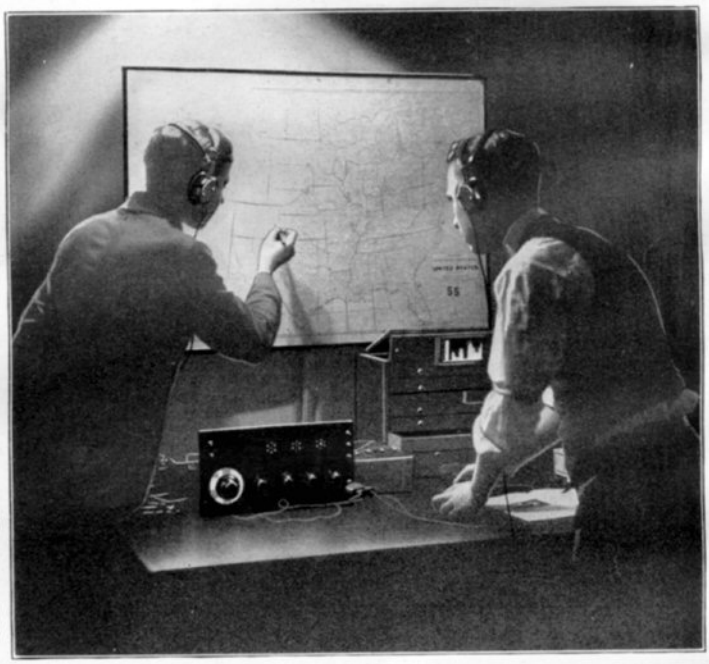
AGAIN A ONE-THIRD INCREASE IN RADIO ARTICLES

Vol. III No. 4

RADIO & MODEL ENGINEERING

Edited by ~ **M.B.Sleeper**



10 Cents a Copy MAY 1923 $1.00 Per Year

A Magazine For The Experimenter Who Builds His Own Equipment

SLEEPER
Radio
CONSTRUCTION PARTS

The Sleeper Fixed Coupler is the newest member in the famous series of Sleeper standardized, construction parts. It is the first real improvement in ten years in short wave loose couplers or variocouplers.

Description: built on the same lines as the beautiful Sleeper Variometer, its appearance excites admiration. Itl construction employing an untuned primary completely destroys the time honored belief that couplers require switches and coupling adjustments. The Sleeper Coupler has no movable control yet gives louder signals and sharper tuning than any old style variocoupler. It can be used in any circuit calling for a variocoupler.

Specifications and Use: Primary Circuit. In the ordinary variocoupler, when primary switches are changed, signals can be brought back to the same intensity by readjusting the secondary condenser proving that tuning is really done in the secondary. The primary of the Sleeper Coupler is fixed at the correct value for wave lengths between 150 and 1000 meters.

Coupling: The coupling in the Sleeper Coupler is fixed at the proper value for extremely sharp tuning without loss of signal strength.

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Voltage Step-up: The Sleeper Coupler offers a step-up ratio of one to eight between the primary and secondary turns, highly desirable as in an amplifying transformer because the audion is a voltage-operated device. Ordinary variocouplers give no step-up ratio.

Operation: Without coupling adjustment or switches the Sleeper Coupler will give better results than a variocoupler in any circuit where a variocoupler can be used. Once you have operated a set with those controls eliminated you will never have them on a set again.

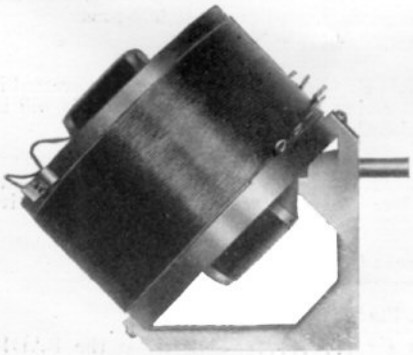
Price: Type A-209 SLEEPER COUPLER, weight 1 lb. $4.00

SLEEPER RADIO CORPORATION
88-F Park Place, New York City

FADA Rheostats *and* Potentiometers—

Fada Vernier Rheostat

Fada Potentiometer



Fada Vario-coupler

are practically standard with the whole radio industry. It was FADA rheostats in 1921 that were in greatest demand and today FADA rheostats and potentiometers are sold in most every store. Despite imitations, and bootleg radio traffic the FADA trade-mark on rheostats still sets the standard of quality and service.

120-A	5 ohm plain rheostat for all 6 volt tubes	**$.75**
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The FADA Handbook of Radio Facts and a bulletin describing the new FADA "ONE-SIXTY" receiver with the neutrodyne circuit will be sent for 10c.

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Will You Be There ?

Are You Making *YOUR* Plans for the Radio Cruise?

On August 4th the first assembly of radio men will sail on the S. S. Franconia for a five-weeks' tour to England and France, a representative body of Experimenters and Manufacturers, to investigate radio developments abroad and to meet and become acquainted with the men who are putting across radio there. Various types of American-made equipment will be taken over to exhibit at the conference. In addition, the RADIO CRUISE offers the best way you can think of to spend your summer's vacation.

HERE IN BRIEF IS THE STORY OF THE 5 WEEKS' RADIO CRUISE

Aug. 4th. Sail from New York for Liverpool, first class passage, on board S. S. Franconia, 20,000 tons. Special arrangements for radio tests and experiments on board.

12th. Arrive at Liverpool, and start on 4-day swing thru Shakespeare County with a special stop at Oxford University.

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25th. Leave by airplane for Paris.

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Sept. 1st. Sail from Cherbourg, first class passage, S. S. Aquitania, 46,000 tons.

7th. Arrive at New York.

NOTE: For those particularly interested in sight-seeing private motors and guides will be furnished without extra charge.

The cost of the RADIO CRUISE, including every item of expense from New York to New York except tips and spending money, is $825 per passenger. Of this amount $25 is paid upon registration, $400 by July 1st, and the balance before August 1st. A very interesting set of descriptive pamphlets will be sent without charge upon request.

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---

RADIO AND MODEL ENGINEERING, A-88 Park Place, New York City.

Enclosed are $.....as reservation deposit for.....passengers on the RADIO CRUISE. I agree to pay one-half of the balance on or before July 1, 1923, and the other half on or before August 1, 1923. I reserve the right to cancel this reservation before July 5, 1923, by forfeiting the reservation deposit.

Name..... Street .....

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Simplified Reinartz Receiver

This new design, eliminating all switches, has the same characteristics as the conventional circuit without some of its disadvantages.

How the Circuit Is Simplified

THE ordinary Reinartz receiver which has come into such popularity recently is not as easy or simple to construct as the circuit would indicate, for the work of bringing off taps from the coil, soldering them to switch points, and the arrangement of the various controls as well as their operation bring in difficulties such as are experienced in the more elaborate receiving sets.

So great has been the popularity of the type 3300 Reinartz Receiver, described in the Red Book,* that further work was done on the outfit to see if the circuit could not be simplified so as to do away with the three switches. In practice it was found that the set was ordinarily operated with all three switches set at maximum. Consequently we constructed an experimental set in which the coils were not tapped and leads taken off from the full inductance, as was the case when the switches were at their maximum settings. Careful experiments showed that there was no loss introduced by doing away with those controls, although the set operated in a slightly different manner.

Taps always cause losses. These losses are even present when the unused turns are short-circuited or dead-end switches employed. Therefore, when switches are eliminated a certain improvement is bound to be noticed both as to signal strength and sharpness of tuning.

The Reinartz set, when made according to the data in this article, is probably the best of all the inexpensive types of circuits. It is much sharper than the single circuit outfit, and has very little tendency to radiate energy. The parts are very simple and what there are of them are inexpensive to purchase.

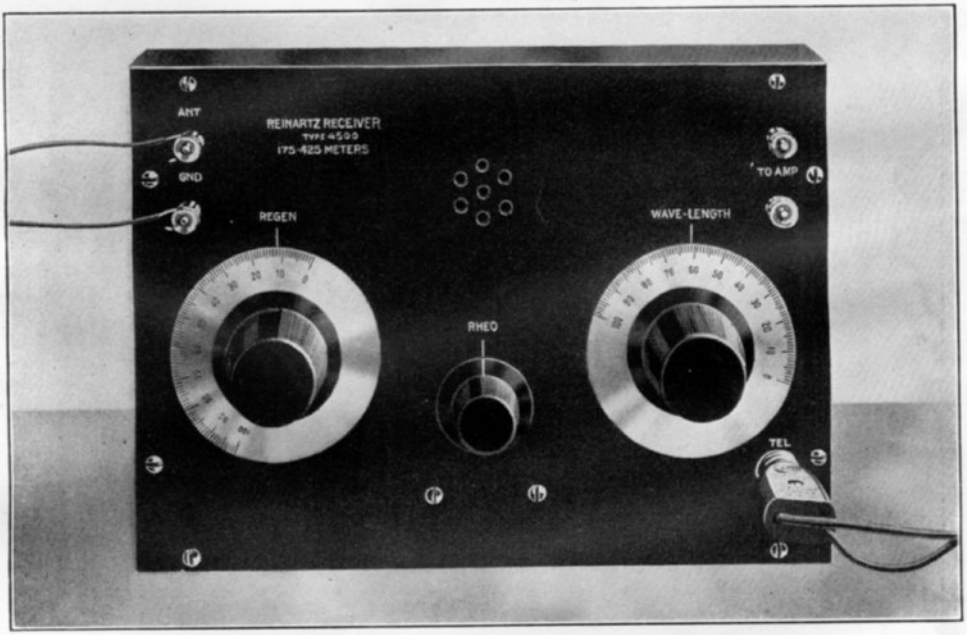

Fig. 1. The simplified Reinartz set as it appears when it is assembled and ready to operate

Letters have come in from all over the country about the type 3300 Reinartz sets recording remarkable long distance reception, and the comparative tests which have been made show that this type 4500 set can do anything that can be accomplished by the other.

Construction Work Required

A panel 7 by 10 in. carries the instruments for this receiver. This size was chosen because panels 7 in. high seem to be most

* Six Successful Radio Sets, published by M. B. Sleeper, Inc. Price fifty cents.

widely used and cabinets are available at practically all the radio supply stores for panels of these dimensions. Consequently it is not necessary for you to build your own cabinet unless you are particularly anxious to do it. A clearance of ½ in. is allowed all around the outside so that a cabinet of ½-in. or ⅜-in. stock is suitable.

You will notice that no angle brackets are required for mounting the base panel which carries the socket and battery binding posts. Instead the socket is mounted at the rear of the front panel by means of screws going in the bushings moulded into the socket. To allow sufficient space between the socket tube and panel for the rheostat to fit in, binding post bases 5-16 in. long are put between panel and socket. Then the base panel is secured to the underside of the socket by means of screws and nuts. The arrangement can be seen in the accompanying photographs. This method of mounting is much stronger mechanically than when angle brackets are employed.

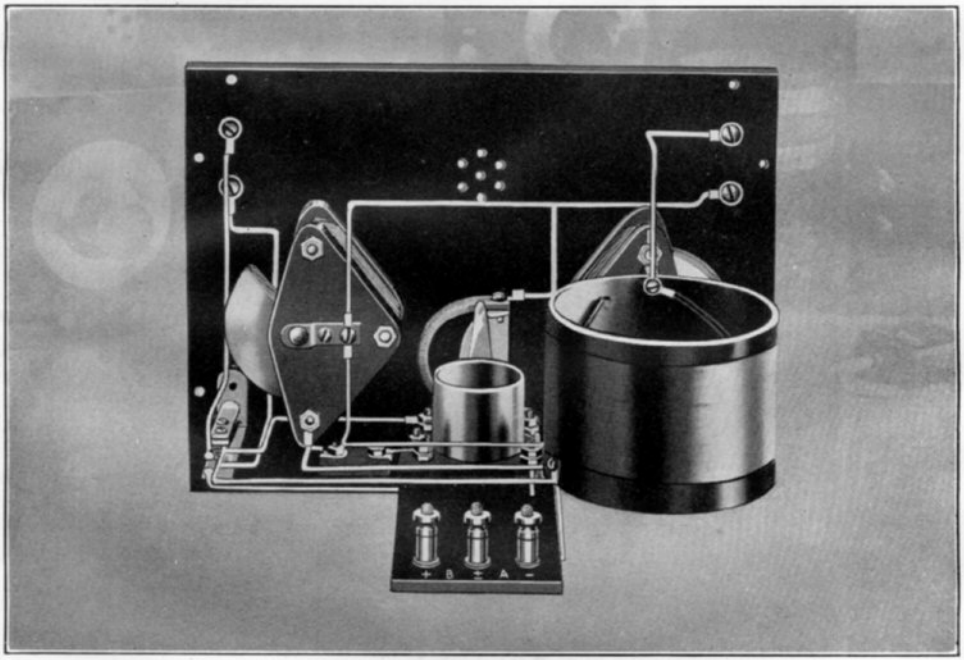

Fig. 2. From the rear view you can see how easy it is to put the set together. Since no switches are used one of the hardest jobs is eliminated

Instead of mounting the coil directly on the panel, which would make it necessary to use a larger size, it is secured by means of coil mounting pillars to the rear end plate of the variable condenser. As it worked out, this also makes the connections shorter than they would have been otherwise. You will see that the holes in the condenser plate are 2⅛ in. apart and on a line with the screws carrying the separating washers. This brings the coil to a position where there is sufficient clearance over the side of the panel.

No special machine work is required other than drilling the panels and winding the coil.

Laying out the Panels

Fig. 6 gives the layout for the front and base panels and the coil tube at one-half scale. From this illustration it is an easy matter to scale off the distances and lay them out doubled on the panels. If you do not want to go to that work, however, you can obtain full size blue prints. Then the panel blueprint can be set directly on the panel and the holes punched through the print by means of a center punch.

The inductance tube sketch shows the two holes for the coil mounting pillar screws, and the points at which taps are taken from the winding. The start of the upper coil is marked zero and the end 24. Then another zero indicates the beginning of the second coil, ending at the hole marked 44. A tap is taken off at the 10th turn. In addition there are four holes to be made with No. 18 drill on a line 3-16 in. from the lower end of the tube. These four holes are indicated in the upper part of the inductance tube drawing. They are for the ter-

minals of the coil. The fifth terminal, as will be explained later on, goes to the screw holding the tube to the upper mounting pillar.

Where no size for the holes are given a No. 18 drill should be used. Concentric circles indicate that the holes must be countersunk for a flat-head screw.

Winding the Coil

There are two ways the coil can be wound depending upon the wavelength range to be covered. The coil used on the set illustrated is for 175 to 425 meters. It consists of two sections, one for the plate and one for the grid. The former has 24 turns and the latter, 44 turns. No. 24 S. S. C. wire (22 S. W. G.) is the correct size for the winding. If, however, you want to tune up to 600 meters a slight change must be made. After winding on the 24-turn plate coil, start the grid coil with mounting pillar. The tap at the tenth turn goes to the second lower terminal to the right, and the end of the winding to the third bottom terminal to the right. It is advisable to cover these leads with Empire tubing to protect them.

These instructions are made somewhat more clear by referring to Figs. 5 and 6.

Assembly and Wiring

Step by step instructions have been prepared for the assembly and wiring as a protection against errors in putting the parts together. Following them carefully will protect you against mistakes.

1. Fasten the binding posts marked, 9, 21, 19 and 17 to the front panel, with a soldering lug between each screw-head and washer. Have the lugs pointing in the direction shown by the short heavy lines. If you do this it will make the wiring clear.

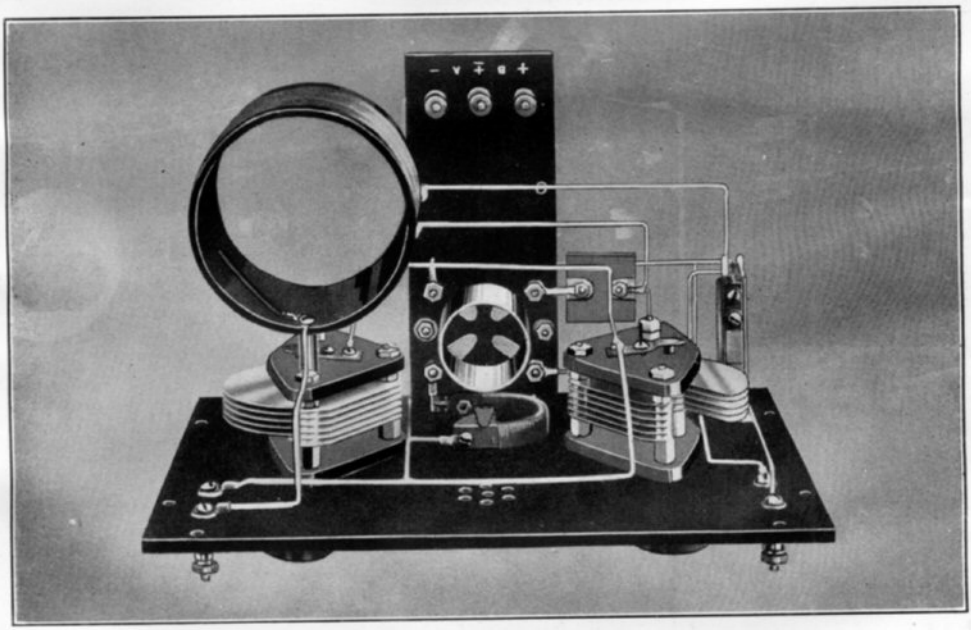

Fig. 3. Considerable space is saved by mounting the coil on the variable condenser. See how short the grid lead is—only a matter of two inches

two banks. Continue this until 40 turns have been put on. Then wind the balance of the coil in a single layer. That will give you sufficient inductance, with an 11-plate condenser, to bring in the new longer-wave broadcasting stations as well as 600-meter commercial transmitters.

Looking at the coil from the top, as it is mounted on the condenser and panel, the start of the plate coil should go to the right hand terminal at the bottom of the tube. The end of the plate coil must go to the left hand bottom terminal. Then the start of the grid coil runs to the screw holding the coil to the upper

2. Get the regeneration condenser ready for mounting on the front panel. Put soldering lugs on the condenser terminals 10 and 13. Then mount the coil on the pillars using ½-in. 6-32 R. H. screws. Remember to put an extra lug under the head of the screw which holds the tube to the upper pillar. This is terminal 12. On this screw also is the lug to which the lead from the start of the lower coil is connected.

3. Mount the rheostat in the position indicated. Be sure that the terminals are to the right. The rheostat should be fitted with one lug on each terminal screw.

4. Mount the binding posts 4, 8, and 24 at

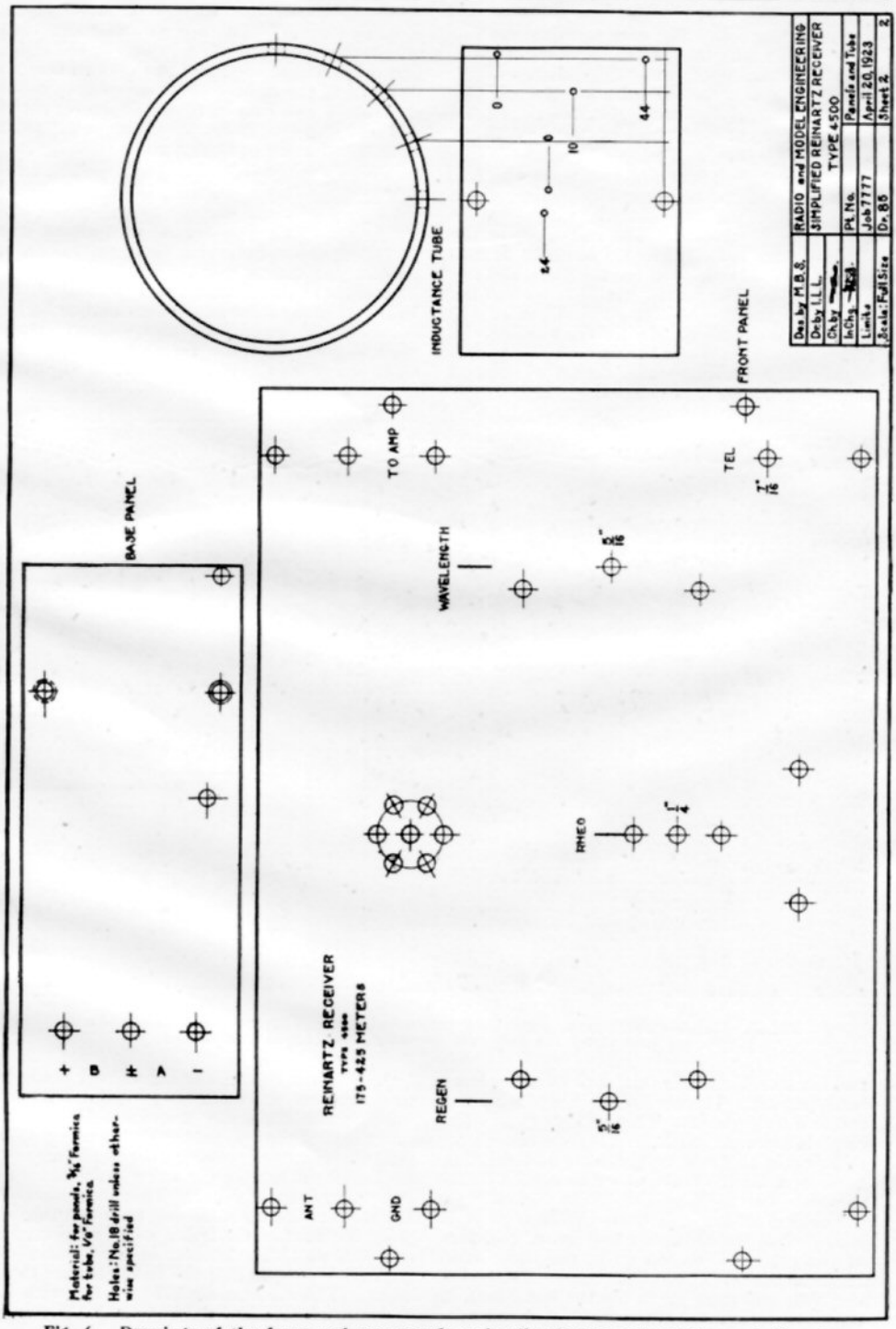

Fig. 6. Drawings of the front and rear panels and coil tube are reduced to one-half scale, so that you can scale off the dimensions easily

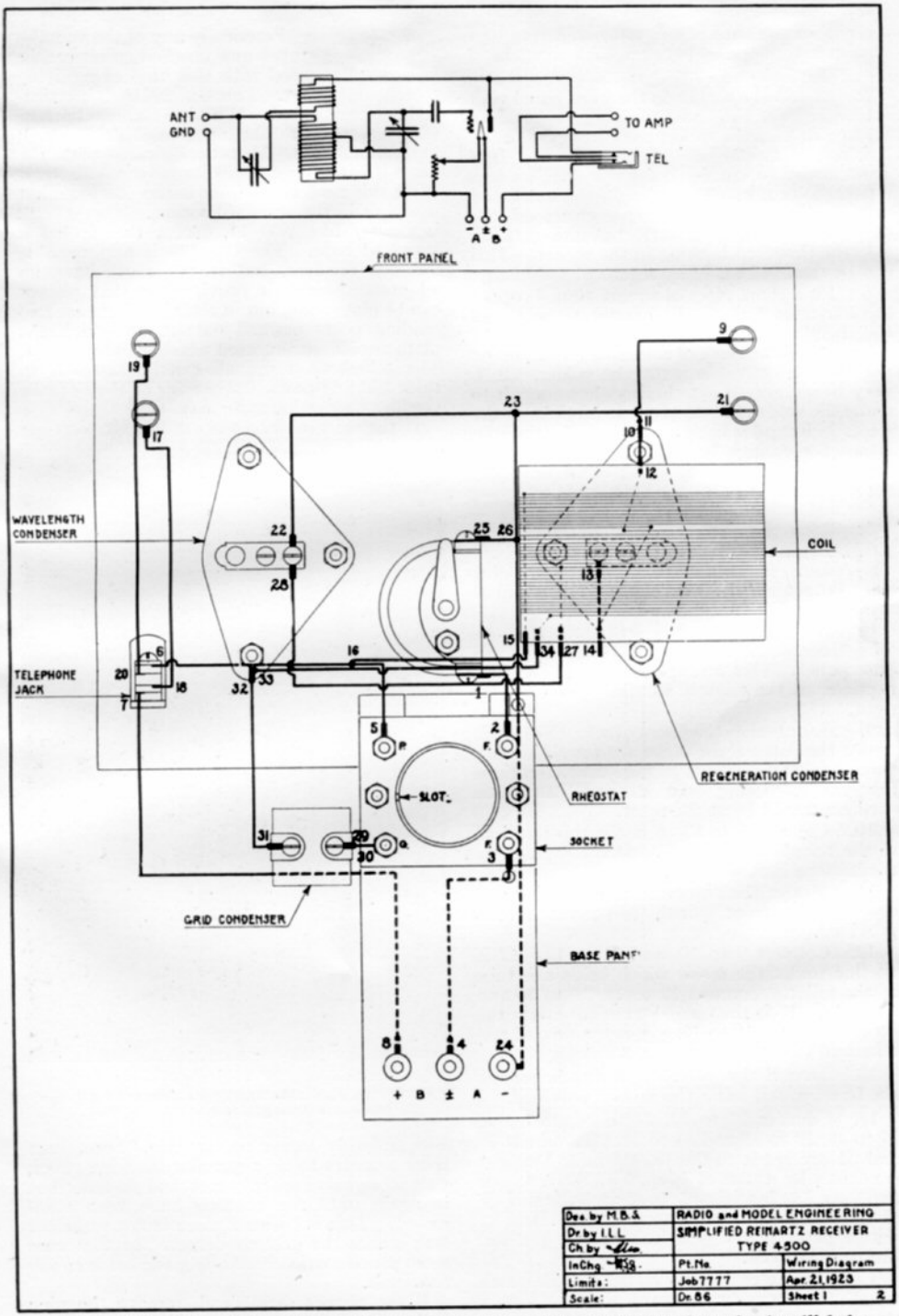

Fig. 5. Follow the picture wiring diagram when you make your connections, for it will help you to avoid mistakes. Above is a schematic hook-up

the rear of the base panel, using soldering lugs underneath the panel between each screw head and washer.

5. Mount the socket on the front panel with a binding post base or separating washer 5-16 in. long to keep the socket back from the panel. The screws should be ¾-in. 6-32 R. H. If it is necessary to cut off the screw, put on it a a 6-32 die or nut. Then clip off the screw and remove the die or nut. This clears off the thread. Sometimes a little bakelite gets inside the threaded bushing in the socket. This can be removed easily by means of a 6-32 tap.

6. Fit a short piece of square tinned copper bus bar from 1 to 2. Be careful to make all the bends exactly right angles. Use the least possible amount of soldering paste and do not be too generous with the solder. It is very important to get the iron hot enough to make the solder flow freely. If it sticks at the joints in irregular lumps, it is because the iron is not hot enough or it needs cleaning. The iron can be cleaned by filing it off until the copper shows brightly. Then put soldering paste and a little solder on the point.

7. With the socket mounting screws provided, fasten the base panel to the underside of the socket. Make sure that the base panel is right up against the rear of the front panel as this gives additional bracing.

8. Connect 3 to 4. You will notice that the wire drops down from 3 through a hole in the base panel. This arrangement keeps the connections to the battery binding posts out of sight.

9. Mount the telephone jack. You will notice that all Pacent jacks are provided with three washers. This is to take care of various size panels. Using 3-16 in. panel all three washers should be at the front.

10. Connect 5 to 6. 6 is the top terminal of the telephone jack. Connect 7 to 8. 7 is the bottom jack terminal.

11. Mount the regeneration condenser and coil on the front panel, using the screws provided.

12. Connect 9 to 10, and 11 to 12. 12 is the lug under the screw which holds the tube at the pillar. Connect 13 to 14, 15 to 16 and 17 to 18. 18 is the second terminal up on the jack. Connect 19 to 20. 20 is the second terminal down on the jack.

13. Mount the wavelength condenser on the front panel, using the screws provided.

14. Connect 21 to 22, 23 to 24, 25 to 26, 27 to 28, 29 to 30 and 31 to 32. Terminals 29 and 31 are made to the 0.0005 mfd. Dubilier condenser by means of ¼-in. 6-32 R. H. screws and nuts. It is advisable to scratch the surface of the clamping plate between the terminals, so that a pencil mark grid leak can be put on. Connect 33 to 34.

This completes the wiring of the Reinartz set. The schematic diagram given in Fig. 5 may be of assistance in following out the circuit as it is presented in the picture diagram.

Testing and Operating

Practically any of the vacuum tubes now on the market can be used with this kind of receiving set. The UV 201-A is particularly recommended. With it a filament battery of 6 volts should be used and a 22-volt B battery. A WD 11 tube operates with the same B battery by 1½ volts for the A battery. With this tube an adapter is necessary so that it will fit in the standard socket. The WD 12 is exactly like WD 11, except that it has a standard base. The UV 199 is also suitable for this receiver, but it too must have an adapter. A jack is provided so that phones can be plugged in, but in addition there are two binding posts marked output, to which the plate circuit is connected when the plug is out. The telephone terminals can be fastened to these binding posts if necessary or they can be used for connection to an amplifier.

If the set does not work a few simple tests

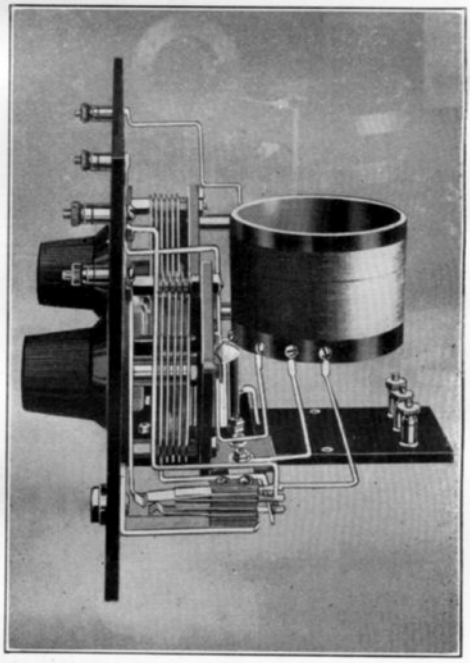

Fig 4. In this side view you can see how the leads are brought off from the coil

will probably locate the trouble. Sometimes there appears to be a peculiar blocking effect, that is, signals suddenly stop and do not come in again until the controls have been readjusted. This is because there is not sufficient leak across the grid condenser. In that case more pencil marks should be made between the terminals.

If the phones seem dead, remove the plug and notice if there is a sharp click—not a weak sound, but a good clear noise. If no click is

(Concluded on page 90)

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Radio and Model Engineering is mailed to subscribers on the tenth of the month, and appears in the radio stores on that date.

EDITORIAL

MOST people think of summer as a dull time for radio, when the public puts down its phones until after warm weather, the dealers get out their easy chairs, and manufacturers cut down their staffs to skeleton office forces. That will not be true of the regular experimenters this year for, altho vacations and out-door sports make demands on all of us which we cannot deny, there is too much ahead in radio for us to drop behind.

This may not seem like the right time to again increase the size of R and M. Perhaps it isn't. But to tell the honest truth I'm going to push and push right thru this summer so that, when fall comes, I can surprise you. I have some real ambitions for this magazine that you and I have been working on to put across. I say you because almost every reader has pitched in to help get subscriptions, offered suggestions and criticisms, and got his local news dealer to carry R and M in his store.

You remember when the magazine had only eight pages? Then twelve, sixteen, twenty-four, and now thirty-two? We've got to keep it climbing—not so as to make it into a popular magazine with news pictures and photographs of broadcast entertainers, but so that we can give you a wider range of ideas to make your radio work more interesting. There are so many things to do in radio that there's no trouble in getting articles. The problem is to get enough pages to carry them.

This summer we've got to carry on a regular camp meeting. Instead, however, of getting a lot of religion to keep us good thru the winter, we must whip R and M into shape ready for big things this fall. You must take charge of the field work, while I make things hum at the home office. If you are a subscriber you will find with your magazine this month a double form. One half of this form is for a new subscription. Among your acquaintances I know there is at least one man who should get R and M but doesn't. Don't give him the blank and ask him to send it in. Fill it out for him, get his dollar bill, and see yourself that it is put in the letter box.

Then take the other blank to your local radio dealer. Study it so that you will understand what it says. Show him a copy of R and M, tell him what you think of it, explain to him our idea of insuring the success of the Experimenters' work. Then explain to him that by paying six dollars he will get ten copies of the Magazine each month for twelve months, a total of one hundred and twenty copies. These he will sell for ten cents each, or twelve dollars, a profit of one hundred per cent on his investment. Again—don't leave it to him to send in the blank. See that he makes out his check for six dollars and watch it until it drops in the mail box.

If you aren't a subscriber, you can do your part by pinning a dollar bill to a sheet of paper bearing your name and address and mailing that into R and M. Then the Magazine will be sent directly to your home each month.

Don't fail on this job, now, for the success of the plan depends upon the work done by each and every one. With this help from you we're going to swing R and M right into line in a way that will surprise us all.

Remember that I'm counting on you.

In this issue is the second article on radio frequency amplification. Our editorial conference board which plans the articles each month has been hesitant about taking up this subject because radio frequency circuits have seemed too difficult to handle. The vacuum tube situation has further complicated matters, since the type of tube greatly affects the results obtained. Thorough tests and careful experiments show that radio frequency sets can be made easily if the instructions are followed carefully. Substitutions and changes in design are not advised, however, for they are liable to upset the balances which have been determined during the development work done on these sets. If you have tried radio frequency amplification before, and failed to get results, you will be much surprised to see what the two-step radio set, described in this issue, will do.

It is very important for those who are planning to be on hand with the gang to make the Radio Cruise to get in their reservation orders just as early as possible. The Cunard Line is already booking passengers for this summer and fall. If you make your reservations early you can get a much better stateroom than you will at the last minute. Moreover, you can then get a stateroom for two, three or four people if some of your own friends are going too.

M. B. SLEEPER,
Editor.

A New Idea In Tuning Circuits

This new device does away with primary inductance switches and the coupling adjustment on short-wave receiving sets.

WE have been so accustomed to using switches to adjust the antenna circuit inductance and a rotating ball to vary the secondary capacity that, as often happens in other things, we have not thought of doing anything else.

The new tuning device, or fixed coupler, illustrated in Fig. 1, is a radical departure from current practice. It is equally an improvement both in design and operating qualities. Practically all receiving sets which employ vacuum tubes require very nearly zero coupling between the primary and secondary coils. This adjustment is seldom changed. Consequently there is little advantage in having it adjustable except for those who like to have knobs to turn.

That it is unnecessary to tune the primary circuit can be demonstrated by setting the inductance switches at any points and tuning in signals. Then change the switches, readjust the secondary condenser, and the signals will come in as before. Change the switches again and you will find that the signals can be brought back by the secondary condenser. This is conclusive evidence that switches, too, are unnecessary.

A point that experimenters do not seem to consider is that in most variocouplers there are fewer turns on the coupling ball than on the antenna coil. This results in a voltage step-down. The vacuum tube, however, is a voltage operative device and requires the highest possible voltage on the grid. It is for that reason that the capacity of the secondary tuning condenser is kept as low as possible. It seems strange that the turn ratio in the coupler has not been considered before.

In this new fixed coupler there is a voltage step-up of one to eight.

Tests made on a variety of circuits show that, on wavelengths from 175 to 700 meters there is no advantage in the conventional variocoupler design over the fixed coupler. In fact, if there is any choice in signal volume it is in favor of the fixed coupler. As for sharpness in tuning the new design appears to be superior. Moreover, to cover a range of 200 to 600 meters, an 11-plate condenser can be used, where otherwise at least a 23-plate size would be necessary. This is made possible by the extremely low distributed capacity in the secondary winding. The radio frequency losses are also reduced to a minimum by the design of the frame-work holding the secondary coil. This causes a material improvement in the signal strength and sharpness of tuning.

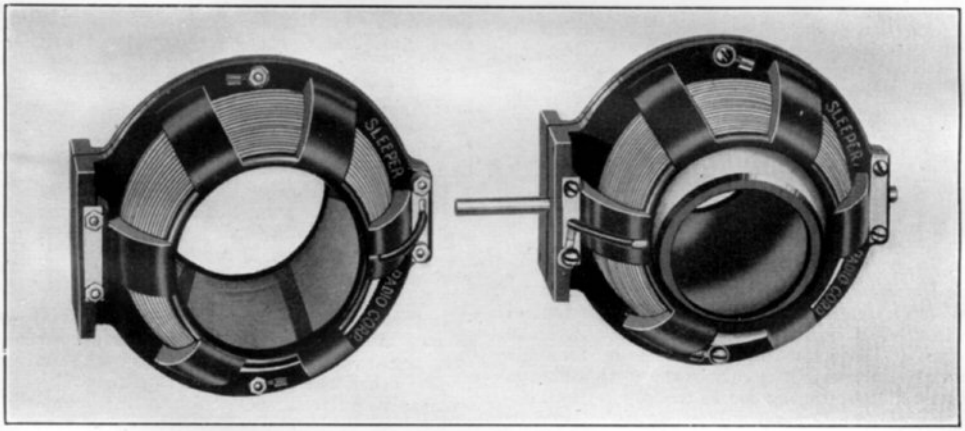
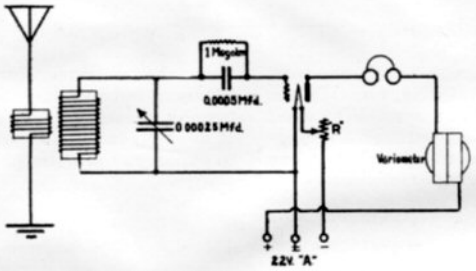


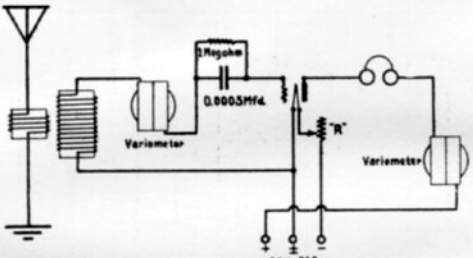
Fig. 1. At the left, the new fixed coupler; the variometer for use with it at the right

In Fig. 2 are circuits for the fixed coupler. The first is a 3-circuit tuner with a variable condenser in the secondary circuit and plate variometer. The second diagram is of the familiar 2-variometer type. These sets have only two controls as compared to at least five in the conventional 3-circuit outfits.

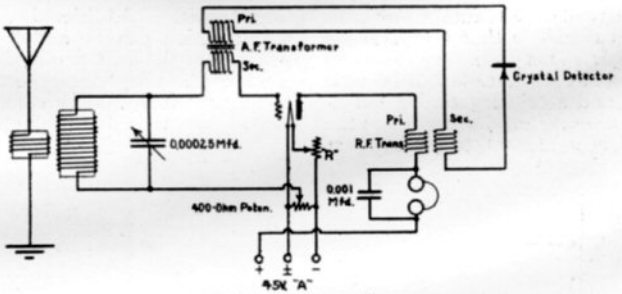
Only one control is needed in the 1-tube Reflex set or the receiver with radio frequency amplification. The 1-tube Reflex set is described in detail in the April 1923 issue of RADIO and MODEL ENGINEERING. The radio frequency set is designed for UV 199 vacuum tubes, which accounts for the method of connecting the grid-filament circuit. Acme transformers R2 and R3 are recommended for this circuit.



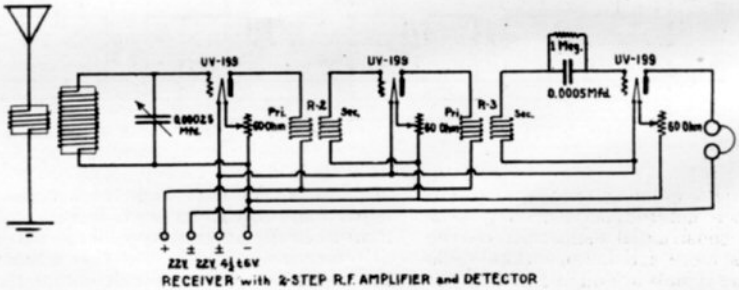
3-CIRCUIT TUNER with 1 VARIOMETER



3-CIRCUIT TUNER with 2 VARIOMETERS



1-TUBE REFLEX RECEIVER



RECEIVER with 2-STEP R.F. AMPLIFIER and DETECTOR

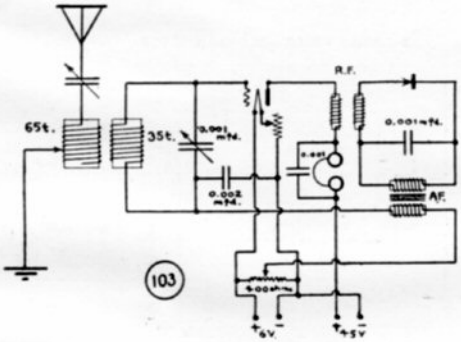
Des. by M.B.&	RADIO and MODEL ENGINEERING	
Dr. by I.L.L.	TUNING CIRCUITS for the	
Ch. by	FIXED COUPLER	
In Chg.	Pt. No.	
Scale	Job 7777	Apr. 25, 1923
Limits	Dr. 88	Sheet 1

Fig. 2. Some of the standard circuits in which the fixed coupler can be used. Only two tuning controls are required in the regenerative sets, and one in the reflex type

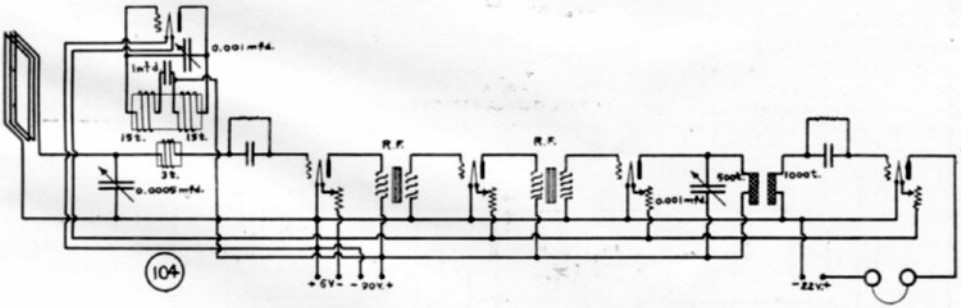
101 Receiving Circuits

Last Installment

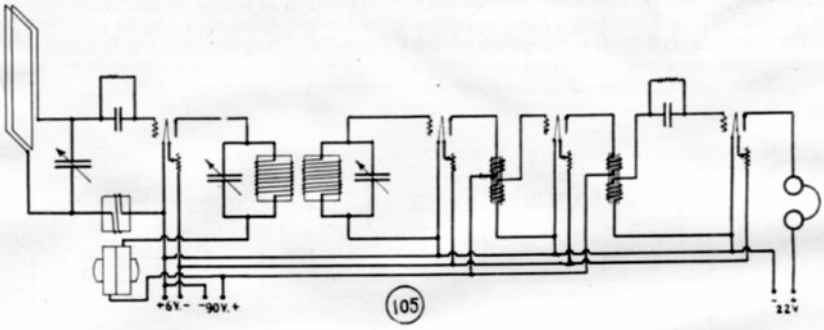
102. A reflex circuit using a vacuum tube detector is illustrated in this diagram. This is one of the successful reflex circuits. Very good results have been obtained with it on long-distance work. Note that the primary of the radio frequency amplifying transformer is tuned by a condenser of 0.0005 mfd. The antenna inductance can be of the ordinary type or a honey-comb coil of about 60 turns. It is important to arrange the wiring carefully to avoid coupling between the various circuits.



103. The particular advantage of this single tube reflex circuit is that a crystal detector is employed. This gives very clear and quiet speech. Honey-comb coils can be used for the primary and secondary tuning inductances. The 400 ohm potentiometer across the filament battery is important to get the best adjustment. Additional audio frequency amplification can be added by inserting the primary of the next amplifying transformer in place of the telephones. If a loop antenna is to be used it should be connected in place of the 35 turn secondary inductance.

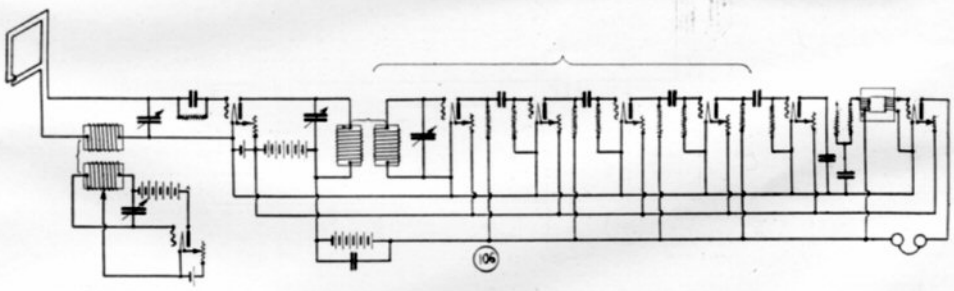


104. There is a growing tendency toward the use of super heterodyne receiving sets. When properly constructed a super heterodyne receiving set is more satisfactory than radio frequency. The signals are augmented by the application of an additional voltage from the radio frequency oscillator. This oscillator is tuned to a wave length 50,000 cycles above or below the frequency of the incoming signals. Then the 50,000 cycle beat note is amplified for one or more steps and again detected. Radio frequency amplification is far more efficient at low frequencies than high frequencies, giving much more signal strength increase per step than when the ordinary type of radio frequency amplifier is employed. Another advantage in the super heterodyne circuit is that the wave length range is not limited by the resonance curve of the transformers, as the 50,000 cycles is obtained by adjusting the oscillator to a frequency different by that amount from the frequency of the incoming signals. Tuning is sharper than in ordinary radio frequency amplifier sets.



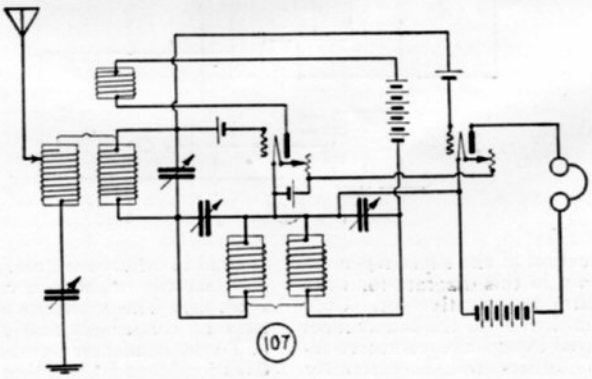
105

105. A different arrangement for a super heterodyne set is shown in this diagram. The first 50,000 cycle amplifying transformer is made of two honey-comb coils of about 1250 turns shunted by condensers of 0.001 mfd. Once these condensers are adjusted no further change is necessary. A variometer is inserted in the plate circuit of the first tube to make it self-oscillating. In this way the use of a separate oscillator is obviated. This is not quite as efficient as the other method, however, as it requires the detuning of the receiver to give the 50,000 cycle beat note.



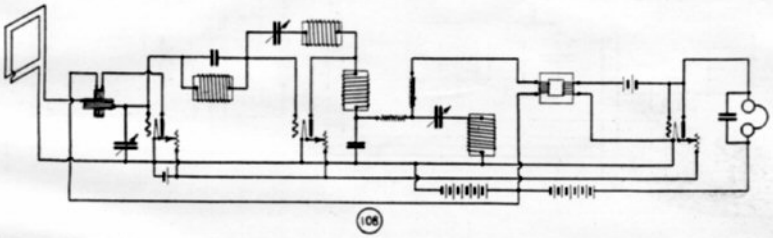
106

106. Resistance coupling is employed in place of the 50,000 cycle transformers in this circuit except for the first stage which is arranged in a manner similar to that shown in 105. A separate oscillator is employed for this receiver. Unlike the one shown in 104, a separate B battery must be employed for the oscillator, although the same A battery can be used for all the tubes. The coupling resistance must be of the same resistance as the impedance of the tubes, usually about 20,000 ohms. Gridleak resistances are of 1 megohm.

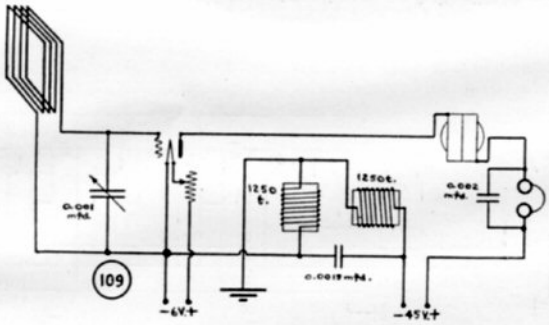


107

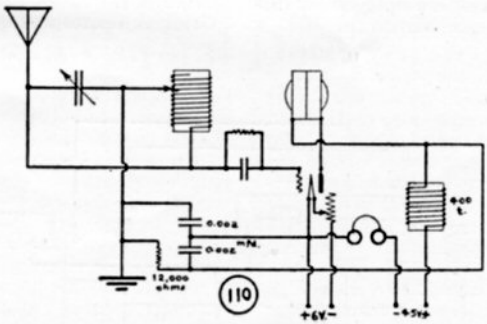
107. Here is one of the most widely used super regenerative circuits. This type of circuit is best adapted to the reception of undamped waves, as super regenerative circuits usually cause considerable distortion in the reception of spark or telephone signals. Considerable experimenting is required to get the proper arrangement of the inductances, in order to produce correct coupling between the various coils.



108. Another super regenerative circuit is illustrated in this diagram. Experimenters should not attempt the construction of super regenerative sets unless they are prepared to meet with considerable initial discouragement for they do not, as a rule, work satisfactorily except after much experimenting. A particular difficulty encountered is in the elimination of the 10,000 cycle squeal.



109. This super regenerative circuit, usually called the Flivver or Flewelling set, is one which has given very satisfactory results. It is sufficiently easy to build and operate to be a safe problem to tackle. The constants of the coils and condensers are shown as they have been worked out in actual practice. A vernier adjustment is needed on the tuning condenser and also on the rheostat.



110. A modification of the super regenerative circuit is shown in this diagram for what is called as an ultra regenerative set. Condensers of 0.002 mfd. replace the inductances more often employed in super regenerative receivers. Like the others this is extremely critical in adjustment and cannot be operated satisfactorily without a careful study of the controls. The constants are given for the resistance condensers and coils. The gridleak and grid condenser are of the usual design, 0.0005 mfd. and 1 megohm respectively.

Practical Notes on Portable Sets

These suggestions will be found helpful to experimenters who are planning portable outfits for summer use.

ONE of the first questions to be decided in designing a portable is the type of antenna to be used for all other factors in the design of the outfit will depend upon this decision.

There is only one type of receiver which will operate satisfactorily and dependably on the loop antenna, that is the set with high frequency amplification, either straight radio or superheterodyne. Ordinary regenerative receivers, no matter what circuit is used, or the amount of audio frequency amplification added, will not do good work, except on a regular antenna.

These limitations for regenerative sets are not as serious as they may sound, however. If you take your set out in your automobile, it is only necessary to stop near a tree of moderate size. Then lay out on the ground 50 to 100 ft. of No. 18 annunciator wire (No. 16 S. W. G.) fitted with a weight at the forward end. Simply throw the weight with the wire as high as possible into the tree and connect the other end to the antenna binding post of your set. A wire can be fastened to the frame of the car as a ground. When no motor car is available for the ground connection two or three spikes can be driven into the trunk of the tree and connected together as the ground, or a plate of metal one foot square can be dropped into a near-by brook. With such an antenna and ground very good work can be done. A wire fence is also a good antenna. Sometimes it is advisable to connect a mica condenser 0.0005 mfd. in series with the lead from the fence.

A plain radio frequency amplifier of two steps, with a detector and two step audio frequency amplifier will produce signals of considerable volume when receiving on a loop about 2 ft. square, made up of 8 to 12 turns spaced about ¼ inch apart. Sometimes it is more convenient to wind on the turns close together and bind them into a single cable. This is particularly true when the loop is to be of collapsable construction. Sets are often made with the loop built right into the cover. This is a very convenient design, except for the fact that the set must be turned around to orient the antenna. A very handy mounting for a set of that sort is a sturdy tripod, such as can be obtained at photograph supply stores.

Reflex sets using two tubes and a crystal detector will operate on a loop for telephone reception, but do not give sufficient volume for loud speakers unless the outfit is set up quite near a broadcasting station. The three tube set, with a crystal detector, however, will operate a loud speaker at considerable distance, even on an 18 inch loop. For such reception the Grimes circuit is particularly recommended.

With the new low current tubes it seems offhand an easy matter to put together a portable set, since the battery problems have been so well solved. This is not entirely true in practice. The W. D. 11 or W. D. 12 tube is not suitable for radio frequency circuits and is not a particularly efficient amplifier. The UV 201-A tube is generally considered to be a dry cell tube. In practice it has not been found practical to operate the UV 201-A on dry cells for the filament puts too heavy a load on the batteries. Moreover the plate current is very high. A three tube set using these tubes must have large size B batteries. Small B batteries, such as the Ever Ready 763 will not last for more than two hours and give out in a comparatively short time. The 767 Ever Ready battery has sufficient capacity, but as 90 or 135 volts are required they are too heavy.

It is advisable, therefore, in planning a loop receiving set to use the two tube reflex with a crystal detector, for the small B batteries will then be sufficient. A storage battery is necessary for the UV 201-A tubes. When the set is to be taken out in a motor car a cord and plug should be arranged for connection in the lamp socket on the dashboard. While the current drawn is too heavy for dry cells, it is less than that taken by the light, so that no excessive load is put on the automobile battery.

Of course, the UV 199 tubes are ideal for portable sets, but they are very hard to get. If you do decide to use this type of tube, it is well to install standard sockets and fit them with adapters for the reason that, if you are finally unable to get the UV 199's or burn one out and cannot get another for replacement, you can then substitute the UV 201 or UV 201-A.

When UV 199 or UV 201-A tubes are used the current through the phones is so heavy, compared to that when UV 201 tubes are employed, you may find some difference in the signal strength upon reversing polarity of the phones. The reason is that the heavy current flowing when no signals are coming in tends to increase or decrease the magnetism of the magnet cores. An ideal system is to use a telephone transformer, the primary of which is inserted in the plate circuit instead of the phones, while the secondary goes to the telephone receivers. Then no current at all flows through the phones except when signals are coming in.

Remember when you plan the design of this set to make it sturdy and rugged. Portable equipment is bound to be more or less roughly treated and flimsy construction will surely cause trouble. While minor repairs can be made in the field, there is nothing more discouraging than to set up the outfit only to find

that parts have come loose or connections broken because they were not well made. A necessary precaution is to solder all nuts to the screws so that they will not jar loose.

Remember too that a rain storm may come up at a time when it is not possible to adequately protect the radio outfit. For that reason, it is worth while to put a little more work into the carrying case to make it reasonably weatherproof. An auxiliary cover of canvas or rubberized cloth provides such protection and also keeps the cabinet from being damaged while the equipment is being moved about.

Portable sets should always be of single purpose design. Complicated equipment for tuning to long wavelength ranges is always unsatisfactory. Therefore, the tuning circuits should be designed for 200 to 600 meter reception or for the particular class of stations to be copied. The untuned primary type of coupler is particularly well adapted for portable sets, as it eliminates the use of switches and the coupling adjustment. The type of mounting employed in the type 4600 receiver is substantial and simple and it takes up very little panel space.

It is a good idea to mount the vacuum tube sockets on a shock absorber. Another idea for protecting the tubes in transit is to mount three sockets on a strip of rubber cut from an old inner tube. When the tubes are not in use they can be put in the auxiliary sockets and carried, without danger of breakage, on the rubber mounting.

Arrange some sort of protection for your B batteries too. If the wax becomes cracked they will quickly absorb moisture and there will be a very considerable leakage across the terminals. Moreover the individual cells will leak around the sealing at the upper end. Mount them vertically as an additional protection against that difficulty.

Simplified Reinartz Receiver

Continued from page 82

heard there is an opening in the plate circuit or else the B battery is run down. Notice also if the socket contact springs show little shiny marks from touching the tube contact pins. If they do not, the contacts are not touching the pins. A short circuit in the variable condenser can be located by connecting the battery and phones across the terminals. Even though a coil is connected around the condenser there will be enough difference in the resistance when the condenser is short circuited to make a sound in the phones. Also test the windings for open circuits. Occasionally, the coil terminals become loose after the wires have been soldered. These should be tightened up.

In operation you will find that the wavelength condenser tunes in the station and the regeneration condenser controls the signal strength. Because the regeneration condenser must be very sharply tuned it is sometimes an advantage to bring the filament down to a little less than normal brilliancy. Then, when the regeneration condenser has been brought up nearly to the point of oscillation, the final adjustment can be obtained by slightly increasing the filament brilliancy.

It is not practical to use more than one stage of radio frequency amplification with this set. The type 4300 one-step radio frequency amplifier is suitable for use with this receiver. Do not try to receive long-distance on a loop connected to the Reinartz set for it will not do good work. On an indoor antenna or a 100-ft. single wire outdoor antenna, very long distances can be covered and, by means of an audio frequency amplifier the stations can be brought in with sufficient strength to operate a loud speaker.

Substituting a Crystal Detector for an Audion

If you examine an audion detector circuit and compare it with the wiring of a crystal set you will see that it is an easy matter to substitute the latter for the former. Once in a while an emergency arises when such a change is necessary. Here are two ways in which it can be done.

Mount a crystal detector on a Formica disc of the proper size to fit in the base of a burned out tube. Connect one side of the detector to the grid pin, and the other side to the plate pin of the base. Leave the other two pins open. When this device is plugged in the detector tube socket it puts the crystal in series with the telephones. However, the other side of phones, connected to the positive side of the B battery, is open. Therefore that terminal must be connected to the A battery post to which the tuning circuit is also joined. Ordinarily this is the positive A battery terminal. Check your wiring carefully so that you will not short either battery.

With the crystal plugged in you can operate your set in the usual way. An audio frequency amplifier can be hooked in at the telephone terminals, just as is done when the audion is working.

You may not find it convenient to adjust the detector inside the cabinet. In that case mount two binding posts on the tube base, connect them as before, and bring leads out to a crystal detector set up on the table.

Remember this stunt next time your detector burns out or your battery drops down just at the time you are specially anxious to use your set.

A Radio Frequency Set That Works

You will not have the trouble with this receiving set that so many experimenters have found with radio frequency amplification.

Advantages of Radio Frequency

IT sometimes happens that a new and good idea is launched in such a way that its development is very greatly hindered and delayed. This has been particularly true of radio frequency amplifying circuits. The concensus of opinion from those who had worked on radio frequency circuits for short wavelengths, during the war, was that these circuits were not practical for general use. When, later on, radio frequency transformers were put on the market they were not satisfactory, and sufficient information concerning their use was not available. At the same time articles appeared in some of the magazines enthusiastically reporting results obtained with radio frequency amplifiers. This enthusiasm was overdone, with the result that Experimenters working without complete information and using transformers which were not properly designed became discouraged, and, as a result, this type of amplifier lost the popularity it might have had from the beginning.

In the meantime, engineers in the various manufacturing concerns and Experimenters working on their own initiative have developed the transformer design and the circuits to a point where they are more successful than ordinarily admitted by those who had unfortunate experiences in the beginning.

Radio frequency amplifiers which do not work are most discouraging devices, but when a set of that type does work it brings out new possibilities which are not yet fully realized.

There are, of course, very definite limitations, particularly when transformers are employed. These limitations are not serious, however, for the latitude of application is sufficiently broad to cover the requirements of amateur and broadcast reception. It must be borne in mind, first off, that the real purpose of a radio frequency amplifier is to do the work which the detector cannot do. It is not possible to operate a loud speaker on a detector alone without overloading the tube. It is true that loud speakers are sometimes operated directly from the detector, but when that is done, if the signals are of reasonable volume, the quality will always be found quite poor. Since the radio amplifier comes before the detector it does not raise the maximum limit of the energy which can be taken from the detector. Its purpose, therefore, is to bring all signals, far and near, up to the maximum output limit of the detector.

If the foregoing is borne in mind the real

Fig. 1. You will be proud of this receiving set with its two stages of radio frequency amplification and detector. The three binding posts at the right are for connections to an audio frequency amplifier

purpose of radio amplification will be understood and things it cannot do will not be expected of it.

General Description of the Set

Receiving sets which employ radio amplifiers must be of single purpose design. The wavelength is definitely set by the characteristic of the amplifying transformers. It is useless to attempt a long wavelength range, for the efficiency at the extremities will be too low to be worthwhile. The set described here is designed for 200 to 600 meters. This is about the limit for the Acme transformers used in this set. There was some discussion when the design was first planned as to whether or not this set should be arranged for a loop or a regular antenna. It was finally decided that the antenna would be used, although, as explained later on, a simple change makes it adaptable for loop reception.

The results obtained with the one-tube reflex set were so encouraging that the same type of coupler was employed for this receiver. That is, an untuned primary is coupled to a secondary coil of high inductance, shunted by a variable condenser of low capacity. The design was made just as simple as possible. The only features which might have been eliminated are the two rheostats for the two radio frequency amplifying tubes and the filament control jack. Because of the various types of tubes now on the market separate rheostats were provided to allow the use of UV 201 or UV 201-A tubes. A rheostat in the detector filament circuit is always essential.

A very interesting idea is introduced in this type of filament control circuit. There is no advantage, of course, in plugging in the telephones at any point other than the detector plate.

However, if the set is to be used with an audio frequency amplifier a special arrangement is required, so that, when the phones are plugged into the first or second step the first three tubes will light. By careful planning a method of wiring illustrated in Fig. 9 was worked out so that by adding the binding post at the right-hand end of the panel connections can be made to an audio frequency amplifier which will be described later or to one of the ordinary types in which filament control jacks are not employed. Remember that the post marked X must be connected to the positive A battery terminal if the special filament control circuit is not used in the amplifier.

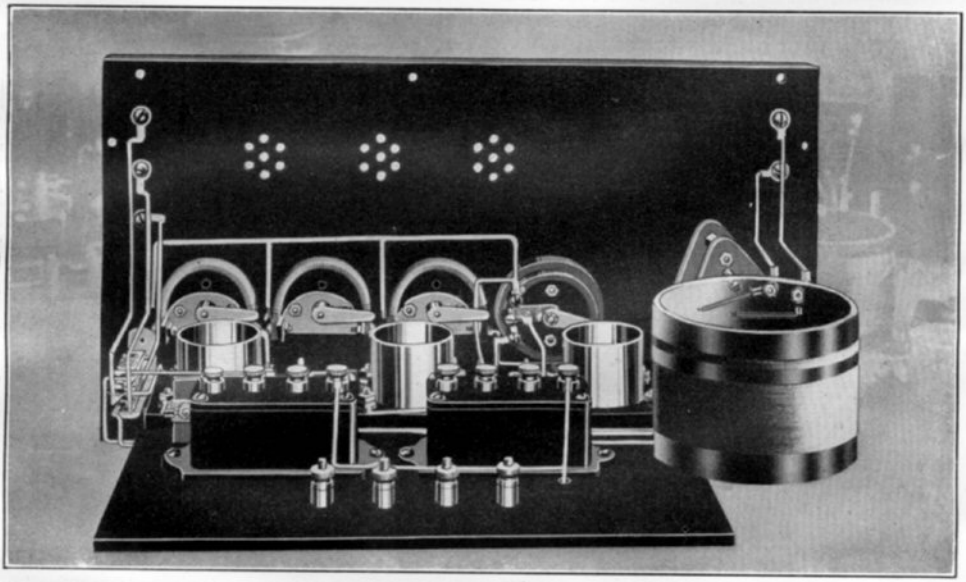


Fig. 2. In this set, too, the inductance is mounted on the variable condenser. Notice the two windings on the tube, the upper for the primary and the lower for the secondary circuit

Construction Work Required

Because of the limitations of most experimenters' shops, the design of this outfit has been arranged so as to call for as little special work as possible. The front panel, measuring 7 by 14 by 3-16 in., is a standard size that is readily obtainable, cut to those dimensions. This is also true of the base panel, 7 by 10 by 3-16 in.

The coil is of the same design that is employed in the one tube reflex set, type 4200. This is a simple winding of one layer without taps. No machine work whatever is required, except for the drilling of the holes. These are of common sizes, for which drills are always

available. As in all radio frequency sets it is absolutely necessary to use the utmost care and accuracy in the work. If you cannot solder neatly it will not be safe for you to attempt the building of this set, for joints crudely made will in almost every case cause trouble that will prevent the set from working properly.

Standardized Parts Employed

You will recognize readily the various parts which make up this outfit, for they are all from manufacturers of long standing. Moreover, these parts are on hand in practically every retail store in any part of the country. The panels are of Formica, chosen for its insulating qualities, its high finish, and its mechanical strength. This is also true of the tube which carries the inductance coil. Acme transformers, R-2, R-3, provide the coupling between the radio frequency amplifying tubes. It is important to use the two types mentioned for the results are much improved by the use of transformers of different ratios.

The 0.00025 mfd. variable condenser, socket, and rheostats were supplied by the Sleeper Radio Corporation. An important feature of the sockets is the mounting which they provide for the base panel. It will be seen from the illustrations that no support is required other than that provided by the sockets.

To keep the load on the A battery as small as possible a Fada potentiometer of 400 ohms is used. The filament control jack is the Pacent No. 66 type. This is a new jack recently brought out. It has the advantage over other filament control jacks of disconnecting the transformers entirely when the telephone plug is inserted.

A Dubilier fixed condenser of 0.0005 mfd. is connected in the grid circuit. It is just the right size to fit in conveniently between the transformer and socket, as you will see from the illustrations. No separate grid leak is employed but the surface of one end plate was scratched and pencil marks put on to provide a leakage path.

Laying out the Panels

Scale drawings for the front and rear panels are given in Figs. 6 and 7. These drawings are exactly one half size, making it an easy matter to scale off dimensions directly on to the panels by doubling each distance as it appears on the illustrations. This work should be done carefully so that the parts will fit together without trouble. Be sure before you start locating the holes that the corners of the panels are perfectly square, for otherwise your measurements will not come out right. If you are not able to get panels accurately cut, choose one side, preferably the top or bottom, and work from that side alone in drawing vertical lines.

A line should be scratched across the center of the panel and a similar line made on the drawing at the center, then horizontal distances can be laid out from the center line.

A polished finish on the panels is becoming more and more popular. Not only does a polished panel retain its color, without turning

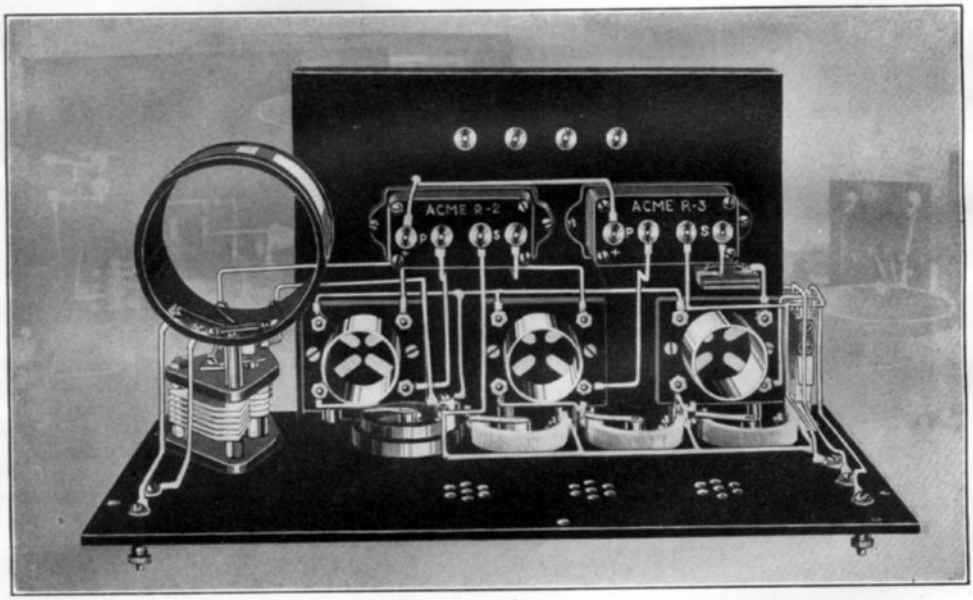


Fig. 3. The base panel which carries the transformers and battery binding posts is secured to the under sides of the sockets, and they, in turn, are fastened to the rear of the front panel

gray or brown, but it presents a surface which does not easily collect dust, as is the case when the panel is rubbed down with oil and sand paper.

Note that all holes are to be made with a No. 18 drill unless otherwise specified. Holes for the condenser and rheostat shafts should be made oversize, because it is difficult to locate the holes for the mounting screws exactly. Consequently if a 3-16 in. shaft is put thru a 3-16 in. hole it is sure to bind and turn irregularly.

Winding the Coils

As shown in Fig. 7 the tube measuring 3½ in. in diameter by 2½ in. long, with a ⅛ in. wall, is wound at the upper end with six turns of No. 24 S. S. C. wire (No. 22 S. W. G.) and at the lower end with 50 turns of the same size wire.

The primary winding starts ½ in. down from the top of the tube. The secondary is begun the same distance up. This allows a separation of approximately 3-16 in. between the coils. The terminals are made up of ¼ in. 6-32 R. H. screws fitted with lugs on the inside for connection to the ends of the coils and on the outside for the external wiring. Coil mounting pillars are used to fasten the tube to the rear plate of the variable condenser. They are 11-16 in. long by 5-16 in. in diameter, threaded for 6-32 screws. The centers of these pillars are 2⅛ in. apart. Holes on the variable condenser plate are in line with the supporting posts which hold the fixed plates.

Assembling Wiring

All the parts should be ready for assembling before any of them are put together. In the following instructions the steps are arranged in the proper order so that there will be no interference or necessity for taking apart things that have already been put together. The complete instructions should be read carefully before the work is begun.

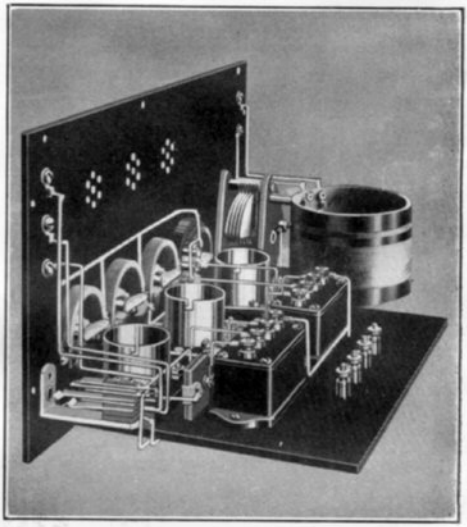


Fig. 5. This view shows in detail the filament control jack and the connections to it

1. Mount the five binding posts, Nos. 15, 17, 19, 35, and 37 on the front panel. Put a soldering lug between the screw head and

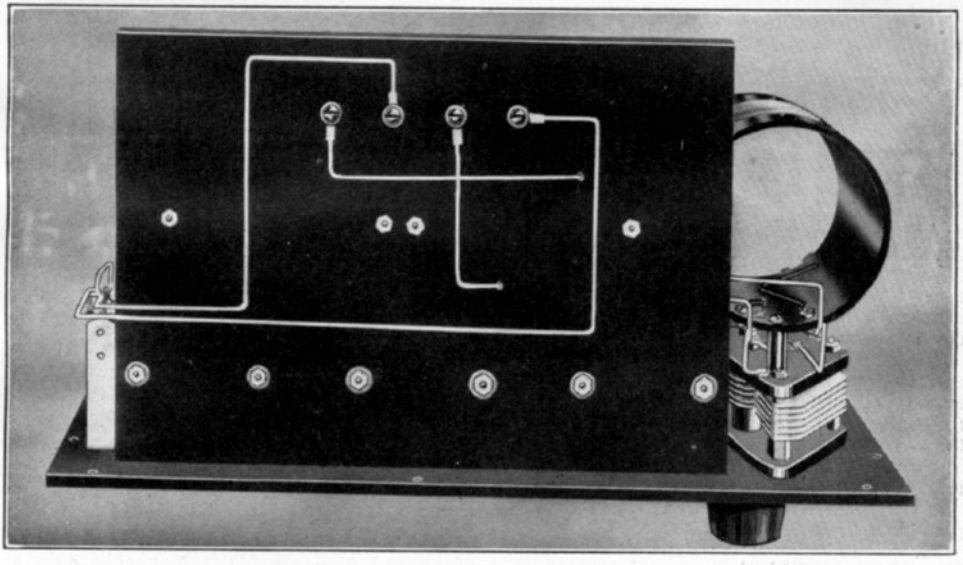


Fig. 4. You can see from this illustration the arrangement of the wiring to the binding posts. This is much neater than to run the wires around on the upper side of the base panel

washer of each one. The lugs should point in the direction indicated by the short heavy lines in Fig. 8.

2. Mount the three rheostats on the front panel, but do not put on the contact arms and knobs. Each rheostat should be fitted with soldering lugs, pointing in the correct direction, before it is screwed in place. Also mount the potentiometer on the panel.

Note that binding post bases 5-16 in. high are set between the panels and the sockets. You may find it necessary to cut off the screws. An easy way to do that is to turn a 6-32 die on to the screw, clip off the end, and remove the die. In this way the thread is left clean.

5. Connect 7 to 8, 9 to 10 and 11 to 12.

6. Mount the filament control jack.

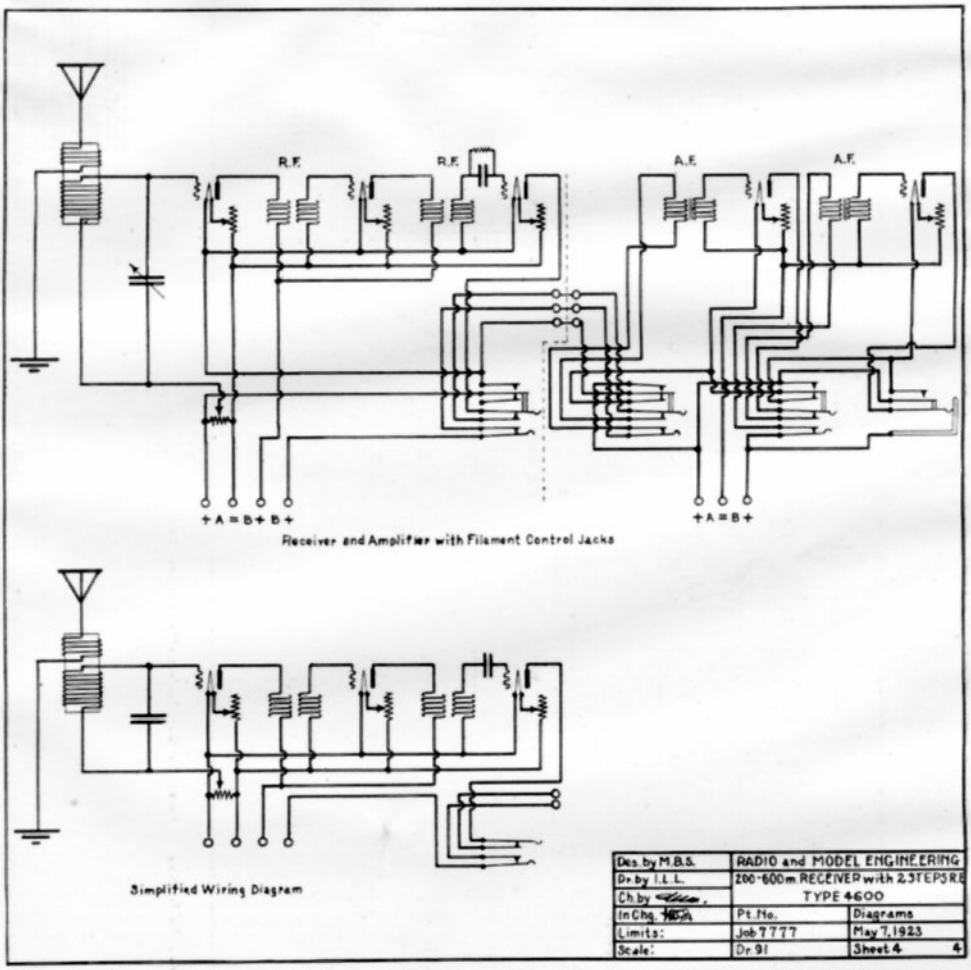


Fig. 9. Above, a schematic diagram of the set and the filament control type of audio frequency amplifier. Below, a simpler system of connections for the set when filament control jacks are not used

3. Using square tinned copper bus bar bend a short length so as to fit from 1 to 2. Use great care in soldering and the least possible amount of paste. Have your wire hot enough so that it makes the solder flow freely. Use only a little solder but make it run all around the joint. In the same way connect 3 to 4 and 5 to 6.

4. Mount the three sockets on the front panel using ¾-in. 6-32 round R. H. screws.

7. Connect 13 to 14. 14 is the fourth contact up on the jack. Connect 15 to 16. 16 is the top terminal of the jack. Connect 17 to 18. 18 is the second contact up on the jack. Connect 19 to 20. 20 is the third contact up on the jack.

8. Mount the four binding posts on the base panel, fitting them with soldering lugs. Then, by means of ¾-in. 6-32 F. H. screws fasten the base panel to the under side of the sockets.

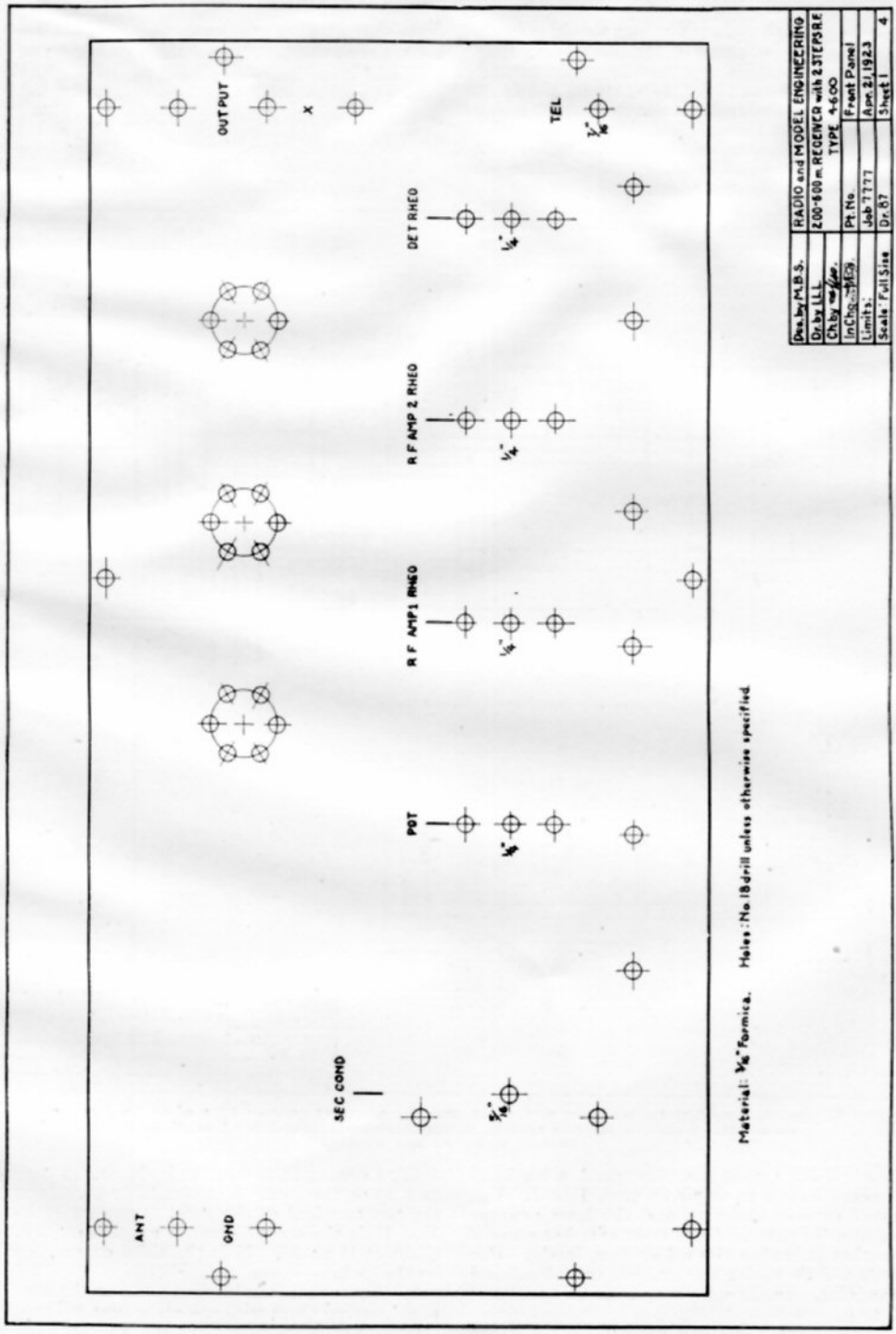


Fig. 6. Exactly one-half size. The layout of the front panel. Since a standard size, 7 x 14 ins., is used, you can get a stock cabinet to fit it

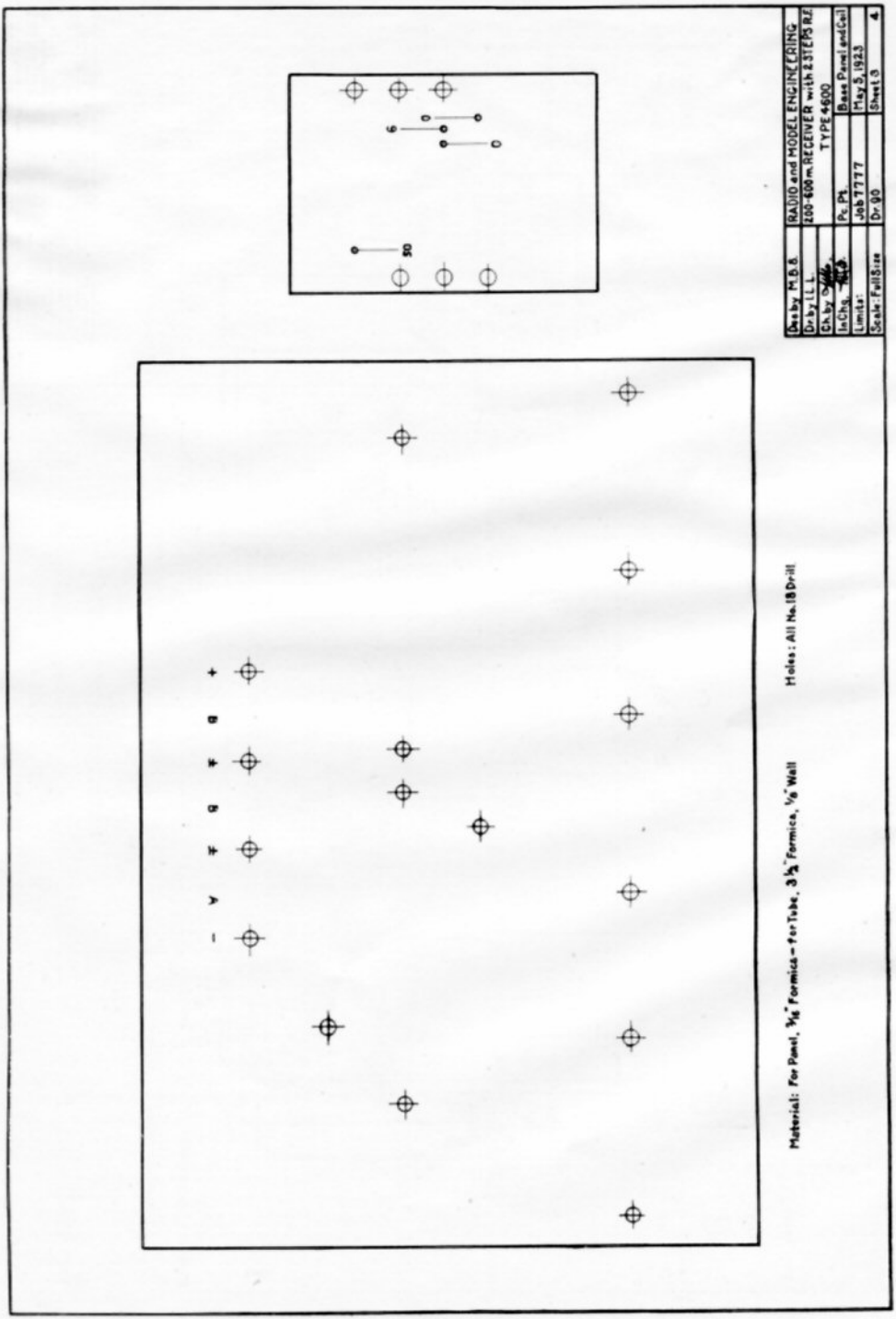


Fig. 7. Exactly one-half scale. These drawings show the base panel and the tube for the coil. Small circles show where the windings start and stop

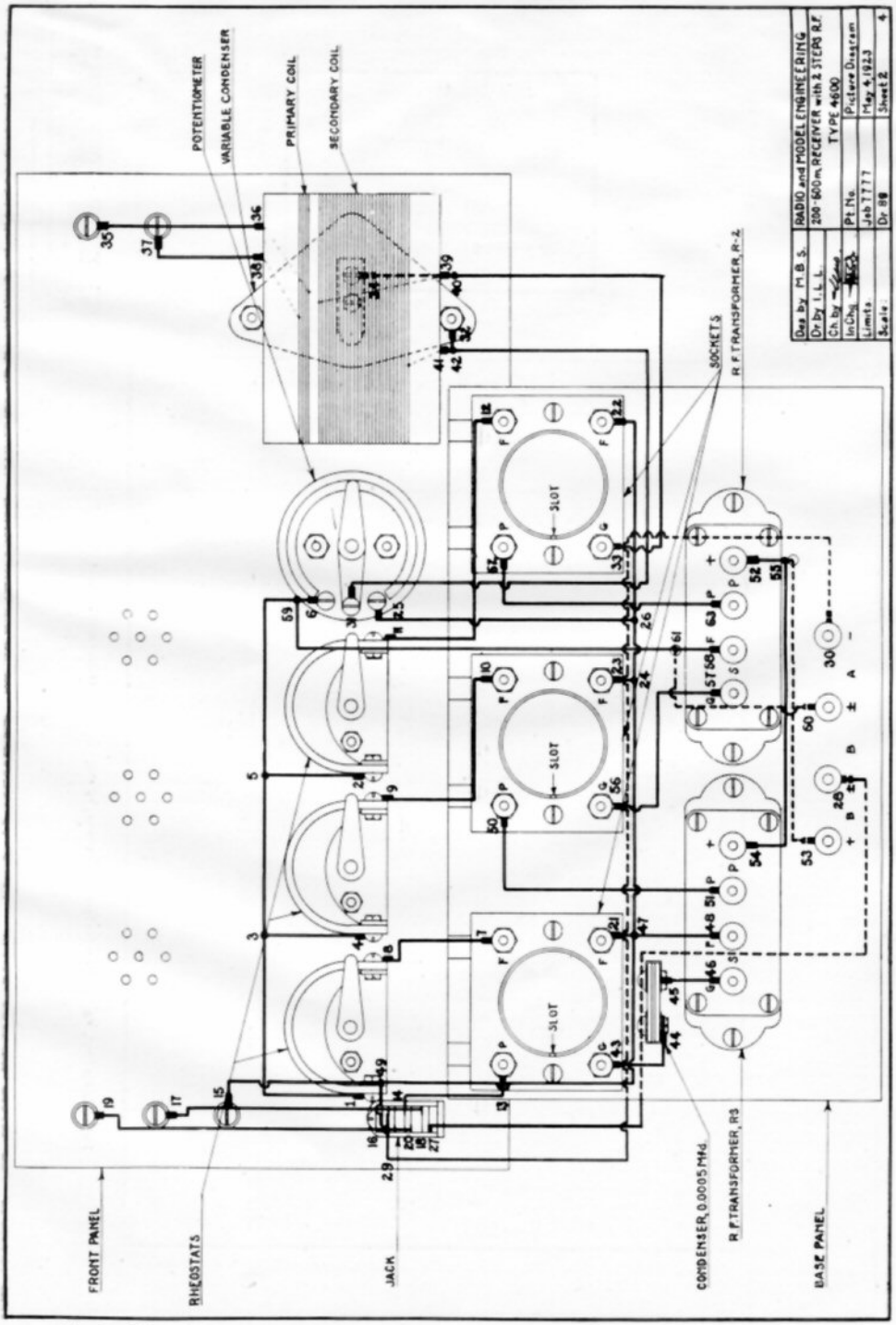


Fig. 8. The wiring as it actually appears on the set. Each connection is marked with a numeral in the order in which it is made

The No. 18 holes in the base panel provide a little clearance around the screws, so that the base panel can be set flush up against the front panel.

9. Connect 21 to 22, 23 to 24, 25 to 26 and 27 to 28. 27 is the bottom contact on the jack. Connect 29 to 30. 29 is the second contact down on the jack.

10. Secure the coil mounting pillars to the rear condenser plate by means of ½-in. 6-32 R. H. screws. Mount the condenser on the front panel with the screws provided.

11. Connect 31 to 32 and 33 to 34.

12. Mount the coil on the pillars at the rear of the condenser, using ½-in. 6-32 R. H. screws. Make sure that the primary coil is up.

13. Connect 35 to 36, 37 to 38, 39 to 40 and 41 to 42. The lugs at 36 and 38 are terminals for the primary winding, and 39 and 41 for the secondary winding.

14. Mount the radio frequency transformers. Make sure that the terminals are as indicated in picture wiring diagram.

15. Connect 43 to 44 and 45 to 46. The 0.0005 mfd. Dubilier condenser must be fitted with lugs held in place by ¼-in. 6-32 R. H. screws and nuts. Connect 47 to 48, 47 to 49, 50 to 51 and 52 to 53. Note that this wire goes through a hole in the base panel so as to make connection to 53 from the under side. Connect 54 to 55, 56 to 57, 58 to 59 and 60 to 61. This wire also goes through a hole in the panel. Connect 62 to 63. This completes the wiring of the set.

16. Put the indicating knobs on the rheostats with the white lines on the knobs and panel coinciding when the contact arms are in the positions shown in Fig. 8. Put the knob and dial on the condenser with the 100-division mark coinciding with the line on the panel when the plates are totally interleaved.

Changes in the Circuit

Fig. 9 shows the schematic wiring of the set as it appears in Fig. 8. There is also a diagram showing the simplified connections for those who do not want to use the filament control circuit. The latter is not much more difficult to wire, however, so that there is little advantage in the second diagram.

If the set is to be used on a loop no inductance coil is necessary. Instead 32 should be connected to 37 and 34 to 35. This puts the loop directly across the variable condenser, taking the place of the coil.

Testing and Operating

When you are ready to hook up the receiver attach the antenna and ground wires, plug in your telephones and connect the A battery, of the correct voltage for the tubes used, across 30 and 60. Do not put on the B battery until you have found that the filament lights properly. Then connect 22 volts across 28 and 60, putting the minus lead on the 60 and the plus lead on 28. Put the 22 or 45 volts across 28 and 53, the negative lead going to 28 and the positive to 53. As the potentiometer is turned around the circuit should oscillate. This condition is indicated by a plucking sound when the grid terminal of the detector tube is touched with the finger. If the set seems to be dead, withdraw the telephone plug slowly until the plate circuit is open, but the filament circuit is still closed. There should be a strong click in the phones when this is done; if no click is heard there is an open circuit in the plate or in the telephones themselves.

To pick up signals set the potentiometer so the circuit oscillates slightly and turn the condenser back and forth. As soon as the whistle of the transmitter is heard leave the condenser at that point and turn the potentiometer until the set stops oscillating. Then get a final adjustment with the condenser. Advancing the potentiometer a little more may strengthen the signals, but this must be done carefully for, if it is turned too far, the circuit will oscillate again. Operating this set in New York stations several hundred miles distant can be brought in with considerable strength. One or two step of audio frequency amplification increase the volume to a point where a loud speaker can be used to fill a large room.

Some question has been raised as to whether the Acme transformers will operate with UV 201-A tubes. We have been most successful with this combination and with UV 199 tubes, in spite of the apparently large difference in their capacity. One of the reasons for this effect is probably that the transformers are adjusted to different wavelength peaks.

Last Minute Notice

Just as we are going to press one of our dealers in Philadelphia writes that he has come across some back numbers of R & M that had been tucked away out of sight, and that he is sending them in. With these copies we can make up ten of the bound volumes starting with the February 1922 issue. Therefor, the first Experimenters who send in orders will receive volumes dating back to February.

A further description of this special offering is given on page 100.

Hazeltine Neutrodyne Set

Complete circuit details of the Hazeltine Neutrodyne Receiver and a full size drawing of the transformer tuning units are given in a special set of two blue prints. Instructions for balancing the neutralizing condensers are also furnished. This is one of the most interesting circuits for radio Experimenters. The design presented in these prints is for tuning from 200 to 600 meters. The price of the set is one dollar. No charge is made for postage on blue prints.

A Complete List of Full Size Blue Prints Now Available

To those Experimenters who have trouble in scaling off dimensions from the one-half scale drawings in R and M, the full size blue prints are particularly helpful. The print can be laid directly on the panel and the hole centers pricked right thru the paper. The sets listed below include the panel and coil drawings and the schematic and picture wiring diagrams.

Type X-1900, 150 to 600 meter super-range receiver, a 3-circuit regenerative set with a detector, 3 sheets ..... $.75

Type 3100, 2-step audio frequency amplifier with telephone jacks. For use with any of the receiving sets except the type 3900, 3 sheets ..... .75

Type 3300, Reinartz tuner, one of the most popular sets ever described in R and M. A splendid set for all-round reception on 200 to 600 meters, 4 sheets 1.00

Type 3900, Non-regenerative receiver for 150 to 600 meter. It can be loaded for reception on any wavelength. A detector and 2-step amplifier, with telephone jacks, are included in the set. 2 sheets, one-half scale ..... .50

Type 4000, Sleeper circuit set. Exceptionally fine for long distance reception on a short indoor antenna. It is also well adapted to portable use. 3 sheets ..... $.75

Type 4100, Single-circuit regenerative set for 200 to 700 meters. This is of the popular type using a variometer in the plate circuit for regenerative control. 2 sheets ..... .50

Type 4200, One-tube reflex set, 250 to 500 meters. Particularly adapted for local reception where perfect reproduction is required. 3 sheets..... .75

Type 4300, One-step radio frequency amplifier, the only type which gives satisfactory results with regenerative sets. 3 sheets ..... .75

Type 4500, Simplified Reinartz receiver, described in this issue of R and M. 3 sheets ..... .75

Type 4600, Receiver with 2-step radio frequency amplifier and detector. For 200 to 600 meters. Described in this issue of R and M. 4 sheets 1.00

101 Receiving Circuits

If you have missed any of the installments of 101 Receiving Circuits, or even if you have all the back numbers, you ought to have the Green Book for quick reference, for it is made up of all the circuits which have appeared and some special ones in addition.

Any good circuit that is in common use, as well as many good circuits not commonly known, you will find in 101 Receiving Circuits. And with each circuit is an explanation of its use. There were one hundred and ten circuits in the first edition. The second edition, now ready for delivery, has complete data on the new Hazeltine Neutrodyne set, with disclosures of features which have been kept secret up to this time. In the new supplement the latest Reinartz and Flewelling circuits are shown, with constants for each instrument. Among the diagrams are:

Regenerative	Flewelling
Super-Regenerative	Reflex
Super-Heterodyne	Radio Frequency
Haynes	Neutrodyne
Flivver	Reinartz

This, by the way, is the first book of circuits published since 1920, and contains twice as many receiving diagrams as any other book. You can see this book at your local radio store.

Radio and Model Engineering Series No. 3, 50c. Mailing charges 4c.

Buy Your Equipment with Apparatus Coupons

If you could see the quantity of Apparatus Coupons which we handle every day you'd realize what you are missing if you are not using them, too, to buy your apparatus and supplies. These coupons are given for subscriptions to Radio and Model Engineering Magazine, a fifty-cent coupon for each year's subscription. Two extra coupons are given for every tenth subscription, and ten extra coupons for every fiftieth subscription.

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And it's so easy to sell a dollar sub. You'll surprise yourself when you tackle the Experimenters you know or even those you don't know. Just write in to the Circulation Department of R and M and ask for a Receipt Book. Apparatus Coupons can be spent like money for any Sleeper Radio Corporation equipment and supplies.

GET YOUR BOOK AND GET BUSY

STANDARDIZED PARTS FOR THE TYPE 4600 R. F. SET

The materials used to make up the sets in the R and M laboratory, and the companies from which they were obtained are as follows:

Type	Name	Price
F. A. D. Andrea, 1581-s Jerome Ave., New York City.		
154-A	1—400-ohm potentiometer	$1.00
Acme Apparatus Co., Cambridge, Mass.		
R-2	1—Radio frequency amplifying transformer	5.00
R-3	1—Radio frequency amplifying transformer	5.00
Dubilier Condenser & Radio Corp., A-48 W. 4th St., New York City.		
601	1—0.0005 mfd. condenser	.35
Pacent Electric Co., A-22 Park Pl., New York City.		
66	1—Double circuit filament control jack	1.00
Sleeper Radio Corp., 88-F Park Pl., New York City.		
154	1—Formica panel 7 x 14 x 3-16 in.	2.46
153	1—Formica panel 7 x 10 x 3-16 in.	1.81
A-2	1—100-division knob and dial	1.00
A-22-X	3—Rheostats	3.00
A-10	9—Binding posts, R. H. screws	.90
A-1-X	3—Audion sockets	2.40
A-15	1—11-plate condenser	3.25
A-88	1—Indicating knob, 3-16 in. hole	.35
8	6—Binding post base	.24
58	2—Pkgs. 25 small soldering lugs	.40
47	4—2-ft. lengths sq. tinned copper bus bar	.20
61	1—Pkg. 10 ¼-in. 6-32 R. H. nickeled screws	.11
141	1—Pkg. 10 ½-in. 6-32 R. H. nickeled screws	.12
143	1—Pkg. 10 1-in. 6-32 R. H. nickeled screws	.18
49	2—Pkg. 10 6-32 nickeled nuts	.16
91	1—2-ft. length Empire tubing	.25
14	2—Coil mounting pillars	.16
174	1—Formica tube 3½ ins. diam. 2½ ins. long, ⅛-in. wall	.56
40	1—¼ lb. spool No. 24 S. S. C wire	.80

DRILLING AND ENGRAVING

Drilling front panel, extra	$2.90
Engraving front panel, extra	5.70
Drilling base panel, extra	.75
Engraving base panel, extra	.42

STANDARDIZED PARTS FOR THE TYPE 4500 REINARTZ SET

Dubilier Condenser & Radio Corp., A-48 W. 4th St. New York City.		
601	1—0.0005 mfd. condenser	$ .35
Pacent Electric Co., A-22 Park Pl., New York City.		
63	1—Double circuit jack	.85
Sleeper Radio Corp., 88-F Park Pl., New York City.		
153	1—Formica panel 7 x 10 x 3-16 in.	1.81
30	1—Formica panel 2½ x 6 x 3-16 in.	.39
A-2	2—100-division knobs and dials	2.00
A-22-X	1—Rheostat	1.00
A-10	7—Binding posts	.70
A-1-X	1—Audion socket	.80
A-15	2—11-plate condensers	6.50
8	2—Binding post bases	.08
58	1—Pkg. 25 small soldering lugs	.20
47	2—2-ft. lengths sq. tinned copper bus bar	.10
61	1—Pkg. 10 ¼-in. 6-32 R. H. nickeled screws	.11
141	1—Pkg. 10 ½-in. 6-32 R. H. nickeled screws	.12
143	1—Pkg. 10 1-in. 6-32 R. H. nickeled screws	.18
49	1—Pkg. 10 6-32 nickeled nuts	.08
91	1—2-ft. length Empire tubing	.25
14	2—Coil mounting pillars	.16
174	1—Formica tube 3½ ins. diam., 2½ ins. long, ⅛-in. wall	.56
40	1—¼ lb. spool No. 24 S. S. C. wire	.80

DRILLING AND ENGRAVING

Drilling front panel, extra	$1.65
Engraving front panel, extra	4.02
Drilling base panel, extra	.40
Engraving base panel, extra	.30

BLUE PRINTS

M. B. Sleeper, Inc., A-88 Park Place, New York.		
4500	Simplified Reinartz receiver, set of 3 full-sized blue prints	$ .75
4600	Receiver with two-step radio frequency amplifier, set of 4 full-size blue prints	1.00

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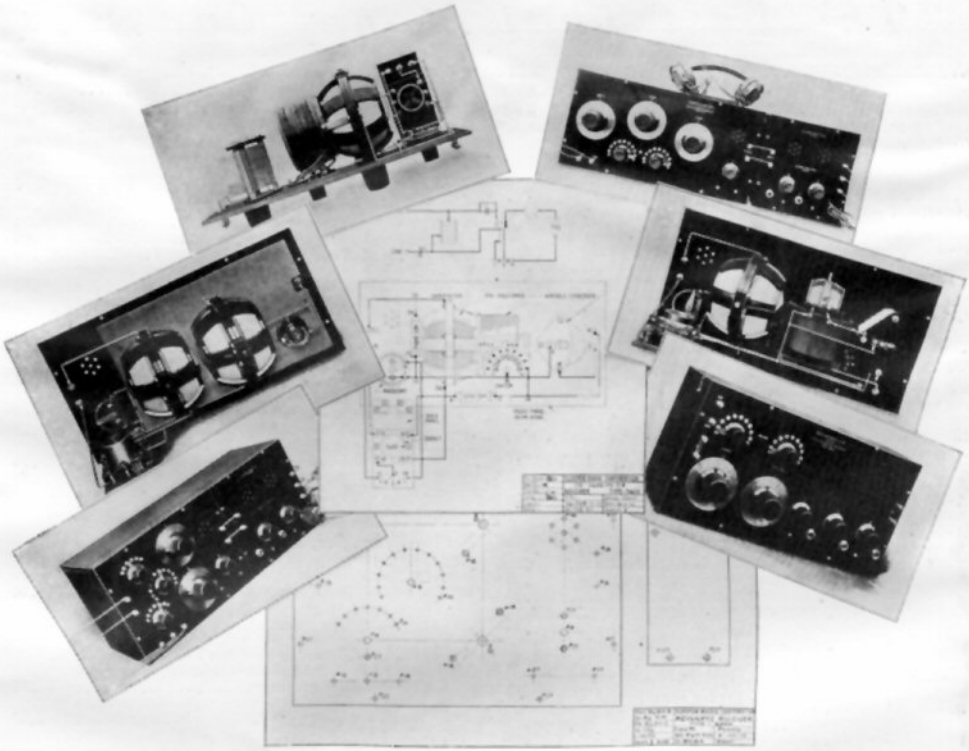
Pacent Electric Co., 22 Park Place, New York City.		
40	Telephone plug	.50
National Carbon Co., Long Island City, N. Y.		
767	45-volt variable B battery	5.00
6860	6-volt, 90-ampere-hour storage battery	18.00
Radio Corporation of America.		
UV-201	Amplifier tube, 6 volts, 1.2 ampere	6.50
UV-201-A	Amplifier tube, 6 volts, ¼ ampere	6.50
WD-11	Detector-amplifier tube, 1½ volts ¼ ampere	6.50



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For an inexpensive outfit to set to give long distance and sharp tuning, nothing can equal the type 3300 Reinartz set. Thru the avalanche of trick circuits the Reinartz has held its own as the favorite simple set.

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If you want to operate a loud speaker add the type 3300 2-step audio to any of these receivers. Any of the tubes now on the market, including WD11 or UV201-A, and UV199's can be used with proper socket adapters.

FOR LOCAL RECEPTION

A plain loosely coupled set with a detector and 2-step amplifier is preferred by many people who want the purest reception of local stations, either on phones or a loud speaker.

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The type 4000, 3300, or X1900, with the 3300 amplifier, can be used for portable work. An antenna of 50 ft. of annunciator wire should be thrown up in a convenient tree, and the ground connection made to the motor car frame or to a metal plate 1 ft. square dropped in water.

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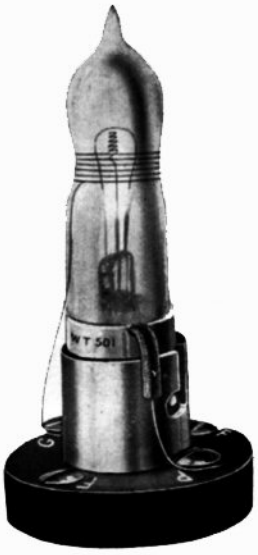

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