sprang up all over the country. They flew from clothes poles and brick chimneys, from the ridge-pole of one house to the ridge-pole of the house next door, from flag-pole to porch post. With further development and progress, such as attended in part the less extensive game of wireless, receivers wanted masts for their aerials, masts which would not only serve their purpose better than makeshift aerial supports, but which would also look far neater.

Innumerable are the types of masts which were used and are still being used. One essential prerequisite for every mast, however, is that it be sturdy. Of course metal, being far stronger and more durable than wood, is consequently more popular with radio fans. But for those who have little money to invest in their sets, metal masts are apt to be thought too expensive. It isn't every dad who can go to an extensive layout for his son. Nor every dad who is prepared to do so for himself.

As a matter of fact, however, the fan who wants a metal mast for his radio, one that will last out the roughest tornado, the most continuous rains, the bleakest of winters, need not go to any great expense to have one. He has but to secure some scrap pipe and steel bars or angle irons, and then call in the services of the welder in his community.

It's Inexpensive

Scrap pipe and steel bars or angle irons are always cheap. Often they can be had gratis, after a little search around a factory or shop dump pile. A welder's charge for his part of the bargain will be comparatively little.



Upper—Looking up through the lattice of a welded aerial. This construction will survive high winds.

Left—"Fresno Welding Works," faintly visible in outline letters strung between tre two towers, gives unusual advertising value to a California broadcaster's installation.

Right—W. L. Samelson, designer of the triangular welded radio towers of the Fresno Welding Co. and a ten-foot section. Note the straight straps on one side to be used as a ladder.

The trick, then, is as inexpensive as it is simple. The sketch shows how the finished job will look. And here you have directions for making the mast.

Suppose your masts are to be about 40 feet high. The best procedure is to make each in two sections, the lower section being of 1 inch pipe and the upper of ¾ inch. However, in the event that pieces of the desired length cannot be secured, it is perfectly feasible to use shorter lengths. These pieces are welded together and, since an oxy-acetylene welded joint is just as strong as the base metal itself (in this case the pipe), the mast will be as sturdy as could be desired.

If steel bars are procured for cross-arms instead of angle irons, they can be heated with an oxygen blowpipe and bent to the desired shape for welding to the mast.

It is advisable to have these "queen posts," nine of which are used on each mast, of different lengths; for instance, 12 inches, 18 inches and 15 inches.

How It's Done

With an oxygen blowpipe they are cut to the desired length and holes are pierced in the end of each one for stay wires. Finally the cross-arms are welded to the mast with steel or bronze welding rod, three together at intervals of ten feet, as shown in the sketch. The shortest cross-arms are best placed nearest the top and the longest in the middle.

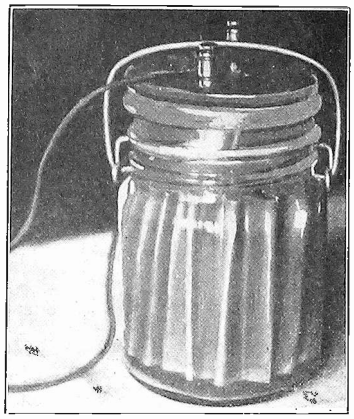
A cap is next welded on the end of the mast, and an eye bolt is inserted through a hole cut with the blowpipe. The radio fan will find that it is best to secure this bolt by welding, since it must support the strain of the pulley and aerial wires.

There are various kinds of bases for the mast that can be used. The best kind, and it is not very expensive, is a concrete block. Or again, the mast can be fitted into a pipe nipple which has been secured in such a block. A fillet weld of bronze will then secure the mast to this base pipe. Or if need be, the mast can simply be sunk in the ground, although something of firmer nature is best to support the upward pull of the stays.

Advantages Gained

These guy wires, which have been strung from the top of the mast down through the holes which have been cut in the ends of the cross-arms, are tightened at the base by means of turnbuckles attached to small eyebolts set in the concrete. Care should be taken before it is raised that the mast is straight, for tightening the turnbuckle will not straighten it.

The listener-in will readily appreciate the advantages of this mast. The fact that it is compact because it requires no guy wires which extend all over the lot, will meet especially with his approval. But more than this; it is as cheap as it is light. Such a set of masts can be erected for ten dollars or less. And it can be put up in an afternoon. Its most striking feature, however, is its strength and durability. The radio enthusiast will find that it is strong enough not only to last out his own lifetime but until the youngster alluded to earlier in the story has gray whiskers that extend down to his knees.



THIS depicts an electrolytic condenser built according to the description given in the accompanying article. It has a capacity of over 3,000 mfd., having been formed at about 7.5 volts. Used as a ripple remover it is quite effective.

An Electrolytic Condenser

Full Directions on How to Make One

By J. E. Anderson

Consulting Engineer; Contributing Editor; Associate, Institute of Radio Engineers

THE first thing to decide on in making an electrolytic condenser is the type of jar to use. The size would depend on the capacity that is wanted, and this may be easily 5,000 m.f.d. It may be anything from a tiny ointment jar to a large fruit jar. The jar should have straight sides nearly all the way up to the cap. The mouth should be nearly as wide as the diameter of the main body. It should be provided with a suitable cap, either of the screw or the spring variety. It should be possible to seal the cap so thoroughly that no water can leak out anywhere, but it should not be airtight. The cap should be either of metal or workable insulating material. Glass is not suitable.

Suppose a quart fruit jar with a metal cap with spring lock be selected for a large capacity condenser. The terminals of the condenser should be mounted on the cap, but since this is metal they cannot both be mounted on it directly. At least one of them must be insulated from the cap. Several methods can be employed, but that of insulting bushings for the central electrode is one of the simplest and best.

Cut Fairly Large Hole

A fairly large hole is cut in the center of the metal cap. Then two large hard rubber or fibre washers are placed over the hole, one on each side of the metal. A binding post is mounted in the central hole. The inside diameter of the washers should be no larger than just to accommodate the binding post and the outside diameter should be at least half an inch greater than the diameter of the central hole in the metal. When the binding post is screwed up tightly the washers and the post will be held securely in the center. However, lest there be any chance of play it is well to secure them still further by means of a couple of 2-56 machine screws through the washers and the metal.

The second binding post should be mounted near one side of the cap and directly on the metal. If the metal is not thick enough to support the two binding posts it is well to extend the central washers as far as the edges of the jar permit, and then mount both binding posts on this reinforcement. Only the center post need be insulated from the metal cap.

Prevention of Convection

Now it is well to prevent electric convection over the surface of the cap, which might become of considerable magnitude as soon as the under-surface of the cap is wet. This can be done by dipping the entire cap with the binding posts in place in melted paraffine.

Let us now turn our attention to the aluminum electrode, which is the most important part of the condenser. A good grade of aluminum is essential. One may buy the aluminum from a house specializing in chemicals or from any other reliable concern, to be sure that the metal is pure. The thickness of the aluminum for this particular job may have any value from .005" to .020". Procure a strip of this at least 18 inches long and 3 inches wide. This will make the effective area of the aluminum 128 square inches.

Cut a tab about ⅜ inch wide and 2½ inches long off one end of the aluminum sheet, leaving this tab attached to the main sheet for about ½ inch. Bend this tab so that it will extend about 2 inches to one side of the main sheet. At the end of the tab drill a hole large enough to accommodate the binding post expressly provided for it on the cap of the jar.

Now rub both sides of the alumnium sheet thoroughly with emery cloth until every spot is clean and bright. Then corrugate the sheet in the manner of the metal sheet on a washboard, but make the pitch of the cororugations steeper. The idea is to get the 18-inch strip into a space less than 10 inches long. Do this job neatly. If the corrugation has been overdone it is always poossible to stretch the sheet a bit to make it the proper length. Bend into a circle which will just slip into the jar.

Fingers Off From Now On

Now boil the corrugated sheet in a strong solution of caustic potash to remove all trace of grease. Keep the fingers off the aluminum from now on. Rinse in clean water and insert into the quart jar. If the corrugated ring of aluminum sheet does not fit well in the jar it can be spread with some clean tools until the ring fits against the glass wall. There should be ample room in the center of the aluminum ring for the negative electrode. The tab, which should extend above the top of the jar a little, should be adjusted so that it fits over the binding post when the cap is put in place.

Next comes the negative electrode. This can well be a rod of lead a quarter-inch in diameter or equivalent electrode. Clean it and attach it to the central binding post on the cap of the jar. The rod of lead should extend to the bottom of the jar, and it should be stiff enough not to bend and come in contact with the aluminum when the jar is tilted.

The next ingredient is a saturated solution of ammonium phosphate. Fill the jar nearly full with distilled water. This can be procured from a drug store or a battery service station. Then put as much of the ammonium phosphate crystals into the jar as will dissolve. The crystals will not dissolve very rapidly and it is well to let stand over night with an ample supply of crystals. If there are any crystals left the next morning all is well, otherwise add a few more.

When the solution has dissolved all the crystals it will hold, and with the aluminum electrode immersed, pour a layer of thin mineral oil on top of the solution. A quarter of an inch of oil is enough.

Now apply the cap with the lead electrode attached. Clamp down tightly and seal around the edges with paraffine wax. The seal should now be thorough enough to prevent spilling of the liquid, but not tight enough to prevent the escape of gas. If there is not a small vent hole near the center of the cap, it is well to drill one. It need not be larger than a 1-16 inch.

The center electrode is the negative and the off-center is the positive, as has been stated before. The posts should be plainly marked with their polarities.

The next operation is to form the condenser. Suppose it is to be used as a ripple remover across the output of a 5-volt rectifier. The voltage will not exceed 7 volts at any time. Hence the condenser may be formed at 8 volts. Any source of direct current having a pressure of 8 volts can be used, for example an 8-volt storage battery.

The positive terminal of the source is connected to the positive (aluminum) electrode of the condenser-to-be. The negative electrode of the source is connected through a resistance to the negative of the condenser. The resistance in series is adjusted to a suitable value, and the condenser will begin to form. The value of the resistance might be 20 ohms and it must be able to carry at least one ampere.

Finishing Touches

The forming will be accompanied by a profuse generation of bubbles, which indicate the liberation of gas. This gas must escape through the vent hole. The amount of gas, and hence the number of bubbles, is proportional to the current flowing through the condenser. As the forming goes on the number of bubbles decreases, indicating that the current also is decreasing. The forming may be continued over a period of 24 hours, after which time the number of bubbles should be very small. They will not cease entirely.

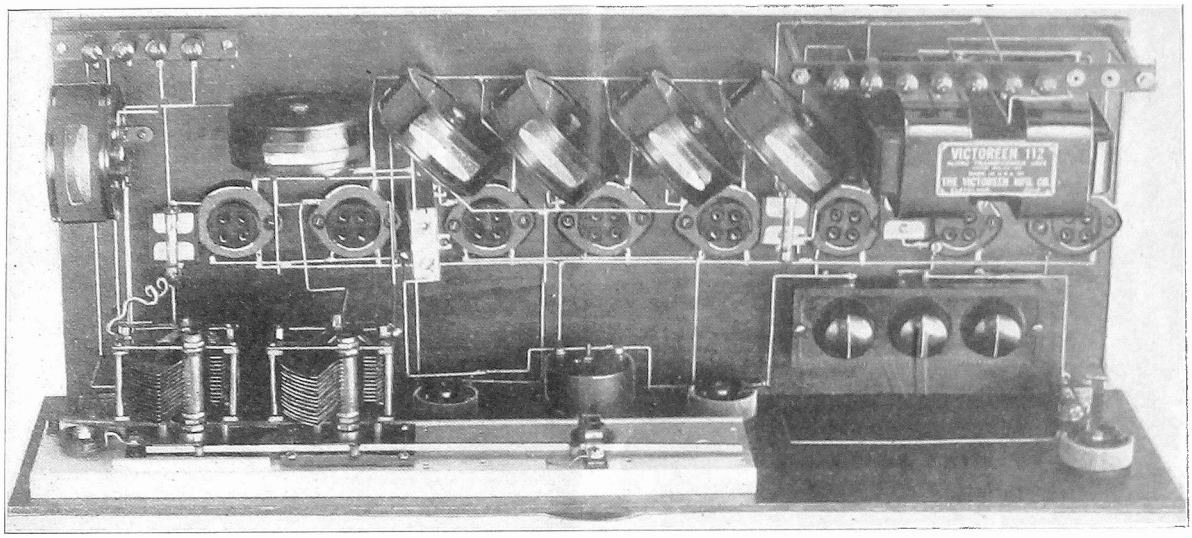
If a milliammeter is inserted in series with the condenser when the number of bubbles is very small the current will also be small. If the condenser is well formed the current might be down to a fraction of a milliampere; if it is not made quite so well the current might be as high as 20 millamperes. But even if the current is up to that value, the condenser will serve well as a ripple remover. A little leakage current through the condenser is of no consequence.

Mark the forming voltage on the condenser very plainly. It cannot be used safely for any higher voltage. If connected to a higher voltage a high current will flow again and this might be so high as to damage other parts of the circuit.

The condenser can be formed for a higher voltage with a higher voltage at any time. It is only necessary to connect a suitable resistance in series until a thicker film has been built up on the aluminum plate.

Preserving 100% Efficiency in The Victoreen

By Capt. Peter V. O'Rourke



THE ATTRACTIVE LAYOUT of the 1928 Victoreen Universal, showing placement of coils and the 112 Victoreen audio unit, as well as Eby sockets, condenser and all other parts.

[*The construction of the 1928 Victoreen Universal was described in the September 3, 10 and 17 issues.*]

A FEATURE often overlooked in radio receivers is proper by-passing. In many cases by-pass condensers which are too large are used. In other cases the condensers are not large enough or are omitted.

When the by-pass condenser is used to provide a low impedance route for the radio frequency currents across a high impedance audio device, two forces enter to decide the size of the condenser to use, and these forces pull in opposite directions.

The first is the requirement of using as large a condenser as possible across the high audio impedance in order that the by-passing shall be as thorough as practical. The other is the requirement that the by-pass condenser be as small as possible in order that the high audio frequency currents be not depressed as well as the radio frequency currents. A compromise is necessary, and just how much weight is given to the opposing requirements depends on the position of a given by-pass condenser and on the circuit in which it is used.

Victoreen Considerations

Let us consider the by-pass condenser across the primary of the first audio transformer in the Universal Victoreen. If this condenser is not used, no satisfactory results can be obtained. The detector tube will not operate properly. If the condenser is too large the output of the receiver will be too boomy and the articulation in speech will be very poor.

Now, if this receiver were an ordinary circuit the by-pass condenser would not have to be larger than .0005 mfd. because the radio frequency currents would be high and this condenser would not offer much impedance.

The effect of this condenser would be entirely negligible on any of the audible frequencies. But this is a Super-Heterodyne in which the frequency to be by-passed is only one-fifth of the lowest radio frequency in the broadcast band. This would call for a by-pass condenser of .0025 mfd. to get the same by-passing in the Super-Heterodyne. The condenser chosen by the Victoreen engineers is a .002 mfd. Dubilier, a value which gives the best compromise in this case. If the condenser were made large the higher notes would be somewhat suppressed by it; if it were smaller the detector would not work efficiently.

Another Important Point

Another condenser of importance is the large Tobe by-pass in the oscillator. Its value has no effect on the audio frequency output and therefore we are not limited as to the size to use. It does serve to complete the oscillating circuit and is essentially in series with the oscillator tuning condenser. This fact makes it desirable to use as large a condenser as possible in order that it shall have as little effect on the tuning as possible. But there is no object of using an immensely large condenser here since all the currents in it will be at radio frequency. The one mfd. Tobe selected by the Victoreen engineers is entirely satisfactory.

A feature which has ordinarily been regarded as a luxury in a Super-Heterodyne is a voltmeter on the panel. It is beginning to be regarded as a necessity. When one is mounted on the Lignole panel together with a master rheostat, the voltage on the filaments is always known and it can be kept in correct adjustment at all times.

Cost Low Now

Very good voltmeters can now be obtained at a cost which is small in comparison with the total cost of accessories, and it is a good insurance against run down A batteries and interrupted service. With a few changes in the wiring the same voltmeter can also be used as a check on the B battery voltage, when such is used. If a B battery eliminator is used the voltmeter used will have to be more expensive and be of the high resistance per volt type. But this can also be used to measure the filament voltage.

When first turning on a Super-Heterodyne it may happen that nothing comes through. A check of the wiring may show that everything is apparently according with the diagram. Yet the circuit does not deliver a note. Do not immediately jump at the conclusion that something is wrong with the parts. The chances favor they are all right and that the trouble lies in the wiring. The following test will help to locate the trouble.

First take out all the tubes from the sockets and connect a milliammeter or a voltmeter of low resistance in the negative lead of the B battery, that is, in the lead running from the battery or eliminator to the minus B post on the set. Now insert a tube in the last socket. Does it light?

Other Trouble Cures

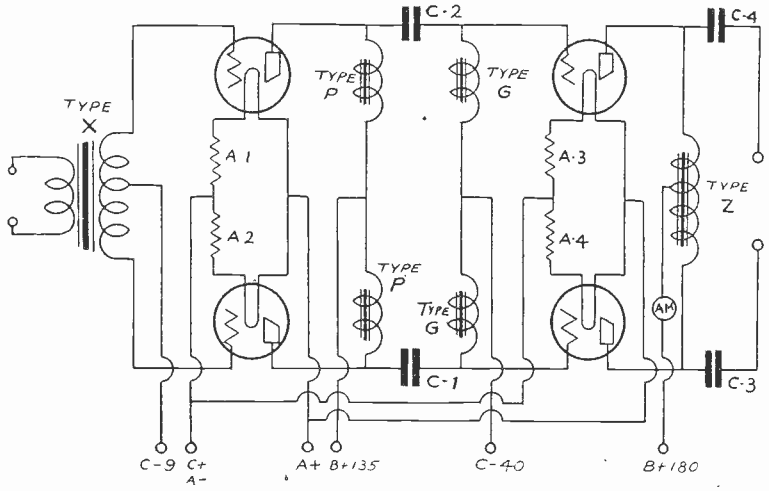
If it does the filament circuit can be eliminated as the source of trouble.

Does the meter in the circuit show a deflection when the plate voltage is turned on? If it does, the plate circuit of that tube is continuous. Now vary the grid bias on the tube while the meter is still in the circuit. Does an increase in the negative bias decrease the reading on the meter, and vice versa? If it does, the grid circuit is continuous.

Remove the tube from the last socket and insert the same tube in next preceding socket and repeat all the tests. Do they test as they should? If so, the first audio stage is probably all right. Do the same for every tube in the circuit, one at a time. In the two detectors the grid bias can be inserted across the grid leak temporarily. This process should reveal a defect if the circuit does not operate and it should tell whether the defect is in the grid or the plate circuit. Having found approximately where the defect is, bracket it in and catch it like a ball player is caught off bases. Then complete the circuit or else substitute the defective part.

These tests do not show whether the windings in the grid and plate circuits are short-circuit, only that the circuits are complete. To test where audio transformer windings are short-circuited measure the voltage of a small battery with the voltmeter in series with the suspected winding.

The Audio Amplifier



THE WIRING diagram of the audio amplifier that brought nothing but praise from vocal experts, radio engineers and acoustical scientists.

By John F. Rider

Associate Institute of Radio Engineers

THIS is an account about an audio amplifier—the amplifier I am using at my home. I am submitting its constructional details to the radio fan public because I am certain that it will be of interest to them.

Many radio enthusiasts have ascertained that friendly animosity exists among radio receiver owners as well as among friendly golfers. It is quite difficult to please one's friends with a radio receiver installation. Fault-finding is easy; the comments are various. Sometimes the criticism is justified, at other times the adverse comment is wholly unjust. Be that as it may, someone will usually express an adverse opinion.

But when the day arrives when all who listen to an amplifier-speaker combination declare it to be excellent, then it is time to sit up and take notice. When all who listen to the amplifier used in conjunction with various types of receivers, declare it to be beyond reproach, then one has attained a goal. And when this group of listeners includes men and women well versed in music, familiar with speech enunciation, acoustics and radio, the complimentary reaction bears much significance.

Stands Acid Test

It is for these reasons that I am submitting this constructional article for public perusal. The unit described in the text successfully withstood the acid test. I want my readers fully to appreciate what I am saying; not to misconstrue any of my statements. My remarks are not intended as a conventional laudatory discourse upon an audio amplifier. I am enthusiastic about my audio amplifier. I want to instil some of this enthusiasm into my readers, because I am certain that they will not be disappointed. I am stating the facts of the case.

I was surprised to receive the multitudinous approval. Not that I personally did not believe in my amplifier, for I was positive that my confidence was well placed, but when "we" (to steal Col. Lindbergh's comment) received hearty approval, I was gratified and felt that the combination as a unit could be recommended with a free hand and without any reservations.

Unfortunately I am not in a position to express on my typewriter the pleasing harmony of sound obtainable with the equipment which I will describe in subsequent paragraphs. I personally and many of my friends believe this unit to afford the closest approximation to the original. The paramount factor necessary for good musical reproduction is present, the faithful maintenance of the relative amplitudes of the fundamental and harmonic frequencies. It is this characteristic which results in the excellent reproduction of music and speech; particularly noticeable with the feminine voice. The original harmony between the low and high audio frequencies is preserved. This audio amplifier-speaker combination operating with conventional radio frequency amplifiers and detector circuits has thrilled perfect strangers.

I have been thrilled, truly thrilled, by the reproduction, and I am giving my honest opinion when I state that I have listened in ecstacy to the reproduction available with this amplifier. I do not say that such receiver reproduction has not been accomplished by some of my readers. I do not know, hence cannot pass opinion. Neither do I say that the results I am obtaining are not obtainable with some other system or achieved in some other manner, but I have accomplished it in the manner shown and am therefore describing this installation.

Before I enter upon the description of the unit I wish to make some comment upon the associated equipment. It is not absolutely necessary that every fan utilize exactly the radio frequency systems I employed. I have experimented with practically every conventional radio frequency and detector circuit and can say with perfect impunity and without fear of contradiction that any radio frequency and detector system may be employed if certain rules are followed.

1. The radio frequency amplifier must be stable in operation.

2. The radio frequency amplifier should possess sufficient selectivity and yet operate much below the point of oscillation; in this manner diminishing sideband cutoff.

3. The detector should not be overloaded, and the carrier wave component in the plate circuit should be properly bypassed and excluded from the audio amplifier.

4. The plate voltage source should be in good condition.

5. The correct plate voltages should be applied to the tubes.

6. The audio frequency stage feeding the amplifier unit should contain a high quality audio frequency coupling unit.

If the above mentioned rules are adhered to, this audio amplifier unit can be utilized with any radio frequency and detector circuit.

Use With Any Good Receiver

The unit is an audio amplifier to be used in conjunction with any receiver and is fed from the first stage of audio amplification. The use of a single stage of audio amplification preceding the amplifier is not a strict reservation. If so desired the amplifier unit can be coupled directly to the detector tube in the receiver. The use of the single-stage unit, however, augments the utility of the amplifier in that it may be placed at some point distant from the receiver.

The system of amplification is a combination of transformer coupled push-pull and impedance coupled push-pull with impedance coupled push-pull output. The input is transformer coupled and the other tubes are impedance coupled. The input tubes are of the 1A type and the output tubes of the 171 type, four tubes being used in all, each stage utilizing two tubes.

I do not wish to enter into a discussion of push-pull amplification, its merits and advantages. Much has been written upon this subject and I do not wish to bore the readers with more technical explanations. Let it suffice to say that push-pull audio amplification affords advantages unavailable with other system. The selection of the combination of transformer coupled push-pull and impedance coupled push-pull had been meditated upon for a long time. With and efficient and stable radio-frequency amplifying system and a good speaker a push-pull am-

That Pleased Everybody

LISTS OF PARTS

One Samson push-pull input transformer type X.
Two Aerovox No. 400 filter condensers (400 volts) 4 mfd C3 and C4.
Four Amsco type 102 sockets.
Two Amperites type 112 (A3 and A4).
Two Amperites type 1A (A1 and A2).
Two Samson plate impedance, type P.
Two Samson grid impedances, type G.
One Westinghouse Micarta Panel Black 7x18x¾".
One Samson output impedance type Z.
One Jewell 0 to 50 DC milliammeter.
One Electrad battery switch.
Two boxes of Acme Celatsite wire.
Ten binding posts.
One baseboard 7x17.5x¾".

plifier of this nature possesses the characteristics essential for fidelity reproduction. Hence this amplifier.

The Output Coupling

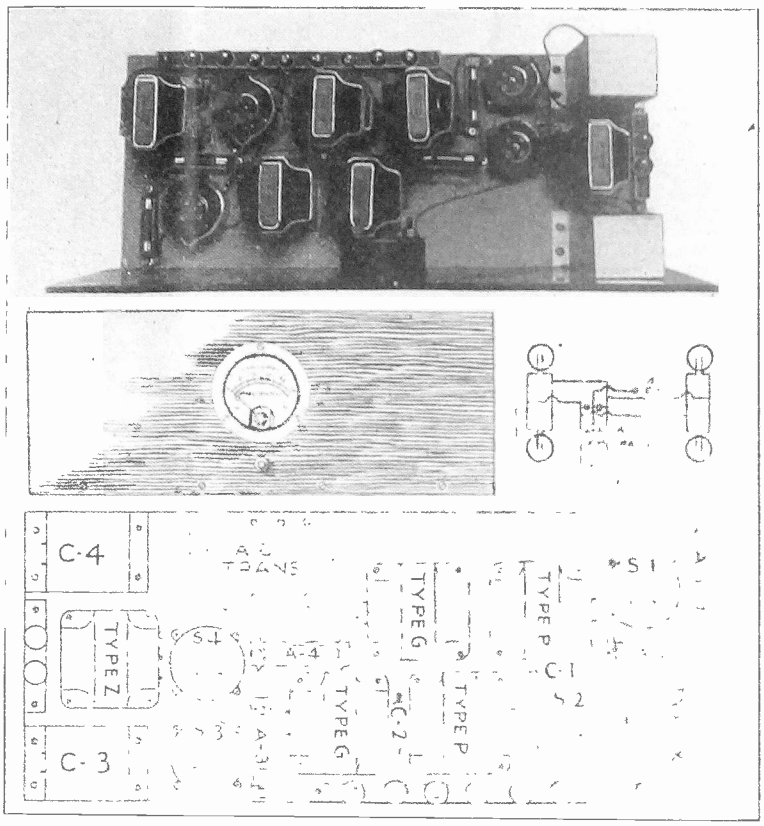
As to the oupput impedance coupling, a comparison of the relative energy transfer from the output tube to the speaker with impedance-capacity coupling and with transformer coupling may be of interest to the reader. With a 171 tube in the output socked and the input being a series of low frequencies, the ratio of energy transfer was 1.30 for the impedance-choke combination and 1.00 for the transformer. The speaker used was of high quality. On high audio frequencies the ratio of energy transfer was approximately 2 for the choke-condenser system and 1.00 for the transformer. With a 210 in the output stage, the ratios were a little lower but still in favor of the impedance-capacity coupling. The reasons for the selection of impedance-capacity coupling to the speaker are evident.

The coupling condensers in the impedance coupled stage, designated as C1 and C2 are mica condensers moulded in Bakelite, thus precluding the possibility of distortion, due to moisture absorption and consequent lowering of the insulation resistance, under which circumstances some portion of the plate voltage applied to the plate of the preceding tube would find its way to the grid of the succeeding tube and even injure the tube. This is a very important detail. The output coupling condensers C3 and C4 are filter condensers rated at 400 volts. They are non inductively wound, have a low power and a high value of insulation resistance.

Advocates a Meter

An illustration shows the front view of the panel showing the distortion meter and the battery switch. The rear view of the panel is given. The panel is black and of Micarta, with excellent electrical qualities. This is essential, since the meter on the panel is at high potential. The quality of the material is such that it is impervious to moisture, will not change color and will not warp. All these details are important when one constructs a unit which is to last for a long time.

The distortion meter as I call it, is in my estimation one of the most important adiuncts of any audio amplifier, since it affords the owner a means of visually observing the presence of distortion and tube overloading, and furthermore facilitates the adjustment of the correct B and C voltages. I heartily recommend and have recommended frequently that each and every receiver owner install such a meter if possible. It is connected into the plate circuit of the



THE TOP NEW layout of parts and transformer connections are shown, as well as the front panel view.

output tube or tubes and shows the plate current fluctuations when the signal is passing through the tube. Its fluctuations are interpreted as indicating tube overloading or freedom from tube overloading. A fluctuation greater than 10% of the steady plate current reading, (without any AC input) is permissible. A fluctuation greater than 10% indicates tube overloading or incorrect values of B or C voltage.

How Amperites Work

The layout of the parts of the amplifier are shown. For the present we will ignore the AC transformer drawn in dotted lines. Looking down upon the baseboard with the rear edge nearest the observer, the image would appear as shown. The input would be to the right and the output to the left. The designations marked upon the drawing are as mentioned in the list of parts.

The amperites are the automatic filament control units and maintain the filament at the correct potential. In addition they permit the interchanging of tubes with greatest ease. When a tube is changed and the filament specifications differ, the correct filament control can be obtained by simply inserting the required amperite into its allotted mounting. The quarter-ampere units are utilized for the input tubes S1 and S2. The .5 ampere units (112) are utilized for the 171 tubes.

The construction will not require the services of a trained radio technician. The layout of the parts should be followed. The respective plate, grid, battery and filament terminals are designated on the units and the wiring can be followed with the greatest ease. Fans who have had meagre experience with push-pull units should not be surprised at the two grid terminals and the single filament terminal on the push-pull transformer secondary; nor at the two plate terminals and single battery terminal on the output impedance. The terminals of the plate and grid impedances should be wired into the circuit as designated. It may be wise to correlate the wiring with the parts layout.

The two posts on the primary of the type X unit are connected to the two input terminals. Remember which is the B and which is the P connection. One grid terminal of the Type X unit is connected to the grid terminal of S1 and the other grid terminal of the same unit is connected to the grid terminal of S2. The filament terminal on type X unit is connected to the G minus binding posts nearest the input binding posts.

(*Continued on page* 18)

DX Comes in Easily

[The theory and construction of the Knickerbocker Four were discussed in last week's issue, September 17.]

DX hunting for a whole evening with a regenerative receiver without a single squeal! That is the astounding experience which I have just enjoyed. The results were surprising to me, although I had thought I was well familiar with the set before. In view of that experience on DX, I believe that I have just begun to explore the possibilities of the Knickerbocker Four.

As I turned the two dials of the receiver in unison, station after station rolled in with strong volume and perfect clarity. For some reason or other it seemed that even static was absent. Whether this was a property of the set or a lucky coincidence I am not prepared to say. But it is a fact that the noise level was very low, and the received signals, both DX and local, were enjoyable.

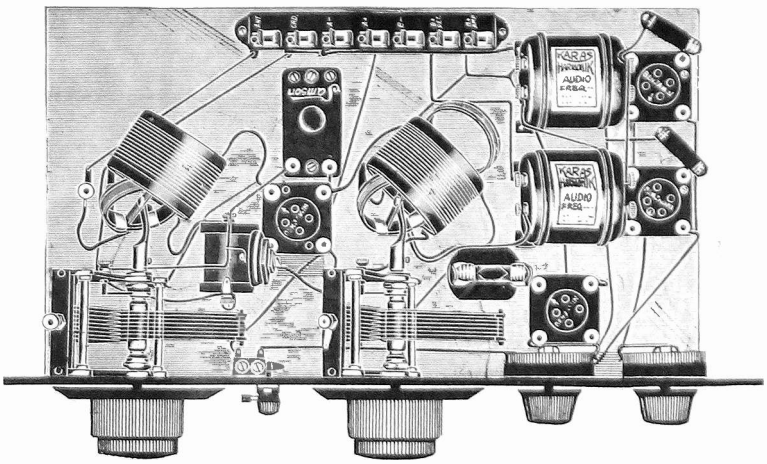
I might have established a record for the number of DX stations received in one evening had there been any desire on the part of the announcers to cooperate. There was none whatsoever. Sometimes a station would play half a dozen numbers without giving its identity.

Uniformity the Motto

Uniformity is a word applicable to the Knickerbocker Four. It has a uniform sensitivity over the entire broadcast band. It does not amplify the higher frequencies to the point of squealing, as is the case with most receivers, but it does amplify them almost up to the oscillating point. This stability at the higher radio frequencies is not gained by the sacrifice of the amplification of the lower frequencies. Not at all, for the amplification at 550 kc is as great as it is at 1,500 kc.

And there is no partiality shown to any of the intermediate frequencies. The circuit has a uniform amplification characteristic over the entire broadcast spectrum. As a direct result of this there was no blocking of the grid of the detector at any setting of the tuning dials, although a 2-megohm leak was used.

Another delightful feature of the Knickerbocker Four is uniformity of distribution of the stations over the dials. When a curve is plotted of dial settings against the frequency of the stations a straight line is obtained. That means that stations separated by equal frequency differences are also separated by equal distances on the tuning dials. This fact is very convenient because as soon as the location of one station on the dials is known, the locations of all the others are also known. A simple problem in proportion will tell where to search for a given station when its operating frequency is known. Another desirable feature of the straight line tuning is that the higher frequency stations are just as easy to tune in accurately as the lower. And the Micrometric dials used on the condensers make the tuning exceedingly simple.



POINT-TO-POINT WIRING is used. This keeps leads short and efficiency high. The rheostats at right control volume and sensitivity.

LIST OF PARTS

C1, C2—Two Karas Orthometric .00037 mfd. condensers.

L1, L2—One Karas antenna coupler to match C1.

L2, L3, L4—One Karas three-circuit coil to match C2.

AF1, AF2—Two Karas Harmonik audio transformers.

Sw—One Yaxley filament switch.

PTJ—Two Amsco pin jacks.

RFC—One Samson 85-millihenry RF choke coil.

Cn—One Samson neutralizing condenser (.00003 to .0003 mfd.).

C3—One Sangamo .00025 mfd. by-pass condenser with clips.

C4—One Sangamo .0001 mfd. by-pass condenser.

R3—One Amsco 2-megohm grid leak.

R1, R2—Two Yaxley 20-ohm rheostats.

R3, R4—Two 1A Amperites.

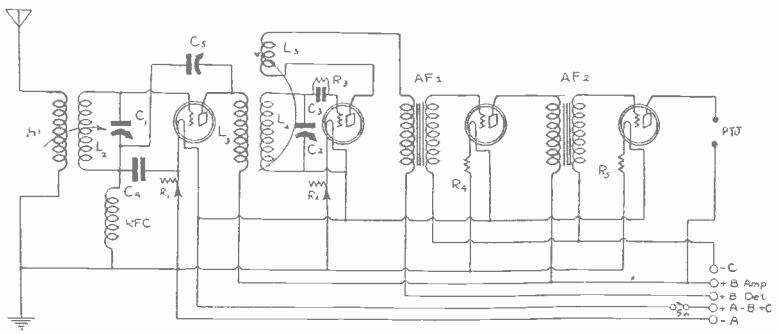
Two Karas Micrometric dials.

One 7x18x3 16 inch Micarta panel.

One wooden baseboard, 9¾x17¼x¾ inch.

One Mucher binding post strip containing 7 Fahnestock clips.

Four Benjamin baseboard-mounting sockets.



THE RHEOSTATS in the Knickerbocker Four are used for volume control and for sensitivity adjustment.

Very Good Audio

Another feature of uniformity that should not be forgotten is the audio frequency amplification. The quality that is obtainable with this set is really remarkable. The thunderous tones of the organ and the different basses in the orchestra come through in a manner delightful to hear. And this amplification of the lower octaves has not been achieved by by-passing the higher notes. Not unless there was more than enough of the higher frequencies, because these, too, come out in full force.

It seems even that compensation must have been made for the effects of selectivity, because the sibilants and the fricatives come through with distinctness.

The imagination of the listener does not have to supply the esses, the zees and the tee-aitches, the effs, the vees, and similar sounds. The loudspeaker, as actuated by the Knickerbocker Four, supplies them.

Does this strength in the higher audible frequencies indicate a lack of selectivity of the receiver? Not at all. The set is adequately selective to cut through the locals and receive distant stations without interference. During that delightful evening of squealless DX hunting there was also a complete lack of cross talk between stations, and this despite the fact that ordinarily WEAF is overwhelming all other stations in the locality of test.

How is the set with regard to volume control? If it is able to reach out for distance stations and yet not overload on powerful local stations there must be thorough volume control in the set. There is in the Knickerbocker Four. Two Yaxley rheostats, one in the filament circuit of the R.F. tube and one in the filament circuit of the detector tube, are provided. The provision is adequate for all needs. In fact, the first rheostat alone is enough for nearly all cases, and the second rheostat is held in reserve.

Efficiency Factors

How is the receiver in respect to microphonism? A forceful test demonstrated that it is entirely absent. The receiver stood on an oak table without any buffers between. The landing of a heavy fist on the table did not start the circuit to sing even momentarily. The absence of any

When One Tunes the Knickerbocker Four

By Herbert E. Hayden

ringing in this test was due to the spring suspension of the Benjamin sockets which are used in the set.

The lack of squealing on the higher radio frequencies is due to a combination of circumstances. First is the particular method used for preventing oscillations in the first tube. A Samson 85-millihenry choke coil shunted with a .0001 mfd. Sangamo condenser is connected in the grid circuit of the first tube below the tuned circuit.

A Samson variable condenser is then connected from the plate of the first tube to the high potential side of the condenser-choke combination, or to the low side of the tuned circuit. This variable neutralizing condenser is adjusted to such a value that the circuit will not oscillate at any frequency but that the first tube amplifies as much as possible without unstability.

The second fact that prevents oscillation in the first tube is that fairly loose coupling is used between the plate coil of that tube and the tuned circuit that follows.

Automatic Tickler

The third fact is that the tickler is turned automatically with the rotor so that the coupling between the secondary and the tickler is changed in proportion to requirements. This makes the detector tube work at maximum efficiency over the entire band without spilling over into oscillation at any point. Since neither the first nor the second tube can oscillate, the receiver is squeal free, and since both the RF tube and the detector work at maximum efficiency, the set is as sensitive as it is possible to make a receiver of this type. And the sensitivity attainable with this type of receiver is enough to meet all practical requirements.

It should not be lost sight of that this receiver employs only four tubes and that it is regenerative. This combination has always been looked upon as the greatest radio value in results for a given expenditure. This particular design of this combination retains all the desirable features of the circuit and eliminates all the undesirable. I for one think it a great set.

The right-hand part of the Knickerbocker Four includes the audio amplifier and also the controls of the radio frequency output. The controls are two Yaxley rheostats, connected in the filament circuit of the RF tube and the detector tube respectively.

There is a double advantage in having a separate rheostat for each of these tubes. The first is that the RF tube can be cut out of the circuit completely, a step which is sometimes desirable. There is enough coupling between the two stages when the filament of the first tube is extinguished to pass considerable energy over to the second tuned circuit on strong local signals. With this and what the second tuner picks up directly, enough volume for loudspeaker operation can be obtained without the first tube contributing any gain. When this is the case there is no object of operating with the extra tube at all.

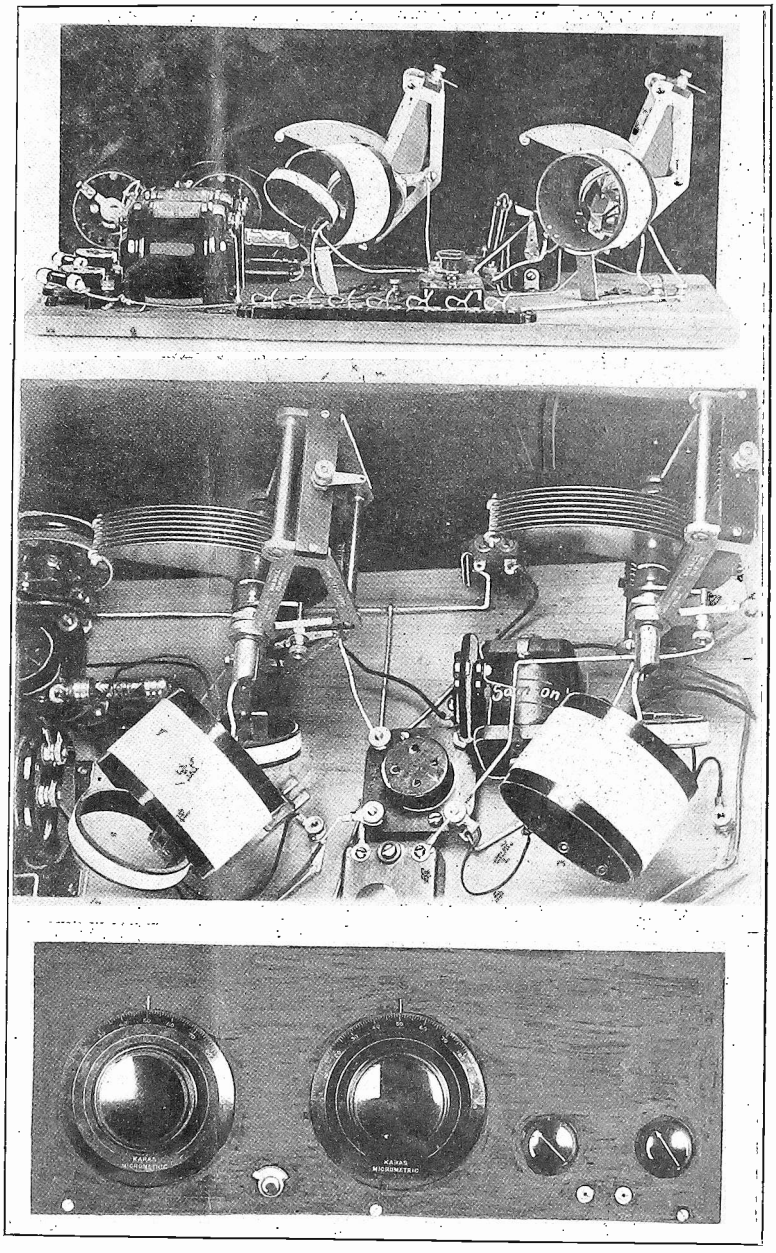
Optimum Detection

The second advantage is that the detector tube can be operated at its optimum adjustment at all times when that tube alone is on one rheostat.

As is well known, the detecting efficiency of a tube depends on the grid leak, the grid condenser, the plate voltage and on the filament current. When all of these but one are constant at some value the most efficient adjustment of the detector can be obtained by adjusting the filament current. Under average conditions the optimum filament current for detection is slightly under normal value. While the adjustment is rather critical it can be effected very easily with the Yaxley rheostat provided.

The setting of the filament rheostat, as well as that of the RF rheostat, also has a marked effect on the sensitivity aside from that of optimum detecting efficiency. Since the tube is regenerative, and since the degree of regeneration depends on the filament current, the radio frequency amplification in the detector tube will depend on the setting of the filament rheostat.

In this respect the tube is much more sensitive to changes in the filament current than with respect to optimum detecting efficiency, and it is advantageous to have a smooth running rheostat.



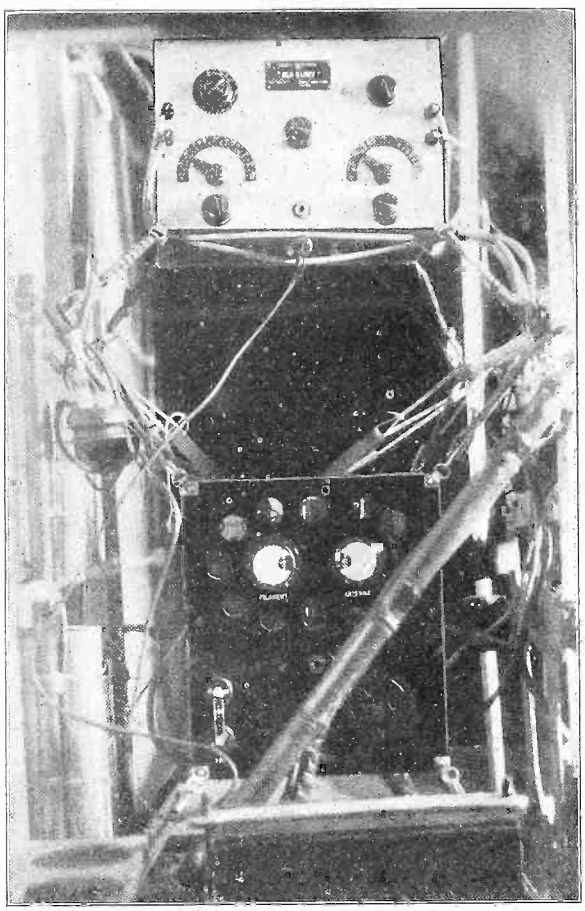
Upper—The rear view of the Knickerbocker Four. It clearly shows the advantageous placement of all the parts.

Middle—This is a close-up, looking down from the rear, giving emphasis on the radio frequency portion. It shows clearly how the primary of the first coil (at right) and the tickler in the second (left rear) are connected to the shafts of the variable condensers, and how the coupling and "tickling" are varied automatically as the condensers are tuned.

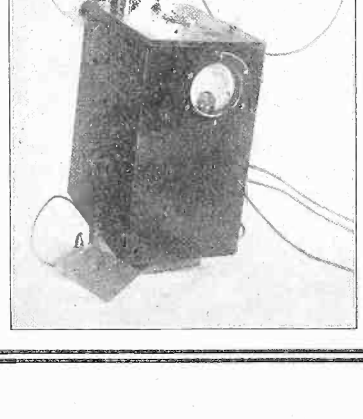
Lower—The front view of the receiver is attractively simple. Two condenser dials, two rheostats, two output tip jackets and a filament switch.

Rescue of "Old Glory" Fliers

Nobody Aboard was Proficient at Sendi
Bert E. Smith Demands Law Compelli
Regular Operators Aboard Just as Sh
Precaution Could Have Saved Li



THE RECEIVER (above) and the transmitter that were aboard Old Glory when she made her fatal plunge into the whirling waters of the North Atlantic. It was the key of this transmitter that Philip Payne pressed in his slow attempt to convey to the world the general position of the already plighted plane. This was probably Payne's last living act, for the lives of Bertaud, Hill and himself were snuffed out soon thereafter.



THE EMERGENCY transmitter which apparently was not given an opportunity to prove its worth. It is entirely waterproof. Everything from the key, which is under the little rubber diaphragm on top, to the batteries was inside. The ground plate and antenna reel were attached to the outside of the box. A small code chart is on the side, to the left. This outfit was identical as the one on the America, the Pride of Detroit, and the Royal Windsor.

[On Tuesday, September 6, at 12:39 P.M., E.S.T., the monoplane Old Glory, sponsored by William Randolph Hearst, took off from Old Orchard, Me., with three men aboard—Lloyd W. Bertaud, and James D. Hill, pilots and Philip A. Payne, managing editor of The New York "Daily Mirror," passenger. The destination was Rome. In the early morning of the next day, an SOS was sent out by the plane. This was followed by the indefinite information the plane was "five hours out of Newfoundland, east." Immediately the steamers Carmania, Lapland and Translyvania rushed to the rescue. For hours these ships patroled the region where the distress signal was thought to have come from, but in vain. On September 12, the steamer Kyle, which put out on September 10 to search for the missing flyers, reported finding some wreckage off St. John's, Newfoundland, which they believed to be part of Old Glory. Communication on Old Glory up until the last location message was sent out was carried on with the aid of a special transmitter and receiver, designed and constructed by the Allen D. Cardwell Manufacturing Corporation, 81 Prospect Street, Brooklyn, N. Y.]

Henry Miller

ENSIGN S. V. EDW the radio set he will Sikorsky plane rece Atlantic flights. The capable of sending sages from France o soon as it takes the low and long waveler 25 pounds and was b ton Nav

By Bert E. Smith

The Allen D. Caldwell Mfg. Co.

The fate of the plane Old Glory has probably brought the perils of trans-oceanic flights more vividly to the minds of most of us than any similar fatality. It was the first American plane to be lost on a trans-Atlantic flight and it was equipped with every possible safety device, including a radio installation of the most elaborate and advanced type.

We have already given a description of this radio installation in these columns (September 10 issue), but a brief review may not be amiss. The main ship's transmitter was a 100-watt CW affair with two UV-211 Radio Corporation tubes supplied with current from a 200-watt, 1,000-cycle generator mounted on the side of the fuselage. The receiver had four tubes and utilized the Roberts circuit.

An automatic wind-driven key kept the call letters of the plane on the air all the time when no messages were being sent or received.

Emergency Transmitter

A completely self-contained spark transmitter, weighing less than fourteen pounds, complete with kite and kite string-antenna wire, was close at hand to be taken into the collapsible lifeboat if the aviators succeeded in getting clear of the plane. Altogether no possible safeguard which could lessen the risk of the pilots in the event of trouble over the sea was omitted.

And yet when something went wrong five hours after they saw the last of the coast of America, only the most brief of distress calls spanned the wind-swept torment of the Atlantic and then a silence fell which probably never will be broken. Nothing was given which would aid ships to come to the rescue of the pilots except that they were five hours east of Newfoundland—which gi where in an area a h and in which the ch was virtually nil, par were running which up a floating plane.

None of the three perienced radio oper Bertaud had been ta for several weeks Neither was any o With these qualificat most extensive radio most useless.

What Cap

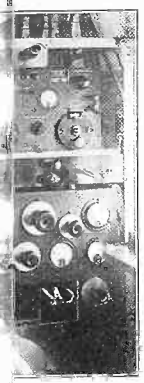
To quote the mast ers which participate

"After we had re had to proceed by not know the speed did not know its cou on the Great Circle fornia reported sight earlier, at 2 a.m., som ward. Nor were the to Rome. It was a were. We guessed t in a fifteen-hour sea over the ship, saw of wreckage, not a sea."

If one of the pilot he would have know of the ship at all tim operator could have tion in the four min tween the first SOS ently was their final several of the ship where the plane la Furthermore, a ski have been gossiping liners nearby, and by compasses the ship

Balked By Lack of Radio Skill

or Receiving, or was a Navigator— All Ocean-Flying Planes to Have Must Have—Describes How Such of Bertaud, Hill and Payne.



DS, U. S. N., at ate in the huge built for trans- designed to be receiving mes- United States as having both a The set weighs by the Washing- rd.

space was any- ed miles square, of finding them irly as high seas id quickly break

tors was an ex- although Lloyd lessons in code ore the flight. m a navigator. lacking even the allation was al-

Said

one of the lin- the search: d the SOS we swork. We did the plane. We They were not rse, as the Cali- hem three hours les to the south- the direct route tion where they est we could and with lookouts all ng, not a scrap r of oil on the

been a navigator e exact position d a skilled radio enough informa- that elapsed be- and what appar- h to have guided arby directly to on the waves. operator would the operators on ns of their radio ator could have calculated the plane's position immediately when the distress call broke the regular message. Those aboard Old Glory evidently had no time to get their collapsible boat overboard, for the emergency transmitter which would have kept them in touch with the searching liners was never heard.

Nothing was said in the brief distress message as to the cause of their trouble, but it would seem probable that one of the pilots endeavored to repair whatever went wrong while the other remained at the flying controls, and Phil Payne, who was neither mechanic, navigator nor radio operator, was told to call for help. Perhaps he sent the SOS after laboriously translating the short message into code, utilizing enough time for coding the message to enable a skilled operator to quote full details of trouble and position. Perhaps the trouble with the plane was something which would have been unimportant over land, and the pilots thought they could fix it before striking the water, as happened to one of the Hawaiian planes, where the ship was brought down to within fifty feet of the dashing waves but was able to make her way aloft again. For this reason perhaps they did not empty their gas tanks, and if Old Glory struck the water with her full load of gasoline she undoubtedly sank within a minute or two.

One tremendous lesson is to be learned from this as well as from other mishaps —even the most nearly perfect and modern of safety devices and the greatest bravery and coolness on the part of the aviators are of no avail in the event of trouble if the fliers are incompetent to operate the devices.

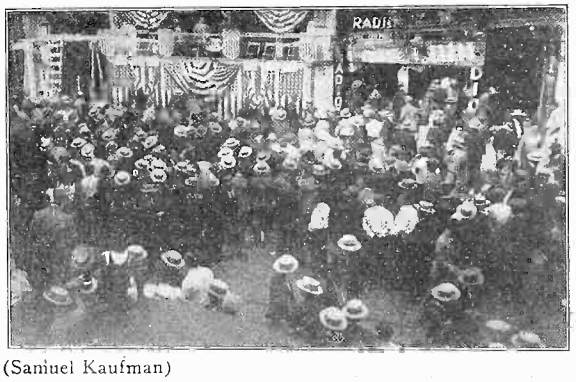
An airplane is a very fragile thing and unless full news of its plight can be broadcast, the passengers have small chance of surviving in case of trouble. Whether it would have been possible for the plane to remain afloat or for the life raft to survive in the rough seas prevailing at the time of the crash, which captains doubted, but they unanimously said that had they been given a definite position to search and not the wide locality of the laconic "Five hours off Newfoundland, East," of the SOS call, they could have proceeded with assurance that they were on the right track.

No ship is allowed to go to sea without a skilled radio operator and the same restriction should be placed on aircraft flying over the open sea.

Shows in Canada

Four radio shows will be held during the months of September and October in Canada. From September 20 to 24, the Chateau Frontenac Hotel in Quebec will house one. The Windsor Hotel in Montreal will have one from September 26 to October 1. The last of these shows will be presented at King Edward Hotel in Toronto from October 17 to 22. A show was held in Toronto from August 27 to September 6. The Royal Alexander Hotel in Winnipeg also housed a show from September 6 to 10.

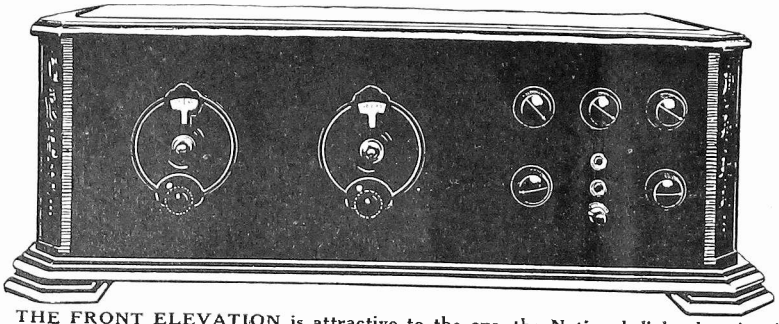
ELSIE MILLER WOOD, pianist, who has recently returned to WSM, Nashville, Tenn., after a concert tour. Mrs. Wood is also an accomplished organist. She has served as choir director and pipe organist in the east.



(Samuel Kaufman)

CITY OFFICIALS addressed throngs that gathered along Radio Row (Cortlandt Street), in New York City, during the special Radio Week held recently by the stores.

Strobodyne Flings Challe



THE FRONT ELEVATION is attractive to the eye, the National dials gleaming in all their beauty through the illuminated windows, while the switch and sensitivity controls are conveniently at right.

[*Last week the Strobodyne receiver was introduced to readers of* RADIO WORLD. *An explanation was given of the principle on which it works. The receiver as built and designed by Robert E. Lacault was described. This circuit has aroused nation-wide enthusiasm because of its remarkable achievements. One man reported that while exploring the ether with the set he was able to receive stations* 1,500 *miles away while he himself was in a steel tube under the river, virtually encased in solid metal, as far as the radio waves are concerned. Again, distant reception of the same order was achieved inside a steel structure in the center of the skyscraper district of New York City. A man testing the receiver under the most difficult situations he could find in the city was clearly elated with its performance. An interested spectator in the gallery asked the man what he thought of the new receiver. "Why, it is positively Napoleonic in its mastery of difficult situations," was his enthusiastic reply. "I have tried many receivers under the same conditions as this, but this beats them all. Never before have I experienced such uncanny sensitivity and such incisive selectivity."*]

By Brunsten Brunn

SO remarkable are the verified reports of the performances of the Strobodyne that its achievements are becoming world-famous. The receiver has only to reach out its invisible tentacles toward a given station as objective and the signals of that station roll in, say constructors.

Distances melt away before its power just as the armies of Napoleon's enemies melted away before the might of the great general and his brave fighters.

If ever there will be any international tests of radio reception it surely should be a Strobodyne that carries off the victory.

At the conclusion of last week's installment of the Strobodyne we were discussing the balancing of the bridge circuit that has so much to do with this super-performance. The bridge minimizes the dependence of the oscillator circuit on the modulator tuned circuit.

A Vital Condenser Is C4

The bridge balanced, there will be no flow of current in the wire connecting the two. The adjustment holds only for one frequency unless the two parts of the inductance coil L2 are accurately the same. But small deviations will not make any appreciable difference in the operation of the Strobodyne. When the bridge circuit has been balanced with the aid of C3 the lead from the tap on coil L1 can be connected to the neutral wire without any interaction between the oscillator coil and the tuning coil.

The coil L3 is the plate or tickler coil. It is coupled to the oscillation coil in such a manner that the circuit will oscillate. The larger coil L3 is, and the closer it is to L2, the more violent will the oscillations be in the circuit. The number of turns on this coil and the coupling between L2 and L3 should be adjusted for best results.

The product of the frequency changer is taken to the IF leads, to which the primary of an intermediate frequency transformer is supposed to be connected. A condenser C4 is connected across the primary to aid in the selection of the intermediate frequency and also to by-pass all high frequency components in the plate circuit of the oscillator tube. Without this condenser the circuit will not oscillate.

The balancing condenser C3 should be as small as possible in order not to affect greatly the tuning range of C2. Since the capacity of C3 is in parallel with C2 it adds to that condenser and is in effect a large zero setting capacity. The smaller it is the wider will be the tuning range of the oscillating circuit.

Advantageous Combination

Since a tube has been saved by combining the oscillator and the frequency changer to such great advantage another tube can be added to the circuit ahead of the frequency changer. Greater selectivity and distance can be achieved with this addition. When this addition is contemplated the question arises as to what method to use for coupling the RF tube to the oscillator. The circuit used in the Strobodyne is shown in Fig. 2. A change has been effected in the method of coupling the tuned circuit L1C1 to the oscillator grid. It has been accomplished by the introduction of the coil L4, which is a small coil loosely coupled to the tuned circuit L1C1 and connected in series with the grid lead of the oscillator. Coil L1 in the tuned circuit is in turn coupled to the primary L5 which is connected in the plate circuit of the RF tube. This double coupling avoids the undesirable effects of tuning the plate coil L5 or the grid coil L4.

It will be noted that the grid returns of the IFT were left unconnected in last week's diagram. These should be connected to the arm of the potentiometer.

Two Enough—Third Is Reserve

In a circuit of this type three tuning controls are required. The first is Co, which is connected across the loop or the secondary of the first RF transformer. But this does not increase the difficulty of tuning the circuit because Co and C1 are put on a common shaft and are manipulated simultaneously. The rotors of both of these condensers are grounded, to stabilize the tuning. This fact also makes possible the use of a double condenser in which the two rotors are connected metallically.

The oscillator condenser must be separate since that will have different settings.

The selectivity and sensitivity achieved with the Strobodyne frequency changer and the radio frequency amplifier preceding it are very great, and ordinarily it is not necessary to use more than two intermediate frequency stages of amplification. But sometimes it is desirable to have a little reserve amplification to draw on, particularly when "shooting" stations located on the other side of the globe. For this reason three stages of intermediate amplification have been included in the Strobodyne receiver. Rarely will all this amplification be needed, but there is just as much satisfaction in knowing that it is available as there is in knowing that an automobile has more power than is ever required.

There are ample volume controls in the Strobodyne to cut down the volume on strong local stations.

The several methods of controlling the volume in the circuit can best be seen from the circuit diagram of the receiver. This is given in Fig. 3. The first control is rheostat R1 in the filament circuit of the first tube. This can be used freely as it is a very effective control and it has no bad effects on either quality or selectivity. The second volume control is the rheostat R2 in the filament circuit of the oscillator tube. This can only be used to a certain extent because if too much resistance is inserted here the oscillations stop and the circuit ceases to function.

One at Each Level

A third control is the potentiometer R6 in the grid circuits of the intermediate amplifiers. This controls the volume by varying the grid potential of the IF amplifiers. It is quite effective but it should be used sparingly since it causes a heavy drain on the B battery. A fourth control is the rheostat R7 in the second detector tube. This can be almost as much as the rheostat in the first tube.

The next volume control is the variable resistance R5 across the secondary of the first audio transformer. By means of this the volume can be varied from almost zero to maximum obtainable. The last volume control is the jack-and-plug arrangement whereby the loudspeaker can be plugged in the plate circuit of either the first or second audio tube.

There is at least one volume control in each of the three frequency levels, and that is as it should be. In operating a set like this, care should be taken that the volume is so controlled in each level that there is the least possible distortion. This requires that the filament current must not be reduced in the audio tubes to limit volume. Any operation must be confined to the signal voltage which is impressed on the grids. In the intermediate channel some tampering with the filament current is allowable, since the signal is still undetected. But it should not be carried too far.

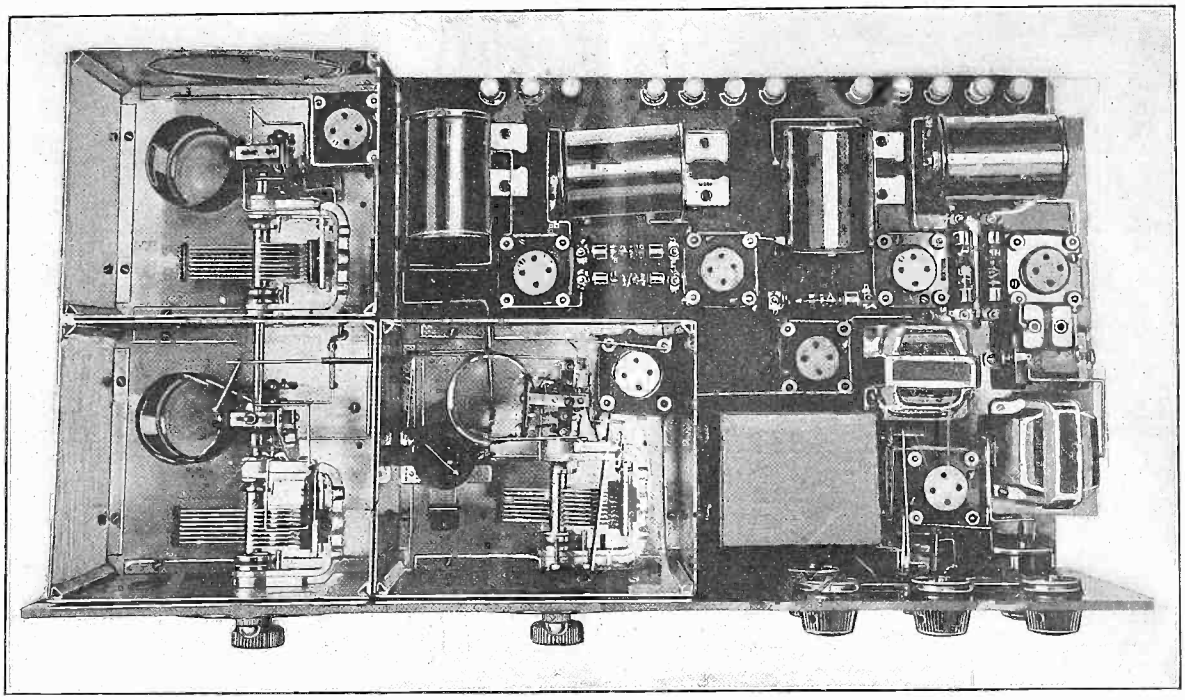
Interesting Details

R7 is in the final detector and therefore that affects both intermediate frequency and audio frequency currents. It used to be used only when R1 and R5 failed to give adequate control.

Minimum distortion will occur when the volume is controlled from the in-put side as much as possible because this keeps the level of the signal voltage a minimum throughout the circuit for any given output.

There are other interesting details about the circuit which are indicated on the circuit diagram. One is the tapped in-put coil for adapting the receiver for short and long waves. For the longer waves in the broadcast band the entire coil is used and for the shorter only a part of it is used. Of course, which one of these taps is used depends not only on the wavelength but also on the requirements and on the length of the antenna in use.

ge—"Napoleon of the Air"



THE NEAT layout of the parts may be viewed in the above photograph.

Another important feature is the thorough shielding indicated in the drawing. One metal shield surrounds the parts pertaining to the radio frequency tube. Another shield surrounds those parts which belong to the tuned coupling arrangement between the RF tube and the oscillator. A third shield surrounds all the parts belonging to the oscillator. All shielding is made of aluminum and is grounded.

A feature worthy of special notice is the absence of grid condensers. None is used in either the frequency changer or in the second detector. This is quite unusual. It is a guaranty against blocking and kindred troubles, and indicates unusually quiet operation.

RF Is Neutralized

Neutralization has been used to prevent radio frequency oscillations in the radio frequency tube on the shorter waves. For this purpose a small winding Ln, equal to L5, has been put on the form of L1, and this small winding has been connected to a small variable neutralizing condenser Cn, which in turn is connected to the first grid. Very satisfactory neutralization can be effected with these devices.

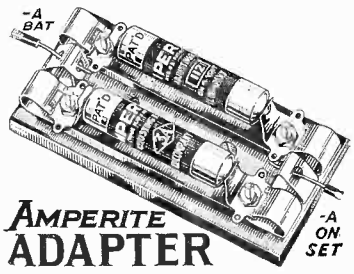
An intermediate frequency filter consisting of condenser C8 and choke coil RFC has been connected in the plate circuit of the detector tube to assist the primary of the first audio transformer to suppress the super-audible frequencies present in the output of the detector.

The mechanical construction of the Strobodyne receiver can be seen from the photograph above. All the parts are clearly labeled to conform to the designation in the circuit diagram. Note the shields in which the radio frequency elements of the circuit are enclosed. In operation these metal compartments also have metal lids to make the shields complete. The remaining parts of the circuit are placed outside the shields, and appear a bit crowded, but the arrangement is so orderly that the crowding becomes an advantage rather than a source of trouble. How the interior of the receiver appears with the shield caps in place and the tubes in their sockets is shown in last week's photograph. One of the intermediate frequency coils has been taken out of its socket.

The plug-in feature of the intermediate frequency transformers is important in that it is possible to change the intermediate frequency to some other value by plugging in a new set of coils. In certain localities there might be interference when one frequency is used and the signals may be entirely clear when another is used. However, the design of the radio frequency end of the Strobodyne minimizes the necessity for having a supply of extra coils to avoid possible interference. This interference is not at all a matter of lack of selectivity in the intermediate channel.

(*More about the Strobodyne next week.*)

Amperite Adapter Removes Guesswork



By means of a new device just introduced, it becomes possible to modernize the old set without the use of tools or the performance of a major operation. In fact, not a single wire within the set is altered; not a thing is changed; not a single practical fact need be known about radio: yet the old set is instantly transformed into a modern set so far as efficient and simplified operation is concerned.

Briefly, the new device is the Amperite Adapter, comprising a base with clips to take two standard Amperite units complete, which are thereby connected in parallel so as to obtain their combined current-carrying capacity. The Amperite units are selected in order that the combination may provide the desired amperage for the group of tubes in the receiver thus controlled. Combinations are available for the precise control of any set from the simple three-tube layout without power tubes, to the six-tube layout with power tube.

The Amperite Adapter may be mounted within the cabinet or at the rear or again near the external storage battery, according to preference. It is connected in the minus A lead, between storage battery and receiver. No tools are required. The wire ends clip into place. The only remaining step is to turn the rheostats of the set full on. If there are individual resistances or so-called ballasts, these are short-circuited.

The set is now ready to operate with the group control of the tube filaments, removing all guesswork as well as the extra manipulation of antiquated rheostats. The receiver is started or stopped by means of a single switch. The longest life is assured from the tubes, since they are operated at the currect filament temperature at all times.

The illustrations show what a neat arrangement the adapter makes. The size of the adapter is a trifle larger than two mounted amperites side by side.

A THOUGHT FOR THE WEEK

THERE is one angle that aviators and aviation enthusiasts probably did not give much attention to until recently—and that had to do with radio. With the aid of radio there is not the slightest doubt that aviation has been made safer for the man of the air and vastly more interesting for the man on the ground.

SIXTH YEAR

RADIO WORLD

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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EDITOR, Roland Burke Hennessy
MANAGING EDITOR, Herman Bernard
TECHNICAL EDITOR, Lewis Winner
CONTRIBUTING EDITORS:
J. E. Anderson, Capt. Peter V. O'Rourke, and James H. Carroll

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

Dubilier Announces Two New Power Banks

Two balanced condenser banks especially designed for satisfactory service with present-day power compacts are announced by the Dubilier ondenser Corporation of New York City.

The Dubilier Condenser Bank Type PL-574 has been designed primarily for the Thordarson R-171 Power Compact, althought it is equally suitable for use with the new Raytheon BH rectifier or the UX-213 or CX-313 full-wave filament rectifiers. The condenser Bank PL575 has been designed primarily for the Thordar son R-210 Power Compact, but it is equally applicable to any other type of 216-B or 316-B high-voltage, half-wave rectifier layout for operating a UX-210 or CX-310 type of power tube, together with supplying the plate requirements of the usual receiver.

Television Scenes Sent Invisibly

By Hutchins Foster

At the Leeds meeting of the British Association for the Advancement of Science, John L. Baird, the youthful inventor of a television machine, demonstrated his latest development in this new field. This was a process for sending pictures by wire and wireless by invisible rays, or by infra-red light waves. The process has been called noctovision because the object whose picture is transmitted is seated in what appears to the human eyes as perfect darkness.

By this process Mr. Baird's image was sent from Leeds to London, a distance of 200 miles, by telephone wires, and the image was perfectly recognizable as that of Baird although the inventor was seated in a dark room at the transmitting end of the line.

Flooded With Invisible Light

While the room in which the inventor was seated appeared dark to the observers it was in reality flooded by infra-red light intense enough to affect the transmitting instruments. The human eye is sensitive to only a very narrow band of light waves, approximately one octave.

Above the last visible violet light there is a world of intense illumination to which the eye does not respond, though it usually is injuriously affected by it, but to which the photographic plate is intensely responsive.

Below the last visible red light wave there is another world of intense radiation to which the eye does not respond as light, and to which none of the human senses responds until the waves become long enough to constitute heat waves. These infra-red waves are relatively inert with respect to the photographic plate unless this has been specially treated, and they are also relatively inert with respect to the photo-electric cell.

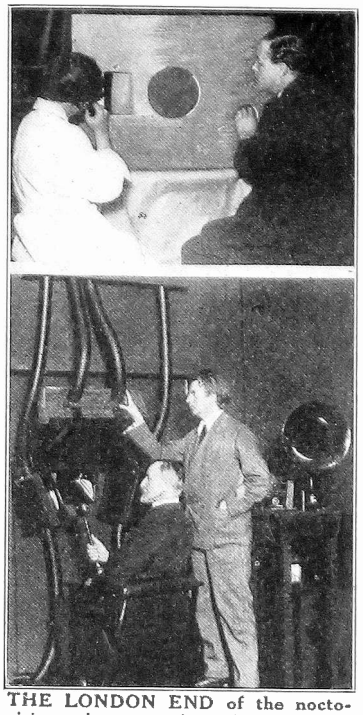
Yet in his noctovision Mr. Baird makes use of infra-red radiation. He bathes the object to be transmitted with intense subvisible light. The object reflects some of this light and the reflected portion is passed into a photo-electric cell. This cell converts the light values into equivalent electric values and noctovision becomes the same as television of the ordinary kind.

Uses Own Type of Cell

Mr. Baird's contribution lies mainly in the type of photo-electric cell he uses. Ordinary cells, as was stated above, are not sensitive to infra-red light, but Mr. Baird has discovered a method of making these cells responsive just as the chemists have succeeded in making photographic plates sensitive to infra-red light. The method Mr. Baird uses in this treatment of the photo-electric cells is still kept secret for patent reasons.

A peculiarity of noctovision is a slight distortion of the image. This is of the same kind of distortion of light values that occurs in ordinary photography and is due to similar causes. We are accustomed to see things with natural sun light, or with artificial light resembling it.

Only a certain part of the light is transmitted from the object, and we judge the object by what it reflects of the natural light. If we see the same object in light widely different from sun light the light values are badly distorted. An example of this is the appearance of objects flooded by the light from mercury arc tubes. Everything is green-purple. This is because these colors predominate in the source of light while many are missing entirely. When nothing but a certain infra-red radiation strikes the object only that can be reflected; and it is not likely that the same areas on the object will reflect the infra-red light as will reflect visible light.



THE LONDON END of the noctovision demonstration from Leeds, England, shows the screen on which the animated image of John L. Baird appeared after it had traveled from Leeds over telephone lines. Below is Baird, youthful television inventor, demonstrating his latest development, the noctovisor, to Wm. Miller (seated)

Commercial Prospects

The prospects for wide commercial application of noctovision are very promising due to the peculiar properties of the infra-red light. Visible and ultra violet light are absorbed and scattered by fog, dust, clouds and similar substances. Infra-red light passes through them. Hence it is possible to use infra-red light in connection with signalling at sea in thick weather. This peculiarity of the infra-red light was strikingly demonstrated while Mr. Baird's image was being transmitted from Leeds to London. During the demonstration Mr. Baird was in telephonic communication with the persons at the London end he was asked to light a cigarette and blow smoke. He did so and all the motions were plainly visible in London, but there was no smoke. The infra-red light passed right through the smoke and none of the light was reflected by it into the photo-electric cell.

Midwest Reception Pleasure to Bullard

Washington.

After making a tour of the middle western cities, which included Cincinnati, Columbus, Akron, Cleveland, Detroit and Pittsburgh, Admiral William H. G. Bullard, chairman of the Federal Radio Commission, reported that reception was very good there. He also visited the principal broadcasting stations in these cities, and found the managers to be very well pleased with conditions.

Admiral Bullard is the first of the members of the commission to return from the inspection tours.

Public's Confidence Finally Won, Says Kent

By A. Atwater Kent

I am gratified at the past, delighted with the present and enthusiastic over the future of radio. Great things have been done. Even greater things will be done.

Two important developments are rapidly bringing more and more satisfaction to radio users. One is the working out of the problem of regulation and allocation by the Radio Commission. The other is the production by manufacturers of reliable sets and equipment, simplified as to operation and maintenance, and at reasonable prices. The public no longer hesitates to buy radios because of unsatisfactory broadcasting conditions or because of uncertainty as to quality and character of sets.

Entertainment Better

Simultaneously with these developments has come a great advance in the quality of broadcast entertainment and in the number of important, thrilling events of world-wide consequence brought into the home by radio—such as the Lindbergh celebrations, the trans-oceanic airplane flights, etc. During the last two years broadcast programs have become better and better, until now the millions of people constituting the great radio audience may hear the best in music at almost any hour.

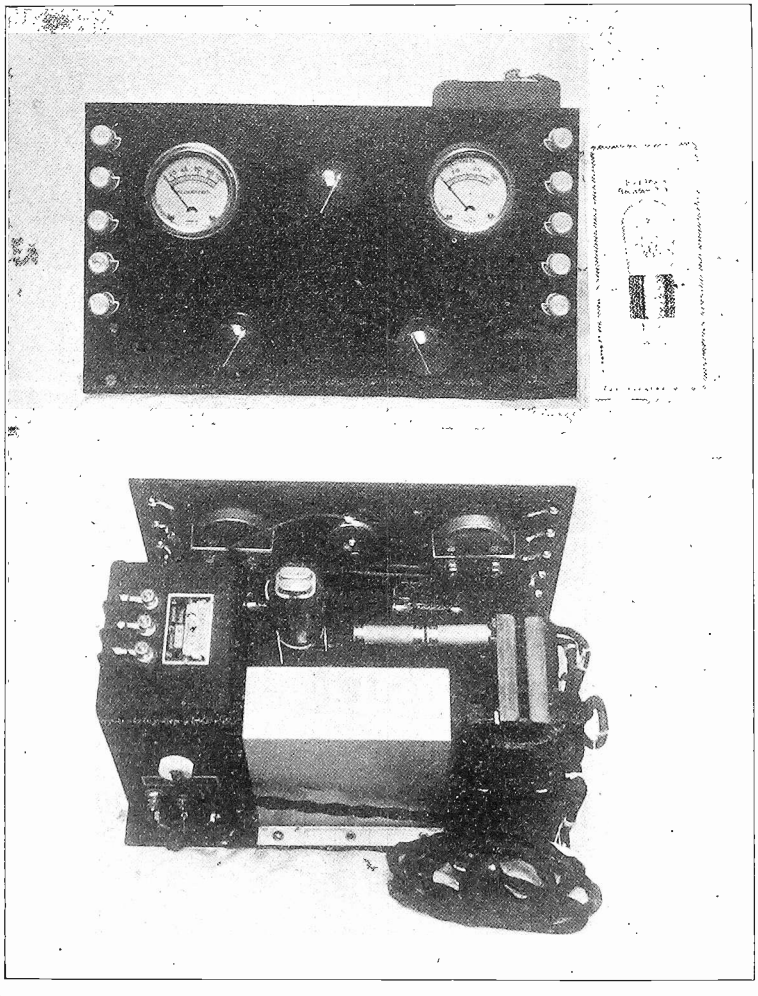
Hand in hand with the foregoing has come a wider use of radio for educational and business purposes. Schools are adopting it. Broadcasting stations are putting on educational programs for students.

Education Grows

The Department of Agriculture, colleges and others are broadcasting both instruction and entertainment in an interesting way, which means dollars and cents to farmers and business men. While we do not perhaps hear so much about it, this practical use of radio has, I think, grown in the same ratio as its cultural use.

I have been delighted to note that there is a keen appreciation on the part of the public of the advantages and privileges it now enjoys from radio. The public realizes that this great growth has been made possible by the willingness of manufacturers, broadcasters and others to spend millions for development and promotion. Surveys of their industry indicate that the public is showing its appreciation in the most effective manner—by the purchase of radios in steadily increasing volume.

B AND C ELIMINATOR



AN ATTRACTIVE LAYOUT for a B and C eliminator, using a QRS 85-mil rectifier tube. A high resistance 0 to 300 voltmeter and a 0 to 100 milliammeter are mounted on the panel so that the voltages applied to the plates via Electrad Truvolts of the various tubes may be accurate. The two bottom knobs control the Truvolts. The center knob controls a Carter 1,000-ohm Potentiometer, used for varying the C bias.

90,000,000 Listeners-In Throughout the World

Washington.

There are approximately 90,000,000 people who now receive radio programs, according to a report made to Secretary Herbert Hoover by Lawrence D. Batson of the Electrical Equipment Division of the Department of Commerce. About 18,000,000 sets are used. At least 200,000,000 sets would be necessary to serve all the people, there being five persons to every set.

"Radio programs have a striking similarity all over the world, and it is not without some basis of possibility that programs broadcast throughout the universe may be expected to prove more popular than those of local origin," said Mr. Batson.

"More news and some direct advertising find place in foreign programs and government communications are formally presented to the people through the microphone, but in general a typical American program is likewise typical for any part of the world."

Radio Device Prevents Train Collisions

A recent demonstration of a special miniature transmitter designed by Bernays Johnson, to prevent train collisions, was very successful. The miniature transmitter, which is mounted on the rear of the train, generates a note of constant frequency. This is, in turn, picked up by an antenna mounted on the engine running behind it. As the rear train approaches the forward train, a glow lamp located in the cab, starts to glow. The nearer the rear train approaches the forward train, the brighter the light becomes. In this way, the rear train is automatically notified of its proximity to the train ahead, thereby averting a crash.

More Women Broadcasters Than Men, Says Report

Baltimore.

There are more women broadcasters than there are men, according to the program files of WBAL, Baltimore's superpower station. And this, in spite of the assertion made from time to time by accoustical experts, that male voices lend themselves better to the intricacies of radio transmission than do those of feminine quality.

FORD AND GLENN HEARD FROM WJR

Detroit.

Ford and Glenn, the popular songsters, known as the "Lullaby Boys," recently broadcast their premiere program from WJR. In the past they have been heard from stations WLS, Chicago, and WLW, Cincinnati. They will continue broadcasting from WJR at various periods during the day and night as part of an elaborately planned schedule.

Rider Enthusiastic Over Audio Channel

(*Continued from page 9*)

The plate of one type P unit is then connected to the plate terminal of S1 and to one side of C1. The plate terminal of the other type P unit is then connected to the plate terminal of S2 and to one side of C2. The B plus terminals on the two type P units are interconnected and then connected to the B plus binding post nearest the input terminals. This is the 135 volt post. The next B plus is the 180 volt post.

The other terminal on C1 is now connected to the grid terminal of the type G unit nearest to it, and the lead is carried on to the grid terminal of S4. The open terminal on C2 is connected to the grid terminal on the other type G unit and the lead is carried on to the grid terminal of S3. The filament terminals on the type G units are connected to each other and a lead brought out to the C minus binding post nearest the A minus post. The 40-volt negative bias for the 171s is connected to this terminal. The plate of S3 is then connected to the plate terminal of the type Z output impedance, and a lead is carried on to one terminal of C3.

Terminals Distinguished

The other terminal of C3 is connected to one of the output binding posts. The plate terminal of S4 is connected to the other plate terminal on the type Z unit and a lead is carried on to one terminal of C4. The other terminal of C4 is connected to the remaining output binding post. The battery terminal on the type Z impedance is then connected to one side of the milliammeter. The other side of the milliammeter is connected to the B plus terminal mentioned previously and designated as the 180 volt terminal. If when the filament and plate voltages are applied the milliammeter pointer does not read correctly, that it reads reverse, the leads to the meter should be reversed.

The connection of the Amperites into the circuit is very simple and requires no detailed discussion. However mention must be

(*Concluded on page 19*)

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DATA ON the new Raytheon rectifier cartridge appeared in the May 21 issue of RADIO WORLD. Send 15c for this issue or begin your sub. with this issue. RADIO WORLD, 145 West 45th St., New York City.

BETTER THAN ANY FIXED LEAK is the Bretwood Variable Grid Leak. It allows adjustment of grid voltage to maximum sensitivity for reception of far-distant signals, with distortion. The Improved 1928 Model De Luxe Bretwood Grid Leak, $1.75; or $2.25 for Grid Leak with Bretwood Bullet Condenser attached. The North American Bretwood Co., 145 West 45th Street, New York City.

HOW TO BUILD RADIO WORLD'S Four-Tube Universal Receiver fully described by Herman Bernard in the March 12, 19 and 26 issues of RADIO WORLD. Send 45c and get these three numbers. RADIO WORLD, 145 West 45th Street, New York City.

(Concluded from preceding page)

made of the connecting wire, because of its importance to the fan constructor. The Celatsite wire is recommended heartily because it greatly facilitates wiring. It is stranded and therefore flexible, yet when once "put" it stays "put." Furthermore the wire is tinned and soldering is easy. Last but not the least the insulation will not burn when touched with a hot iron, an experience frequently encountered by all wiremen when working in close quarters.

The discussion thus far was based upon DC filament operation, the source of filament potential being a storage battery or some similar unit. Let me state, however, that AC operation is perfectly satisfactory, that is AC upon the filaments of the four tubes and a B battery eliminator for the B supply. With raw AC applied to the filaments and eliminator B supply, this unit is truly an AC operated device. To incorporate AC filament wiring, the small wiring diagram should be used. Only the filament circuit need be changed. All of the other connections remain intact.

Transformer Facts

The small drawing shows the method of connecting the filament lighting transformer to the filament circuit. If originally provision was made for DC operation with amperite control, the amperites can be removed from the circuit by simply removing the cartridges and securely shorting the two posts on each mounting. The transformer should be capable of furnishing 3 volts at 2 amps. The condensers connected across each leg of the low voltage side of the filament lighting transformer are 2 mfd Aerovox filter condensers rated at 200 volts DC. The midpoint tap is connected as shown, to the C_4 plus and B minus terminals. When AC operation is used, the designations on the A terminals are of course ignored.

The tubes used in the input stage are two 1A and the output tubes are two 171.

With respect to the operation of the amplifier very little need be said. The P and B plus terminals of the input should be connected to the plate and battery terminals feeding the first audio stage in the receiver. That is, the primary of the push pull input transformer should be the load placed upon the first audio tube in the receiver. If the amplifier is to be connected directly to the detector tube, the plate connection in the detector circuit should be carried to the P input terminal and the battery connection for the detector tube should be connected to the B terminal on the input unit. Provision for volume control has been purposely omitted from the amplifier, since its position may well be in the radio frequency circuit.

With the correct A, B and C voltages applied to this audio amplifier the results will surprise the listener. I feel so certain about the excellence of this amplifier that I'm willing to answer any and all types of correspondence pertaining to this amplifier, even if it takes all my spare time. Address questions to me in care of RADIO WORLD.

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WHAT IS A band pass filter? I see that such devices are now recommended for the intermediate frequency amplifier.

(2) What are the advantages of band pass filters in such receivers?

(3) Can these devices be made at home?

(4) If they can be made at home will you kindly explain the details and give the necessary constants?

SPENCER WILLIAMS.
Fort Worth, Texas.

(1) A band pass filter is a combination of condensers, inductances and resistances which will pass a certain band of frequencies without much attenuation and which will suppress all frequencies lying outside this band. The limiting frequencies are called the cut-off frequencies.

(2) The advantage of the band pass filter is that selectivity can be obtained without cutting off the higher frequencies in the side bands, thus preserving quality.

(3) These devices cannot be made easily at home, for it is difficult to adjust them to a specified intermediate frequency at mid-band and specified cut-off frequencies. Facilities must be available for measuring and adjusting all capacities, inductances and resistnces that go into the network. The impedances between which the filter is to work must also be known before the design can be given. * * *

THERE IS a persistent squeal in my Super-Heterodyne receiver when I tune in WHT, which spoils reception of that station. I have tried many things suggested to me by Super-Heterodyne fans but have found no relief. What is the cause of the trouble and how can I remedy it? The intermediate frequency of the filter in my set is supposed to be 110 kilocycles.

FRED OLSOKN,
Chicago, Ill.

The trouble you are experiencing has been called secondary interference or image interferennce. Your receiver is probably beating with station WHA of Madison, Wisc. This station is operating on 940 kc and WHT is operating on 720 kc. The difference of your intermediate frequency. This is the condition for the production of squeals between the two on one dial setting. You have another choice of oscillator setting for

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APRIL 16.—Part I of the description of the Melo-Heald Super-Heterodyne, by Herbert E. Hayden. Part II of discussion on the Nine-in-Line Super-Heterodyne, by Lewis Rand.

APRIL 9.—A five-tube shielded set employing transformer AF, by Herbert E. Hayden. Part II of constructional data on Power Compact, by Lewis Winner. Part II of the four-part article on the Nine-in-Line Super-Heterodyne, by Lewis Rand.

APRIL 2.—(Fifth Anniversary Number) Part I of the four-part article on the super-sensitive Nine-in-Line Super-Heterodyne, by Lewis Rand. The three-tube compact, a simple one-dial, three-tube regenerative set by Jasper Henry. Part I of the two-part article on a Power Compact, the B eliminator with a stage of power audio frequency amplification by Lewis Winner.

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getting WHT, and this may be clear. The best remedy in this case is to introduce additional selectivity in the radio frequency level, either with regeneration or with another tuned stage of RF.

* * *

HOW many stages of intermediate frequency are best in a Super-Heterodyne? I note that some recommend three stages and others four.

(2) What is the best volume control in a Super-Heterodyne, filament current control in the IF grid bias control, or grid input control with a potentiometer?

(3) Is there any other method which may be better than any of those mentioned above?

(4) Is it possible to get enough volume with only one stage of audio amplification in a Super-Heterodyne?

(5) Is it advisable to install a tuned radio frequency tube ahead of the first detector?

ERNO SAPPALA,
Duluth, Minn.

(1) The number of stages to use depends on the location and on the purpose of the receiver. If stations up to only 1,000 miles are required, three stages will be enough. For greater distances it is well to add another stage. A three-stage IF amplifier is much simpler to control than a four-stage.

2) In the IF amplifier one of the best volume controls is a filament rheostat in the first IF tube. The high resistance potentiometer is also very good, provided that the frequency is not too high. The grid bias potentiometer serves a useful purpose.

(3) Perhaps the best volume control of all is a variation of the coupling between the pick-up coil and the oscillator coil. This requires that the pick-up coil be placed on a shaft and that a knob be provided for it on the panel. The volume can also be controlled with a rheostat in the filament circuit of the first detector tube or the RF tube.

(4) Yes, it is possible to get enough volume with a single stage of audio amplification, with an efficient detector and a transformer having a ratio of about 6-to-1. The danger is in overloading of the detector tube, particularly when the grid condenser and leak method of detection is used. With a single stage of amplification at audio frequency all the distortion which is introduced by the second tube and the extra transformer will be eliminated.

(5) It is not only advisable to install a radio frequency amplifier ahead of the first detector, but it is sometimes necessary in order to rid the output of the Super from a lot of squeals. Radio frequency amplification and increased selectivity in the RF level are the only practical means of eliminating the interference. The added stage also adds greatly to the sensitivity of the set and is valuable from this angle.

Thousands Write On WGY's 100-kw Programs

WGY, Schenectady, conducting comparative tests, using alternately 30 kilowatts and 100 kilowatts and used 100 kilowatts for an entire hour.

Several thousand letters were received and are now being analyzed by engineers and statistical experts. With very few exceptions the 100-kilowatt transmissions appear to have met the favor of the radio listeners. The single complaint is that fading continues on high power in most places where fading is observable on the 30-kilowatt transmission. However, to offset this are thousands of letters in which it is stated that the 100-kilowatt signals come in with the volume and clearness of local stations, overriding every form of Summer-time interference.

Many who live outside of the limits of any "local" station, informed WGY that they received pure, uninterrupted signals for the first time since early spring.

Local Reception No Different

Reception in Schenectady and immediate vicinity appeared to be little different under the 30 and 100-kilowatt conditions. Radio receiving sets which were selective enough to tune out the 30-kilowatt signals and pick up outside stations have no difficulty in tuning out the 100-kilowatt signals and bringing in outside stations within 20 kilocycles of WGY's frequency.

According to Martin P. Rice, director of broadcasting for the General Electric Company, the 100-kilowatt transmitter delivers a more reliable and clean-cut signal to receivers that formerly had received the 30-kw. and 50-kw. broadcasts from WGY considerably marred by ground noise and static. While many listeners report less fading, apparently an equal number report no change noticeable in regard to fading. The outstanding comment is that the 100-kw. transmitter delivers the program free from static and local interference.

Digest of First Glimpses

In a preliminary survey of 1,000 reports, the letters were divided under the headings: "exceptionally good," "good," "fair" and "poor." In the first group were gathered those who reported no fading and exceptional reception. Under "good" were counted those who reported fading so slight that it was no bar to the enjoyment of the program. The "fair" classification included those who found considerable fading but reported enjoyment of program. Letters reporting poor reception were assembled in the "poor" group.

PICTURE RATE BY INCHES

Facsimilies of trans-Atlantic messages within the next year will be sent at a certain rate per square inch or page, instead of the word rate, General James G. Harbord, president of the Radio Corporation of America, recently prophesized.

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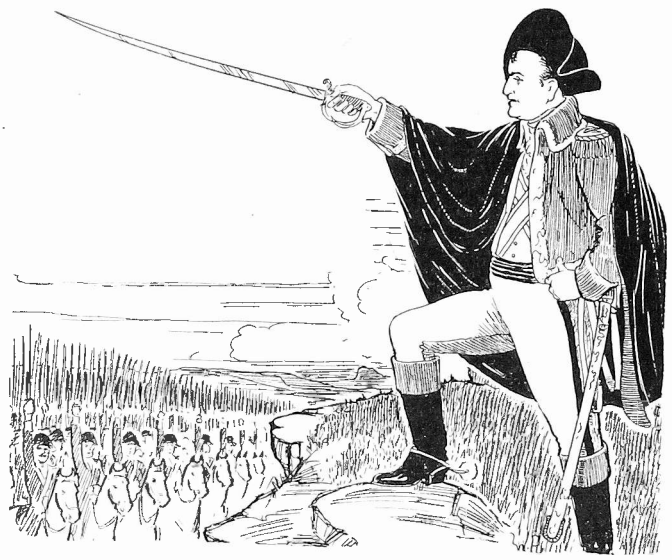
While Corsica gave the world a baby named Bonaparte, it was France that blazed the heavens and the earth with that achieving giant of small physical stature—Napoleon, the impressive warrior.

And it was France, too, that produced the pioneering radio engineer, **Lucien Chretien,** to whose genius in the still wider pursuits of peace the world is now indebted for the Strobodyne.



This modest engineer, discovering the marvelous effectiveness of a new principle in radio reception, falteringly confided his secret to a few friends. One of these friends was **Robert E. Lacault,** who persuaded Chretien to permit him to impart all the information to the American public.

Reluctantly the modest Chretien submitted—but a lucky thing it was for the home constructor of radio sets, for it has resulted in the world-wide imparting of full details on how to build this majestic circuit. It was Lacault who Americanized and popularized the receiver—the same Lacault who distinguished himself in war as an Army engineer, and in peace as the originator of the famous Ultradyne. And it was in France, too, that he first beheld the sunlight.

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