

RADIO ENGINEERING

*A Magazine of Technical Accuracy
for the Radio Engineer, Dealer, and Manufacturer*

Edited by M. B. SLEEPER

R-D-X

A new set which makes one-tube
reflexes sit up and take notice

Assembling the Haynes 1,000-
mile broadcast receiver

Ideas from the Freshman tuned
R. F. receiver and Ware type T
neutrodyne

Working data on new products

We predict—about some things
which will and will not be done

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SEPTEMBER, 1924

Vol. 4

No. 8

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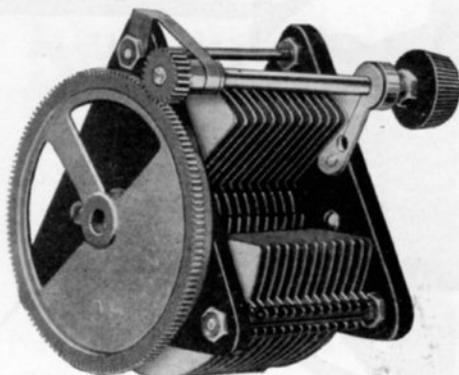
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CONDENSER AND RADIO CORPORATION

R-D-X Reflex

This receiving set represents the highest development in one-tube reflex efficiency.



WHEN we first read of one-tube sets operating loud speakers, most of us were dubious for, since it had not been done, it seemed far fetched to think of doing it. But is there any reason why a UV201-A or a DV-2, used in a reflex circuit, should not operate a loud speaker? These tubes pass plenty of current in the plate circuit. The problem, then, is controlling or modulating that current sufficiently.

During the last four months we have been working on this problem in the RADIO ENGINEERING laboratory—the construction of a “maximum control” receiving set. What we have achieved as a maximum is not 100%, to be sure, but it is much nearer than any other design has come to it. Details of the equipment tried and discarded would make a fair size volume. We set out to make an outfit that would be highly efficient electrically, that would not oscillate uncontrollably, give full advantage of the reflex action, and not be tricky to tune.

The R-A-R circuit, described in RADIO ENGINEERING for August, 1924, was finally discarded, as well as another hook-up, which had promised much, using a variable resistance control in the plate circuit. The greatest difficulty was that of overcoming the howling when the circuit was brought out of oscillation. It was on that account that the Eastern coupler was used as an R. F. transformer, rather than the conventional types.

Design of
The R-D-X
Reflex Set

Along with the other features, we wanted to make this set, indicated as the type 6400, just as simple as possible, so that it could be assembled by an absolute novice. Therefore, the tube

panel, shown in Fig. 4, was arranged to be put together as a unit, separate from the balance of the parts mounted on the front panel. This makes it much easier to put the set together.

Going over the wiring diagram you will see that the untuned antenna is non-adjustably coupled to the secondary. Across the secondary coil is the variable condenser which, in turn, is connected to the grid on one side and, through the secondary of the A. F. transformer, to the filament on the other. From the plate a wire runs to the coupling coil, down to the primary of the R. F. transformer, and on to the telephone jack and B battery. The R. F. transformer secondary goes to the crystal detector and primary of the A. F. transformer. In the filament circuit the jack is connected so that the circuit is open when the telephone plug is removed, and on to a 1A Amperite which automatically regulates the filament current to the proper value. This permits the use of a DV-2, UV-201-A, or C-301-A tube.

A special coupler is employed in this set, made by the Eastern Coil Company who also manufacture the pickle bottle coil type R. F. transformer. These are the key instruments in addition to which there are a 0.00035 mfd. Paragon variable condenser, Bestone socket, Modern 1 to 4 A. F. transformer, Rasla fixed crystal detector, Carter 3-spring filament control jack, 1A Amperite, Dubilier Micadons of 0.00025 and 0.0005 mfd., four engraved Eby binding posts, and two 3-in. Kurz-Kasch knobs and dials.

The front panel is of Formica, measuring 7 by 14 ins. and the rear panel 3½ by 6 ins. Both are 3/16-in. thick. For hard-

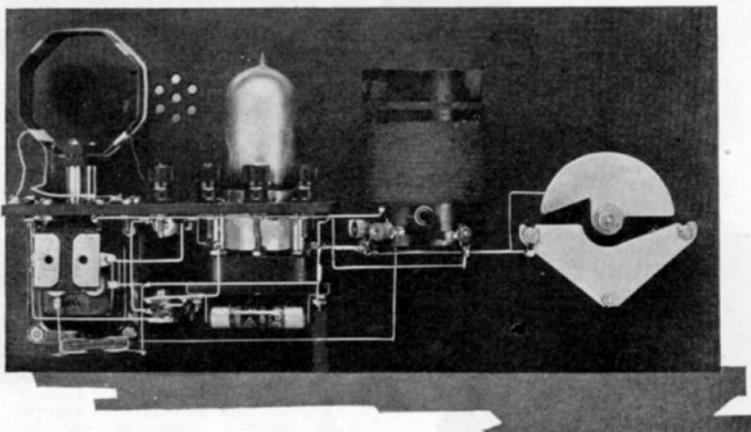


Fig. 1. See how neatly the tube panel unit fits in with the other parts mounted on the front panel.

ware, three left hand angle brackets and four coil mounting pillars are required.

Drilling The Panels

One-half scale drawings of the front and tube panels are given in Figs. 2 and 6. You will see that all the holes are to be made a No. 18 drill except in cases where other sizes are specified. The large hole for the socket tube can be most easily made by means of a Stevens panel cutter. A 3/16-in. hole must be drilled first, to take the centering point of the panel cutter. Then the large hole can be cut out very quickly.

To locate the holes, measure each distance on the drawing from the center of the crossed lines to the outside of the line on the panel drawing. Then double this distance and mark it off on the panel itself. For those who prefer, full size blue prints can be obtained and laid directly on the panel. With an automatic center punch the centers can be punched through the drawing on the panel. This makes the work very simple indeed. For those who prefer the dull panels, they should be rubbed down with No. 1 sandpaper, or polished with a soft cloth and linseed oil if they are to be left with the natural high finish.

Assembly And Wiring

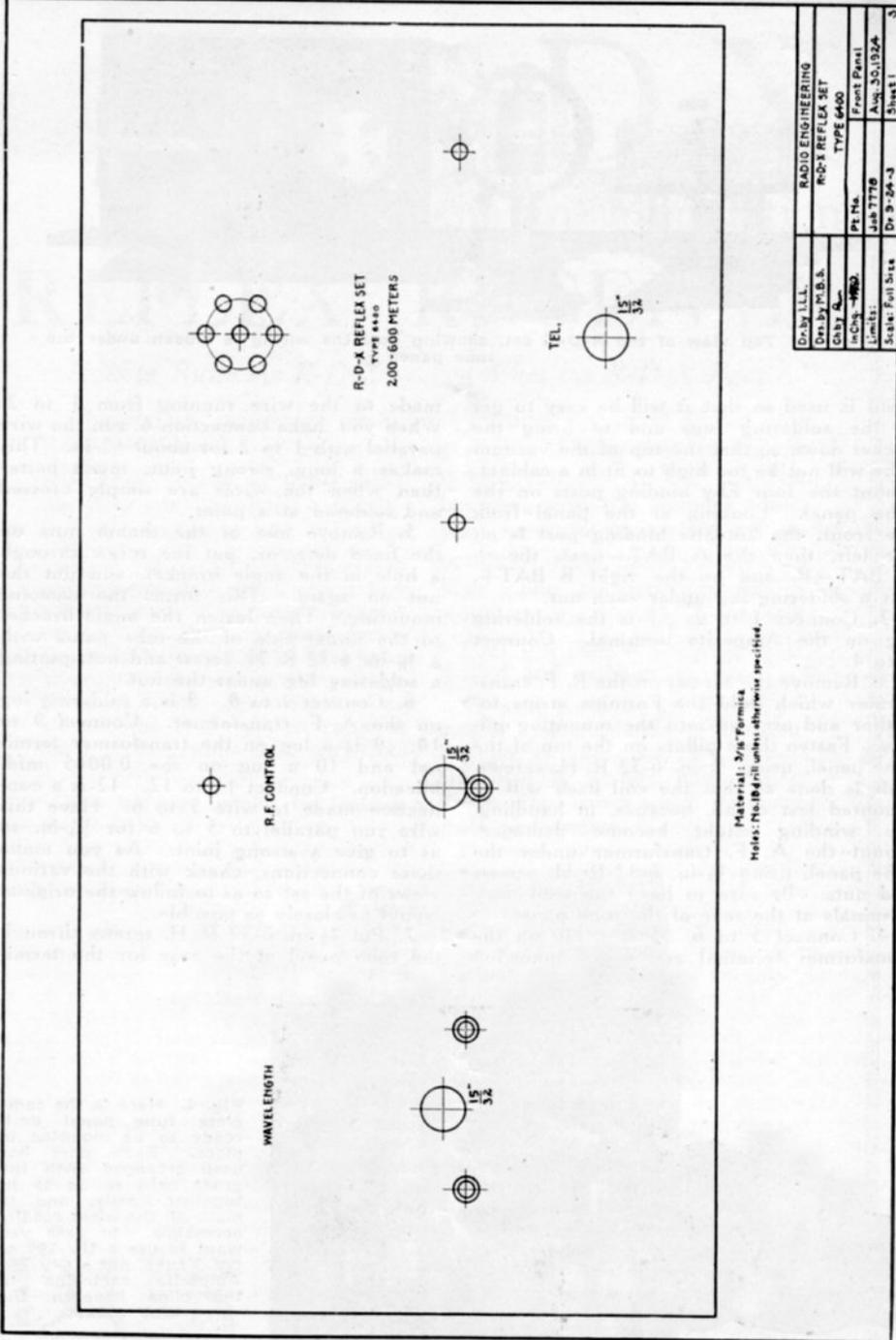
Since there are no special parts required, or coils to wind, this set is unusually simple to make up and assemble. The wiring can be done without the use of soldered connections if you are not familiar with the manipulation of a soldering iron. In that case, the ends of the wires should be carefully looped by using the special attachment on the Rance combination pliers. If the joints are to be soldered, however, lugs should be used.

Have all the parts ready before you start the assembly work. You will need a pair of cutting pliers, and a screw driver. A set of Spintite wrenches will make the assembly work much easier and will assure the permanence of the connections, because, with the Spintites, nuts can be turned on more securely than is possible with a pair of pliers.

Before putting on an instrument, have soldering lugs on the terminals, arranged to point in the directions indicated by the heavy lines in Fig. 5. Use an electric soldering iron if possible. For soldering, the Kester rosin core brand is recommended although plain solder with Nokorode paste is satisfactory provided the tiniest amount of paste is used and any excess carefully wiped away.

Fig. 5 shows the arrangement of the instruments and the wires as they are actually put on in the set. It was necessary, to make the wiring clear, to turn up the tube panel so that you can see it from the under side. The coupler is also turned, instead of being vertical as it appears in the rear view in Fig. 1. Follow the assembly steps exactly as they are given and you will save much time and trouble.

1. Mount the Amperite on the under side of the socket, in the position shown, using a 1-in. 6-32 R. H. screw and nut. Soldering lugs are provided on the Amperite. Mount the socket on the under side of the front panel. Remove the thumb nuts from the binding posts, put a soldering lug in place by a mounting pillar on each terminal screw. Then put the socket in place under the panel and fasten it by means of 1/2-in. 6-32 R. H. screws threaded into the support pillars. This arrange-



Material: 3/16" Formica
Holes: No. 18 drill unless otherwise specified.

Fig. 2. One-half scale drawing of the front panel for the R-D-X reflex set

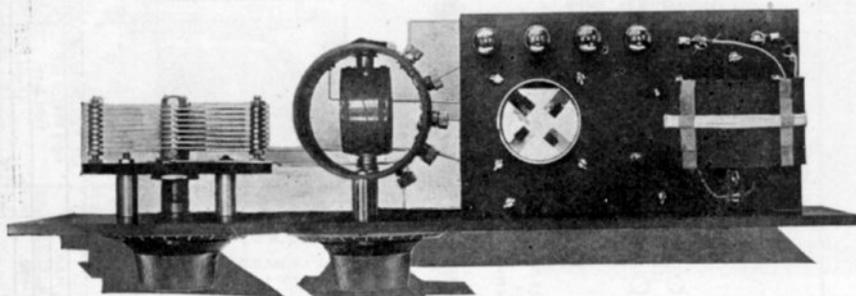


Fig. 3. Top view of the R-D-X set, showing how the wiring is hidden under the tube panel.

ment is used so that it will be easy to get at the soldering lugs and to bring the socket down so that the top of the vacuum tube will not be too high to fit in a cabinet. Mount the four Eby binding posts on the tube panel. Looking at the panel from the front, the antenna binding post is on the left, then the A BAT—next, the + A BAT—B, and on the right B BAT+. Put a soldering lug under each nut.

2. Connect 1 to 2. 1 is the soldering lug on the Amperite terminal. Connect 3 to 4.

3. Remove the screws on the R. F. transformer which hold the Formica strips together and also go into the mounting pillars. Fasten these pillars on the top of the tube panel, using $\frac{1}{2}$ -in. 6-32 R. H. screws. This is done so that the coil itself will be mounted last of all, because, in handling, the winding might become damaged. Mount the A. F. transformer under the tube panel, using $\frac{1}{2}$ -in. 6-32 R. H. screws and nuts. Be sure to have the secondary terminals at the rear of the tube panel.

4. Connect 5 to 6. 5 is a lug on the transformer terminal and 6 a connection

made to the wire running from 1 to 2. When you make connection 6, run the wire parallel with 1 to 2 for about $\frac{1}{4}$ -in. This makes a long, strong joint, much better than when the wires are simply crossed and soldered at a point.

5. Remove one of the thumb nuts on the fixed detector, put the screw through a hole in the angle bracket, and put the nut on again. This forms the detector mounting. Then fasten the angle bracket to the under side of the tube panel with a $\frac{1}{2}$ -in. 6-32 R. H. screw and nut, putting a soldering lug under the nut.

6. Connect 7 to 8. 8 is a soldering lug on the A. F. transformer. Connect 9 to 10. 9 is a lug on the transformer terminal and 10 a lug on the 0.0005 mfd. Micadon. Connect 11 to 12. 12 is a connection made to wire 5 to 6. Have this wire run parallel to 5 to 6 for $\frac{1}{4}$ -in. so as to give a strong joint. As you make these connections, check with the various views of the set so as to follow the original layout as closely as possible.

7. Put $\frac{1}{2}$ -in. 6-32 R. H. screws through the tube panel at the rear for the termi-

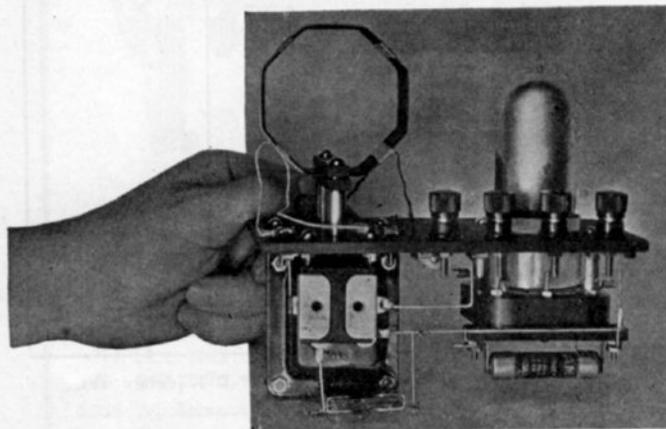
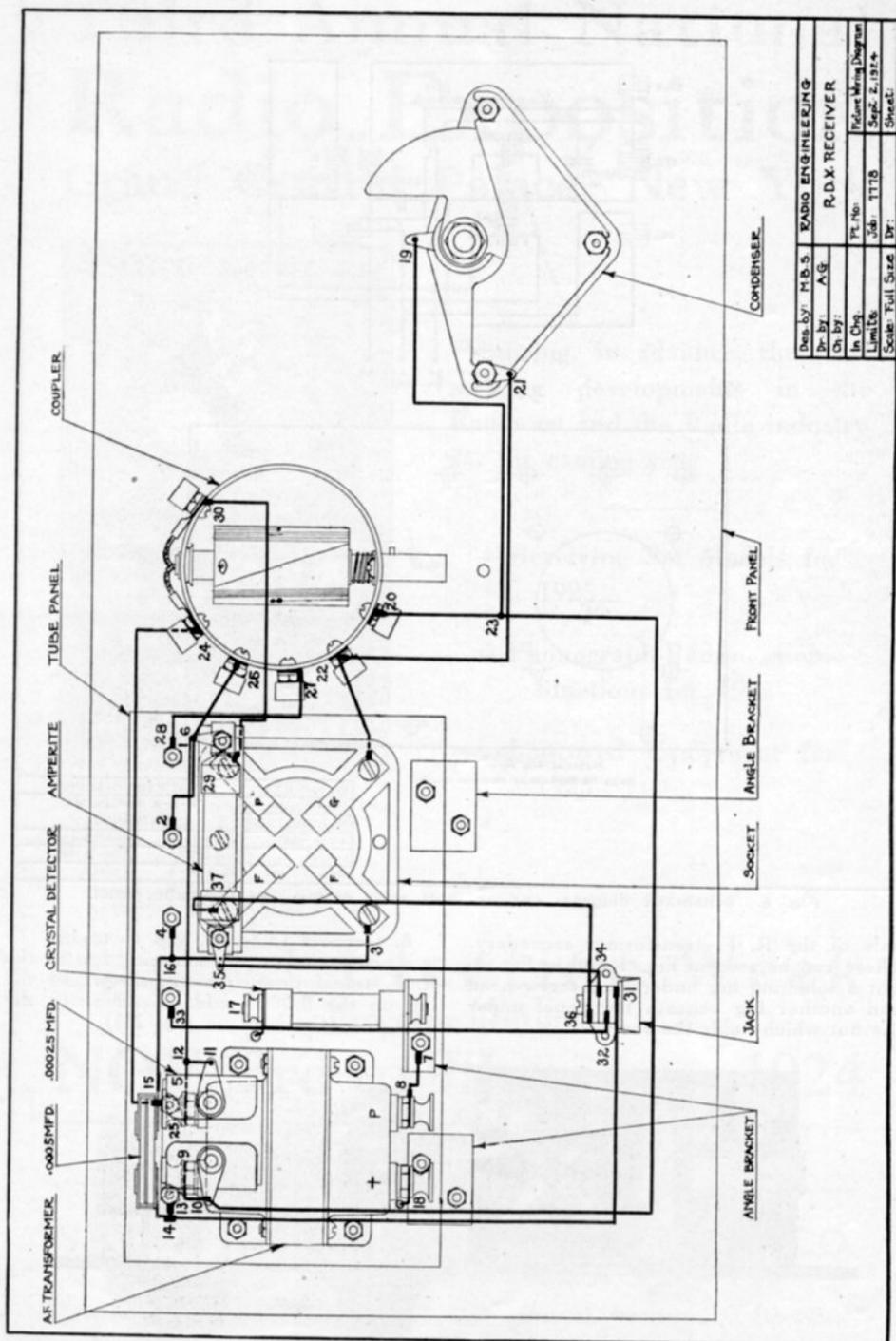


Fig. 4. Here is the complete tube panel unit, ready to be mounted in place. Each part has been arranged with the great care so as to fit together easily, and to make all the wires readily accessible. In case you want to use a UV-199 or DV-3 tube, put a 6-V-199 Amperite cartridge in the clips beneath the tube socket.



Des. by:	M.B.S.	RADIO ENGINEERING
Ch. by:	A.G.	R.D.X. RECEIVER
In Chg.		PL. No.
Limits	JOB - 1118	Picture Wiring Diagram
Scale:	Full Size	Sept. 2, 1924
	Dr:	Sheet:

Fig. 5. In this picture wiring diagram, the tube panel is turned up, and the coupler put on end, to show the connections.

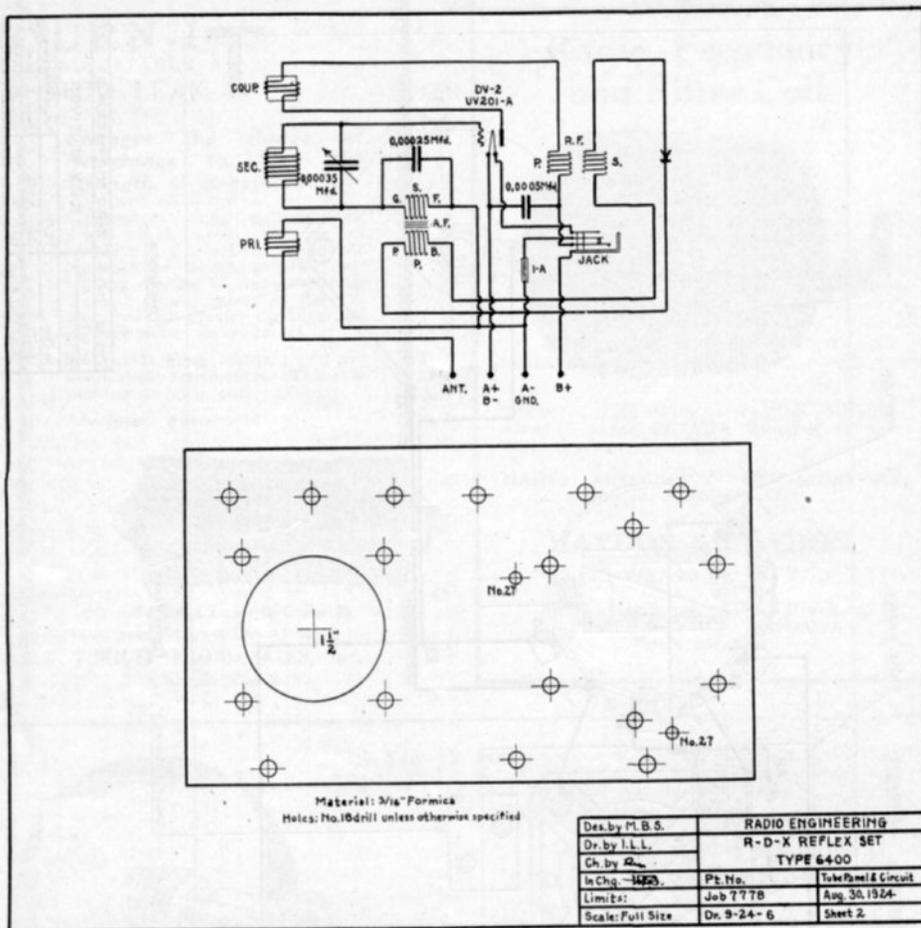


Fig. 6. Schematic diagram and one-half scale drawing of the tube panel.

nals of the R. F. transformer secondary. These can be seen in Fig. 1 and in Fig. 3. Put a soldering lug under each screw head and another lug beneath the panel under the nut which holds the screws.

8. Connect 13 to 14, and 15 to 16. This is a connection to the soldering lug on the R. F. transformer terminal screw, 14 the lug on the 0.0005 mfd. Micadon, 15 the
(Concluded on page 233)

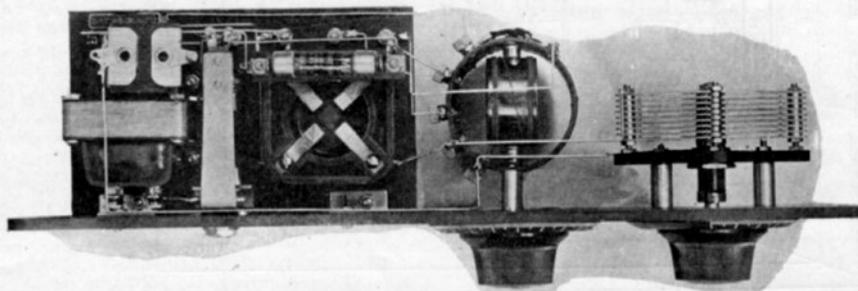


Fig. 7. Looking at the set from beneath, you can see how the jack fits in place.

RADIO ENGINEERING

M. B. SLEEPER, Editor

F. A. SKELTON, Managing Editor

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EDITORIAL

JUST as radio has grown up during the past few years, so we have had to grow up editorially. In these days we were all working for the love of the work, idling ourselves along with spare time visions of what we hoped was ahead. We didn't have to act, or think, or write like business men, because we were just plain boys, playing at something that was a lot of fun and no responsibility.

But now we've grown up, along with the radio business. We have payrolls to meet and bank balances to maintain, employees to hire and fire, things to do which must be done. With it all, we must be serious because the new people interested in radio take seriously what was playing to us.

So editorials have changed. K. B. now is the only one who can tell his readers in the old-fashioned way the intimate things he is doing and planning, and what a thrill he gets from putting across the ideas he has been hoping and scheming for—because, thank goodness, QST magazine hasn't had to grow up. Just the same, the old gang is the old gang still, and we love our work and we still play at it, when we get a chance, business or no.

Manufacturers of radio equipment have most elaborate methods of testing and inspection to guard against defects which may occur during assembly or later on under operating conditions. In a well regulated factory, ninety-nine per cent of the sets may pass the inspector. The investment in testing apparatus and inspectors' wages is to catch the one per cent, or one hundred defective sets in ten thousand.

One error in a book or magazine, however, means several thousand or several hundred thousand mistakes. Publishing books or magazines is as much of a

manufacturing problem as building sets, as manufacturers and dealers have discovered when they have attempted to get out their own books. Of course, publishers do make mistakes, but those who realize their responsibility to the public take as elaborate precautions against errors as the manufacturers against defects.

That this is necessary is indicated by the fact that one of the first neurodyne licensees put out a book in which, among other innovations, the filaments were lighted by the B battery, a super-heterodyne kit company put the negative B on the oscillator plate, a chain store contributed to radio literature a book on a reflex set that can't possibly work.—No, the shoemaker must stick to his last. A radio manufacturer should be able to make electrical devices, perhaps, but he is no more tooled up for radio books than a machine shop for mechanics' books.

There is one thing we need for our laboratory which would help us greatly, but which is too expensive for us to buy—an engraving machine for lettering panels. Which leads us to wonder why some clever machine designer in one of our many tool shops hasn't built an engraving machine which can be sold for about one hundred dollars. It would not be a cheap edition of the Gorton machine, but something working on a different and less involved principle. Such a device could be sold to nearly every radio dealer in the country to do custom engraving. In the meantime we'll have to be content with envying Mr. Poster's battery of machines.

As soon as alterations have been completed, we're going to have some pictures and a description of our laboratory at Darien, Connecticut. The increased amount of work to be done this winter made it imperative to increase the facilities and working space. Also, we have added a new man, Alfred Ghirardi, with whose work you will soon become familiar. If you read the advertisement for an assistant, in the July issue, you will recall that the requirements were pretty stiff. In fact, Mr. Bragdon, editor of the New York Sun radio section, offered to bet that we wouldn't get a single answer. Actually, over fifty applicants came in from which we picked Mr. Ghirardi as being the man whose work you would like best.

The changes and increased number of pages in this issue are the surprises promised last month. But stand by for the next numbers and see what happens. If you paid a dollar for a year's subscription and saw the Magazine jump from eight to thirty-two pages, you'll see the market value of a two-dollar subscription go up still faster and higher during the next twelve months.

M. B. SLEEPER, Editor.

We Predict: That certain things will be and others won't during the approaching radio season.

That there will be—

IN spite of the popularity of tuned radio frequency or neutrodyne circuits last season, regeneration will be used more and more during the coming season, probably in circuits different from those with which we are now familiar. As a matter of fact, neutrodyne sets employ regeneration, reflex sets operate just under oscillation, and super-heterodyne circuits have potentiometers to bring the circuits into a regenerating condition.

Retail prices will be more stable than ever before. There has been too much money lost, and too much effort put into small-profit returns for a continuance of the extreme price competition which is found in many of the larger cities. Manufacturers have not been able to prevent price cutting. The answer will come from the dealers themselves when they realize the profits are not measured in direct ratio to gross sales.

Some company will produce a "radio machine" on a quantity basis. Crosley has worked all around it, but there is a certain lack of refinement in design about Crosley products. The Ware type T comes nearer, and should be a big success, altho WD 11 tubes are safer to bet on than UV 199's.

Expensive sets will be equipped with built-in battery substitute devices for operating the tubes from the 110-volt supply. A recent advertisement from one of the New York radio stores characterizes these devices as dangerous, but such a statement is absolutely absurd, as evidenced by the fact that with thousands of home-made transmitting stations equipped with step-up transformers delivering 1,000 to 10,000 volts, no one has even been injured. Battery substitute devices deliver a perfectly harmless voltage of 6 to 90 which is as safe to handle as an ordinary B battery. The only evident reason for the statement made is that this store could not buy the devices low enough to sell them at cut prices.

But for all the big business to be done in battery substitutes, sales of B batteries, storage batteries, and battery chargers will be bigger than ever. In the matter of economy, batteries are less expensive over a period of years, and, what is of more vital importance to the pocket book, do not require a larger initial investment.

And there won't be—

BONUSSES of common stock, assets consisting largely of patents of questionable value, big offices, and an imposing list of officers and directors will not insure the payment of dividends. As the Radio Corporation of America discovered, making money in the radio business means getting right down to brass tacks with men to whom flourishes and gestures mean nothing.

The crystal detector will not replace the vacuum tube. We shall not have three crystal sets or six crystal sets. To say—"That this is a revolutionary radio invention need be emphasized no further,"—referring to the use of oscillating crystal detectors, is either the shout of a side-show barker, or the admission of utter ignorance on the part of one who has much responsibility for technical truths to the radio public.

Complete sets will not be sold to the exclusion of parts. In fact, during 1925 we can expect a percentage increase as great or greater in parts sales as in sets. Looking still farther ahead, parts will be going strong when set sales level off. Manufacturers and publishers have an undeveloped market for construction parts and books as large as there is for complete sets. As long as there are boys, old and young, new ideas in circuits and designs will keep the parts moving.

Knobs and dials will not be as prominent as decorations for set panels as before. Meters on motor car dash boards are not objectionable because one can simply refuse to look at them, but rare is the man who can refrain from twirling a knob, however inconspicuous, unless he refuses to operate the set altogether. The most successful sets will be those designed to give the appearance of being operable by intuition.

Square tinned copper bus bar will not be sold in large quantities this winter because experimenters and manufacturers as well are turning to Wirit, No. 18 medium temper round tinned copper wire. This is cheaper, it can be stretched straight as it is used, it can be worked faster and easier, and is far safer than bus bar because, being more flexible, it does not put a strain on the lugs and soldered joints. If necessary, it can be covered with M-R varnished tubing, No. 7 gauge.

How to Assemble The Haynes Tuner



Complete data for the set builder giving full information on the latest type of Haynes tuner, designed to cover the amateur and broadcast wave length range

ONE of the most interesting developments in construction sets is the Haynes tuner, originally brought out under the unusual slogan, "One thousand miles for Fifteen Dollars". The surprising thing about this outfit is that, in spite of its simplicity, it really does bring in stations consistently over a surprising range. The circuit is an adaptation of the old Reinartz, somewhat simplified so as to make the set easier to tune and less expensive to build.

The tuning circuit is designed to cover approximately 200 to 600 meters, controlled by the variable condenser. A switch with four taps adjusts the antenna circuit, not as much to tune it, however, as to regulate the sharpness of tuning. The coupling coil is to provide a regenerative action for increasing the signal strength.

A Formica panel 7 by 15 ins., 3/16-in. thick, carries Details of the various instruments. This the Tuner is planned to line up with the 2-step A. F. amplifier panel, altho some experimenters prefer to mount both tuner and amplifier on the same panel which then measures 7 by 24 ins. You will note that no special tube panel or sub-panel is employed, as everything is mounted directly on the front panel. This makes the construction work quite simple.

Parts required for this outfit are:—A Haynes bank-wound coupler, Haynes 7-plate condenser, 10-ohm Fada rheostat, Haynes socket, a 0.001 mfd. plain Micadon and a 0.00025 mfd. Micadon with grid-leak mounting clips, 2-megohm gridleak, a Fada switch, four switch points, two stopping points, and eight binding posts.

Fig. 2 shows the front panel at exactly one half scale. Dimensions can be taken off from the drawing and, doubled, applied to the panel. If the panel is not absolutely true and square, scratch a line

across the center and work from the center line to the left and to the right and up from the bottom edge. If this is done, the holes can be correctly located even tho the panel is too long or too short.

Fig. 3 shows a picture wiring diagram of the Haynes tuner, in which the wires have been drawn exactly as they were arranged on the original receiver. The socket is tipped down so that the connections can be seen clearly. This set can be put together without soldering the connections altho it is very much better to make a good job of it and solder each wire securely. Kester rosin core solder is recommended or plain soft solder with Nokorode paste used very sparingly, as a flux. Be sure to keep the iron clean and bright while you are soldering the joints and have it hot enough so that the solder flows freely instead of cooling in irregular lumps. This is particularly important with rosin core solder as a greater heat is required to make the solder take hold firmly.

The following instructions have been prepared so as to make the assembly and wiring as simple as possible. You will find it much easier to follow through these steps than to put the set together in a haphazard way.

1. Mount the eight binding posts on the front panel, arranging the lugs to point in the directions indicated by the short heavy lines in the drawing.

2. Connect 1 to 2, and 3 to 4.

3. Mount the rheostat on the front panel, using the screws and nuts provided. Adjust the arm on the rheostat so that it makes firm contact with the wire all the way around.

4. Connect 5 to 6. Make sure that this wire runs close to the rheostat for, if it is too far down, it will interfere with the

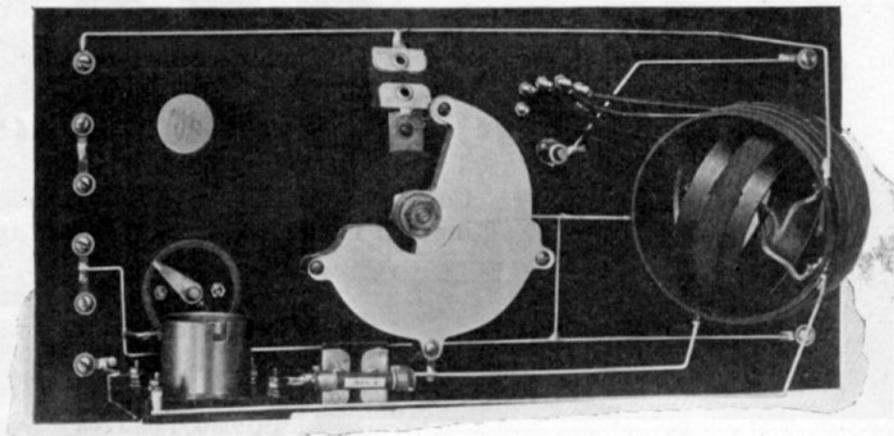


Fig. 1. This rear view shows the special condenser and bank-wound coupler. When you wire your set, check against the connections as they appear here.

socket when it is mounted. Connect 7 to 8.

5. Mount the switch, switch points, and stopping points on the front panel. It is advisable to use a Spintite wrench on the switch points so that the nuts will not come loose later on. See that the switch is held in place securely and that the arm makes firm contact with each point.

6. Connect 9 to 10.

7. Mount the socket on the front panel, using the screws provided. Do not turn in the screws too far for by so doing you may injure the threads in the socket.

8. Connect 11 to 12, and 13 to 14.

9. Mount the variable condenser and bank wound coupler as shown in the picture wiring diagram. Screws are provided with these instruments. Put a condenser dial on the shaft so that the 100 division mark on the dial coincides with the line engraved on the panel when the plates are totally interleaved. Have the 100 division mark on the coupler dial coincide with the line engraved on the panel when the winding on the inner coil is parallel with the winding on the outer coil.

10. Connect 15 to 16. 16 is a terminal on the grid condenser held in place by a 6-32 screw and nut. Connect 17, the other terminal on the grid condenser, to 18, soldering it also to 19, the lug on the variable condenser which wire 17 to 18 passes over. Connect 20 to 21, and 22 to 23. Solder one lug of the 0.001 mfd. Micadon to wire 22 to 23 at point 24 and solder the other condenser lug to the contact extension on the variable condenser at 25. Connect 26 to 27, and 28 to 29. When you solder the connection 28 to 29, bend the wire at right angles for one-fourth inch so that, at the upper connection, the

wire will run parallel with wire 26 to 27 and at the bottom parallel to wire 5 to 6. This makes a joint $\frac{1}{4}$ -in. long instead of localizing it at a point which may break away.

11. Bring the four taps from the bank wound coupler to the switch points in the order shown in the drawing and solder them at 30, 31, 32, and 33. Put a short length of M-R varnished tubing over each lead to protect it against short circuiting. Apply as little heat as possible for, if the switch points are heated excessively, the nuts will become loose. Snap the gridleak in place between the clips on the grid condenser. This completes the wiring of the Haynes tuner.

If the tuner and amplifier are assembled on one panel the same general procedure should be followed except that there will be a slight difference in the wiring because of connections to the amplifier circuit. The diagram will be shown in the second part of these instructions.

Before you set up the out-
fit, ready for operation,
And make the simple tests which
Testing follow, so as to make sure
that the wiring has been done in exactly
the right way.

Connect one terminal of a dry cell or 22 $\frac{1}{2}$ -volt B battery to one terminal of a pair of telephones. Bring off leads about 18 ins. long from the other side of the B battery and the other side of the telephones. Touch these leads to terminals 6 and 10. This should make a strong click in the phones. Keeping the leads on those terminals move the switch back and forth. There should be a strong click at each setting of the switch. Connect the leads across terminals 20 and 23. This should

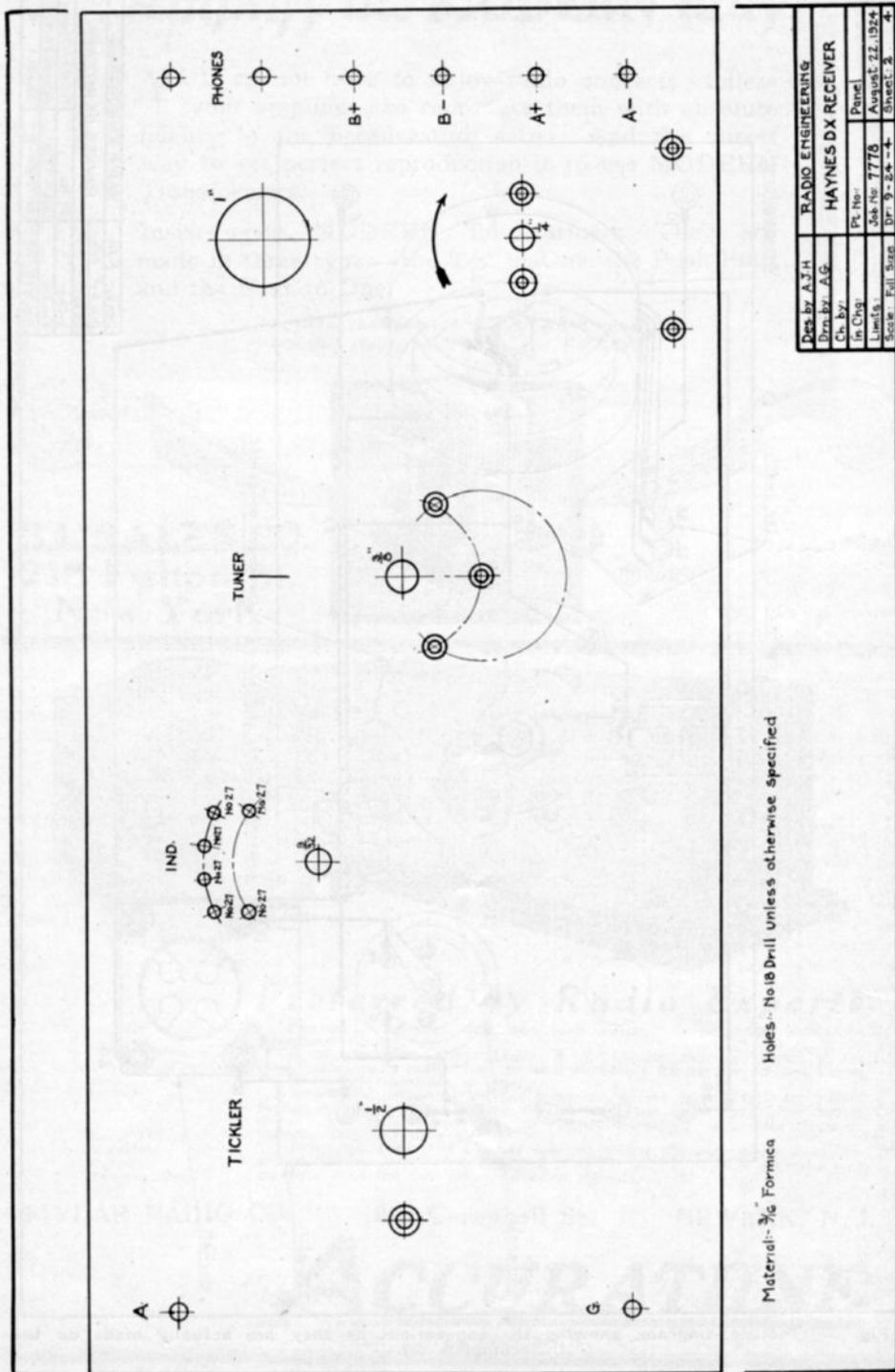
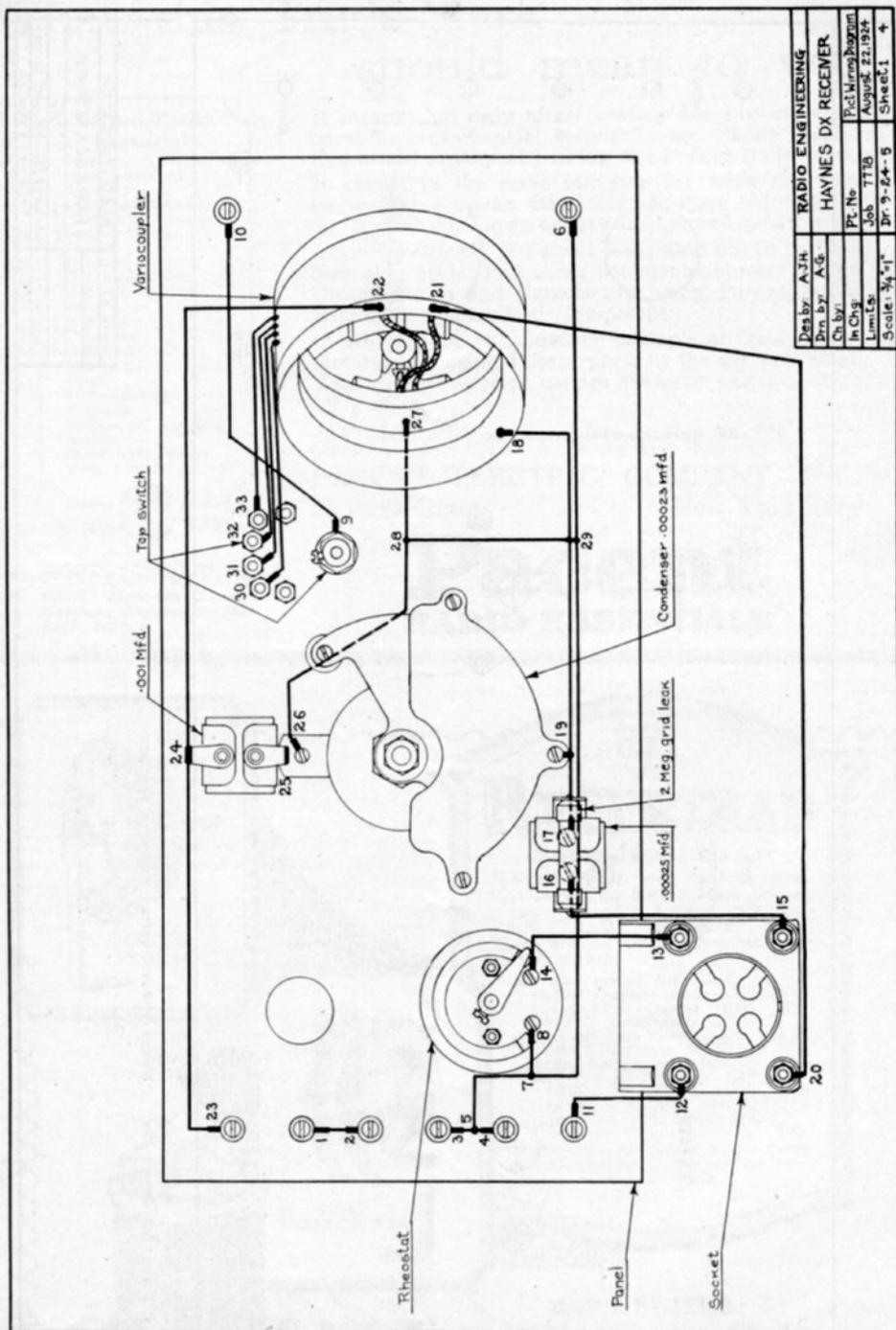


Fig. 3. One-half scale drawing of the front panel for the Haynes tuner.



Desig.	A.J.H.	RADIO ENGINEERING
Des. by.	A.G.	HAYNES DX RECEIVER
Ch. by.		Pat. Mfg. Diagram
In Chg.	J.L.S.	Job - 7178 August, 22, 1924
Limit		Scale: 3/4"=1" Sheet 1

Fig. 3. Picture diagram, showing the connections as they are actually made on the complete set.

give a strong click. Put the leads across 11 and 4. There should be no click but, if a screw driver is put across terminals 12 and 13, a click should come in the phones provided the rheostat contact arm is on the wire but no click if the arm is in the off position. Connect the leads across 15 and 4. With the gridleak out there should be no click but a fairly strong click when the gridleak is put in place.

If you are going to use a UV201-A, C301-A, or DV2, put six volts of battery, either four 7111 Eveready dry cells or a storage battery, across the A + and A - binding posts. The center contact on a dry cell is always positive.

Now put on the B battery. An Eveready 764, the vertical 22½-volt type, is recommended as being the correct size and the most convenient to use.

With the rheostat turned up until the tube filament lights at moderate brilliancy,

put the inductance switch on the right hand contact, set the tickler coil dial at 60, and run the tuner dial back and forth until signals are heard. If you hear little whistling sounds, reduce the tickler adjustment slightly and turn the tuner dial back and forth right at the point where the whistle comes in. If the tickler is turned back far enough the whistling will stop and clear music will come through.

Under normal conditions, with an efficient vacuum tube, a good ground connection to a water pipe from which all paint and rust has been scraped away, and using an antenna of one wire about 20 ft. high and 75 to 150 ft. long, signals from local stations should operate a good loud speaker with moderate volume and should bring in the more powerful stations, up to a thousand miles away, with sufficient strength to be heard in the telephone receivers.

R-D-X SET (from page 226)

other condenser lug, and 16 a connection made to the wire running from 3 to 4.

9. Fasten the other two angle brackets to the tube panel by means of ½-in. 6-32 R. H. screws and nuts.

10. Put the pickle bottle coil between the mounting strips and fasten it in place on the mounting pillars. Solder one primary lead to the upper lug on terminal screw 13 and the other lead to the lug on terminal screw 25. The primary is, of course, the narrow outside winding. The rear wire from the secondary must be run through the No. 27 hole to terminal 17 on the crystal detector; and the other lead through the upper small hole, to terminal 18 on the A. F. transformer.

11. Mount the variable condenser at the rear of the front panel and put the coupler in place. Mounting screws are provided with these instruments.

12. Connect 19 to 20, and 21 to 22.

13. Mount the tube panel unit to the front panel by putting ½-in. 6-32 screws through the angle brackets, fastening them with ½-in. 6-32 R. H. screws.

14. Connect 10 to 23, and 24 to 25. 25 is the right hand terminal screw for the R. F. transformer primary. Connect 26 to 6, and 27 to 28. Terminal 28 is the antenna binding post. Connect 29 to 30. 29 is the P terminal on the socket.

15. Mount the telephone jack on the front panel.

16. Connect 31 to 14. 14 is a lug on the 0.0005 mfd. Micadon. Connect 32 to 33, 34 to 35, and 36 to 37. 35 is a lug on the Amperite and 37 the F terminal on the socket.

Testing And Operating

Connect the A battery, of 6 volts, to the two inside binding posts. The A battery may be a 6-volt storage battery or four 6-in. Eveready dry cells, type 7111. The center terminal of a dry cell is always positive. Put the tube in the socket and insert the plug in the jack. The tube should light. If it doesn't, go over the connections to find out what mistake has been made. If everything is allright, put on the B battery across the right hand and next to right hand binding posts, looking at the set from the front. With the phones plugged in so that the tube is lighted, take off the B + lead from the B battery. When it is removed or put on to the binding post there should be a loud click in the telephones. If the click is faint, something is wrong with the circuit. Connect the antenna to the antenna binding posts and the ground to the A BAT.-post. Turn the coupling coil through 180 degrees, starting with the inner coil winding parallel to the winding on the outer coil. At the start, while the turns are parallel, touch the fixed plates of the variable condenser, first wetting your finger slightly. This should give a loud click. If it does not, turn the coil 180 degrees so that the windings are parallel in the opposite direction. Then there should be a loud click. With the coil in the position at which the click is heard, put on the dial so that the 100-division line coincides with the line engraved on the panel.

To tune the set, put the coupler dial at about 100 degrees, and run the condenser dial until the whistling sound is heard. Move the condenser back and forth three or four degrees each side of the point at which the whistle is heard and at the same time reduce the coupling dial until signals are clear and undistorted.

Ware Type T Neutrodyne

The first neutrodyne set with three tubes, employing reflexed circuit system.



THE new Ware Type T Neutrodyne is a decided innovation in Neutrodyne receiving sets, not only because it has only two controls but because it employs a reflex circuit. In fact, of the 1925 models this receiving set is being most enthusiastically received, both because it requires only two tuning controls and because it operates entirely from dry cells since the set is designed for UV-199 tubes.

The assembled set is shown on this page with an interior view opposite. On the front panel there are two large dials for the tuning, jacks for plugging in at medium and full volume, a rheostat which regulates all three tubes, the UV-199 tubes, and three binding posts, one for the ground and two antenna posts arranged as shown in the wiring diagram for a long or short antenna.

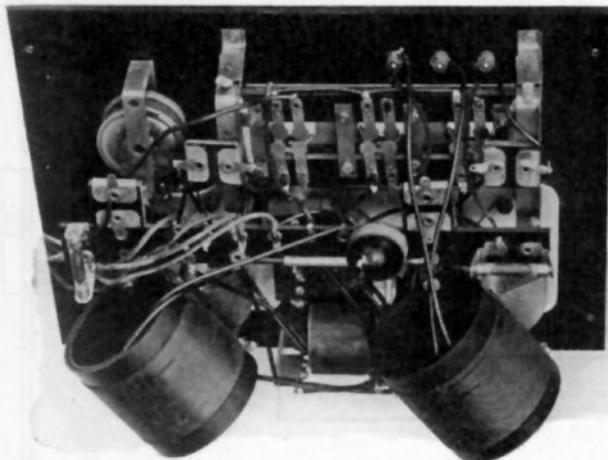
Inside the set you will see the neutroformer, at the left, and the inductance which, with its variable condenser, tunes the first stage of radio frequency. By using an auto-transformer type of coil the volume is increased considerably over that obtained with a loosely coupled antenna but the tuning is kept sharp by having only a part of the coil in the antenna circuit. A very clever arrangement is employed for the vacuum tube mountings. You will see that one pair of contacts is mounted on the upper insulating strip and a pair on the lower strip, thereby making the socket capacity and the losses as low as is possible. A flexible rubber is employed as a shock absorber so that any vibration in the room or jarring of the

operating table is not transmitted to the 199's. In fact, the noises from this source are entirely eliminated.

It is interesting to note that, unlike many sets built for UV-199 or C-299 tubes, the variations in tubes does not affect the operation appreciably. In other words, it isn't necessary to select tubes for the Type T set as is so often the case with other outfits. This is very important for, in a number of cases, good outfits have not been successful for that very reason.

The advantage in using only two dials for tuning will be quickly recognized by those who have used the three-control sets. In many cases, it has not been possible to pick up stations because the operator did not happen to strike the correct combination of the three controls but on this outfit one dial can be turned up slowly while the other is worked back and forth, in that way covering all possible adjustments and picking up even the faintest signals.

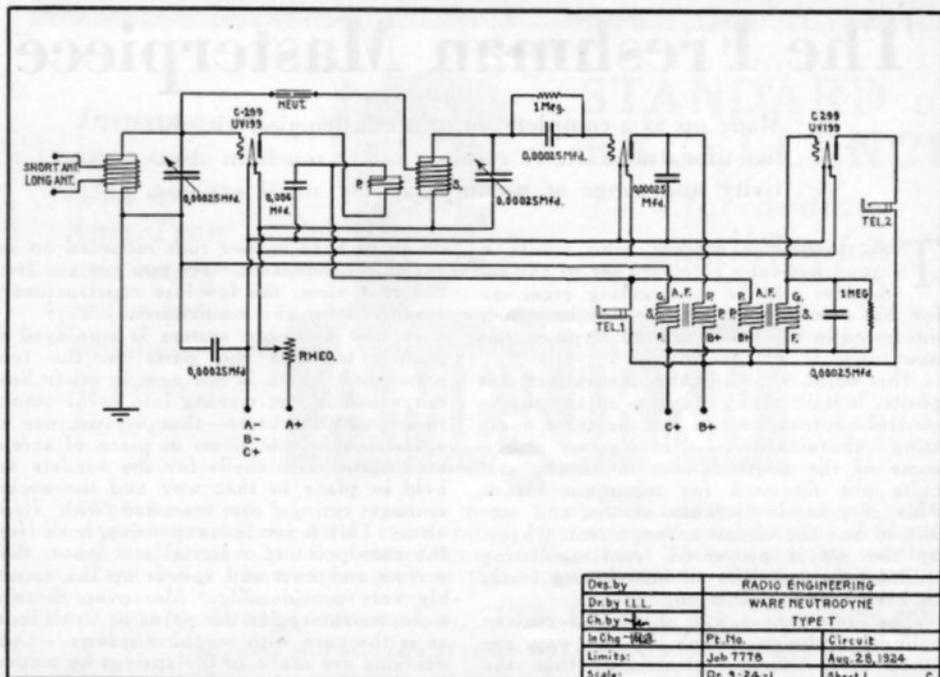
The wiring diagram of this set shows the general scheme employed in the Type T outfit but there are special manufacturing features in the assembled set which are responsible for the results obtained. Therefore, experimenters constructing a set according to the diagram given may find it difficult to approach the efficiency of the manufactured receiver, even though the hook-up is followed exactly. However, it is expected that this design will be very popular among set builders and experimenters this winter, since there is much interesting work to be done on the two-control reflexed neutrodyne.



The arrangement of the parts on this neutrodyne receiver will offer many suggestions in working out new designs. Note the unit method of supporting the sockets and the terminal panel strip which also carries the gridleaks, choke coil, and balancing condenser. If you look closely you will see where the two audio frequency transformers are mounted.

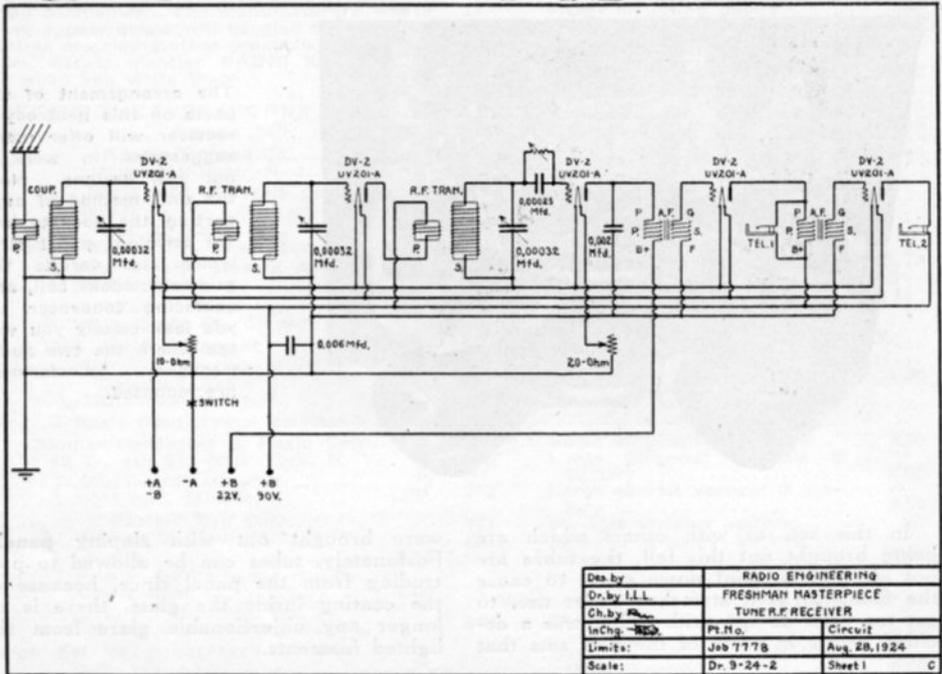
In this set, as with others which are being brought out this fall, the tubes are not allowed to point down so as to cause the filament, as it stretches under use, to get too close to the grid. That was a decided defect in some of the first sets that

were brought out with sloping panels. Fortunately, tubes can be allowed to protrude from the panel since, because of the coating inside the glass, there is no longer any objectionable glare from the lighted filaments.



Schematic wiring diagram, showing the system employed in the reflexed neutrodyne.

Des. by	RADIO ENGINEERING	
Dr. by	WARE NEUTRODYNE	
Ch. by	TYPE T	
In Chg. by	Pt. No.	Circuit
Limits:	Job 777A	Aug. 28, 1924
Scale:	Dr. 9-24-1	Sheet 1 C



The Freshman Masterpiece

Made up as a complete set or a construction kit, this five-tube tuned R. F. receiver offers much in selectivity and range at a comparatively small expense.

THE broadcast listener who wants a good five-tube receiving set or the set builder who is constructing receivers for his own use or to sell will be much interested in the Freshman masterpiece, the new tuned R. F. receiver.

This outfit, shown in the illustrations opposite, is built along the lines of the three-control neutrodyne and has the same operating characteristics. However, unlike some of the neutrodynes, the tuning circuits are designed for minimum losses. This is possible because of the coil employed and the circuit arrangement, whereby the set is prevented from oscillating without the necessity of introducing losses to keep it in a stable condition.

The inductances are of the interwoven cylindrical design, which, by the way, are much more efficient electrically than the spider web coils. Dielectric losses are kept at a minimum by supporting the coils

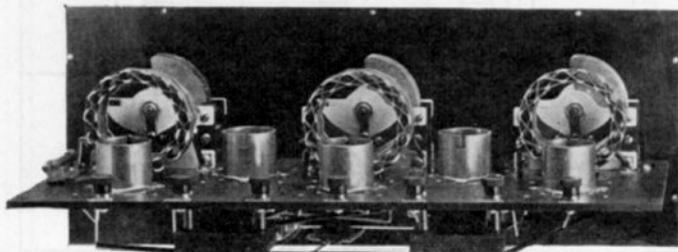
on small hard rubber rods mounted on the variable condensers. As you can see from the rear view, the low-loss construction is employed for the condensers.

A new assembly system is employed in putting together the parts on the tube panel, one which is not new in other lines but which is just coming into favor among radio manufacturers—that is, the use of eyelets or hollow rivets in place of screws and nuts. The shells for the sockets are held in place in that way and the socket contact springs are mounted with rivets also. This is far less expensive, both from the standpoint of material and labor, than screws and nuts and speeds up the assembly very considerably. Moreover, there is no opportunity for the rivets to work loose as is the case with machine screws. Connections are made to the springs by soldering directly to them, thus assuring continuous circuits and perfect connections.

An interesting method is employed for mounting the complete set in the mahogany cabinet. Instead of relying on the braces which hold the tube panel to the front panel for supporting the tube panel, three small wooden blocks are nailed inside the cabinet, one block on each end and another at the center, and screws are

sumption on the Sodian is exceedingly small, only 0.05 to 0.08 miliampere. Consequently, the small 22-volt battery can be used, such as the Eveready 763. The drain on this battery is so small that it will last practically as long as its shelf life.

You will see that no peep-sights are provided on this Freshman set. There is



Inside and outside views of the Freshman five-tube tuned R. F. set which employs a non-oscillating circuit system.

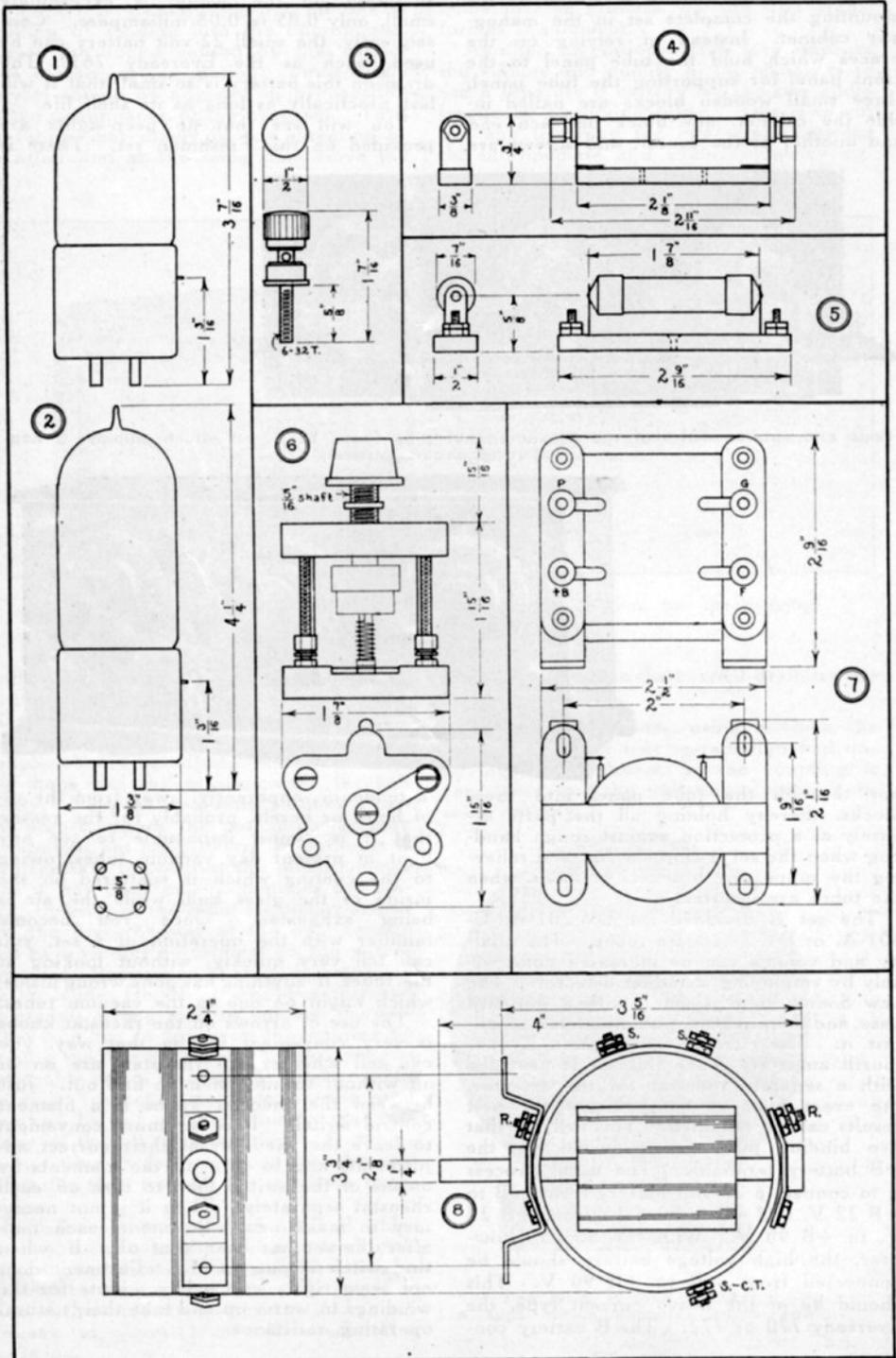


put through the tube panel into these blocks, thereby holding all the parts securely as a protection against rough handling when the set is shipped out, and relieving the supporting brackets of strain when the tubes are inserted.

The set is designed for UV-201-A, C-301-A, or DV-2 vacuum tubes. The quality and volume can be increased considerably by employing a Sodian detector. The new Sodian tube is made with a standard base and requires no potentiometer to adjust it. The current consumption is one-fourth ampere. Since this set is provided with a separate rheostat for the detector, the exact filament temperatures for best results can be obtained. You will see that two binding posts are provided for the +B battery terminals. The usual process is to connect a 22-volt battery from -B to +B 22 V. and 45 or 90 volts from +B 22 V. to +B 90 V. With the Sodian, however, the high voltage battery should be connected from -B to +B 90 V. This should be of the heavy current type, the Eveready 770 or 772. The B battery con-

a tendency, apparently, away from the use of holes or bezels, probably for the reason that it is almost impossible to see any light in present day vacuum tubes, owing to the coating which is spattered on the inside of the glass bulb while the air is being exhausted. Once you become familiar with the operation of a set, you can tell very quickly, without looking at the tubes, if anything has gone wrong inside, which might be due to the vacuum tubes.

The use of arrows on the rheostat knobs is very convenient for, in that way, you can tell whether the rheostats are on or off without turning them to find out. Just between the rheostat knobs is a filament control switch. It is far more convenient to leave the rheostats at their correct adjustments and to turn off the filaments by means of the switch than to turn off each rheostat separately. Then it is not necessary to make new adjustments each time after the set has been shut off. If, when the switch is put on, the adjustment does not seem right, wait half a minute for the windings to warm up and take their natural operating resistance.



Data Sheet No. 1

1. DEFOREST DV-3. The low-current Deforest vacuum tube is the equivalent of the UV-199 or C-299, although it fits in a standard socket and is provided with terminals arranged in the same fashion that is employed for the UV-201-A tube.

2. DEFOREST DV-2. This is the standard one-fourth ampere amplifier or detector tube. It can be used in any circuit designed for the UV-201-A or C-301-A without any changes in the connections or the rheostats. It is made to fit a standard socket. Although the DV-2 is an excellent detector or A. F. amplifier its special feature is its efficiency as an intermediate frequency amplifier tube for super-heterodyne receivers.

3. EBY ENSIGN POSTS. Of all the types of Eby binding posts the Ensign is the most popular. This design has a non-removable tap and is arranged to take wires around the shaft or through the hole in the shaft. This hole is large enough to take telephone cord tips also. Ensign posts are made with plain tops, or engraved with any of the twenty-three different markings.

4. PACENT BALCON. This item is designed for use in neutrodyne or other circuits for balancing out tube capacities. The supporting springs are mounted on a piece of insulating material. The balancing condenser itself comprises two nicked rods over which a glass tube is fitted. The adjustable plate has a spring grip on the glass tube so that it stays wherever it is put as it is slid along when the circuit is being balanced.

5. RADIALL AMPERITE. Dimensions of the mounting and the Amperite cartridge are the same for the different types of Amperite automatic filament regulations. This device can be used for regulating the filament current of any of the different types of tubes so that, even though the A battery voltage may vary over the usual range, the current is maintained at its correct value. The 1A type is for UV-201-A, C-301-A, or DV-2 tubes operating on six volts or WD-11, and WD-12 tubes operating on two volts. The 6V-199 Amperite is for controlling the UV-199, C-299, or DV-3 tubes on a 6-volt A battery.

6. FRESHMAN DOUBLE ADJUSTABLE DETECTOR. When used for table mounting, the detector is held in place by screws

passing through holes in the two lugs on the base. For panel mounting, the instrument is held by the hex nut on the threaded shaft through which the adjusting rod passes. The detector is protected from dust by a glass tube.

7. CONNECTICUT A. F. TRANSFORMER. In this drawing the arrangement of the terminals and mounting holes are shown for the Connecticut universal transformer. The turn ratio is 1 to 4.25. The protecting shell around the winding is of aluminum and is grounded to the core of the transformer.

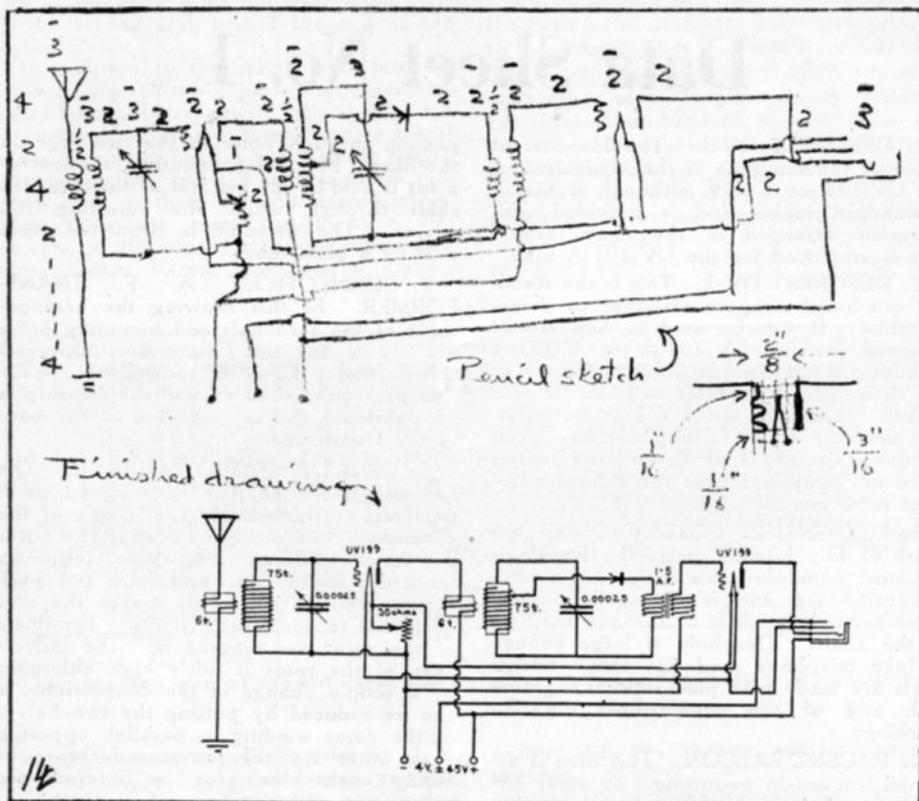
8. GENERAL RADIO COUPLER. The General Radio coupler is designed as a universal instrument for use in any of the various circuits now employed. The outer or stator winding has three terminals marked S for the start and finish and S-CT for the center tap. This makes the unit adaptable to oscillator circuits. Terminals of the rotor are marked R. The inductance of the rotor is fairly high although, by a simple change in the connections, it can be reduced by putting the two halves of the rotor winding in parallel, opposing each other for the lowest inductance or aiding each other for an intermediate value.

NOTE: The drawings on the opposite page are of exactly one-half scale so that dimensions not given can be readily scaled off.

Each month there will be described on these pages new products of particular merit and standard items which are very widely used in various kinds of equipment. With this data available, experimenters and designers can determine without delay whether or not parts they want to use will fit into equipment which they are planning, without waiting to actually buy the parts and take off the dimensions.

This information will be found of great value and it is suggested that the data sheets be torn out from the magazine or the issues kept so that the working data will be available at all times.

Full size blue prints of the drawings can be obtained from the blue print department of Radio Engineering at a price of twenty-five cents each. It may be more convenient to work directly from the full size drawings rather than from those made at one-half scale. Moreover, the blue prints can be filed away for ready reference.



Making Wiring Diagrams

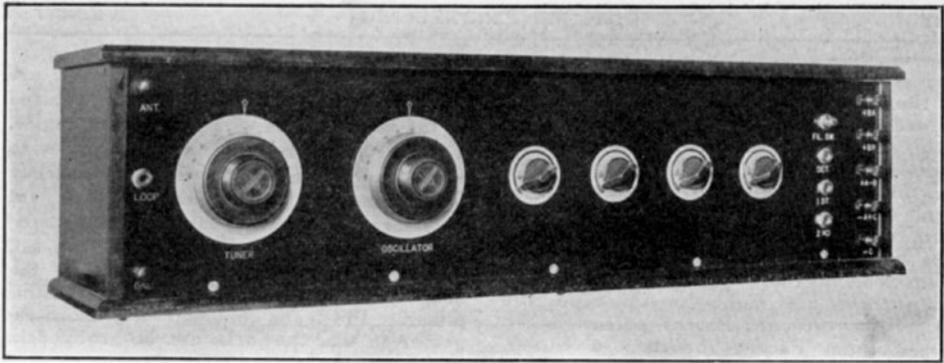
A simple stunt which makes the work easier and neater

MOST mechanical drawings are simple to lay out because they are made to known dimensions, but wiring diagrams present problems of their own for the reason that there is no definite, pre-determined relation between the assorted symbols and wires. In making diagrams for RADIO ENGINEERING we used to lay out the arrangement in pencil, then move this here or that there until the drawing occupied about the correct amount of space. Finally, however, when the lines were inked in, the confusion of pencil marks often caused mistakes, necessitating much checking and correcting.

Now, we have a method by which each line or symbol is located in advance, and the over-all length and width predetermined. The process is indicated above. A rough sketch is made on scrap paper,

Then each symbol and space is marked with the distance it is to occupy. We have definite dimensions which are always used: $\frac{3}{8}$ in. for coil, $\frac{3}{8}$ in. for a variable condenser, $\frac{2}{8}$ for a fixed condenser, $\frac{2}{8}$ for each winding of a transformer, and so on. Wires are spaced $\frac{1}{8}$ in. apart, or kept $\frac{2}{8}$ in. from an instrument symbol. Dimensions are also laid out vertically. For clarity, a dash is put above each instrument symbol.

The total of the vertical or horizontal indications gives the total height or width of the diagram. The distances are marked out on the drawing paper, the lines put in lightly in pencil, and then inked in, unless the drawing is to be traced. By this method the circuits can be made more readable, and produced with a considerable saving of time.



The Ultradyne Super Set

A set for antenna or loop reception using the Ultradyne modulation system, in which the oscillator controls the voltage on the plate of the detector tube

IN the usual super-hetrodyne system the signals are applied to an audion detector coupled to a separate oscillator, with the input of the intermediate amplifier inserted in the detector plate. Quite a different method of applying the local oscillations to the incoming signals is employed in the Ultradyne receiver.

If you will check over the wiring diagram you will see that the plate circuit of the first tube goes to the primary of the first intermediate frequency amplifier and then, through the grid coil, 1-2, of the oscillator on to the filament. Consequently when no oscillations take place in the oscillator circuit, no voltage is applied to the plate of the detector tube. Turning on the oscillator tube, however, puts a voltage on the detector plate which varies with the frequency to which coil 1-2 and the 0.001 mfd. around it are tuned. To produce the intermediate frequency beats the oscillator frequency is adjusted to a difference from the frequency of the incoming signals in the usual fashion.

For the convenience of those who may want to change from a loop to an antenna and ground a fixed coupler is provided. Normally the coupler is connected through a jack to the tuning condenser, but, if a loop is plugged in at the jack, the coupler is disconnected.

Parts Required for Construction of Formica, 7 by 24 by 3/16-in. in thickness, with a base board of seasoned wood, the same width and an inch shorter. This size

is suitable for the six-tube outfit. If, as is usually done, two steps of audio frequency amplification are added, making eight tubes for the set, the length of the panel and base should be increased by 6 ins.

The tuning condenser should be of 0.0005 mfd. maximum and the oscillator condenser 0.001 mfd. maximum. Heath condensers are recommended for this outfit altho the Haig & Haig low-loss condensers are well suited to the mechanical design and give excellent results because of their low losses. Each variable condenser is equipped with an Accuratune micrometer dial for close adjustment. In fact, these dials should be used on all super-hetrodyne sets except where a reduction gear control is provided.

The tuning coil unit, used when the set is connected to an antenna and ground, is made up on a Formica tube 6 ins. long by 3 ins. in diameter. The primary has 7 turns of No. 20 D. C. C. wire. Separated by 1 1/2 in., the secondary coil is put on consisting of 60 turns of the same size wire. The polarity of these windings makes very little difference altho it is well to connect them as shown in the wiring diagram where terminal 3 is the start of the coupling coil, 2 the connection between the coupling and secondary coils, and 1 the end of the secondary coil. For the oscillator unit a tube 3 3/4 ins. long, of the same diameter, is wound with two coils, each of 30 turns of No. 20 D. C. C. wire, separated by 1/2 in. The figures in the wiring diagram indicate 1 as the start of

one of the coils, 2 as the end, 3 the start of the second coil, and 4 the end of the second coil.

In addition to the instruments just described, the following parts are necessary: one Phoenix Ultraformer, type A, for the input transformer, and three Phoenix Ultraformers, type B, for the intermediate stages. The letters UA and UB on the circuit diagram refer to these types of transformers. Then there are eight Na-Ald type 400 sockets, a 400-ohm Pacent potentiometer, three 6-ohm Pacent rheostats, a Cutler-

Inside, behind the tuning condenser, are the tuning and oscillator coil units, secured to the wooden base with small brass angles. The Ultraformers are set at right angles to each other so as to prevent any tendency for interaction between them. It is not necessary, however, to turn the audio transformers in that way. On the eight-tube set, jacks are provided for connecting to the detector, the first amplifier, and second amplifier. The leads come off very close together so that the jacks can be grouped in

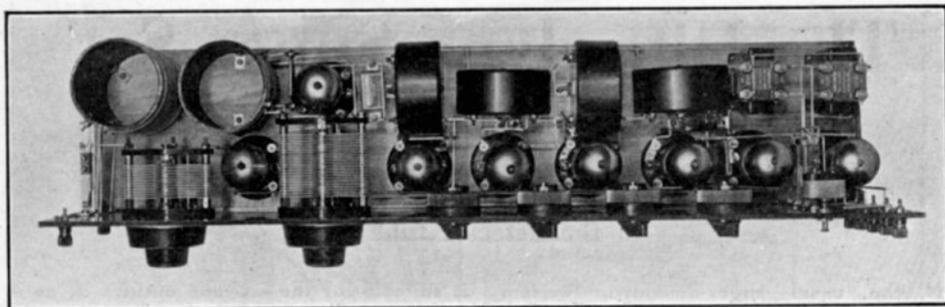


Fig. 22. Top view of the Ultradyn receiver showing the arrangement of the controls.

Hammer filament switch, Thordarson A. F. transformers, a 1-megohm Daven gridleak or an Electrad variohm, seven Eby Ensign binding posts, five 0.00025 mfd. Freshman condensers, two of 0.001 mfd., and one of 0.0005 mfd. condenser.

Other parts than those listed can be substituted, provided they are of good design and of the proper electrical characteristics, except for the type A and B Ultraformers, and the tuning and oscillator coils. The two coils can be purchased already wound if you object to doing the work yourself.

The Ultraformers are rather unusual in appearance as the design is quite different from any other type of transformer. There is no iron core in the Ultraformer altho it is a resonant type of transformer, designed for a wavelength of 2,400 meters or approximately 125,000 cycles. Terminal markings on the Ultraformers are the same as those in the wiring diagram.

The appearance of the front panel of this set is quite attractive because of its neatness and simplicity. If desired, of course, the binding posts can be connected to a terminal panel at the rear to keep the connections away from the front of the set.

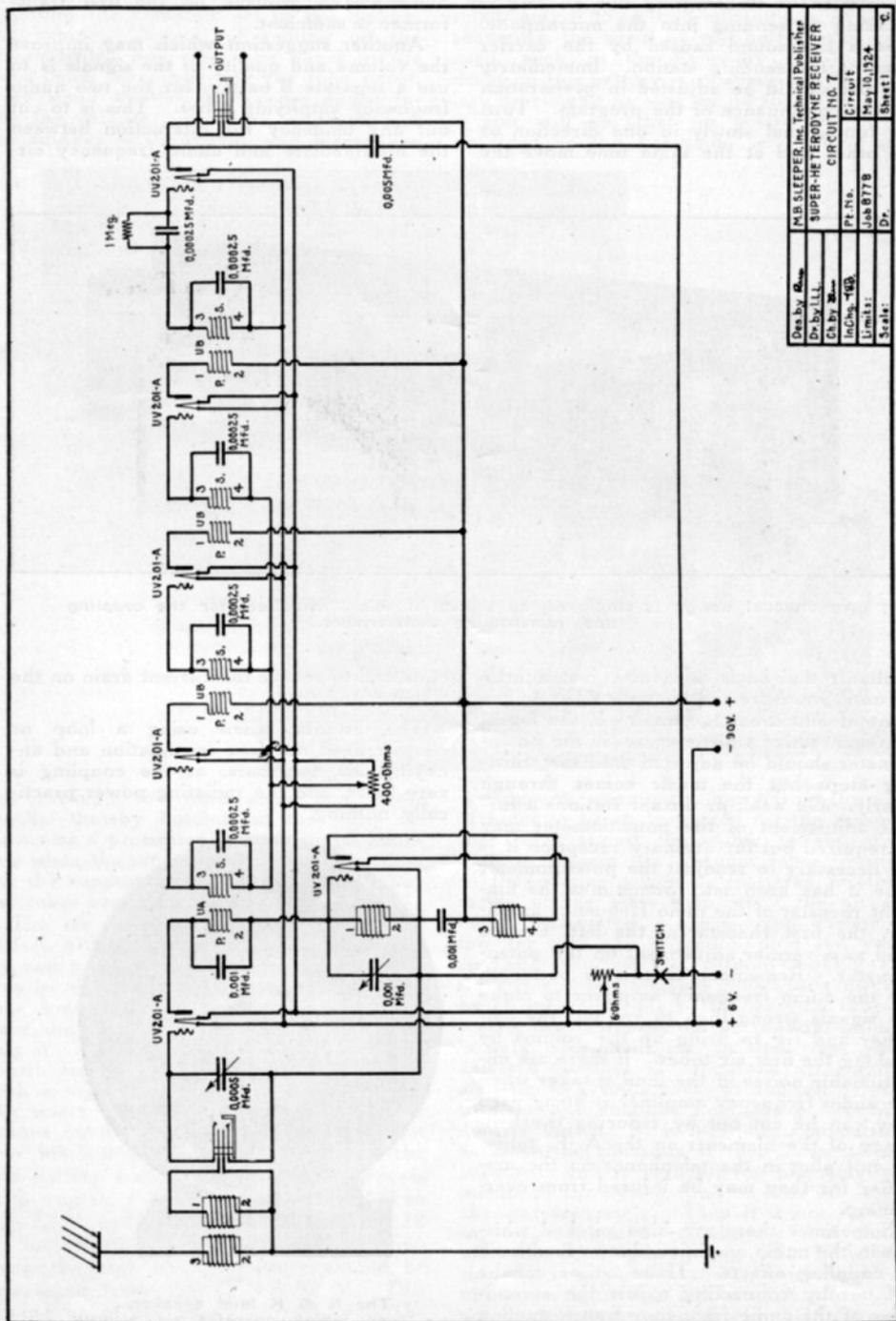
a row, with the filament control switch at the top.

Installation And Operation

Because of the extreme sensitiveness of super-heterodyne receivers, a very small antenna can be used if a water-pipe ground connection is also provided. When stretched out doors, the antenna should be of one wire about 50 ft. in length and 20 or 30 ft. in height. Indoors, one wire can be run through several rooms or down the hallway, or it can be fastened to the walls of a room. One end should be run to the set and the other left open.

If a loop is employed, it should be connected by short leads to a regular telephone plug inserted in the jack provided for that purpose.

The tuning is done in the same way whether antenna or loop is employed. The tuning dial, on the left, is moved about 2 divisions at a time while the oscillator dial is turned back and forth about 15 or 20 degrees on each side of that value. In other words, if the tuning dial is put at 50 divisions the oscillator dial should be rotated from 35 to 65 divisions. If nothing is heard, the tuning dial should be turned one or two divisions and the oscillator control rotated again. As soon as a station comes



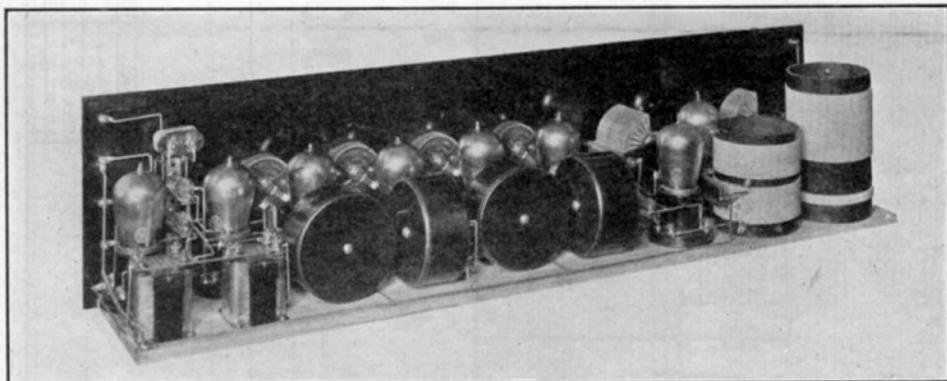
Des. by	W. S. STEEPER, Inc. Technical Publications
Dr. by	W. S. STEEPER, Inc. Technical Publications
Ch. by	W. S. STEEPER, Inc. Technical Publications
InChg.	W. S. STEEPER, Inc. Technical Publications
Limits:	Job 8778 May 10, 1924
Scale:	Dr. Sheet 1 of 1

The wiring for an Ultradyne receiver using Phenix equipment

in a slight hissing noise will be heard when the station is transmitting but no one is speaking or sending into the microphone. This is the sound caused by the carrier wave of the sending station. Immediately the dial should be adjusted in preparation for the continuance of the program. Turn the tuning dial slowly in one direction or the other and at the same time move the

This value may change in different sets. Sometimes a gridleak on the first transformer is sufficient.

Another suggestion which may improve the volume and quality of the signals is to use a separate B battery for the two audio frequency amplifying tubes. This is to cut out any tendency for interaction between the intermediate and audio frequency cir-



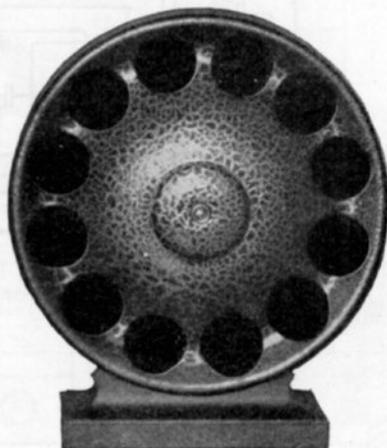
An unusual design is employed, as shown in this illustration, for the coupling and intermediate transformers.

oscillator dial back and forth just a little bit until you have the controls right on the point of maximum response. If the familiar regenerative whistle comes in the potentiometer should be adjusted until the whistling stops but the music comes through clearly. On weak or distant stations a further adjustment of the potentiometer may be required but for ordinary reception it is not necessary to readjust the potentiometer once it has been set. Sometimes the filament rheostat of the radio frequency amplifier, the first rheostat at the left, can be used as a vernier adjustment on the potentiometer. Remember that it is better to use the audio frequency amplifier to make the signals strong than to cut out the amplifier and try to bring up the volume by pushing the first six tubes. If there are objectionable noises in the loud speaker when the audio frequency amplifier is being used they can be cut out by reducing the brilliancy of the filaments on the A. F. tubes. Do not plug in the telephones on the amplifier for they may be injured from overloading.

Sometimes there are high pitched whistles in the audio amplifier, due to feed back or coupling effects. These noises can be cut out by connecting across the secondaries of the audio frequency transformers a gridleak of about 1 megohm resistance.

uits and to reduce the current drain on the B batteries.

The listener when using a loop or coupler need not fear re-radiation and annoying his neighbors, as the coupling is very loose, and the radiating power practically nothing.



The N & K loud speaker, a type which operates on a new principle.

THE PACE SETTER

1924—1925

NOLOSS

Registered U.S. Patent Office

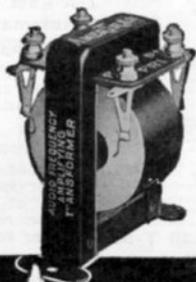
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manufactured by

GENERAL INSTRUMENT CORPORATION

423 Broome Street, New York City

Improve
your set
with an
AmerTran
and enjoy
radio this
summer
as never
before



STANDARD of
EXCELLENCE
for audio
amplification

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TRADE MARK REG. U.S. PAT. OFF.

The AmerTran is now made in two types: AmerTran AF-6 (turn ratio 5), is for use in the first stage; AmerTran AF-7 (turn ratio $3\frac{1}{2}$) is the

companion transformer for use in further stages of amplification. Ask your Electrical Dealer; or sent carriage charges collect. Price, each type, \$7.

American Transformer Co., 173 Emmet St., Newark, N. J.

Designers and builders of radio transformers for over 23 years

Standardized Parts List

The materials used to make up the set described in this issue were supplied by the following companies. The manufacturers whose names appear below will be glad to send you bulletins describing other products which they make. Please mention RADIO ENGINEERING when you write them.

PARTS FOR THE TYPE 6400 RDX RECEIVER

Type	Name	Price
57	Adams-Morgan Co., Upper Montclair, N. J. 1-.00035 mfd. Variable Condenser	\$3.50
	B. L. Sales Co., 35-X Warren St., New York, N. Y. 1-1 to 4 ratio Modern A. F. transformer	5.50
103	Carter Radio Co., G-209 S. State St., Chicago, Ill. 1-3 spring filament control jack .....	.90
FX	Davidson Radio Co., L-222 Fulton St., N. Y., N. Y. 1-Rasla fixed crystal detector	1.25
601	Dubilier Condenser & Radio Corp., A-48 W. 4th St., New York, N. Y. 1-.00025 mfd. Micadon .....	.35
	1-.0005 mfd. Micadon .....	.35
	Eastern Coil Corp., 22 Warren St., New York, N. Y. 1-coupler	3.50
	1-Pickle Bottle coil R. F. transformer	2.00
	H. H. Eby Mfg. Co., X-40 S. 7th St., Philadelphia, Pa. Ensign Set of 4 engraved binding posts .....	.80
W	James Goldmark Co., B-83 Warren St., New York, N. Y. 1-1/2 lb. spool of Wirit .....	.90
	Henry Hyman & Co., Inc., 76-Y Broadway, New York, N. Y. 724 1-Standard base socket .....	.75
	Kurz-Kasch Co., S. Broadway, Dayton, Ohio. 2-3 in. knobs and dials	1.50
	Poster & Co., 26 Barclay St., New York, N. Y. 1-7x14x3-16 in. Formica panel	2.49
	1-3 1-2x6x3-16 in. Formica panel .....	.67
	Radlall Co., 320 W. 42nd St., New York, N. Y. 1A 1-Amperite for 201-A tubes..	2.20

MISCELLANEOUS PARTS

58	1-pkg. of 25 soldering lugs..	.20
	3-left hand nickeled angle brackets .....	.30
14	4-Coil mounting pillars .....	.32
62	1-pkg. of 1/2 in. 6-32 R. H. nickeled screws .....	.12
63	1-pkg. of 10-1/2 in. 6-32 R. H. nickeled screws .....	.12
143	1-pkg. of 10-1 in. 6-32 R. H. nickeled screws .....	.14
49	2-pkg. of 10 6-32 nickeled nuts .....	.16
		\$28.02

COMPLETE SET OF PARTS BLUE PRINTS

6300	Set of three full-size blue prints for the 6400 receiver	\$.75
------	--	--------

AUXILIARY PARTS

	Chas. Freshman Co., Inc. 106 Seventh Ave., New York City, N. Y.	
DA	Double adjustable crystal detector	1.50
	National Carbon Co. Long Island City, N. Y.	
763	Small 22 1/2-volt B battery..	1.50
766	Large 22 1/2-volt variable B battery	2.00
772	Large 45-volt vertical B battery	3.75
771	4 1/2-volt variable battery....	.60
6810	50-amp. storage battery 6-volts	15.00
	Stanley Patterson West and Hubert Sts., New York City	
843	Deveau Gold Seal Phones 2200 ohms	6.00
	Deveau Gold Seal Phones, 32.00 ohms	8.00
	Dictograph Products Corp. A-220 West 42nd St., New York City	
R6	Dictogrand loud speaker	15.00
	Clark & Tilson, Inc. 1-A East 42nd St., New York City	
W	Automatic drilling template.	1.00
	Pacnet Electric Co. A-22 Park Pl., New York City	
40	Universal phone plug..	.50
51	Twinadapter for two plugs..	1.00
	Stevens & Co. 395 Broadway, New York City	
T-71	Set of 3 Spintite wrenches for hexnuts	1.00
T-825	Set of 3 Spintite wrenches for round nuts	1.00
T-580	Reamer for 1-8 to 1-2 in. holes	1.50

Back Issues of Radio Engineering

If you have missed any issues of RADIO and MODEL ENGINEERING for this year, check over the following list and order those that you did not get so as to make your file complete.

January—Tuska Superdyne, 4-tube Monotrol, oscillating wavemeter.....10c.

February—7-tube super-heterodyne set, Cockaday Receiver.

March-April—Portable tuned R. F. set using UV-199 tubes, Harkness circuit for Diode or crystal detector.

May—Improved Rasla reflex, the most successful 1-tube receiver ever built, 100-meter Sodian receiver.

June—Sodian reflex set using UV-201—A amplifier, the Bestone V-60, tuning filter for cutting out interference.

July—Resistance coupled amplifier, Tools for the radio model shop, Crystals that oscillate.

These copies will be sent promptly upon receipt of your order accompanied by a money order or postage stamps.

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Chicago Office: 636 West 22d Street

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90c

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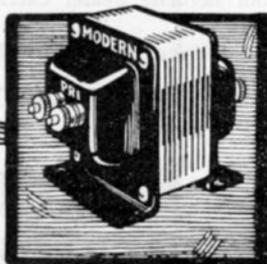


Amplify the MODERN way!

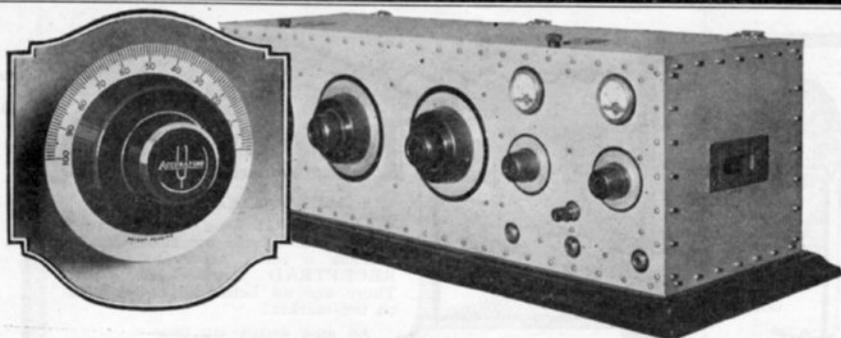
YOU cannot hope to enjoy radio concerts unless your amplifier can reproduce them with absolute fidelity to the broadcasting artist. And the surest way to get perfect reproduction is to use MODERN Transformers.

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It stands in the radio industry for what the best known trade-marks stand for in other industries—for leadership, known quality and assured satisfaction.

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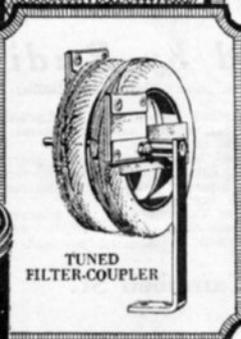
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FREE—Blueprint No. 4 of the Greiff 8 tube super-het if you mention your dealers name and address.

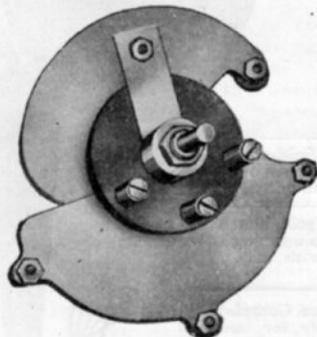
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The Haynes DX Tuner, described by M. B. Sleeper in this issue, has become famous as "1,000 Miles for \$15." Haynes-Griffin parts are specially designed for this circuit, and greatest efficiency will result from their use.

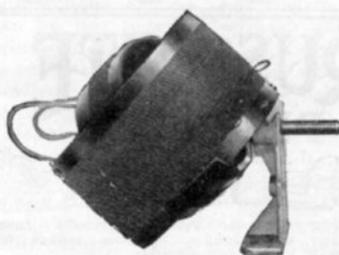
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25 Different Markings

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RUSONITE Fixed Detector—The test of detector value—Results. Try the Rusonite in your reflex and experimental work.

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RUSONITE Fixed Condenser—Capacity absolutely constant. No losses of any kind. Accuracy predominant. Write for literature.

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MODEL 25

An improved Loud Speaker made by loud speaker specialists.

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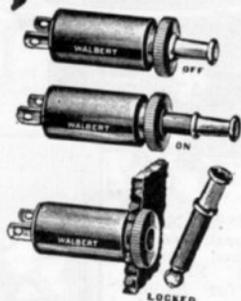
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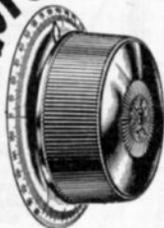
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UNIVERNIER with mahog- any knob and gold-plated dial **\$1.50**

With black knob and silver dial **\$1.25**

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931 Wrightwood Avenue, Chicago, U. S. A.

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that will accu-
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for anything from a
condenser to switch in
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eliminates the need for
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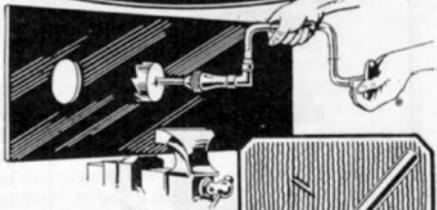
The Church AUTO-
MATIC TEMPLATE
has myriads of uses
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GET ONE TODAY.
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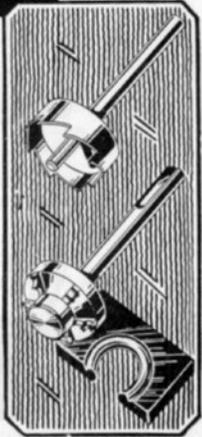
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STEVENS BEZEL BEADER, a beautiful tool that cuts a full, smooth bead in peek holes, just like manufactured sets. Does not chatter. In two sizes: $\frac{3}{4}$ ", \$1.75; 1", \$2.00.

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Descriptive Folder R 4 gladly sent free on request. Or send us \$3.50 for your pair of the Rance Combination Pliers. Complete instructions with each pair.

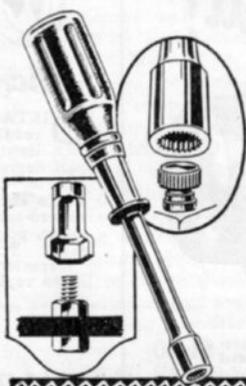
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Enable you to get into confined spaces and spin every nut tight as if soldered. No more fussing with pliers. Time and temper saved. Fans everywhere enthusiastic.

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Toolsmiths since 1899
375 Broadway, N. Y.



Third Annual National Radio Exposition

Grand Central Palace, New York



Featuring, in advance, the most striking developments in the Radio art and the Radio industry for the coming year

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- Phonograph-Radio Combinations for 1925
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TURN-IT

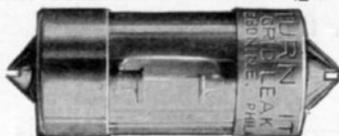
ADJUSTABLE
GRID LEAK

Changes the Range of Resistance to Suit the Strength of Reception.

Constructed along entirely new lines which avoid all use of graphite or carbon and the microphonic noises generally attending the use of these materials Turn-It greatly increases the volume, secures greater distance and reduces noises in your set.

A Turn-It gives constant and undiminished satisfaction. There is nothing to wear out.

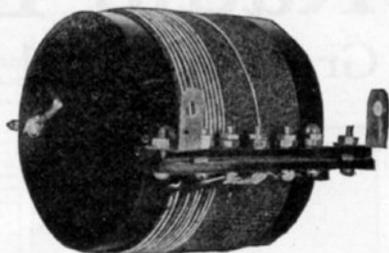
Absolutely guaranteed.



Turn-It Grid Leak is Only \$1
At Your Dealers or Direct from Us
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BONZA

Radio Frequency and Filter Coil

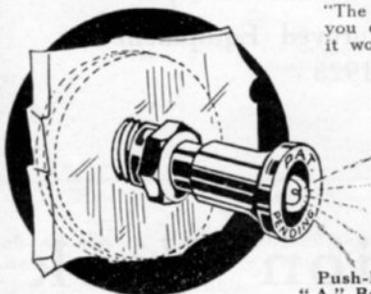


Made of Litz Wire wound on Bakelite. Used in ACME REFLEX, Tuned Radio and other Special Circuits.

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"A" Battery
Switch Style

The Kant-Blo Signal is easily installed. Simply takes the place of either the ordinary push-pull "A" Battery Switch or one "B" Battery Binding Post now on set.

Kant-Blo Signals—both Binding Post Style and Switch Style—are at all the best radio stores. If your dealer is out of stock send us \$2 for a Kant-Blo Binding Post Style, or \$3 for the Switch Style, and we will ship any number of KANT-BLOS direct to you, charges prepaid.

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APEX RADIO COMPANY
Suite 208, 503 Fifth Ave., New York, N. Y.
Telephone Murray Hill 3520

Canadian Distributor:
G. H. BENDER, 23 Tyrrel Ave., Toronto
Manufactured by Gano Kramer Co., Inc., New York

"The Kant-Blo Switch on our Super-Heterodyne does all that you claim for it. If we had installed this signal long ago it would have paid for itself hundreds of times."

(Copy of letter on request)

"Be Sure it Has a Kant-Blo
When You Buy a Radio"

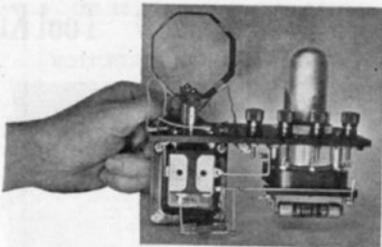
YOUR MONEY BACK

If you blow a tube
when your radio set is
equipped with a

Kant-Blo
SWITCH SIGNAL BINDING POST

"Lights on any Short Circuit"

Only one Kant-Blo needed to protect
any number or any kind of radio tube



R-D-X

Maximum Modulation

REFLEX RECEIVER

How to Build the R-D-X

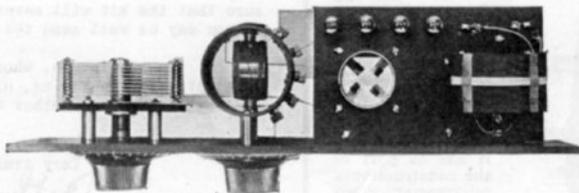
The R-D-X maximum modulation reflex set brings in stations with more volume than any other one-tube set. In quality, it cannot be surpassed. It tunes as sharply as a super-heterodyne, cutting thru local stations as if they did not exist. The R-D-X was designed particularly for local reception, to bring in stations up to 10 miles distant at full loud speaker volume. However, under favorable circumstances, the loud speaker range is much greater, while with telephones it is practically unlimited.

You can't go wrong by building the R-D-X.

What the R-D-X Does

Putting an R-D-X set together is so easy that the merest novice can do it, and it's fun because, with the simplest tools, you can make yourself a set superior to many factory-built outfits. The construction kit is complete to the last post and screw, the panels are accurately drilled and machine engraved.

All parts are from well-known, reputable manufacturers — Paragon, Formica, Dubilier, Eastern Coil, Bestone, Radiall, Modern, Rasla, Kurz-Kasch, Eby—names which guarantee 100% performance.



Looking at the Inside of the R-D-X Reflex Set

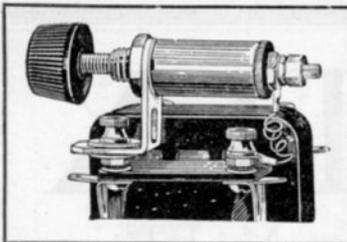
Complete set of parts, with drilled and engraved Formica panels, all ready to assemble, shipped in a strong packing case. Full, illustrated assembly instructions are provided, prepared in such a clear, understandable way that you cannot make mistakes. Each part is guaranteed to be in perfect working order. Price, postage prepaid

\$ 25

DURRANT RADIO
Limited.

C-52 Vanderbilt Avenue

New York City



Electrad Audiohm

C. P. HILDEBRAND said:—
 "This is certainly the Missing
 Link in Radio—To Express it
 Mildly, it is Marvelous."

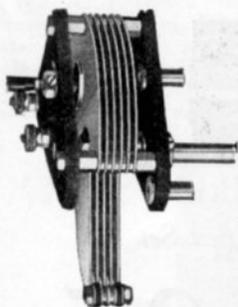
Mr. Hildebrand is one of thousands who have placed this wonderful new radio device across the secondary of their first audio transformer.

If you want to eliminate distortion and improve the tonal quality of your radio set buy an Electrad Audiohm today. Place it across the secondary of your first audio transformer and be convinced. Price, \$1.50. If your dealer cannot supply you order direct, advising us of the name of your local dealer.

ELECTRAD Inc.

Dept. 3F
 428 BROADWAY, N. Y.

TWO CONDENSERS IN ONE



The Kellogg Company have just placed on the market a standard 11 plate variable condenser of minimum .000074 and maximum .00035 microfarads, and it has as part of the construction a micrometer vernier condenser with a capacity minimum of one micro-microfarad and a maximum of ten micro-microfarads.

The use of these condensers in any stage improves not only the appearance of the set, because of reducing the amount of wiring and apparatus, but actually aids in more efficient tuning.

Ask your dealer to show you a complete line of Kellogg Radio Equipment.

Use—Is The Test

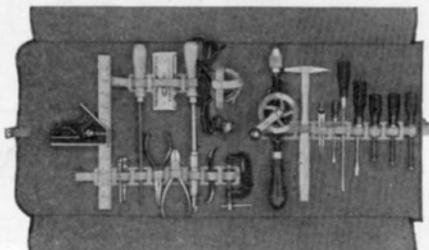


**KELLOGG SWITCHBOARD
 & SUPPLY COMPANY**

1066 W. Adams St. Chicago, Ill.

The "GNOME BRAND" Tool Kit

FOR ALL RADIO CONSTRUCTION



RADIO BROADCAST

DOUBLEDAY, PAGE & CO.
 GARDEN CITY, NEW YORK



Mr. Wm. H. Siebert,
 Hammacher, Schlemmer & Co.,
 4th Ave. & 13th St.,
 New York City.

Dear Mr. Siebert:

Your radio kit arrived this morning. Saturday is a short day with us and I do wish you could have hold off the delivery until Monday. The kit just threw a monkey-wrench in the machinery and I doubt that any of my gang will be able to compose themselves for the rest of the morning.

They have been trying the automatic center punch on all kinds of panel material and are greatly enthused over it. I'm afraid some of our panels may be a little the worse for the wear. Three requests have been made to take the kit home and the only way to settle the dispute is to take it home myself. You may be sure that the kit will never be returned to you so you may as well send the bill along.

In the future, when you have such a pleasant surprise for us, please see that it arrives at some time other than Saturday morning.

Very truly yours,

Arthur H. Snyder
 Editor

AHL:H

"GNOME BRAND" TOOL KITS

Just what you need to build
 "Super-Heterodyne" and all
 other sets and equipment.

RADIO KIT No. 1—22 Tools, \$16.00 each
 (as illustrated)

RADIO KIT No. 3—16 Tools.....\$8.00 each

Also Woodworking and Metal—Working
 Tools in sets or separately for
 household and general use.

Send for circular No. 285

HAMMACHER, SCHLEMMER & CO., Inc.

NEW YORK Since 1848 4th AVE. & 13th ST.

A STEP AHEAD IN RADIO!

The RICHARDSON

"SELF-EVIDENT" WIRING SYSTEM

is a very ingenious method of "fool-proof" assembly for a Superheterodyne Set using

RICHARDSON REPLACEMENT PARTS

Schematic prints are pasted on the base-board and back panel, and the instruments assembled on their images on the prints. Every connection has a number next to it on the print. The wiring, with the 34 lugged and numbered flexible wires, takes only a brief time — *and your 9-tube set is ready to bring in the distant stations.* There is a certain number of posts in the set, and the same number of lugs on the wires, *so that it is impossible to go wrong!*

A screw driver, a pair of pliers, and two hours are all you need!

Large Kit—everything for a complete 9-tube Superheterodyne Set, with push-pull audio (except tubes, batteries, speaker, and loop).

Fits in a standard 7x26 cabinet . . . \$95.00

Small Kit—essential parts only . . . \$40.00

The RICHARDSON "SELF-EVIDENT" WIRING SYSTEM
(WITH PRINT AND WIRES)
is included with each kit

*Ask your dealer to show you
how easy it is!*

RICHARDSON



RADIO, INC.

Canal O100

Factory
45-51 Lispenard St.
New York City

Reg. U. S. Pat. Off.

POSTER'S PERFECT PANELS

THE RECOGNIZED STANDARD

ENGRAVING-MACHINING



Poster Panels are used by M. B. Sleeper in his experiments. The construction article which has appeared in each issue of Radio Engineering for the last six months shows a Panel built by Poster.

This recognition of Poster Quality and Service by Mr. Sleeper is additional confirmation of the dominant position of Poster Panels in the Radio Industry.

We would appreciate the opportunity of quoting prices on your requirements.

Immediate deliveries of panels for the 6400 Receiver.

POSTER & CO. INC.

26-28 BARCLAY ST., N.Y. TEL. CORT. 4-965-6

(WHOLESALE ONLY)

"The Knobs Can't Come Off"



New Improved Model

13 Styles Engraved

"Read'em"

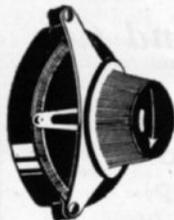
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Manufacturers of radio sets are invited to write for a sample of this new model of the "Read'em" Binding Post, considered to be the finest post made, both in quality and appearance. Retail at 15c.

THE MARSHALL-GERKEN CO.,

Dept. 194

Toledo, Ohio



Cico Bakelite Rheostat

One point mounting. Binding post connections. Vernier or plain types 6-10-20-30 ohms. Absolutely uniform resistance. Plain, \$1.35. Vernier, \$1.50.

CICO

RADIO PRODUCTS are

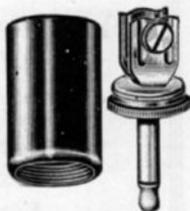
UNQUALIFIEDLY GUARANTEED

against all defects

Look for the distinctive GREEN CICO BOX

Consolidated Instrument Co. of America

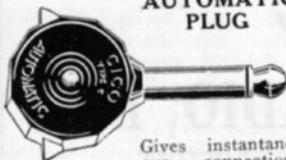
41 East 42nd St., New York



Cico 2-Way Plug

Two sets of headphones or loudspeaker and one set of phones may be connected simultaneously. Fits all standard jacks. Takes all types of tips. Price 40c.

CICO AUTOMATIC PLUG



Gives instantaneous connection. A slight pressure

on the wings with thumb and index finger releases tips for change. Bakelite body. Metal parts nickel-plated. Takes all tips. Price 75c.

CICO BAKELITE JACK

Something entirely new. An improved new principle. Moulded completely from bakelite. No metal in frame construction. Short springs of special phosphor bronze which is non-corrosive. No soldering. Sterling silver contact points assure perfect contacts. Scientifically perfect in every detail. Unusual in design and value. Something well worth all the pride you will take in it.



No. 30-Single circuit open \$.80
No. 31-Single circuit closed .85
No. 32-Double circuit90
No. 33-"A" Battery Switch .90

No antenna — Just the Ducon

No more need to labor and toil over erecting antenna. No more need to worry about the appearance of a bulky indoor loop in your home. The Ducon saves your time — and solves your problem.

Screw the Ducon into an accessible electric light socket and then when you want to hear a program, just tune in.

The Ducon brings in the stations clearly. The fact that over 400,000 fans use it is convincing proof. Try it. You can purchase a Ducon on a five-day trial basis from your radio dealer.



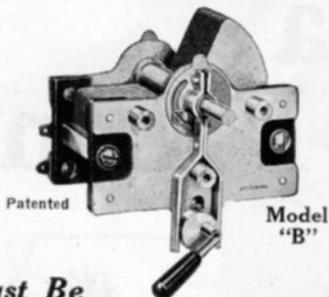
The Ducon sells for \$1.50
in all reliable stores

Dubilier

CONDENSER AND RADIO CORPORATION

HAMMARLUND VERNIER VARIABLE CONDENSER

Will Increase Your Range and Volume
ELIMINATES INTERFERENCE



Patented

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"B"

**"Just Be
Sure It's a Hammarlund"**

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| (1) Lowest losses (too small to measure) | (4) Rotor grounded to frame |
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AMPERITE

The "SELF-ADJUSTING" Rheostat

For Every Type of Tube

- Simplifies wiring
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AMPERITE MOUNTS INSIDE THE SET—
NO KNOB—AUTOMATICALLY GIVES
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\$1.10
Everywhere

Write Dept.
M-3 for free
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Manufactured by

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Remember RASLA for Reflex!

Write for the Rasla Reflex Construction Bulletins with full size layouts. They're FREE!

REFLEX experts built the RASLA Fixed Detector and the RASLA CR Transformer. Much research work was done before they were placed on the market. That is why these RASLA reflex products will mean success for you.



RASLA Type CR Transformer is the only radio frequency transformer designed especially to link a vacuum tube and a crystal detector.



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TRANSFORMER ~ FIXED DETECTOR

DAVEN RADIO

The Sine of Merit

The "Sine" of Merit—and what it means to Good Radio

There are few radio receivers where efficiency can not be increased by the use of one or more DAVEN RADIO ESSENTIALS.

Neat and positive clip mountings permit instant and solderless changes of resistors and by-pass and grid condensers, for the experimentation that is truly essential to the efficient operation of individual receivers. Seventy-five per cent. of all receivers will respond with greater signal strength, selectivity and distance to slight changes in the usual values of capacity and resistance.

And the output of the overall efficient tuner is delivered to a Resistance Coupled Amplifier that preserves, with a more fundamental efficiency, the tonal beauty of the original voice or music. No other amplifier can equal it. And the DAVEN is the peer, as well as the pioneer of RESISTANCE COUPLED AMPLIFIERS.

Think of a DAVEN when You Design Your Next Set

To those who delight in building their own set, the DAVEN KITS will settle their difficulties. In this way—and this way only are they assured of obtaining the right parts—all LABORATORY TESTED.

TYPE 3-K Three-step Resistance Coupled Amplifier Kit without sockets and condensers\$8.00

TYPE 3-C Three-step Resistance Coupled Amplifier Kit complete with sockets and condensers.....\$12.50

Read "Resistors, Their Practical Application in Radio Reception." By Zeh Bouck. Price 15 cents.

These booklets are full of interest and may be obtained from your dealer.

TYPE 4-K Four-step Resistance Coupled Amplifier Kit without sockets and condensers\$10.50

TYPE 4-C Four-Step Resistance Coupled Amplifier Kit complete with sockets and condensers.....\$16.00

Also read "The How and Why of Resistance Coupled Amplification." Price 10 cents.

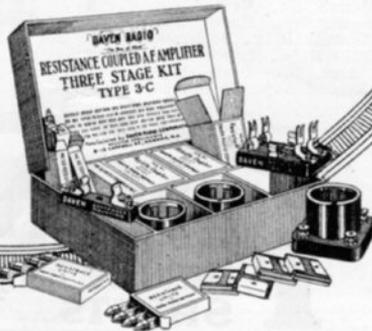
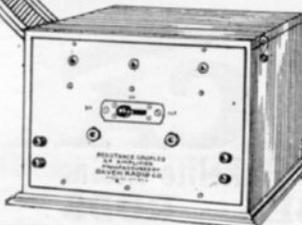
The DAVEN RADIO CORP.

"Resistor Specialists"

9-15 Campbell Street

Newark, N. J.

DEALERS: Ask your jobber to send you proposition on the DAVEN PRODUCTS.



Resistors and Grid Leaks

Filament Ballast Resistors

Resistor-Leak Mounting

Condenser Mounting

Combination Gridleak Condenser Mounting

Resisto-Coupler for resistance Coupled Amplification



*The Formica factory is the largest
of its kind in the world*
—and it is concentrated on just one product

THE equipment is the most modern and efficient that has been devised for the production of material of this kind. Most of it was developed by the Formica engineers and is not duplicated anywhere else.

It is this specialization, this exceptional concentration of men and resources on just one product, that has won for Formica the dominant position among makers of laminated bakelite for electrical and mechanical purposes

Every step in manufacture is under close laboratory control. Research work constantly going on is effecting improvements that keep Formica quality far in front. And the great Formica capacity enables the company to give its customers the best possible service.

The business has been built on the twin pillars of quality and service. Today it is better able to serve you than ever before.

Consult a Formica man about electrical and radio insulation, silent gears or pump valves.

THE FORMICA INSULATION COMPANY

4653 Spring Grove Avenue, Cincinnati, Ohio

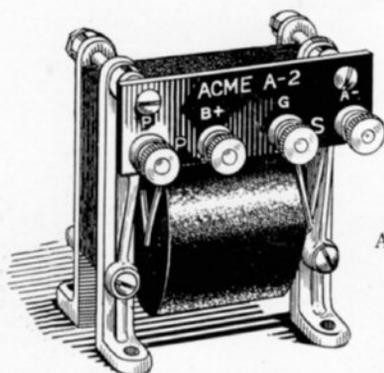
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FORMICA
Made from Anhydrous Bakelite Resins
SHEETS TUBES RODS

This Transformer Has Improved Thousands of Radio Sets



ACME A-2
—for volume

“ . . . Your letter answering mine of December 10th came just as I got home with an ACME A-2 in my pocket. I installed it in my reflex set in place of the — and believe me you cannot exaggerate its good qualities. . . ”
From Winnetka, Illinois.

“ . . . Am using your four-tube Acme circuit, using three audio and three radio transformers, and can pick up any 50-watt station in the U. S. A. . . ”
From Fitzsimmons, Colorado.

These are just typical samples of testimonials picked out at random from our files. If we tried

to show them all to you, we'd have to publish a book. You couldn't read them through in a day.

But right here and now, today, you can, if you will, get the benefit of ACME Transformers. Use them in the set you build. Insist on them in the set you buy. Then your loudspeaker will have a chance to reproduce loud and clear without distortion.

Send 10 cents for 36-page book, “Amplification Without Distortion,” containing many practical wiring diagrams and many hints for getting the best out of your set.

ACME APPARATUS COMPANY, Dept. R. M. 9, Cambridge, Mass.
Transformer and Radio Engineers and Manufacturers

ACME

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Dept. R. M. 9, Cambridge, Mass.
Gentlemen: Enclosed find 10 cents for copy of “Amplification without Distortion.”

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"The Best That Money Can Buy"



"DEVEAU GOLD SEAL" HEAD SETS are electrically and mechanically,—as well as from a radio standpoint,—as perfect as the highest-priced Head Set on the market,—and yet, with all their perfection, they retail at only \$6.00 for 2200 Ohm and \$8.00 for 3200 Ohm.

The trade mark "DEVEAU" has stood for the highest quality in telephone apparatus for thirty years,—a guarantee that every known advantage in design and manufacturing has been taken into careful consideration.

Magnets are extra-heavy one-piece units; cups are of aluminum to keep down the weight but unlike other Head Sets, every exposed metal part of the set is finished in genuine 24-karat gold,—under a protective lacquer so that the finish will last for years; the terminals of each unit are concealed,—no contact possible with user's hands.

"DEVEAU GOLD SEAL," HEAD SETS are like a piece of fine jewelry in appearance, but with all the radio niceties that the most advanced radio enthusiast can desire. DEVEAU Units exactly match each other in

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The patent design of headgear is far ahead of any Head Set on the Market,—affording as it does, instant fitting to ears and head without "re-harnessing" and without binding or pressure—the latter an admitted nuisance with all other makes of Head Sets.

Cups are of genuine Bakelite—of scientific design, and comfortable to the ear; the Bakelite never loses its jet-black lustre or highly polished surface.

"DEVEAU GOLD SEAL" HEAD SETS are never found in the cut-rate market—they are only sold to jobbers who appreciate their value.

"DEVEAU GOLD SEAL" HEAD SETS are guaranteed to be electrically and mechanically perfect—our Guarantee protects every purchaser.

Order through your regular jobber or write direct for the names of authorized Distributors throughout the country.

Send for descriptive Bulletin of Deveau Radio Apparatus and Micrometer Adjustable Air-Gap Radio Loud Speakers.

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