RADIO Engineering

A Magazine of Technical Accuracy for the Radio Set Builder, Engineer and Manufacturer

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Edited by
M.B.SLEEPER

MAY 1925

VOL V NO. 5

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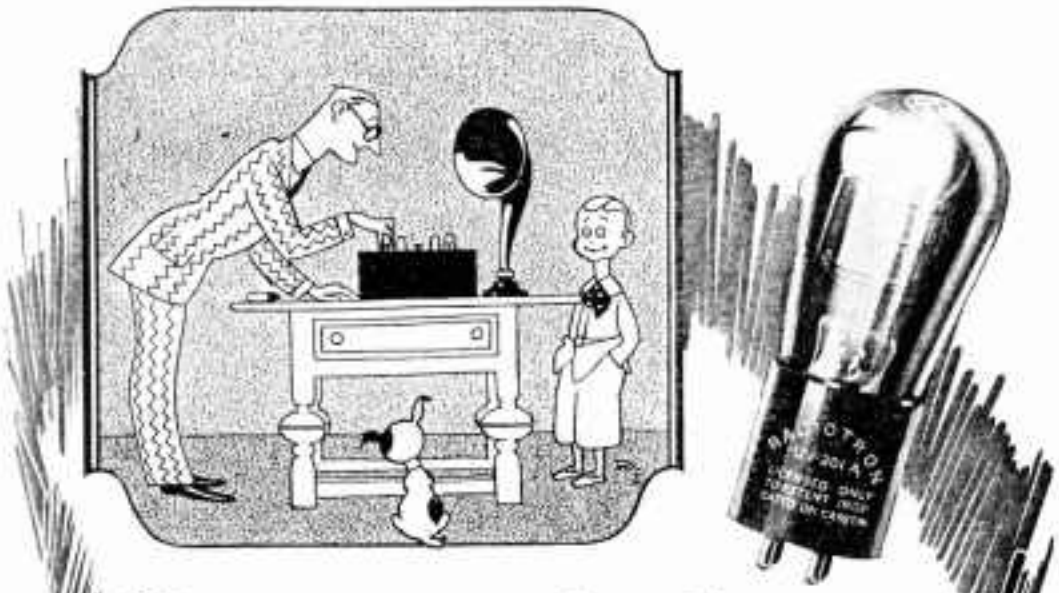

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RADIO ENGINEERING

Edited by M. B. SLEEPER
Associate Editor, Alfred A. Ghirardi

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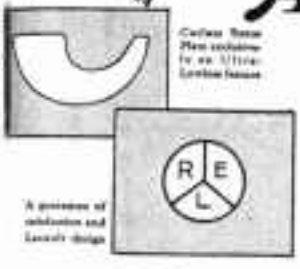
As positive as Big Ben



SET Big Ben at seven and at seven o'clock you're bound to get the alarm.

Just so, the Ultra-Lowloss condenser can be set at any wavelength—the corresponding station will come in clear and sharp. You know instantly where to turn, once a station of known wavelength is located. Makes tuning easy—direct—positive. Special Cutlass Stator Plates spread wavelengths evenly over a 100 degree scale dial so that each degree represents approximately 3½ meters.

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At your dealers, otherwise send purchase price and you will be supplied postpaid.

Design of lowloss coils furnished free with each condenser for amateur and broadcast wavelengths showing which will function most efficiently with the condenser.

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Mr. Lacault will gladly consult with any manufacturer regarding the application of this condenser to his circuit for obtaining best possible efficiency.

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CONDENSER

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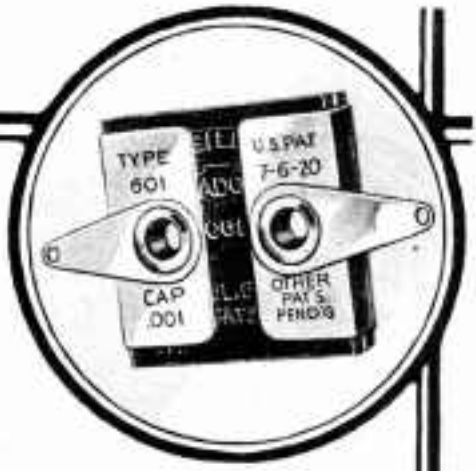


Only specialists can make *good* fixed condensers

THE small fixed condensers in your radio set are there to help you get clear reception. If these little condensers are not made *most accurately* the quality of reception you get—even though your set may be excellent in all other respects—will be greatly impaired.

You will find that nearly all sets made—in fact over 90% of them—are equipped with Dubilier Micadons. This is the name by which all Dubilier fixed condensers are known.

Be sure your set—whether you buy it or build it—is equipped with Micadons. They are made by *specialists*.

Dubilier

CONDENSER AND RADIO CORPORATION

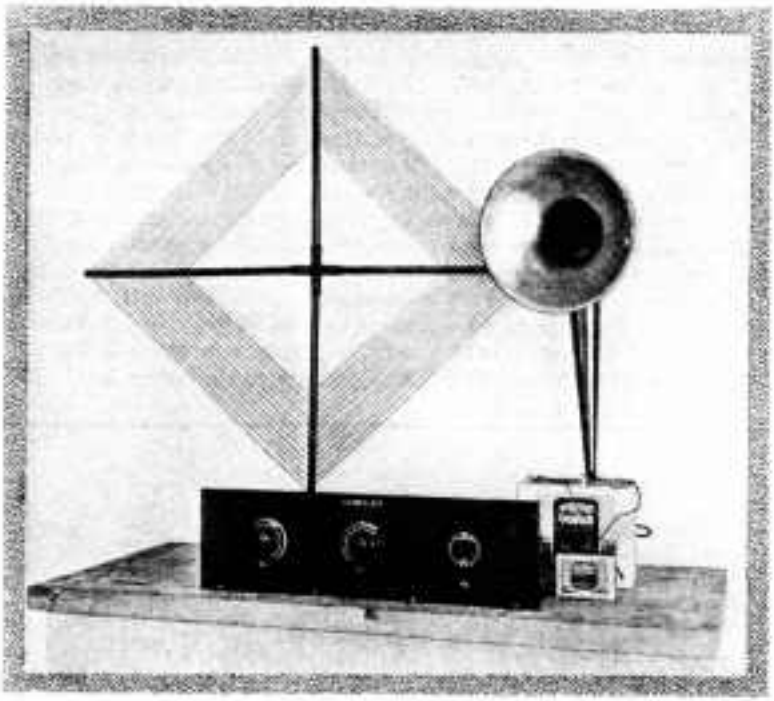


Fig. 1. This is practically a one-control receiver, as the wavelength is controlled entirely by the left hand dial

How to Build the New

Acme Cabot Circuit Receiver

Assembly Instructions for the Acmeflex Kitset, in which a new tuning method is employed. A Sodion tube detector adds to the sensitivity

IT seems as though the designers of the new Model S Acmeflex Kitset have given us plenty of food for thought on the question of what features the future home receiver will have. Loop reception is, of course, very desirable for its convenience, portable features, and selectivity. The drawback to its more extended application has been the need for at least three stages of radio frequency amplification to compensate for the comparatively small energy pickup of the loop. This resulted in the use of many controls and more or less unstable and tricky circuits, all tending to make this type of set unpopular with the average non-technical man and his family.

In the Acmeflex the problem of sensitivity has been attacked by using a good sized loop with one stage of tuned and two stages of transformer coupled R. F. The loop tuning and tuned R. F. controls have been combined by using the D-coil unit described in the February issue of Radio Engineering. We thus have a variable condenser working with the fixed inductance, 16 M. H., of the loop, and a variable inductance working with the fixed capacity of a Micadon, with a second variable condenser for close tuning. Additional sensitivity is obtained by using either a S-13 or D-21 Sodion tube for a detector. A standard socket and adapter are provided since the bases of these two tubes are different. Following

the detector is one stage of A. F. amplification reflexed on the third tube and then a stage of straight A. F. amplification. The reflexed A. F. transformer is not used in the orthodox way but is employed as an impedance coupler because of the impedance of the Sodion tube. This gives a mult-tube loop receiver with only one critical tuning control.

Design Details of the Set

Fig. 1 shows a front view of the assembled set as set up for the final tests at our Darien laboratory. The loop is wound from the panel is of metal, finished attractively with black crystallized lacquer.

The baseboard carries the sockets, transformers, and binding post strips. The binding posts are fastened on Formica strips which are in turn supported by pressed metal angle mountings. These are arranged so that the binding posts tip at an angle making them unusually convenient for connections. A small wooden box is provided for the D battery, and provision is made for fastening this directly to the baseboard. The vari-

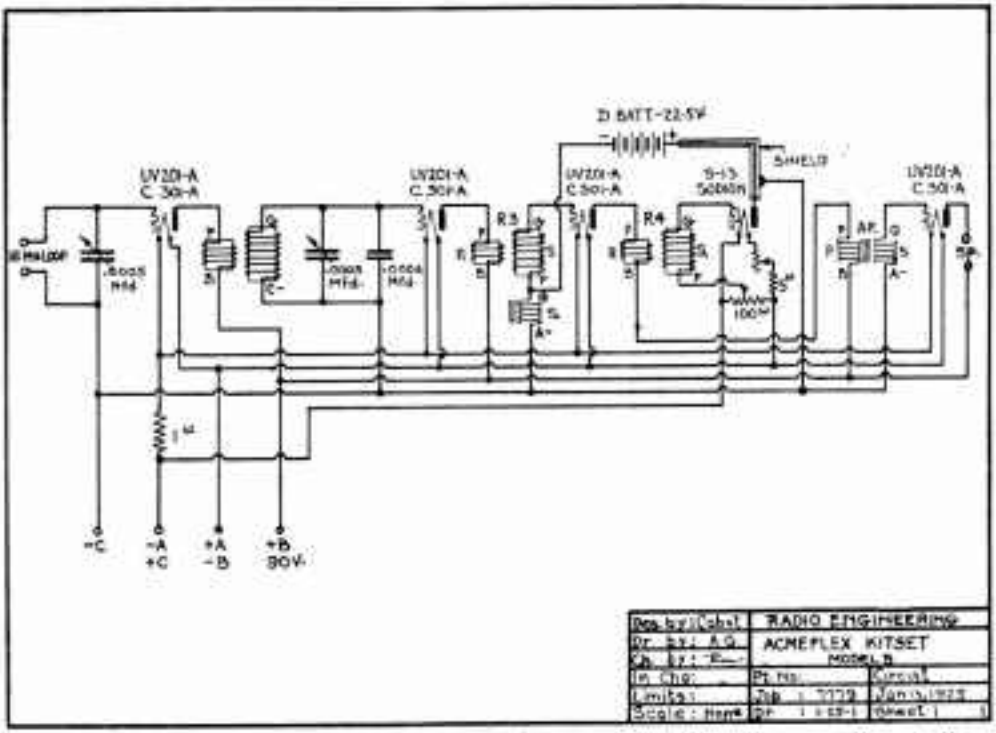


Fig. 2. Schematic wiring diagram of the Acme Cabot receiver. Note the connections to the shielded wire

materials supplied in the kit and has an inductance of 16 M. H. The large dial on the left of the set is for tuning the loop and tuned R. F. stage. The little knob directly below it actuates a vernier which moves the entire set of condenser plates. The next dial is used in combination with the D-coil unit for fine tuning. It can be employed as a volume control in the set. Next is the combination rheostat and potentiometer knobs for the Sodion tube and directly under these is the filament switch knob. The front

ous units have been laid out so as to occupy a minimum of space consistent with easy wiring and accessibility.

Standard Parts Required

The parts required for this outfit are: An Acme D-coil unit, a 0.0005 mfd. variable condenser, a combined 6-ohm rheostat and 100-ohm potentiometer, one R-3 and one R-4 radio frequency transformer, two A-2 A. F. transformers, Acme 16 M. H. loop, five Naald standard sockets, one type 640 Dubilier, 0.0004 mfd. fixed condenser or type R-26 0.0004 mfd.

Splitdorf fixed condenser, one Dubilier 1 mfd. by-pass condenser, eight engraved Eby binding posts, one Connecticut Sodion tube adapter, one D battery box, two drilled Formica binding post strips and mountings, one 1-ohm and one 5-ohm resistor, a battery switch, a 7 by 24 by 3/32 in. aluminum panel, and a 7 by 23 by ⅝-in. laminated wooden baseboard. In addition, all bus wire, shielding, screws, screwdriver, pair of pliers, 15-in. rule, soldering lugs, storage battery clips, log sheet, and walnut stained box are supplied with the kit.

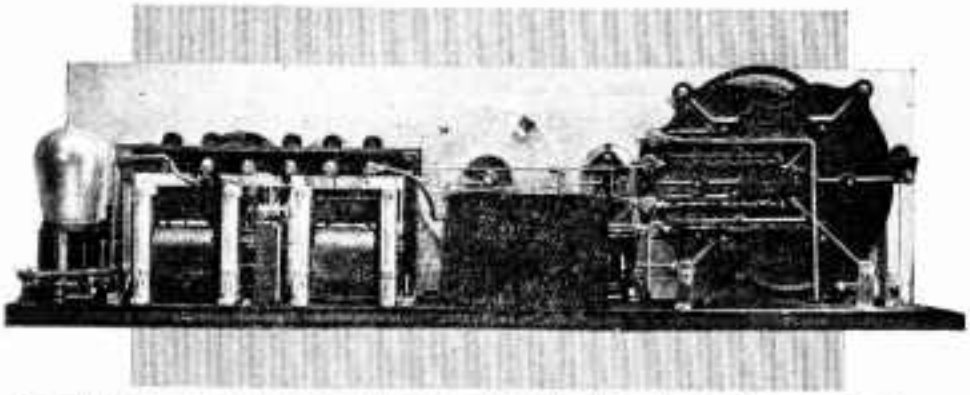


Fig. 3. Here you can see the rear of the automatically tuned D-coil radio frequency transformer, mounted on the loop condenser

Assembly and Wiring

Figs. 4 and 5 show a picture wiring diagram of the set, in which the connections have been drawn exactly as they were arranged in the original receiver. The set can be put together without soldered connections by making loops or eyes in the wires with the pliers provided, but we have found that the work can be done much easier and quicker if the wires are soldered to lugs. The short heavy lines at the terminals in the picture wiring diagram show the directions in which these lugs should point. They should be fastened in place on the instruments as they are mounted and should be well tinned. Use either Kester or Belden rosin core solder, or plain soft solder with Nokorode paste put on very sparingly. The iron should be thoroughly clean and hot enough to make the solder flow freely.

The following instructions have been prepared in proper sequence to make the wiring as simple as possible. Read through each step before, as it may save time and extra work later.

1. Fasten the five sockets to the side of the baseboard which has the locating holes punched in it. Use the ¾-in. R. H. wood screws provided, and be sure to keep the + and — terminals toward the edge of the board which has the four holes in it for the front panel screws. Now fasten the R. F. transformers R-3 and R-4 on the baseboard with the ½-in. R. H. wood screws, placing R-3 on the right and R-4 on the left, looking at the set from the rear, as shown in the picture wiring diagram. Fasten binding posts on the 1 mfd. by-pass condenser placing a washer under each screw head. Bend the mounting lugs on the can at right angles and use two R. H. wood screws for fastening the condenser to the baseboard. Fasten the two A. F. transformers to the board with ½-in R. H. wood screws, keeping the terminals pointing in the proper direction. Take the 5-ohm resistor, which is wound on a black form, and assemble a binding post on one of the end eyelets. Slip the other eyelet on to the + terminal of the front left hand socket. Assemble the 1-ohm resistance —red—in the same way and mount it on the — binding post of the rear socket next to the A. F. transformers.

2. Connect 1, the + terminal of this socket, to 2, the + terminal of the extreme right hand socket. Run this wire

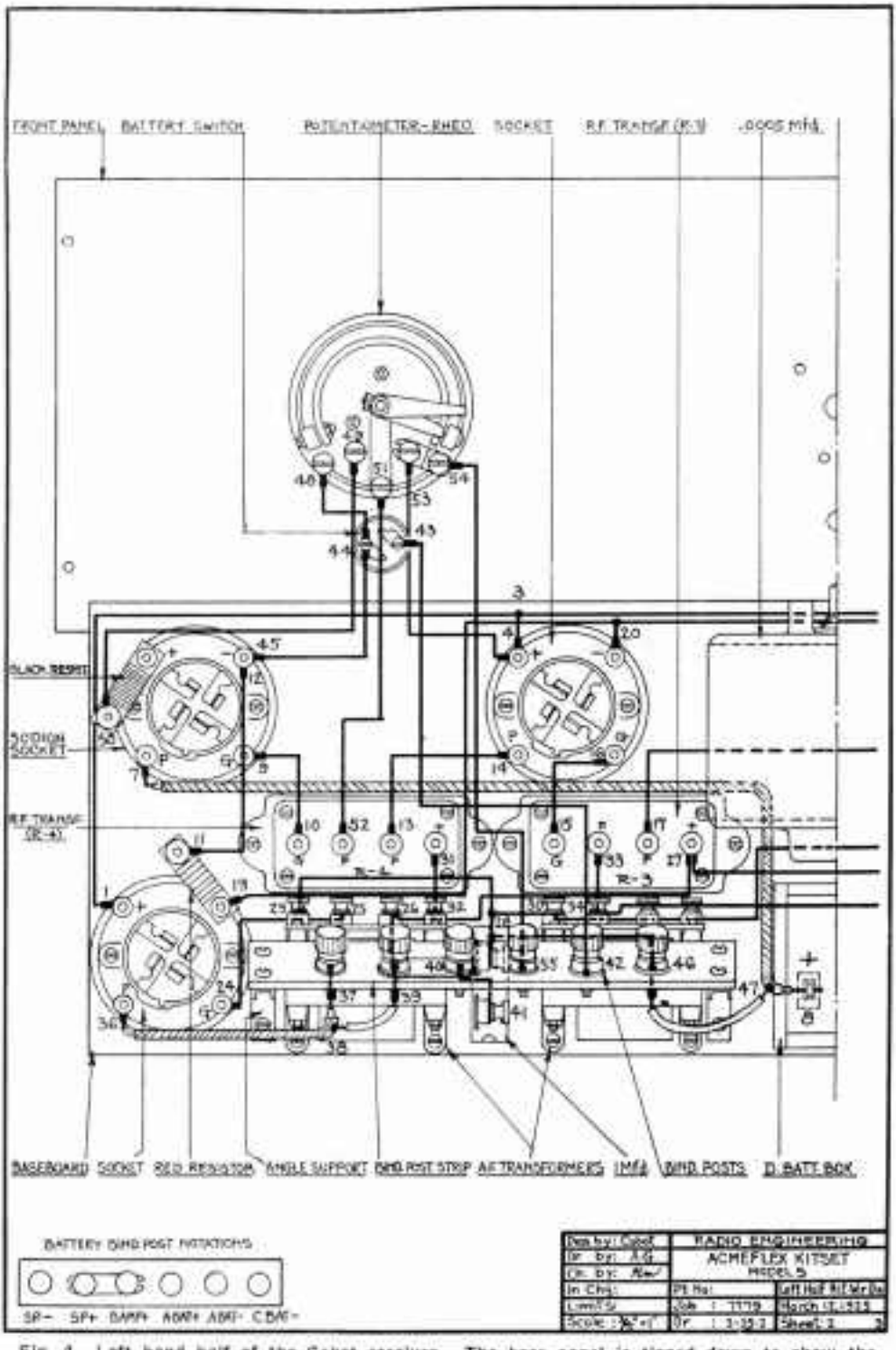


Fig. 4. Left hand half of the Cabot receiver. The base panel is tipped down to show the connections

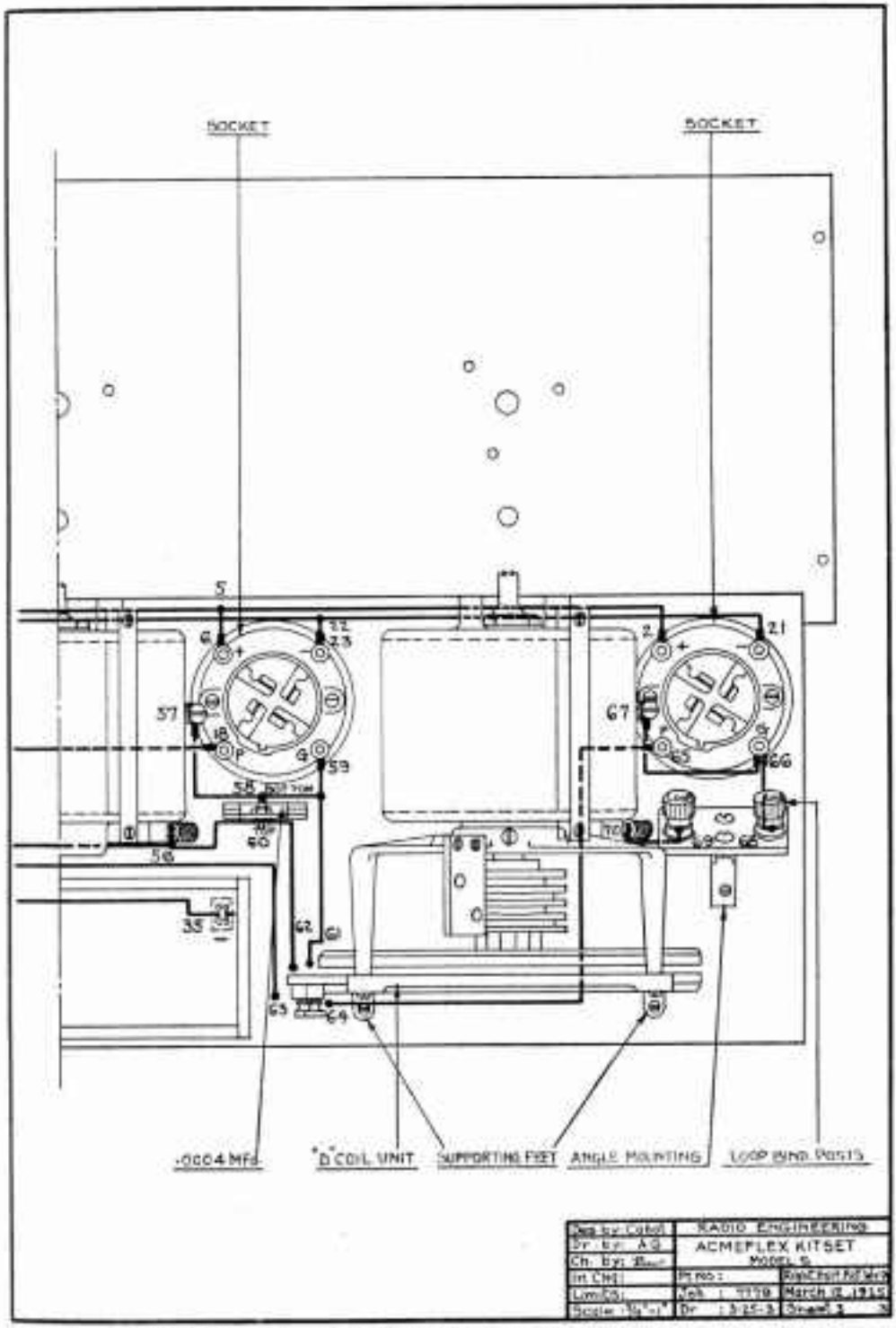


Fig. 5. Right hand half. This picture wiring diagram shows the wiring as it was done on the original set

close to the baseboard. Connect 3, a point on this wire, to 4, the + terminal of the socket. Also connect 5 to 6.

3. Put the D battery box in place temporarily and make up lead 7 to 8 from a piece of copper shielded bus. 7 is the P terminal of the left hand front socket. 8 is a connection which is made to the + terminal of the D battery. Skin the copper shield back about ½-in. from the insulating tubing at each end so there will be no possibility of its touching the inner wire.

4. Now connect 9, the G terminal of this socket, to 10. Connect 11, the free terminal of the red resistor, to 12. Connect 13, the P terminal of R-4, to 14. Connect 15, the G terminal of R-3, to 16. Connect 17, the P terminal, to 18, keeping this wire close to the baseboard. Run a wire from 19, the socket terminal of the red resistor, to 20, keeping it about 1 in. above the baseboard. Now connect 20 to 21, the — terminal of the right hand socket, keeping it 1 in. above the baseboard. Connect 22, on this wire, to 23. Connect 24, the G terminal of the rear socket, to 25, the G terminal of the left hand A. F. transformer. Connect 26, the B+ terminal of this transformer, to 27, running the wire horizontally to terminal 27. Connect 28, one terminal of the 1 mfd. condenser, to 29, the A— terminal of this transformer and to 30, the A— terminal of the other A. F. transformer. Connect 31, the + terminal of R-4, to 32. Connect 33, the F terminal of R-3, to 34, the G terminal of the A. F. transformer. Also connect 34 to 35. 35 is the — terminal of the D battery. The P and +B terminals of this A.F. transformer are to be left unconnected.

5. Fasten the front panel to the baseboard with four ½-in. R. H. wood screws keeping the lacquered side facing away from the baseboard. Remove the knurled collar from the battery switch, mount the switch on the panel by inserting the stem through the hole in the panel, and replace the collar. Put a ¾-in. washer in back of the panel and be sure to have the binding posts in a horizontal position. Assemble the binding posts on the long terminal strip as shown in the insert on the left half of the picture wiring diagram, putting the forked jumper between the B AMP+ and Speaker + binding posts. Now assemble the brackets on this panel with 5/16-in. 6-32 R. H. machine screws and nuts. Fasten the lugs to the binding posts at the underside of the panel. Mount the unit on the baseboard with ½-in. R. H. wood screws.

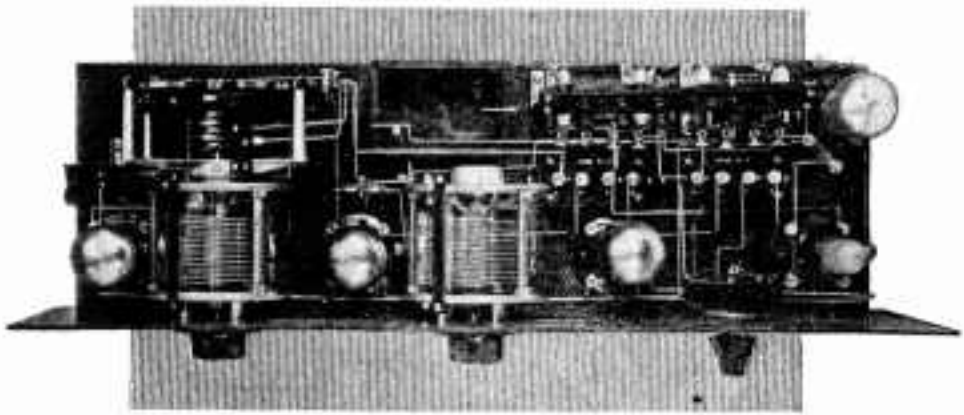


Fig. 6. Top view of the outfit. The D battery has been removed from the box, but the wires are run up in position for the battery clips

6. Connect 36, the P terminal of the rear socket, to 37, the Speaker— binding post. Use a shielded lead for this and skin back the shield ½-in. at each end. Connect 38, a point on this shield, to 39, the Speaker + post, with a piece of flexible rubber covered wire. Also con-

nect 39 to 26, the B+ terminal of the A. F. transformer. Connect 40, the B AMP+ binding post, to 41, the remaining terminal of the 1 mfd. condenser. Connect 42, the A BAT— binding post, to 43, on the battery switch. Connect 44, on the switch, to 45. Connect 46, the C BAT— binding post, to 28, on the 1 mfd. condenser. Also connect 46 to 47, a point on the copper shield, with a piece of flexible rubber covered wire.

7. Loosen the set screw in the potentiometer arm collar, rear, and pull out the arm from the shaft. This leaves a small black bushing on the shaft under the spring connector, which is now exposed. Remember its location, and do not lose it. Loosen the set screw in the rheostat knob collar on front and remove the knob. Remove the dial by taking out the three R. H. screws, and save the nuts. Remove the base by taking out the screw in the bottom. Slide the insulating bushing on the tubular shaft with the end resting against the collar. Mount the potentiometer-rheostat on the panel with the terminals at the bottom, using the three 3/8-in. 6-32 machine screws in the box. Be sure to put the dial upright and in front of the panel. Turn the rheostat arm, the short one, to the position where it leaves the rheostat winding, which is the off position. Put back the rheostat knob, having its front flush with the end of the shaft and pointer at the off position. Tighten the set screw to hold it in place. Stick the potentiometer shaft into place and be sure to put the small black bushing on to the shaft between the spring connector and rheostat arm collar. The smaller diameter of the bushing should be toward the potentiometer-rheostat. Put back the potentiometer arm and collar and fasten in place with the set screw, leaving about 1/64-in. play.

8. Connect 48, on the potentiometer-rheostat, to 44. Connect 49 to 50, the free terminal of the black resistor. Connect 51 to 52, the F terminal of R-4. Connect 53 to 4, the + terminal of the socket. Connect 54 to 55, the A BAT+ binding post.

9. Remove the D battery box. Remove the vernier knob and mount the 0.0005 mfd. condenser on the front panel with three 3/8-in. 6-32 machine screws, keeping the terminals to the right as shown.

10. Connect 30, the A— terminal of the right hand A. F. transformer, to 56, the rotor terminal of the condenser. Keep this wire close to the rear end plate of the condenser so it will not interfere with the D battery box. Run a wire horizontally from 57, the stator terminal of the 0.0005 mfd. condenser, around as shown in the picture wiring diagram, connecting it to 58, the bottom end of the 0.0004 mfd. fixed condenser, fixing the soldering lug with a screw, nut and two washers, and then run it down to 59, the G terminal of the socket. Connect 56 to 60, the top terminal of this condenser, fastening it as before, with a machine screw, two washers, and a nut.

11. Now fasten the D battery box to the baseboard permanently with two F. H. wood screws. Remove the condenser vernier knob, and mount the D-coil unit on the front panel with three 3/8-in. 6-32 machine screws. Loosen the screws which fasten the supporting feet on the back of the D-coil, readjust the feet and fasten them to the baseboard with two 1/2-in. R. H. wood screws. Now tighten up the two machine screws so that the coil is supported rigidly. Assemble the two loop binding posts on the short terminal strip, and then fasten the angle mounting to the center of the strip with two 3/8-in. 6-32 R. H. machine screws and nuts. Fasten the unit to the baseboard with two 1/2-in. R. H. wood screws.

12. Connect 59, the G terminal of the socket, to 61, the lower, or G terminal of the D-coil. Connect 62, the next or C_1 terminal, to 60. Connect 63, the B + terminal, to 27, the + terminal of R-3. Connect 64, the P terminal, to 65, the P terminal of the right hand socket. This wire runs under the D coil unit, near the baseboard. Connect 66, the G terminal of this socket, to 67, the stator terminal of the condenser. Also connect 66 to 68, one of the loop binding posts. Connect 69, the other loop binding post, to 70, the rotor terminal of the con-

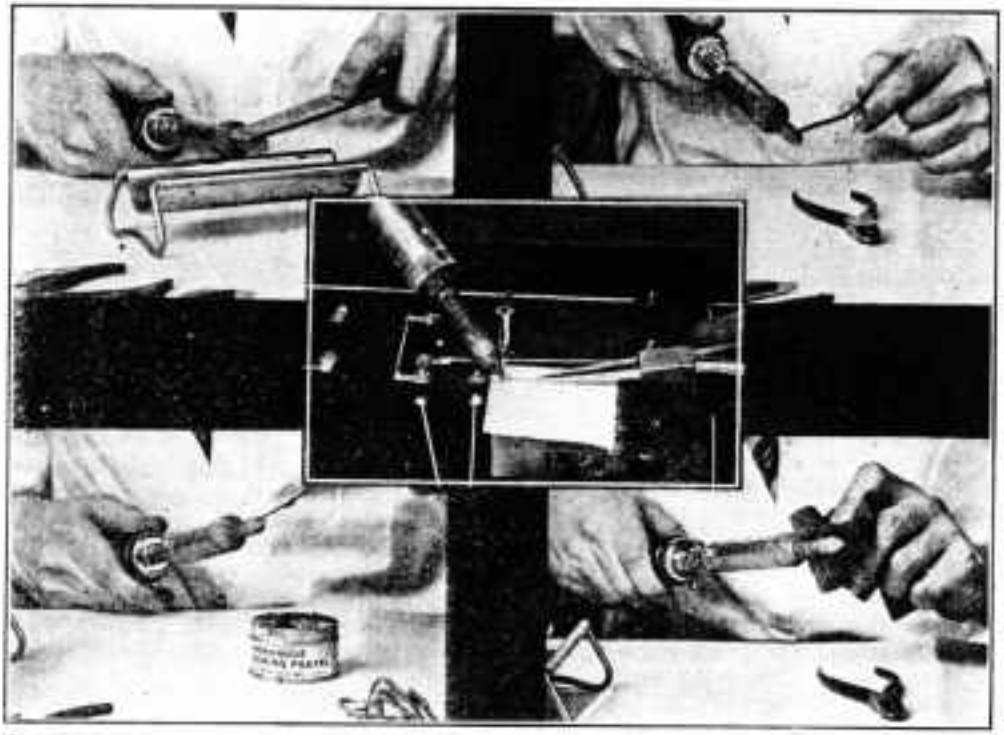
(*Continued on page* 268)

Short Cuts to
Successful Soldering

SOLDERING, though it may be considered as a necessary evil, is a matter of great importance in the construction of radio equipment. A soldered joint is the only permanent and positive method for making connections that we have. There is probably much unwarranted prejudice against soldering, largely because, although it is a simple matter if done right, it is so generally unsuccessful if done incorrectly.

The M. W. Dunton Company, manufacturers of Nokorode soldering paste, publish a splendid construction book which is furnished with their soldering kit, in which the various steps for doing different kinds of soldering are described in much detail.

The five views given in the accompanying illustrations will help much to smooth out some of the soldering difficulties. Although an American Beauty electric soldering iron is shown, the same suggestions apply equally to the ordinary soldering copper. The first thing to watch out for is that the tip is kept clean and bright. For this purpose a coarse file is necessary. As soon as the iron becomes hot, soldering paste should be run over it and, when it is hot enough to melt the solder, a generous amount of solder put on the tip and rubbed around with a clean cloth. If rosin core solder is used, as soon as the iron reaches the melting point, the rosin core solder should be run all over the tip so that the rosin flows over the iron as the solder is melted.



A very easy way to keep the iron tinned at all times is to melt a quantity of solder into a small tin cover and leave the point in the solder between operations.

An important kink, which has never been shown before, is illustrated in the center picture. A sheet of newspaper is put under the soldering lug while the joint is being made. This absorbs either paste or rosin and, when the paper is taken away, leaves the panel clean. This is more satisfactory than cleaning the panel afterward.

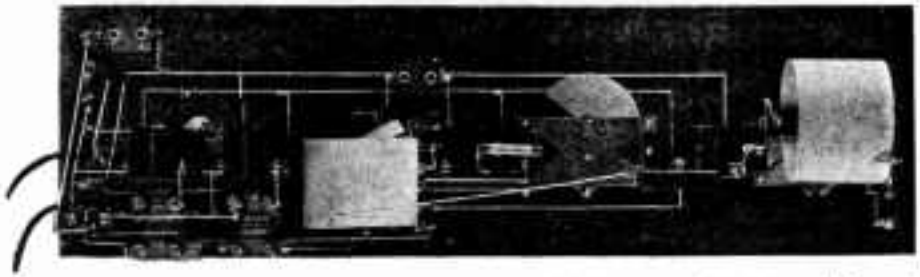


Fig. 1. All the parts are mounted on the front panel, doing away with the need for a tube panel

The Silver-Marshall Receiver

An R. F. regenerative receiver brought to the peak of efficiency by the use of low-loss parts in the tuning circuits.

WHILE it is true that many excellent sets and circuits have been developed during the past few years, it is an open question in the minds of many leading radio engineers whether the old regenerative outfit is not as good as any. For the man of limited means who desires a set capable of bringing in a reasonable number of DX stations day in and day out the three- or four-tube regenerative receiver stands out as the most suitable and practical.

In the Silver-Marshall Knockout Receiver every effort has been made to obtain greater sensitivity and selectivity by cutting down losses to a minimum. The circuit employed provides one stage of tuned radio frequency amplification of the neutralized type, regenerative detector, and two stages of audio frequency amplification. You will see from the accompanying photographs that low-loss condensers are used in conjunction with low-loss coils for tuning. These coils are of the single layer type wound so as to be self-supporting. The antenna coupling coil is of the single circuit type with a tap for the aerial. It is supported on the tuning condenser by means of two narrow Bakelite strips. The coupler has a primary winding of very fine wire placed inside of the secondary coil at the lower end. This is in accordance with recent developments along this line since it gives the maximum energy transfer with minimum capacity coupling. The tickler is wound on a Bakelite tube with as few turns as possible consistent with perfect regeneration control, so as to render the tuning of the second condenser of the position of the tickler coil. The entire unit is mounted on a Bakelite strip with connection terminals arranged in a row. Following the detector we have two stages of audio frequency amplification with jacks arranged for plugging in on either the first or second stage.

Examination of the schematic wiring diagram shows that the radio frequency tube is neutralized by connecting the neutralizing condenser from the grid of the tube to the tap on the coupler. This stabilizes the circuit so as to render it free from oscillation and in addition so balances the R. F. amplifier circuits that the detector tube, when oscillating, cannot feed energy back into the antenna system, thereby preventing interference with other sets.

Looking at the rear of the set you will notice that all of the parts are mounted on the front panel. The sockets are of the panel-mounting type. The wiring is extremely simple as can be seen from both the photographs and the picture wiring diagram. The two A. F. transformers are placed directly under the A. F. sockets. One rheostat controls all four tubes. The antenna and ground binding posts are located on the front

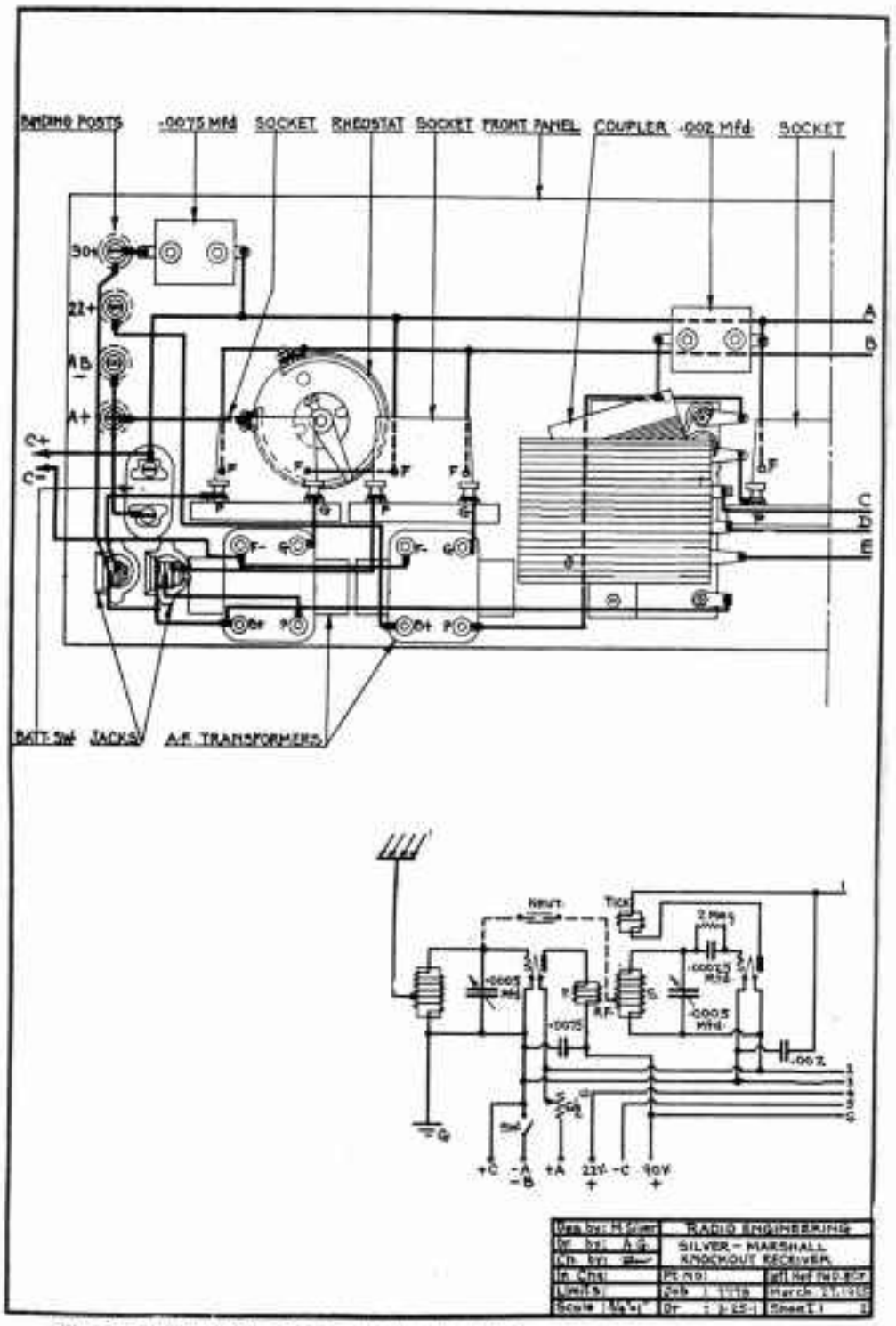


Fig. 2. Picture wiring diagram showing the left hand half of the Silver-Marshall four-tube receiver

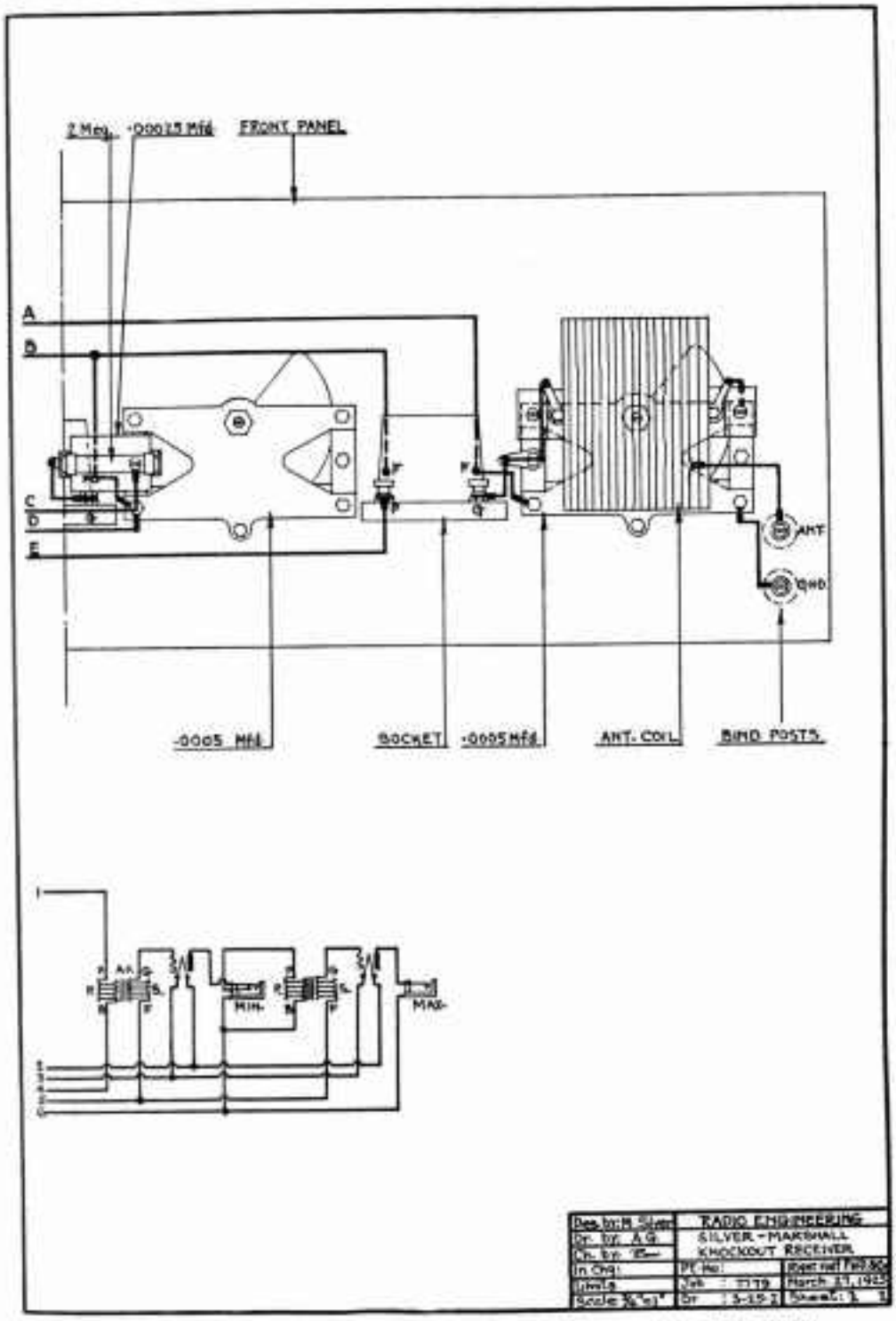


Fig. 3. Right hand half of the set. Numbers and letters on the wires merely indicate connections

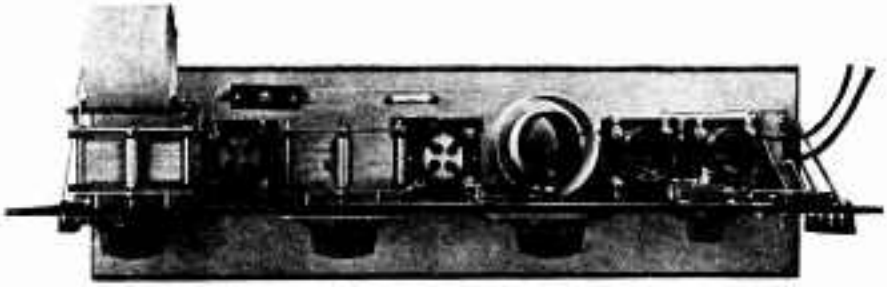


Fig. 4. Top of the Silver-Marshall Receiver, showing the construction of the coils and the arrangement of the separate instruments

panel at the left, with the four battery connection posts on the extreme right end. Two flexible leads are brought out from the set itself for connection to a C battery which can be placed in the cabinet directly behind the set.

Standard Parts Required The standard parts used in this outfit are: Two 0.0005 mfd. Silver low-loss condensers, one Silver low-loss antenna coil and one low-loss coupler, four Hoosick Falls panel mounting sockets, two 3½ to 1 Thordarson A. F. transformers, one Howard 7-ohm rheostat, one Cutler-Hammer Battery switch, one Carter 101 jack and one 102A jack, one 24 by 7-in. by 3/16-in. Bakelite or Formica panel, one 0.00025 mfd. Muter fixed condenser with gridleak clips, one 0.002 mfd. and one 0.0075 mfd. fixed condenser, one 2-megohm Eagle gridleak, six binding posts, one X-L neutralizing condenser, and screws, lugs, spaghetti and bus bar.

Assembly and Wiring The best way to assemble and wire the set is to mount the rheostat on the front panel first. Then mount the rest of the apparatus with the exception of the two variable condensers and antenna coil. Wire up the instruments, as shown in the picture wiring diagram and photographs, making sure that all connections are well soldered. You will find Wirit very convenient for this work. Use either Kester or Belden rosin core solder, or plain solder with Nokorode paste put on very sparingly. You will notice in the picture wiring diagram that F-F terminals of the sockets, next to the panel, are represented by a large dot and elevated slightly so as to avoid confusion. Now fasten the 0.00025 mfd. grid condenser to the 0.0005 mfd. variable condenser with a 6-32 R. H. machine screw 1-in. long screwed into the insulating strip which supports the stator plates. The screw will have to be removed to do this. It is well to put a nut between the grid condenser and insulating strip so as to keep them a short distance apart. Also put two lugs under the front lower left hand screw which holds the front end plate to the spacer rod. Now mount this condenser.

The antenna coil should now be fastened to the other variable condenser. Remove the two screws on the rear end plate of the condenser that are in line with the bearing adjustment screw. Put two 1¼-in. 6-32 R. H. machine screws through the holes in the Bakelite mounting strip of the antenna coil, and two nuts on each screw. Insert these screws in the condenser holes from which the two screws have previously been removed. Keep the coil in the position shown with the tap on the right. Now tighten up one unit on each screw against the condenser frame and tighten the other against the Bakelite strip. Also put lugs under the various condenser terminals as shown in the picture wiring diagrama. Fasten this unit to the front panel and complete the wiring. Put on all the knobs and dials.

Testing and Operating Connect the batteries and antenna and ground to the set. Insert the tubes, pull out the battery switch and turn up the rheostat. Set the tickler at zero, that is, at right angles to the primary and secondary coils. Now turn the first two dials in

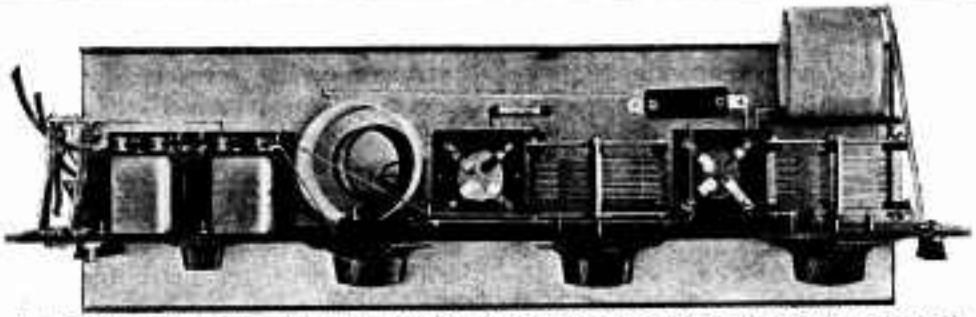


Fig. 5. A bottom view of the set, showing the location of the A. F. Transformers beneath their corresponding sockets

unison. If stations come in with a whistle, it indicates that the amplifier is oscillating and must be neutralized. To do this, connect the neutralizing condenser between the grid of the first tube and the tap on the coupler as shown in the photographs. Tune in a low wavelength station and adjust the neutralizing condenser by turning the nut with a screw driver or stick with a sharpened end until the clicking or whistling disappears.

To operate the set now, set the tickler toward 100 on the dial where stations come in as a squeal. Rotate the second, or detector dial, until a squeal is heard. Then vary the first dial for maximum intensity, following this by turning back the tickler until the squeal disappears and the station heard clearly. Always keep the first dial reading nearly the same as that of the second while hunting for stations, and rotate the dials very slowly as the set is so selective that it is very easy to pass the stations.

New Panel Sizes

DURING the last three or four years practically all radio sets have been constructed on panels 7 ins. high, varying in length from 10 ins. to 48 ins. Exactly why this size was adopted no one seems to know. Probably the reason is that two or three people used this particular size and, as is characteristic in the radio business, everybody else copied it.

The height of 7 ins., however, is not well chosen. It is wasteful, in the first place, because for most designs a lower panel would do just as well. On the other hand, slight variations from ordinary design practice are impossible because the height is not great enough. The greatest disadvantages to the 7-in. panel are the extreme length required for multi-tube sets, the awkwardness of installing long sets in the home, their lack of adaptability to attractive cabinet design, particularly when the panel slopes back, and the necessity for putting the main tuning controls at one end, generally the left end of the panel, instead of at the center where they are easiest to operate.

Radio Engineering is now working with the American Hard Rubber Company, Formica Insulation Company, Spaulding Fibre Company, Diamond State Fibre Company, and Fibroc Insulation Company to determine the best height for a new series of standard panels. The reason for changing the panel size is to permit a two-level arrangement, with the tubes and transformers on the upper level and the tuning instruments on the lower level. This will make the sets shorter and correspondingly easier to install and more attractive in appearance, more symmetrical in the arrangement of the front panel, easier to make adjustments, since the controls will be at the center of the set, and will make possible more attractive cabinet design. The sizes now under discussion are 12 ins. high and 8, 10, 12, 14, and 16 ins. long.

We shall be very glad to have comments from the readers on this subject so that the general opinion can be determined. Letters discussing the advantages or disadvantages of this series of sizes should be addressed to the Panel Standards Committee.

Bremer-Tully Receiver

Complete construction data on what has now become one of the most popular of the five-tube tuned R. F. receivers. Part 2.

Assembly and Testing

With the parts to be put together, carry out the work in accordance with the steps as they are arranged in the instructions following:

1. Ream out the center holes in the dials of the Univernier condenser controls until they are big enough to take the threaded mounting collars on the variable condensers. The Stevens hand reamer is just the thing for this work. Be careful not to bend the dials. Then mount the condensers on the front panel, clamping each dial in place by putting the mounting collar through the center hole. Be sure that the hole in the dial lines up with the hole in the panel through which the fixing pin on the knob must pass. Before tightening the condensers, put a panel along the bottoms of the condensers and have them lined up correctly. Mount the 3-plate variable condenser with the screws provided, the three Howard rheostats, the Walbert lock switch, and the two Carter jacks, the 3-spring jack going at the end of the panel. In these instructions the arrangement will be described as it appears when looking at the set from the rear.

2. Connect 1, the frame binding post on the right hand condenser, to 2, the corresponding terminal on the center condenser. Connect 3, on the left hand rheostat, to 4, on the right hand rheostat and solder the lug on the left hand terminal of the center rheostat to wire 3 to 4, making connection 5. Make a connection at 5, also, to 6, on the lock switch.

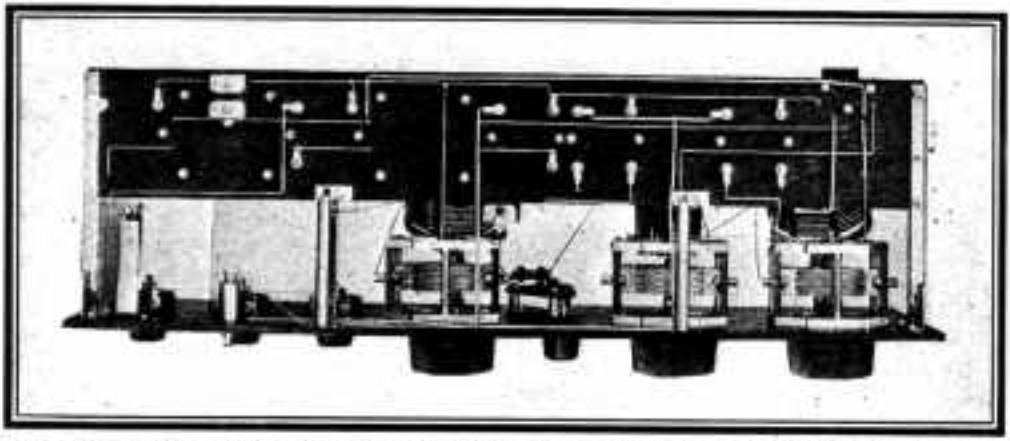


Fig. 5. This view will help you in checking against the step-by-step instructions and the picture wiring diagram

Solder one lug on the 0.001 mfd. Micadon to a lug on the upper stator terminal of the control condenser, making connection 7.

3. Mount the antenna coupling coil unit above the right hand condenser. Put a 1-in. screw through the front panel and into a coil mounting pillar. This will extend out just far enough that another pillar can be threaded on to the screw. Then fasten the inductance unit to the second pillar by means of a ½-in. 6-32 R. H. screw put through the mounting lug.

4. Connect 8 to 9. 8 is the F binding post on the coil and 9 a connection made to wire 1 to 2. Be sure to hook the wire around 1 to 2 before the soldered connection is made. Connect 10, the G post on the coil, to 11, a lug on the stator binding post of the condenser.

5. Mount the first R. F. transformer. This is the unit that has a coil of about eight turns inside the tube. To mount

this coil, remove the mounting lug from the tube and turn it around so that it will be in the position shown in Fig. 4. Before fastening the mounting lug to the tube again, put a ½-in. 6-32 R. H. screw through the mounting hole and into a coil mounting pillar. Then fasten the lug to the coil. Next, put a 1-in. 6-32 F. H. screw through the front panel, through another coil mounting pillar, and into the other end of the pillar already fastened to the mounting lug.

6. Connect 12 to 13. 12 is a lug on the F post of the coil and 13 a connection on wire 1 to 2. Connect 14, the G post, to 15, a lug on the terminal of the stator plates, and connect 16, the No. 1 terminal of the coil to 17, a lug on the control condenser.

7. Mount the second R. F. transformer in the same manner that the first coil was fastened.

8. Connect 18, the F post of the coil, to 19, the binding post on the condenser frame; connect 20, the G terminal, to 21, the stator binding post of the condenser; connect 22, the No. 1 terminal of the coil, to 23, the other lug on the Micadon; and connect 24, the B post, to 25, the B post on the first R. F. transformer.

Connect 26, the lower right hand terminal of the 4-spring jack, to 27, a second lug on the B binding post; connect 26 also to 28, the lower right hand terminal of the 3-spring jack. Connect 29, on the left hand rheostat, to 30, the upper left hand terminal of the 3-spring jack.

9. Clip off the contact spring lugs on the Buell sockets where the lugs extend beyond the bases, as these are not used. Remove the contact mounting screws from two of the sockets and, in their places, put ¾-in. 6-32 R. H. screws inserted from the top down so that the screw heads are on the upper part of the bases. Put a small 6-32 nut on each screw and tighten them so as to hold the contact springs firmly. Be careful not to turn the springs upside down while you are doing this. With the slots in the positions shown, fasten two sockets to the tube panel right behind the center tuning condenser. They carry the two R. F. amplifier tubes. In the same manner, change the screws on the P+ and — contacts of another socket. That is the center socket. The first socket in from the left, carrying the first A. F. amplifier tube, should have the ¾-in. screws put in on the +, —, and grid binding posts, while the left hand socket should have the ¾-in. screws put in on the + and — terminals only.

Fasten the Benjamin support brackets to the ends of the tube panel with ½-in. 6-32 R. H. screws and nuts. Have the horizontal part of the brackets under the tube panel. Fasten the left hand or second A. F. amplifier socket to the base panel. The screw through the — contact comes right against the mounting bracket. Solder this screw to the bracket, making connection 31. Then mount the other four sockets and the

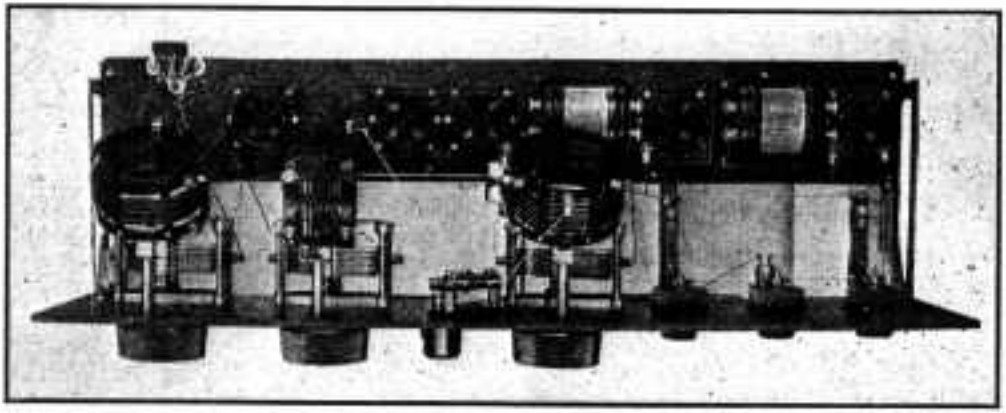


Fig. 6. This view shows the Karas Harmonic transformers, a new type which employs a rather unusual type of mounting

Jones multi-plug on the tube panel.

10. Connect 32, the + terminal of the left hand socket, to 33, on the multi-plug. In Fig. 4 is a separate sketch showing the connections as they are made to the multi-plug, looking at the plug from the rear of the socket. This wire should pass by the + terminals of the other four sockets and connections should be made from 34 to 35, 36 to 37, 38 to 39, and 40 to 41. Note that this wire goes along the underside of the panel and up through a hole to the multi-plug.

11. Fasten the two angle brackets on the bottom of the tube panel at the front edge with ½-in. 6-32 R. H. screws and nuts. The screws should go in the right hand holes of the horizontal part of the bracket. In the left hand hole of the vertical parts, put ½-in. 6-32 screws threaded into panel support pillars, as shown in the picture wiring diagram. The screw into the right hand pillar should have a lug on it.

12. Connect 42, the lug on the pillar, to 43, on the multi-plug. This wire goes up to the plug through a hole in the panel. Fasten the right hand Karas amplifying transformer on the tube panel, using ½-in. 6-32 R. H. screws and nuts. Make sure the terminals are in the correct locations. Connect 44, the G post on the transformer, to 45, the G post on the first A. F. tube socket. This wire goes up through a hole in the panel. Connect 46, the B + post on the transformer, to 47, on the multi-plug. Connect 48, the P post on the transformer, to 49, the P post on the detector socket.

13. Mount the left hand Karas transformer, using ½-in. 6-32 R. H. screws and nuts.

14. Connect 50, the F post on the transformer, to 51, the F post on the other transformer. Fasten a 0.001 Mfd. Micadon to the underside of the tube panel, just under the left hand A. F. transformer, using a ¾-in. 6-32 R. H. screw and nut. This will clamp down on wire 32 to 33, making connection 53. Solder the lug at the other side of the Micadon to wire 50 to 51, making connection 52. Connect 54, the G post of the transformer, to 55, the G post on the left hand socket. This wire goes down through the panel and up again. Solder one lug on the Dubilier grid condenser to the G post of the detector socket, making connection 56.

15. Fasten the Benjamin brackets to the front panel, using ½-in. 6-32 R. H. screws and nuts, and fasten the two pillars to the front panel with ½-in. 6-32 F. H. screws. Put one lug under the right hand post pointing to the left and two lugs under the left hand post, one pointing left and one right.

16. Connect 57, a lug under one post, to 58, a lug under the other post. Connect 59, the other lug on the left hand post, to 60, a terminal on the lock switch. Connect 61, a connection on wire 29 to 30, to 62, the — post of the first A. F. amplifier tube. This runs underneath the panel. Insulate the wire with MR varnished tubing where it runs along the tube panel. Connect 63, the upper right hand lug on the 3-spring jack, to 64, a lug on the screw which fastens the tube panel to the mounting bracket. Connect 65, the lower left hand lug on the 3-spring jack, to 66, the P post of the socket. Connect 67, the right hand terminal of the center rheostat, to 68, the — terminal on the detector socket. Insulate this wire with MR tubing. Connect 69, the B + terminal of the left hand transformer, to 70, the lower left hand terminal of the 4-spring jack. Connect 71, the P terminal of the transformer, to 72, the upper right hand lug on the jack. These last two wires should be insulated with MR tubing. Connect 73, the upper left hand lug on the jack, to 74, the P post on the first A. F. socket.

Connect 75, the second lug on the frame terminal of the left hand condenser, to 76, a connection made to wire 32 to 33. Connect 77, the — terminal of the second R. F. socket, to 78, the — terminal of the first R. F. socket. Connect 79, the right hand terminal of the right hand rheostat, to 80, a connection on wire 77 to 78. This wire should be insulated with MR tubing. Connect 81,

(Concluded on page 256B)

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EDITORIAL

SUMMERTIME is the radio manufacturer's opportunity to take stock of himself and his organization. This, of all summers, is not a mere dull period to be passed away by trips abroad—it's an opportunity to groom for next winter's battle. And battle it will be, too, for we shall see whether or not some of the companies so heavily financed last fall, now closed down tight, will be able to come back and hold on this fall.

The greatest weakness today is in the mechanical design of the sets and the manufacturing methods used to produce them. Last season the general idea seemed to be: slap'em together and throw'em out. The result is proof conclusive that that method doesn't work.

Circuits? There are plenty of good ones. The manufacturer's problem is to use them. Radio engineers? There are too many. The manufacturer needs mechanical designers and competent production and factory superintendents.

Last year's cheap sets were costly to the producer and consumer because they were failures. If they were good, they were not good enough. If you don't believe this, give yourself a little education. Buy a Weston phone plug and break it apart. You will find out more from that plug at less expense than in anything else you can do.

Count the number of parts, look at their design, examine the quality of the workmanship. Compare it with any other plug at any price. Any B. C. L. can tell you that it wasn't made by a radio manufacturer. Yet the Weston Company makes a profit on it at a list price of seventy-five cents.

What's the answer? Factory brains and factory equipment. If you want a post-graduate course, buy a Weston 301 voltmeter and take it apart. What would a radio manufacturer charge for such an instrument? Of course no radio company could produce it. Who controls limits to one-millionth of an inch, puts on knurling so fine it can't be seen, cuts threads two hundred to the inch, or makes parts today, accurate to half a thousandth, which are interchangeable in instruments ten years old? Weston does. Weston does all this and dozens of other things as remarkable in the 301 instrument which you buy for seven dollars and a half—and makes money at it.

Sixty or seventy-five dollars for a cheap, thrown-together radio set? It's absurd. The cost isn't in materials. It's in unnecessary labor, the expense of defective sets, service and sales effort required for inferior merchandise, and the losses on over-production.

The Atwater-Kent Company is the most successful radio manufacturer in this country because there is manufacturing intelligence and built-in honesty and stability in Atwater-Kent apparatus. Others are trying, some don't know how to try, and some don't try at all. The president of a company which put out a large stock issue last winter told me rather proudly that their returned, defective sets were only six per cent. I know they were more than that, and I know that they have on hand parts which will never be used for one-fifth as many sets as they sold.

With such competition it is easy to understand the success of the Atwater-Kent Company. If the public's money had gone into factory equipment rather than into the pockets of the executives, radio would have been saved two or three years of growing pains.

M. B. SLEEPER,
Editor.

Speeding up Set Assembly

Describing two devices used in the factory of the Howard Radio Company, originally designed for their own use, and now supplied by them to other manufacturers

WHILE New York City may be considered the center of the radio industry, there are many very clever things done in other places which are not found in New York.

Two devices which will interest everybody were discovered in the factory of the Howard Radio Company in Chicago. This concern manufactures the most expensive line of neutrodyne receivers, and at prices which are thoroughly justified by the quality of the workmanship and the thoroughness of inspection to which the equipment is subjected at each step.

One operator does not, of course, do all the work but the sets are carried from one bench to another in substantially constructed racks which are wheeled around the factory.

A striking feature of the Howard equipment is the wiring. By using substantial terminals, the ordinary objections to heavy bus bar are overcome. Moreover, the bus bar is only employed between rigid points, where there is not play which would strain the terminals. Every wire is cut to length and bent by means of a jig, so it is not necessary

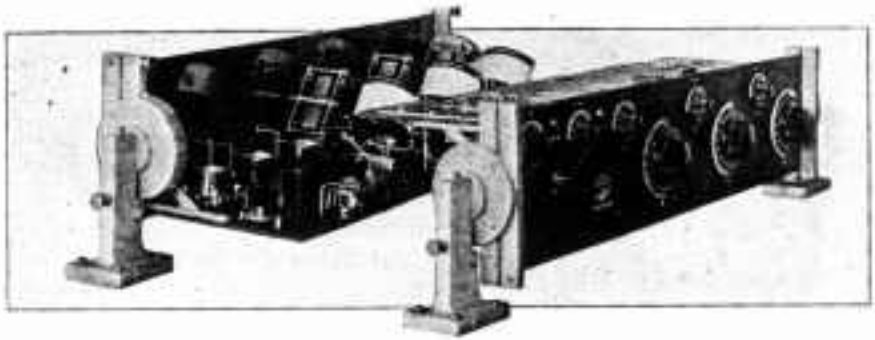


Fig. 1. The device employed for holding the set while the assembly work is being don

In Fig. 1 you will see the fixture employed on the assembly benches for holding the sets while the parts are being assembled and the wiring put on. This fixture consists of a pair of uprights, supporting discs on which clamps are mounted. At the side of each support is a pin which engages in holes in the disc, thereby allowing the set to be rotated at any angle. The clamps are readily released or tightened on the ends of the front panel. By employing this method of mounting the sets, all the work can be done, even to mounting the knobs and dials, without scratching or injuring the set while it is being handled during the assembly processes.

for the operator to do any fitting. Fig. 2 shows the bending device.

The frame carries three blocks against which the bus bar, already cut to length, can be secured. The wire is pushed out to the side until it strikes the corresponding stop. Then the handle is thrown upward, bringing the halfround shaft up against the wire until it is bent to the correct angle as determined by stops on the sector at the front of the jig. In this way the wires are held to uniform dimensions within a very small fraction of an inch.

These devices are now supplied to other manufacturers, for their genuine usefulness has been quickly appreciated by other concerns.

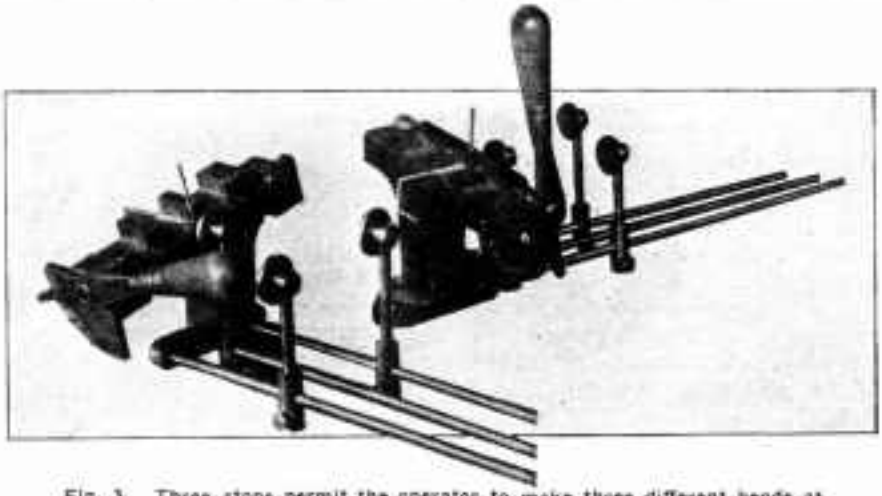


Fig. 3. Three stops permit the operator to make three different bends at angles determined by the stops on the sector

The Latour Patents

THE recent announcements concerning the Latour patents have created much discussion among manufacturers of radio sets. Briefly, Maurice Latour, a French scientist, has come to the United States for the apparent purpose of allowing the use of his name and patents to be capitalized by some of the larger companies who hope to embarrass the smaller concerns by resurrecting these old patents which most of us had forgotten if we ever knew about them at all.

Announcements sent out to magazines and newspapers were so worded as to give radio dealers and jobbers the idea that they might be held liable for all profits made on sets not licensed under the Latour patents.

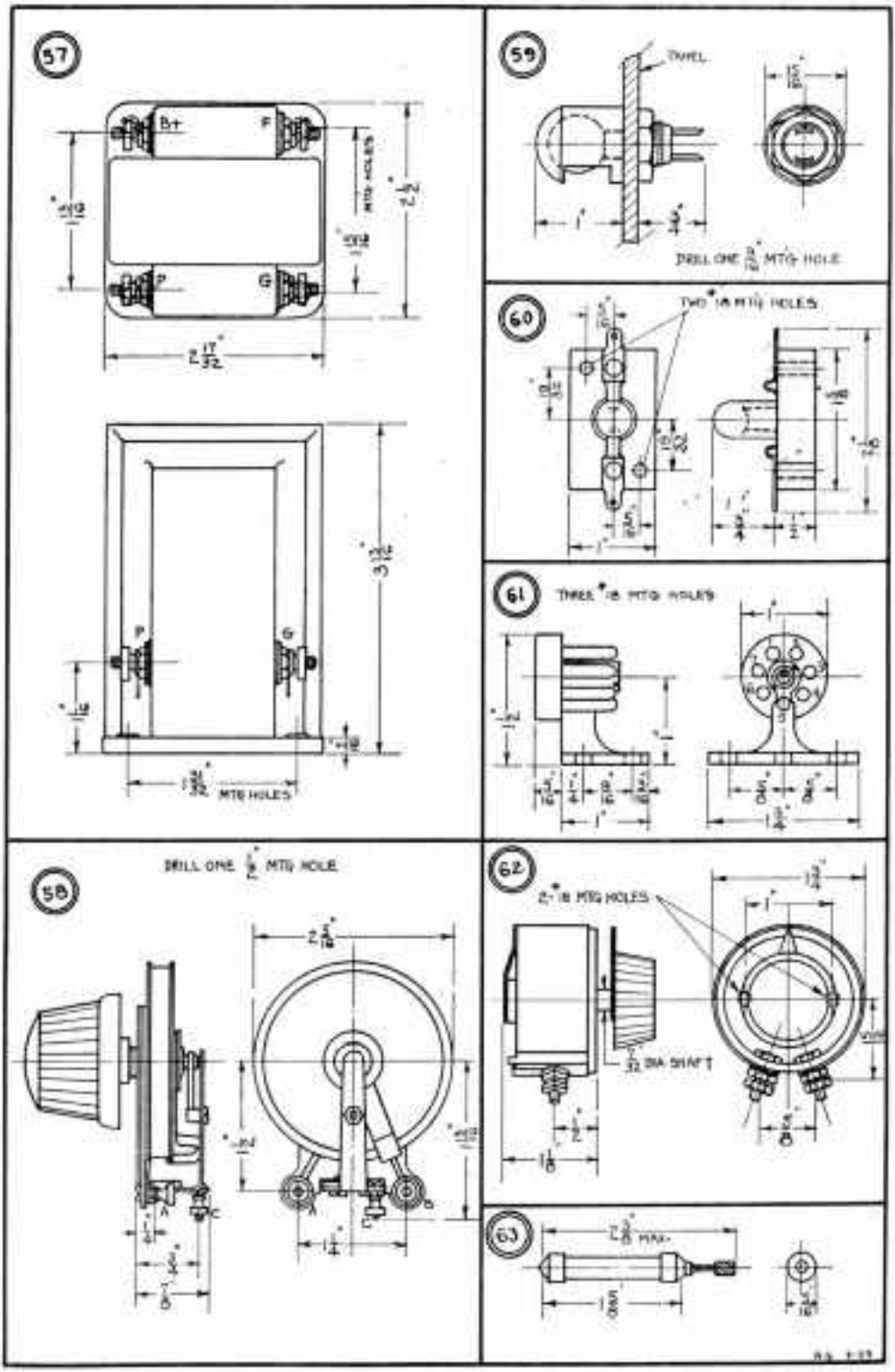
Copy of this sort is just the thing which should be avoided, particularly at this time of the year.

No damages can be collected until these patents have been definitely established by lengthy litigation which might take years to settle. Some of the patents might be sustained, while others might not. As for damages, dealers and jobbers need not be alarmed, for the amount that could be collected would be small compared to the expense of bringing hundreds of separate suits.

In the meantime, it is interesting to speculate as to whether or not any of the Latour patents will be sustained. Some of these patents are said to be ten years old. The use of iron-core transformers and the common B battery for several tubes have been general practice for six or eight years. As for reflex circuits, the decreasing cost of tubes has taken away the economic advantage which has been the main point in favor of that system. If the transformer patents are brought into litigation, manufacturers will simply take up resistance coupling. The only vital patent is that covering the use of a common B battery.

Those familiar with patent laws know that suits have been thrown out of court repeatedly when the public has been allowed to use a patented device or method over a period of years without opposition from the inventor. It certainly looks as if Latour has given away such rights as he may have.

We believe thoroughly in upholding the rights of an inventor to all the profits he can get from his work. In this case, however, it appears that Latour would not have concerned himself with his American patents if he had not been urged to by some of the American manufacturers, already employing his inventions without license, who suddenly decided that it would be to their advantage to stop others from doing the same thing they have been doing.


57
B+
F
P
G
MTG HOLES
2 17/32"
3 1/2"
MTG HOLES
58
DRILL ONE 1/2" MTG HOLE
59
PANEL
DRILL ONE 3/16" MTG HOLE
60
TWO #8 MTG HOLES
61
THREE #8 MTG HOLES
62
2-#8 MTG HOLES
1/32 DIA SHAFT
63
2 3/8" MAX.

Data Sheet No. 8

57. RAULAND-LYRIC A. F. TRANSFORMER: This audio transformer has a ratio of 3 to 1, and has an extremely high inductance combined with a very low distributed capacity in the secondary winding. It is larger in size than the usual transformer due to the high number of turns used, and the abundance of iron in the magnetic circuit. It is enclosed in a handsome metal case having a black crystallized lacquer finish. The terminals, which include both soldering lugs and binding posts, are brought out about 1 in. above the bottom, so that wiring is made very simple in the set. It was designed as a laboratory grade instrument, where high amplification combined with purity of reproduction is desired. Four mounting holes are provided in the base.

58. CARTER POTENTIOMETER: This instrument differs from the ordinary potentiometer both in appearance and principle of operation. The resistance winding is composed of many turns of fine wires carried by the disc unit. The nickel plated phosphor bronze contact arm is shaped so as to give very smooth operation and clock spring pigtail connections eliminate any possibility of poor contacts. The terminals marked A and B in the drawing are for the A battery connections. Terminal C is connected to the contact arm. This device is made in both 200 and 400 ohm sizes, and can be obtained with either black or mahogany knobs or dials.

59. WALBERT PANELITE: The Panelite is designed to mount on the front panels of radio sets, to provide a light for observing the tuning dial numbers. It is similar to the familiar dash light on automobiles. The miniature lamp provided is rated at 6 volts and 0.3 amp., making it suitable for operation on the usual radio storage battery. The light is thrown in a 90-degree angle. All parts are heavily nickeled. Connections are made to two soldering tabs at the rear.

60. GEM RADIO FUSE: This fuse is used as a protection to the vacuum tube filaments against excessive flow of current which would occur should the B battery voltage be impressed upon them accidentally. The composition base has two mounting holes. The fuse is sealed in a transparent glass tube, designed to be plugged into the base. This device should be connected in the negative lead of the B battery circuit between the —B and +A terminals. When a fuse is blown out, another is inserted.

61. JONES MULTI-PLUG: The drawing shows the bracket type socket used with the Multi-Plug. The frame is of nickeled brass. Connections from the set are made to the hollow tubes which are already filled with solder and painted with identifying colors explained on the descriptive card. In the drawing the tubes have been numbered and the connections are: 1, ground; 2, antenna; 3, A+; 4, B+ Amp; 5, B+ Det; 6, B—; 7, A—. The plug which goes with the device has split prongs which fit into the tubes above, with a key slot arrangement to make wrong plugging impossible.

62. GENERAL RADIO RHEOSTAT: The drawing shows the main dimensions of the rheostat. The resistance element is shaped so as to obtain a large heat radiating surface. The supporting frame is of bakelite and two terminals are provided at the bottom. The polished bakelite knob has a small nickeled pointer cast into it. A broad contact arm provides very smooth operation. This rheostat is made in all standard sizes, and mounts on the panel with the two R.H. machine screws and nuts provided.

63. EAGLE VARIABLE GRIDLEAK: This item is an improved type of variable gridleak in cartridge form, in which the plunger is screwed in and out to vary the resistance. It is designed to fit into the standard gridleak mountings. A knurled head on the plunger provides an easy grip. The thread on the shaft is very fine so that critical adjustment is possible.

The D-21 standard base Sodion, around which a number of new sets for fall delivery are being designed.

THE Dayton Fan & Motor Company, of Dayton, Ohio, is the latest company to adopt the plan for exclusive distributor territory and dealer franchise. It is quite possible that the distribution of radio sets will develop along the lines laid down by the phonograph and automobile dealers, in this respect.

A suit brought by the Splitdorf Electrical Company of Newark, N. J., against the Dubilier Corporation in connection with the manufacture of fixed condensers has attracted much attention among manufacturers. The patent at issue, owned by the Splitdorf Company, issued on May 2nd, 1916, number 1181623. This patent is said to cover broadly the ordinary type of fixed mica condenser, used originally in connection with magnetos and spark coils.

Hudson-Ross, the biggest radio distributors in Chicago, have moved to 116 South Wells Street. Robert Himmel, president of the company, has planned a number of new features for the display of nationally advertised equipment which will appeal strongly to the dealers and to the manufacturers as well.

Everyone is wondering if the Dongan Electric Company, of Detroit, has solved the question of producing meters of a quality and at a price suitable for use on receiving sets. There is certainly a psychological advantage in having something on the radio set to give a reaction to the adjustment of some of the controls. Needle-wiggling may have its devotees as well as dial-twisting.

The patent office is at last beginning to issue a number of patents which have a direct bearing upon the activities of radio manufacturers. The H. H. Eby Manufacturing Company, makers of the standard Eby binding posts, has just announced the issuance of patent 1529244, dated March 10th, 1925, covering the design of the familiar Eby binding post.

The Kodell Radio Corporation, of Cincinnati, is now in production on a 5-tube tuned R. F. receiver which they call the Logodyne. This is a much more elaborate outfit than the very low-priced receivers which they have been building, and judging from the photographs it is a thoroughly workmanlike job. The plain model, mounted in a mahogany cabinet, lists at $82.50, while the console model is priced at $250. The cabinet has a built-in loudspeaker and a compartment for all the batteries.

Judging from the results produced, one of the most popular loud speakers and phonograph units this year will be the Symphony reproducer, recently introduced by the Kellogg Switchboard & Supply Company of Chicago. The reproducer unit possesses a remarkable combination of quality and volume which promises to compete favorably with the cone type loudspeaker. Moreover, it has the advantage of fairly high impedance so that no special amplifier tube or circuit is required in the last stage.

The Zenith Radio Corporation has answered everybody's question, "What Next?" by moving their factory into far larger quarters than they occupied before, and the executive offices into an entire floor of the new Straus Building. Obviously, the Zenith Company is not worried about selling its next winter's production.

Manufacturers' and Designers'

Reference Data on

Fixed and Variable Condensers

The data presented have been carefully compiled with the assistance of the manufacturers represented. By removing these pages from the magazine you will have a complete reference file on fixed and variable condensers. Next month this section will be devoted to sockets, dials and switches.

Specifications for Variable and Fixed Condensers

Note: S. & W.—Soldered and washers; H. R.—Hard rubber; St. & W.—Staked and washers; S. P.—Single-plate vernier. Dimensions are given in the order, width, height and depth. When more than one dimension is given for depth, the depths are given in the order of the capacities.

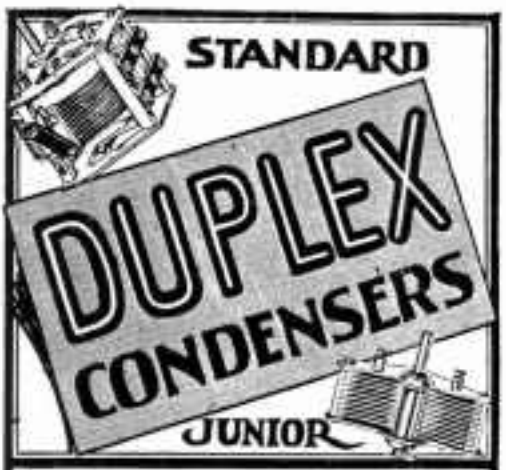
VARIABLE CONDENSERS

Manufacturer	Movement	Insulation	Maximum capacity	End plates	Assembly	Overall size	Shaft diam. and length	Plates	Vernier None
Adams Morgan Co., Inc...	Rotary	Celoron	.00035 mfd.	Celoron	Washers	3½x3½x2½	¼x⅜	Aluminum	Separate, on dial
Allen-Bradley Co.....	Rotary	H. R.	.00025-.00035-0.0005-.001	Metal	Soldered	3 1/16x2½x1 ⅜, 1 ⅜, 2½, 3 ⅜	¼x⅞	Brass	
Ambassador Sales Co., Inc.	Rotary	H. R.	.0005	Metal	Soldered	4x3¼x3¼	¼x⅝	Aluminum	None
*Amsco Products, Inc....	Rotary	Radion	.00032-.0005-.001	Metal	Staked	3x2¼x3	¼x1 1/16	Aluminum	None
Art Craft Mfg. Co.....	Rotary	H. R.	.00025-.00035-.0005-.001	N.P.Brass	S. & W.	———	¼x—	Br. or Alu.	None
Audiola Radio Co.....	Rotary	Bakelite	.00047	Metal	Washers	3½x3½x2¼	¼x⅝	Alu. or zinc	None
*Bremer-Tully Mfg. Co....	Rotary	Redmanol	.000125-.00025-.00035-.0005-.000725	Die cast	Die cast	3½x2½x—	¼x⅜	Aluminum	None
Buell Mfg. Co.....	Rotary	H. R.	.000232-.000482	Die cast	Die cast	3½x3x3, 4	¼x⅜	Aluminum	None
*Cardwell Mfg. Co.....	Rotary	H. R.	.00025-.0003-.00035-.0005-.001	Brass	St. & W.	———	¼x—	Aluminum	Special
Carleton Sanders Co.....	Sliding	Radion	.00025-.00035-.0005	Brass	Soldered	4¼x2½x1 ⅜, 2, 2¼	¼x⅝	Brass	360° dial
*Chelton Electric Co.....	Rotary	H. R.	.00025-.00035-.0005	Aluminum	S. & St.	3½x2x2¼, 2½, 2¾	¼x⅜	Aluminum	None
*Chelton Midget type.....	Rotary	H. R.	.000027	Aluminum	Staked	1¼x1¼x1½	1/16x⅜	Aluminum	None
Cruver Mfg. Co.....	Rotary	H. R.	.00025-.000325-.0005-.000867	Aluminum	Washers	———	¼x⅝	Aluminum	S. P.
Di-Kast Condenser Corp..	Rotary	H. R.	.00026-.00058	Die cast	Die cast	3¼x2½x2¼, 2½	¼x⅝	Die cast	Gear
*Duplex Cond. & Radio Corp.....	Rotary	H. R.	.00026-.00036-.0003-.001	Brass	Cast & St.	4x3½x2⅛, 2½, 2⅞, 3⅝	¼x⅞	Aluminum	S. P.
*Duplex Cond. & Radio Corp.....	Rotary	Bakelite	.00025-.00024-.00029-.0004-.00055-.001	Aluminum	Cast & St.	3½x3½x1 1/16, 1½, 1½, 1 ⅜, 2½, 3 1/16	¼x⅜	Aluminum	S. P.
*D-X-L-Radio Corp.....	Rotary	H. R.	.00001-.00018-.00025-.00032-.00035-.0003-.001	Metal	Soldered	3½x2½x2¼ to 4	¼x1	Brass	None
*Eagle Condensers, Inc...	Rotary	H. R.	All standard capacities	Brass	Washers	———	¼x⅜	Aluminum	S. P.
*Electrical Research Labs.	Rotary	H. R.	.0001-.00025-.00035-.0005-.001	Brass	Staked	3 ⅜x3½x1 7/16, 2 1/16, 2½, 2¾, 4	¼x⅜	Aluminum	None
Elgin Radio Corp.....	Rotary	Bakelite	.00008-.0001-.0002-.00025-.0003-.00035-.0005-.001	Bakelite	Washers	3½x2½x1, 1½, 1½, 1 1/16, 1 ⅜, 2, 3¼	¼x⅜	Aluminum	S. P.
Elgin Radio Corp.....	Rotary	Bakelite	.00025-.0003-.00035-.0005-.001	Metal	Staked	3½, 3⅞ ⅜x1½, 1¾, 1 ⅜, 2⅛, 3 1/16	¼x⅜	Alu. or brass	None
Elgin Radio Corp.....	Rotary	Bakelite	.00025-.0003-.00035-.0005-.001	Metal	Washer	3 ⅜x2¾x1 7/16, 1 ⅜, 2 1/16, 2½, 3¼	¼x⅜	Alu. or brass	None
Federal Tel. Mfg. Co.....	Rotary	Bakelite	.000275-.000525-.001	Bakelite	Washers	———	¼x⅝	Aluminum	None
*Freshman Co., Inc.....	Rotary	Bakelite	.00025-.00035-.0005-.001	Brass	Soldered	———	¼x⅝	Brass	None
Gardiner & Hepburn, Inc..	Rotary	Radion	.00025-.00035-.0005-.001	Metal	Cast	4x2½x2¼, 3, 3, 4¾	¼x⅝	Aluminum	None

VARIABLE CONDENSERS — Continued

Manufacturer	Movement	Insulation	Maximum capacity	End plates	Assembly	Overall size	Shaft diam and length	Plates	Vernier
Gardiner Midget type	Rotary	Radion	.000022	Metal	Wash. & St.	1½x1x1½	⅛x½	Aluminum	None
Garod Corp	Rotary	H. R.	.0003	Metal	Washers	4½x2⅛x2¾	¼x¾	Brass	No
General Instrument Co.	Rotary	H.R. Pyrex Isolantite	.00025-.0003-.00035-.0005-.001	Br. or Alu.	St. & W.	3⅜x2½x2¼, 2¾, 2¾, 3⅜, 4⅞	¼x⅜	Aluminum	Gear
*General Radio Co.	Rotary	H. R.	.00025-.0005	H. R.	Soldered	———	¼x1½	Brass	Gear
Grasser & Sons Co.	Rotary	H. R.	.00025-.00035-.0003	Aluminum	Cast	———	¼x¾	Aluminum	None
*Hammarlund Mfg. Co.	Rotary	Radion	.00025-.0003-.00035-.0005-.001	Aluminum	Soldered	4x3½x2¾, 2¾, 2¾, 2¾, 3⅞	¼x¾	Brass	Cam
Imperial Elect. Mfg. Co.	Rotary	H. R.	.00025-.0003-.00030-.00033-.001	Aluminum	Washers	———	¼x1	Aluminum	Friction
Kodel Radio Corp.	Book	Mica	.0005	Metal	———	2½x3½x¾	¼x¾	Phos. bronze	4-turn dial
Lincoln Radio Corp.	Rotary	H. R.	.0005	Metal	Die cast	4¼x2¼x3¼	¼x¾	Aluminum	None
Manhattan Elect. Supply Co.	Rotary	H. R.	.00028-.00037-.0005-.001	Metal	Soldered	4x4x2½ to 4¼	¼x¾	Brass	Friction
Martin-Copeland Co.	Rotary	H. R.	.00025-.00035-.0005-.001	Brass	Soldered	3½x3½x3, 3⅞, 3¾, 3⅞	¼x¾	Brass	None
Martin-Copeland Co.	Rotary	H. R.	.00002-.00004-.00006	H. R.	Washer	2¼x1¾x1½, ⅜, ⅝	⅜x⅞	Brass	None
Metrie Instrument Co.	Rotary	Bakelite	.0002-.00025-.0003-.00035-.0005-.001	Brass	Staked	3½x3½x2½, 2¾, 2⅞, 2⅞, 2⅜, 3⅜	¼x⅜	Brass	20-1 friction
*National Company	Rotary	Radion	.000125-.00025-.00035-.0005-.001	Aluminum	Washers	3¼x3x2⅞, 2¾, 3, 3⅞, 4⅞	¼x special	Aluminum	5-turn dial
National Radio Co.	Rotary	Formica	.00025-.00035-.0005	Metal	Soldered	2¼x3½x2¼	¼x⅜	Brass	None
Nelson Tool Co. (See Stag Sales Co.)									
New York Coil Co.	Rotary	Bakelite	.00025-.00035-.0005	Metal	Washers	3⅝x3½x2¾, 2⅝, 2¾	¼x¾	Aluminum	None
New York Coil Co.	Rotary	H. R.	.00025-.00035-.0005	Metal	Washers	3½x3¾x2¾, 3⅝, 3½	¼x¾	Aluminum	None
New York Coil Co.	Rotary	Bakelite	.00025-.00035-.0005-.001	Metal	Washers	3½x3¾x2, 2¼, 2½, 4	¼x⅜	Aluminum	None
*Parent Electric Co.	Rotary	H. R.	.0003-.0005	Molded	Special	3⅞x2¾x2½, 3⅛	¼x⅜	Brass	None
*Phenix Radio Corp.	Rotary	Bakelite	.00025-.00035-.0005	Die cast	Die cast	3x3½x3¼, all sizes	¼x⅜	Brass	20-1 dial
Preferred Radio Prod. Co.	Rotary	Radion	.00026-.00039-.00053-.001	Aluminum	Staked	———	¼x⅝	Aluminum	Gear
Premier Electric Co.	Rotary	H. R.	.0001-.00025-.00035-.0005	Brass	Soldered	3x3x2 to 4	¼x⅜	Brass	Ver. dial
Radio Development & Mfg. Co.	Rotary	Bakelite	.00025-.0005	Molded	Die cast	3½x2½x2¼, 2½	¼x⅜	Die cast	Gear
Splitdorf Electrical Co.	Rotary	Bakelite	.00025-.00035-.0005	Metal	Die cast				
Stag Sales Corp.	Sliding	Bakelite	.00025-.00035-.0005-.001	Brass	Washers	4x1⅞x2, 2¼, 2½, 3½	¼x¾	Brass	360° dial
Triangle Atlantic Corp.	Rotary	Radion	.0003-.0004-.00052-.001	Aluminum	Staked	4x3¼x2¾, 2½, 3, 4⅞	¼x⅜	Brass	25-1 gear
*Turn-It Radio Sales, Inc.	Special glass enclosed type, fitting standard grid leak mounting. Mica insulation, 0.0001 to .0006 capacity.								
United Scientific Labs., Inc.	Rotary	Radion	.00025-.00035-.005-.001	Aluminum	S. & W.	3½x2x2, 2¼, 2⅝, 3	¼x⅜	Br. or Alu.	Cam
Viking Tool & Mach. Co.	Sliding	Radion	.000125-.00025-.0005	———	Soldered	2x4½x2⅝, all types	⅛x⅜	Brass	16-1 dial
Wade Mfg. Co. (See Viking Tool & Mach. Co.)									

Manufacturer	Mounting	Mounting material	Capacities	Dielectric	Length and width	Thickness: Smallest cap	Thickness: Largest cap	Terminals	Grid leak Mtgs.
Aerovox	Open	Bakelite Plates	.0001 to .01 mfd.	India mica	1 3/4x1 3/4	1/4 in.	3/4 in.	Lugs	Yes
Aerovox Wireless Corp.	Open	Bakelite Plates	.0001 to .01	India mica	1 1/4x1 1/4	1/4 in.	3/4 in.	Lugs	Yes
Carter Radio Co.	Closed tube	Brass	.04-.01-.1	Linen tissue	2 1/4x3/4 diam.	——	——	Wires	No
Dazalger-Jones	Open	Aluminum	.00005 to .00015	Ruby mica	1 1/4x1/4	1/4	1/4	Lugs	No
*Dubilier Condenser & Radio Co.	Open	Canvas Bakelite	.00005 to .006	India mica	1 1/4x1 1/4	1/4	1/2	Lugs	Yes
*Electrical Research Labs.	Open	Metal	.0001 to .004	Mica	2 1/4x3/4	3/4	1/4	Lugs	——
*Electrical Research Labs.	Open	Metal	.005 to .006	Mica	3x1 1/4	1/4	1/4	Lugs	No
Kodel Radio Corp.	Open	.....	.00025	Mica	1 1/4x3/4	——	1/4	Lugs	——
Manhattan Elect. Supply Co.	Enclosed	Molded Case	.001	Paper	2 1/4x1 1/4	——	3/4	B. Ps.	No
Muter Company	Open	Bakelite Plates	.00015 to .01	Mica	1 1/4x1	1/4	1/2	Lugs	Yes
New York Coil Co.	Open	Canvas Bakelite	.0001 to .006	Mica	1 1/4x1 1/4	1/4	1/4	Lugs	Yes
Splitdorf Electrical Co.	Open	Bakelite	.0001 to .01	Mica	1 1/4x1 1/4	——	——	Lugs	Yes



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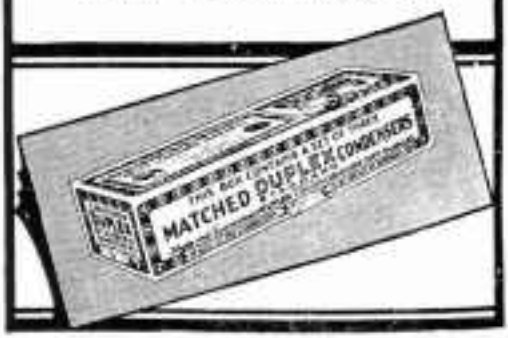

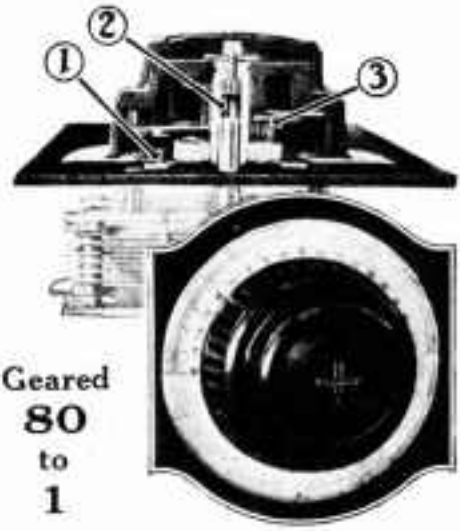

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Fig. 1. Micro photos showing the surface of ink-coated, pencil-coated, and fully impregnated grid leak paper, enlarged 200 times

Notes on Grid Leak Elements

The microscope tells an interesting story about grid leak paper. This data is presented thru the courtesy of Mr. Walter B. Schoeppler, Chief Engineer of the Tridot Electric Company

THE purpose of the grid leak is to provide a path for the escape of the accumulated negative charge, by allowing it to leak off to the filament. A grid leak is an extremely high resistance shunted across the grid condenser or across the grid and filament. As to the magnitude of the resistance employed, every tube, having different characteristics may require a leak of different value. Values from one half to ten megohms are available. If the leak is of too low a value, it will allow the charge to escape before the maximum grid charge has accumulated. On the other hand, if it is too high, the charge will not be allowed to escape quickly enough. An indication of too high a resistance is a knocking sound in receivers produced by the escape of the charge across the tube.

The chief characteristics of a good grid leak, in order of their importance are: 1. Constancy of value. 2. Noiselessness. 3. Accuracy. Why is constancy of value placed first and accuracy last? No matter how accurate a leak is on the manufacturers testing table, if that value does not persist, it is useless in the set. When the correct value of leak for a given tube has been determined, the value of that leak must be permanent or the set will not operate at maximum efficiency.

Care in manufacture and testing alone produce an accurate product. Slight changes in temperature or humidity have the unwelcome habit of changing the resistance values of most grid leaks. In order to produce a grid leak of unalterable value, the material for the resistance element must be properly mounted, enclosed, and sealed so as to minimize any effects of external atmospheric conditions.

The surface coated types of grid leaks were the first to be used. Not many years ago, the lead-pencil grid leak was the only thing to be had. A few pencil lines drawn between two terminals on a piece of cardboard, fibre, or bakelite satisfied the experimenters as well as the manufacturers. The effect of moisture in the air was to change the resistance of the pencil mark by as much as 50%, an amount large enough to spell success or failure of the set. If the tube became inoperative, out came the pencil and eraser. A decrease in temperature causes the individual particles of the resistance carbon forming the leak to contract and pull away from one another, destroying the contact between them. Since the temperature is lower, the suspension of water vapor in the air is less. The moisture is deposited upon the resistance element, forming a film separating the individual granules of carbon.

A rise in temperature results in the expansion of the carbon particles and

less deposit of moisture on the element. It therefore has the effect of decreasing the resistance value of the coated leak.

The ink-paper leak was a slight improvement, due to the fact that a piece of paper can be more uniformly coated with ink than with pencil leak. The microscope reveals the irregularities, cracks, and veins which cannot be avoided in the manufacture of coated elements. The inked paper element possesses the same objectionable features as the pencil line type but to a smaller degree. The absorbing properties of the paper vary considerably over a relatively small area. Since the length and width of the element is fixed, it is the thickness of the coating, that is the depth of penetration of resistive media, that determines the resistance value of the element. This is a serious drawback, for the manufacturer cannot tell the resistance of an element directly from its dimensions.

Neither of the two types of grid leaks described possess the requisite properties of a high-resistance element, constancy in value and noiseless in operation.

Manufacturers now realize that the substance composing the grid leak element should be such that the displacement of the particles of the carbonaceous conducting material should be uniform throughout the cubic content of the paper to provide a smooth, continuous, uniform path.

(*Continued from page 250*)

the P post on the left hand coil unit, to 82, the P post on the second R. F. socket. This wire runs along the underside of the tube panel at the front and then back to the plate terminal. Connect 25, the B post on the center coil unit, to 83, on the Multi-Plug. Connect 84, the P post on the center coil unit, to 85, the P post on the first R. F. socket.

Connect 86, the stator plate terminal of the right hand condenser, to 87, the G post on the first R. F. transformer. Connect 88, the left hand terminal of the antenna coupling coil on the right hand unit, to 89, on the Multi-Plug, and 90, the other coupling coil terminal, to 91, on the Multi-Plug. Both these wires should have take-up ends in them so as to allow for any bending of the coil or tube panel when the set is being handled. This takes the direct strain from the terminals. Connect 92, a lug on the frame terminal of the right hand condenser, to 93, on the Multi-Jack. Connect 94, a joint made to wire 92 to 93, just where it goes up through a hole in the panel, to 95, a connection made to wire 50 to 51 where it goes up through the hole in the panel. This wire should be insulated with MR tubing. Connect 96, the right hand stator terminal of the left hand condenser, to 97, on the grid condenser and put the gridleak in place.

In case you want to use the 0.001 mfd. Micadon in the antenna lead, to make the tuning sharper, connect the Micadon between terminals 88 and 89.

Connect 98, the stator terminal on the center condenser, to 99, the grid contact on the second R. F. socket. Connect 100, on the lead to 33, to 101, on the lead to 91. This completes the wiring of the set.

Testing and Operating

A color chart is supplied with the Multi-Plug so that you can very quickly tell how the leads should be connected to the batteries. Put on the A battery first and then the filament circuit so as to make sure that everything is all right before the B battery is connected. Two 45-volt Eveready B batteries should be used for the plate supply. Connect the — terminal of the first battery to the — B + A lead, the 22½-volt tap of that battery to + B DET and the + binding post of the second battery to + B AMP. the best combination is found.

The C battery should be a 4½-volt Eveready 3. A wire about 75 ft. long and 20 or 30 ft. high is about right for the antenna. The ground must be connected to a water pipe which has water in it at all times.

To tune this set, the three condensers should be put at about the same settings and the control condenser adjusted just under the point of oscillation. When signals are brought in, each tuning condenser should be readjusted and the final setting obtained on the control condenser. Run all the tubes at as low as possible to extend the life of the filament and to conserve the batteries. You may find it advantageous to change the tubes around from one socket to another until

Fig. 1. Showing the front of the amplifier

Ideas for a Two-Step Amplifier

A unit that can be added to a one-tube set, or built right into the receiver

IN a recent issue of Radio Engineering we promised you a two-stage amplifier to match up with the one and two tube sets shown at various times in this magazine. The amplifier shown in the accompanying illustrations was designed after many careful tests and experiments carried on at the Darien laboratory in an effort to produce an outfit as nearly perfect as possible. Various types of transformers were tested comparitively, under exactly the same conditions, the effect of spacing of leads, position of iron cores, and many other things, were considered. We decided it would have to be as compact as possible, yet simple to assemble, and mechanically strong.

Design Of the Amplifier

The circuit, shown in Fig. 3, is a conventional one. Provision for a C battery was made, because in many cases it not only decreases the B battery consumption very materially, but also results in a decided improvement in tone quality.

The design was worked out so that the front, tube, and rear panels can be cut from a single 7 by 14-in. panel of Formica, Celoron, or Radion. A panel 7 by 10-ins., 3/16-in. thick, carries the two rheostats and first and second stage jacks. It also supports the entire tube panel assembly with the aid of two panel support brackets.

The tube panel, measuring 5½ by 7 ins., 3/16-in. thick, supports the two sockets and A.F. transformers. The six binding posts at the rear are kept ¾-in. away from the rear edge to allow easy access when the unit is placed in a cabinet. Two binding posts are provided for the input from the detector circuit, doing away with unsightly wires in front of the set. The transformers are mounted underneath the tube panel and are supported on a Formica strip 1½ by 5½-ins., 3/16-in. thick, which is fastened to the rear flanges of the support brackets. This makes the construction of the amplifier particularly neat and attractive since only the binding posts and the socket shells appear above the

tube panel. It also serves to protect the parts from the inevitable accumulation of dust. The front, tube, and rear panel construction gives the unit remarkable strength and rigidity.

Standard Parts Required The standard parts used are: One panel 7 by 14 ins., 3/16-in. thick, two Amertran 1 to 5 ratio A.F. transformers, two Cutler-Hammer sockets, two 20-ohm

size blue prints. All of the holes for the machine screws are made with a No. 18 drill. The two 1½-in. diameter holes for the socket shells can be cut out very easily with a Stevens panel cutter or Pawood adjustable circle cutter.

Assembly And Wiring The picture wiring diagram in Fig. 3 shows the exact wiring and connections as they appear when looking at the amplifier from

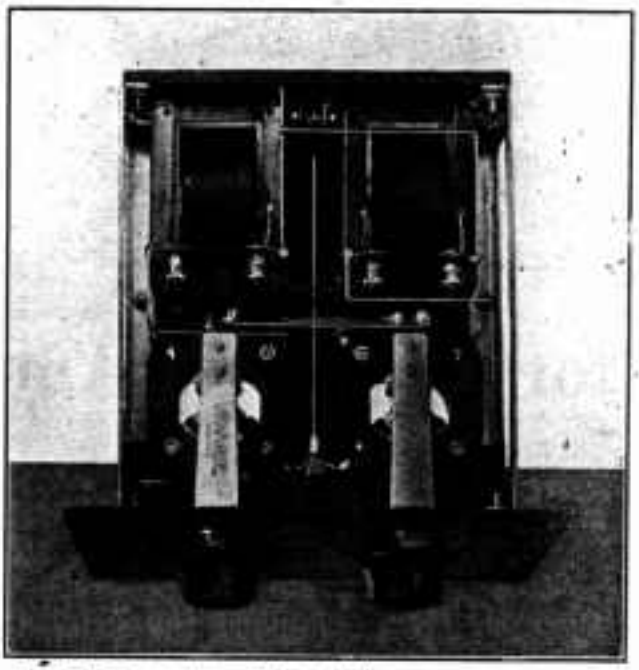

Fig. 2. The bottom of the instrument, illustrating the arrangement of the jacks, sockets, and transformers

De Jur rheostats, and knobs, one pair of Benjamin panel support brackets, with screws and nuts, six Eby or Marshall-Gerken binding posts with soldering lugs, one Carter 101 open circuit jack, one 104 double circuit jack, seven ½-in. 6-32 R. H. brass machine screws, four ¼-in. 6-32 R. H. brass machine screws, nine 6-32 hex brass nuts, ten soldering lugs, a spool of Wirit, and a length of No. 7 Mitchell-Rand varnished tubing.

Drilling The Panels If you desire, you can scale off the location of the holes in the tube panel from the picture wiring diagram as it is shown at exactly one-half size in Fig. 3. However, it is easier to work from the full-

the underside. When assembling the unit you will find that the appearance will be improved greatly if you keep all of the slots in the machine screws pointing in the same direction. Reference to the accompanying photographs will illustrate this. While this point may seem unimportant, it very often means the difference between a neat set and an untidy one. Spintite wrenches will help in accomplishing this since then it is an easy matter to hold the screw with a screwdriver and tighten up the nut with a Spintite. Use Wirit for wiring up the unit, and make all bends square and sharp.

Have the soldering iron hot and clean and use either Kester or Belden rosin

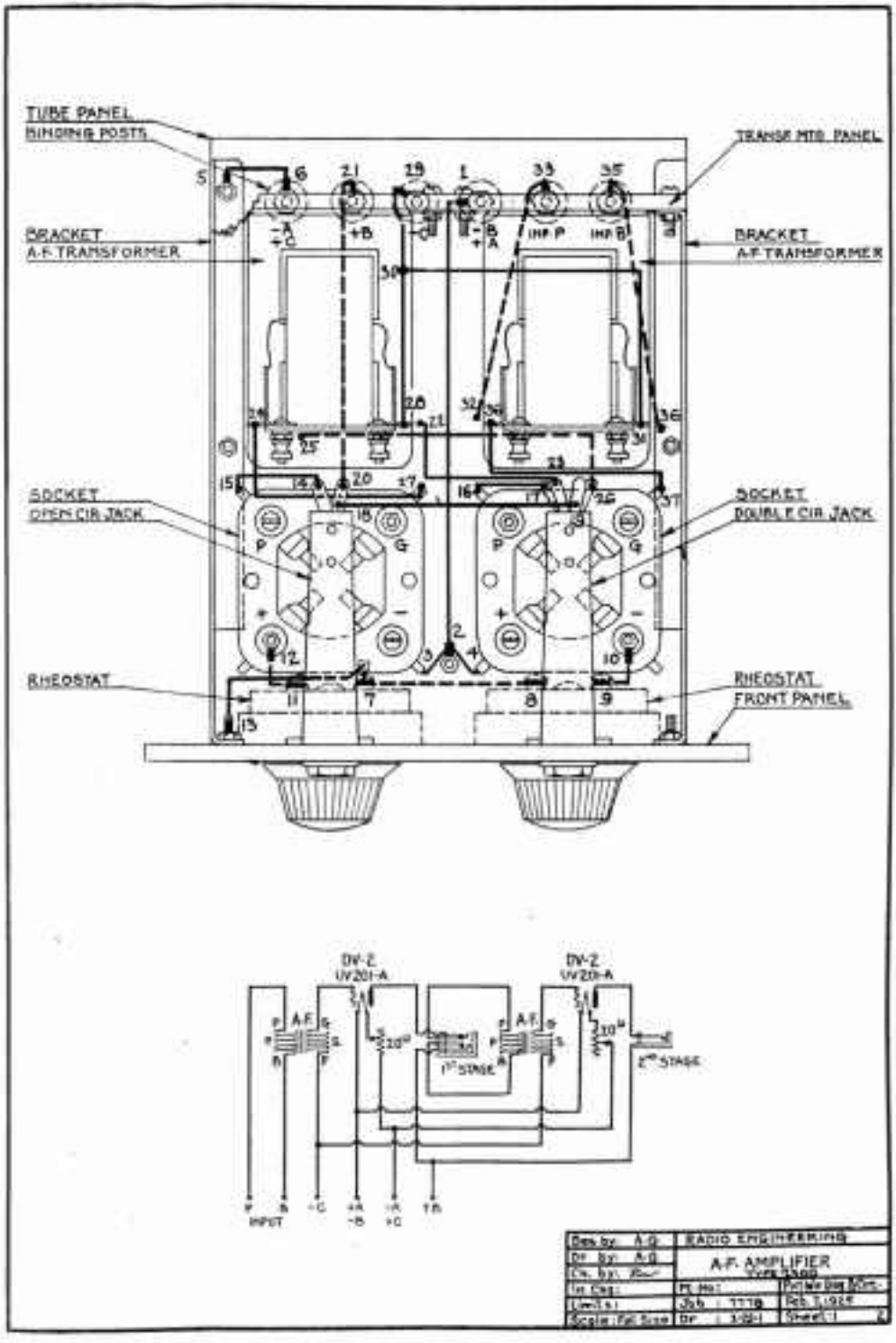

Fig. 3. Schematic and picture wiring diagrams of the two-step amplifier

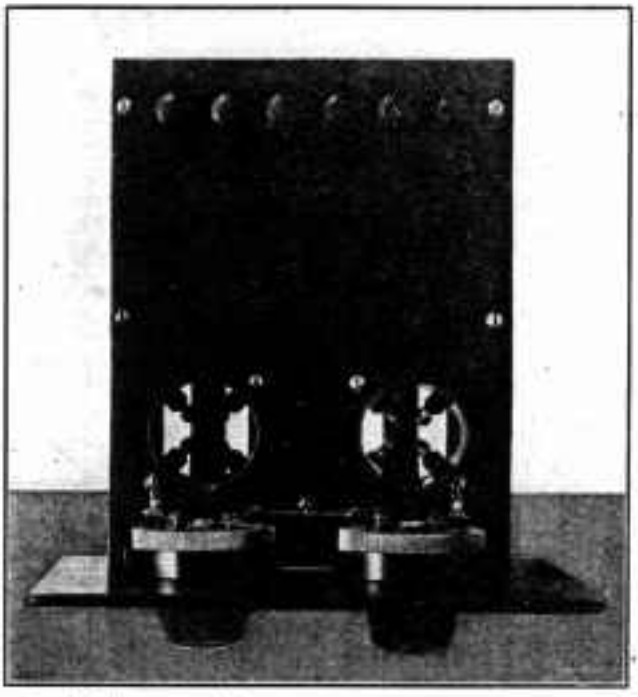

Fig. 4. The very plain appearance of the panel makes the amplifier both attractive and simple in appearance

core solder, or you may prefer plain soft solder with Nokorode paste used sparingly.

1. Mount the six binding posts at the rear of the front panel, keeping the holes in the posts pointing straight to the rear. Put a lug under each nut, pointing in the direction shown by the short heavy lines on the picture wiring diagram. All of the lugs with the exception of 6 and 1 point downward. Remove the screws and nuts from the G and + terminals of the left hand socket, looking up at the panel from the bottom. Put two ¾-in. 6-32 R. H. machine screws through the panel from the top and screw on the two nuts taken from the sockets. Then slip the socket on the screws, replacing the two contact springs in their proper position, and making sure that the socket is turned with its terminals in the position shown in the picture wiring diagram. Now fasten it down with two nuts threaded on to the screws. Be sure to place a soldering lug under the head of the + terminal screw for a connection at the top of the panel. Mount the right hand socket in the same way, only in this case the P and — terminals are fastened to the panel and a lug is put under the head of the — terminal screw. Fill all four lugs of each socket with solder before fastening to the panel, as this will make connection easy later on. Put a ½-in. 6-32 R. H. machine screw through the panel with a lug and nut underneath to make connection No. 2.

2. Connect 1, the —B +C binding post to 2, keeping this wire flat on the underside of the tube panel. Connect 2 to 3, the — lug of the socket. Connect 2 to 4, the + lug of the other socket.

3. Fasten the two Benjamin panel support brackets to the panel with the R. H. machine screws and nuts provided.

4. Put a lug under the rear nut of the left hand bracket for connection 5, and connect this to 6, the —A +C binding post. This bracket is to be used as a —A lead from the binding post to the rheostats.

5. Fasten the front panel to the

brackets with the ½-in. 6-32 F. H. screws and nuts provided. Put a lug under the nut which is nearest the tube panel, on the left hand bracket. Put soldering lugs on the two rheostats, pointing outward, horizontally from the center of each. Mount the rheostats on the front panel with the collar nuts.

6. Connect the two inside terminals 7 and 8 together. Also connect 7 to 13. This wire runs through a hole in the tube panel. 13 is the lug on the left hand bracket. Connect 9 to 10, the lug under the screw of the — terminal. Connect 11 to 12, the lug under the screw of the + terminal.

7. Mount the two jacks under the rheostats with the frames toward the bottom, the open circuit jack going on the left, and the four-spring jack going on the right, looking up at the set from the bottom.

8. Connect 14, the left lug of the open circuit jack to 15, the P terminal of the socket. Connect 16, the P terminal of the other socket, to 17, the lower left hand tab of the other jack. It is advisable to spread the tabs on the jacks apart to provide more room for soldering. Connect 18 to 19 and 20 to 21, the +B binding post. This wire runs straight down from the jack to the tube panel, and along this to the binding post.

9. Fasten the two A. F. transformers to the transformer mounting strip with ½-in. 6-32 R. H. screws and nuts, so that the F— and G terminals of each one will point toward the bottom of the amplifier when the strip is mounted on the brackets. It will be necessary to cut off part of each of the outside mounting fins of the transformers, to fit into the little groove in the brackets. Mount the strip on the rear flanges of the brackets with ½-in. 6-32 R. H. screws and nuts.

10. Connect 22, the B+ lug on the left hand transformer, to 23, the upper left hand tab on the jack. Connect 25, the P lug on this transformer, to 26, the lower right hand tab of the jack. Cover this wire with varnished tubing, and run it just below the cores of the transformers. Connect 24, the G terminal of this transformer, to 27, the G terminal of the socket. Connect 28, the F— terminal of this transformer to 29, running this wire through the hole in the rear strip. Connect 30, a point on this wire, to 31, the F— terminal of the other transformer. Connect 32, the P terminal lug of this transformer, to 33, the INP. P binding post. Connect 36, the B+ terminal lug of the transformer, to 35, the INP. B binding post. Finally connect 36, the G transformer terminal, to 37, the G terminal of the socket. This completes the wiring, and it will be well to check over every connection before testing the unit.

11. Fasten the rheostat knobs to the shafts by means of the set screws, so that the reference marks on the knobs point to the left, when the contact arms are turned all the way to the left. This is the OFF position.

Testing and Operating Place the tubes in the sockets and connect the A battery to the A+ and A— binding posts. Turn up the rheostats three fourths way. This should light the tubes. Now to test the B battery circuit, disconnect the —A terminal from the binding post and connect it to the +B post. The tubes should not light up when this is done. If they do, there is a short circuit somewhere between the plate and filament leads. Now, connect the A, B, and C batteries to the binding posts properly and plug the phones into each jack. This should produce a loud click. Connect the output terminals of the tuner to the input terminals of the amplifier. The INP. B terminal goes to the +B battery side and the INP. P goes to the plate side of the detector. Set the tuner for some station and plug the phones into the first detector jack. This should give an increase in volume over that obtained on the tuner alone. Now plug in on the second jack. This should give a further increase. Try various values of C battery voltage to find which gives the best results. The small Eveready C batteries are handy for this. An Eveready 90-volt B battery is also recommended for the unit. The design has been worked out so that the same A and B batteries can be used for both the detector in the receiving set and the separate A.F. amplifier unit.

Fig. 1. Rawson and Weston types of thermo-ammeters

Thermo-Ammeters for R. F. Tests

A wide range of important R. F. measurements can be made in the thermo-ammeter.

THE most useful, and strangely enough the least known, measuring instrument is the thermo-ammeter. Briefly, a thermo-ammeter is one which indicates the current set up at a connection between two dissimilar metals when they are heated by the passage of a current from an outside circuit. Thus the current to be measured does not operate the meter, but the scale is calibrated so as to indicate the current in the outside circuit. Both alternating and direct currents can be measured on a thermo-ammeter because it operates from a heating effect.

Two conventional types of meters are illustrated in Fig. 1. At the left is an extremely sensitive thermo-ammeter, having a full-scale deflection of 25 milliamperes, made by the Rawson Company, while the smaller one is a Weston meter, reading up to 3 amperes.

For most work on receiving circuit tests, a meter reading to 200 milliamperes is about right. Our 25 M. A. meter is used frequently in special work where the loop attached to the binding posts is merely coupled to the coil in the circuit under test, so as not to introduce a high resistance in the test circuit. In this case the meter is not used to measure a definite current, but simply to indicate resonance.

When it is necessary to handle larger currents, shunts can be obtained to connect across the meter, multiplying the scale reading up to the particular factor of the shunt employed. Several types have self-contained shunts so that the reading can be changed by turning a switch.

The Weston thermo-galvanometer is frequently used in R. F. measurements. This is generally referred to as a current-squared meter for, when the current is doubled, the number of degrees on the scale is multiplied by 4, or to reduce the current by one-half, the circuit must be adjusted until the scale reading is one-fourth of the original value. Full scale deflection is obtained with a current of 115 M. A.

A series of tests are now being carried on in the Darien laboratory to provide more specific data than that given in the October 1924 issue.

BLUEPRINTS for RADIO SET BUILDERS

ONE-TUBE SETS

3 CIRCUIT REGENERATIVE RECEIVER, the famous X-1900 type, sharply tuned and very sensitive. 150 to 600 meters. Type X-1900, 3 sheets. **75c.**

REINARTZ RECEIVER, one of the most popular models ever described in Radio Engineering. A splendid set for all around broadcast work. Type 3300, 4 sheets..... **$1.00**

TC CIRCUIT SET, a 2-control regenerative receiver exceptionally sharp and sensitive. Particularly adapted for indoor antennas. Type X-4000, 3 sheets. **75c.**

IMPROVED RASLA REFLEX, unusually attractive in design as well as in the results produced. This set is also intended for a small antenna. Type 5900, 3 sheets..... **75c.**

HAYNES TUNER, known as the "One Thousand Miled for Fifteen Dollars" set. 2 sheets..... **50c.**

TWO-TUBE SETS

TUNED RADIO REFLEX, using fixed couplers tuned by variable condensers for maximum amplification. Type 5100, 3 sheets..... **75c.**

NEW RASLA REFLEX-2, the 1925 model described in the February issue of Radio Engineering. Has one step R. F., two steps A. F., and fixed crystal detector. Type 7100, 4 sheets..... **$1.00**

BROWNING-DRAKE 199, the standard B-D design, built for dry cell operation. It is equipped with four UV-99 or C-299 types. Type 7000, 5 sheets.... **$1.25**

FOUR-TUBE SETS

PORTABLE TUNED RF RECEIVER, similar in design to the Type 5300 set, but very compact and built for UV-199 tubes. Type 5800, 3 sheets..... **75c.**

BROWNING-DRAKE 201-A, using one UV-199 and three 201-A tubes, arranged to operate on a 6-volt storage battery. Type 6600, 6 sheets..... **$1.50**

BROWNING-DRAKE FIVE, equipped with a 3-step resistance coupled amplifier. Uses one UV-199 and four 201-A's. The finest of all the B-D receivers. Type 7500, 5 sheets..... **$1.25**

FIVE-TUBE SETS

BREMER-TULLY NAMELESS, built with 2-step regenerative tuned R. F. amplifier, detector, and 2-step A. F. amplifier. Type 7400, 5 sheets. **$1.25**

COTTON SUPER-HETERODYNE

COTTON SUPER, peer of long distance receivers, and the simplest of all eight-tube supers in design and construction. Type 7200, 7 sheets..... **$1.75**

AMPLIFIERS

2-STEP AF AMPLIFIER, designed for use with any type of receiving set where additional amplification is required. Type 3100, 3 sheets..... **75c.**

4-TUBE AMPLIFIER, with one stage of transformer coupling and three stages of resistance coupling. Gives tremendous undistorted amplification. Type 6200, 3 sheets..... **75c.**

HAYNES AMPLIFIER, two stages AF. Can be used with any set, although it is designed particularly for the Haynes tuner. 2 sheets..... **50c.**

DEPENDABLE DESIGNS for RADIO SETS

An unfailing power supply
for both circuits

U. S. Patent May 25, 1926
Balkite Battery Charger. Charges 6 volt "A" storage batteries.
Price $19.50
West of Rockies $20

U. S. Patent May 17, 1926
Balkite "B"—replaces "B" batteries and dry cells. Operates from light socket.
Price $55

Here at last is an unfailing power supply for your radio set. Balkite Radio Power Units furnish constant uniform voltage to both "A" and "B" circuits and give your set greater clarity, power and distance. The Balkite Battery Charger keeps your "A" storage battery charged. Balkite "B" replaces "B" batteries entirely and furnishes plate current from the light socket. Both are based on the same principle, are entirely noiseless, and are guaranteed to give satisfaction. *Sold by leading radio dealers everywhere.*

FANSTEEL
Balkite *Radio Power Units*

BALKITE BATTERY CHARGER — BALKITE "B" PLATE CURRENT SUPPLY

Manufactured by FANSTEEL PRODUCTS COMPANY, *Inc., North Chicago, Illinois*

DON'T GUESS! MEASURE
Those Small, Elusive, High Frequency Currents

Rawson Thermal Meters will do this with speed and accuracy.

Use also
Rawson Multimeters, Microammeters, Fluxmeters, Resistance Meters, Thermo Couples in Vacuum, etc.

RAWSON
ELECTRICAL INSTRUMENT COMPANY
Norfolk St., Cambridge, Mass.

DONGAN

35 Types Audio Transformers

Unmounted — CR8 — $1.25
34 other types for every set. Ratios 3-1 to 6-1.

Dongan builds an Audio Transformer for any possible requirement—it is for this reason Dongan Transformers are the choice of so many of the forward-looking set manufacturers. No matter what the requirements Dongan builds the transformer best suited—unmounted (coils and laminations); semi-mounted furnished with bushings and clamps; mounted types—both shields and otherwise.

All Dongan Transformers are constructed for the highest degree of performance. Perfectly balanced transformers, guaranteeing uniformly fine reception, Dongan Audio Transformers already are used as standard equipment by 38 of the leading Set Manufacturers.

Voltmeters for Your Set Insure Performance

Type N
0— 7 volts.. $1.75
0— 50 volts.. 1.75
0—100 volts.. 2.00

5 Types
0-7 to 0-100 volts.

Most of the better sets being built now include Voltmeters as standard equipment. Many manufacturers are choosing Dongan Voltmeters. Built by an organization skilled in the design and manufacture of high grade electrical instruments for 15 years Dongan High Resistance Voltmeters will keep your set accurately checked all the time. Definite readings over the entire range of scale keeps you informed on tube and B battery voltage.

MANUFACTURERS QUOTED ON REQUEST

Jobbers: Get Dongan electros for your catalog

DONGAN ELECTRIC MANUFACTURING CO.

2995 Franklin Street — Detroit, Mich.

Transformers of Merit for 15 years

Cabot Circuit Receiver

(*Continued from page 241*)

denser. This completes the wiring of the set.

13. Put the large dials on the condenser shafts at the front of the panel. They should be fastened to the shafts by means of the set screws, in such a position that the zero division on the dial coincides with the index mark on the panel when the rotor plates are turned all the way clockwise to the stop position. Screw the vernier knobs on the condenser vernier shafts, holding the shafts at the back with pliers, if necessary. Check over all the wiring against both the picture wiring diagrams and the photographs and see that all connections are firm and well made

Assembly of the Loop Place the four loop arms in the metal cross-shaped casting, and fasten them with four ½-in. oval head black screws. Make sure that the slotted ends of the sticks are away from the casting and the slots are all on the same side of the loop. Put one of the binding posts in the hole on the longest arm, nearest the casting. Remove the insulation for about 1 in. from one end of the loop wire and fasten this to the binding post already in position. Keeping the wire taut, wind it on the loop frame, slipping it down into the slots. Be careful to keep the loop arms at right angles to each other. When the slots are filled, thread the free end of the wire through the hole in the long arm, and put the second binding post in place. Measure the amount of wire necessary to connect to this terminal, scrape the insulation away from the end, and connect it securely to the binding post.

Remove the base casting and fit the small end in the hole in the middle of the larger base piece on the opposite side from the feet. Place the smaller base piece in the larger one and fasten it in place with the washer and 10-32 machine screw. With these base pieces at right angles to each other, stand the long arm of the loop in the base casting.

Testing and Operating Wire up the accessories with the rubber covered wire furnished. Put a No. 763 Eveready 22½ volt D battery in the box and connect the two leads to it. A 6-volt, 100-ampere hour Eveready storage

Demand the Best
Your Trade Deserves It

NO PENCIL MARKS **NO** INDIA INK

Used in the construction of our leaks

WE USE THE

GENUINE IMPREGNATED

Resistance element, machined ferrules

Glass Grid Leaks

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LEAD-INS

With the Copper Riveted Fahnstock Type Clips

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No more loose eyelet clips to contend with—all clips are copper riveted

Write for Price List

TRIDOT

ELECTRIC CO., INC.

16 HUDSON ST., NEW YORK CITY

WHOLESALE ONLY

NOTE: Manufacturers, jobbers—we are the sole manufacturers of "IMPREGNATED" element grid leaks

(Continued from page 268)

battery can be used for lighting the tube filaments. This, combined with a Balkite charger, will give very efficient operation. Connect two No. 772 Eveready 45-volt B batteries in series and to the set across the A+ and B AMP+ posts. A 4½ volt Eveready C battery should be connected across the A— and C— binding posts. The loud speaker goes to the Speaker + and — posts. Connect the inside binding post of the loop to the right hand loop binding post 68 of the set. Connect the outside loop terminal to 69 of the set. Push in the filament switch. Put the Sodion tube in the adapter and fit it in in the front left hand socket. See picture wiring diagram and photographs.

Insert the four standard tubes, which may be UV201A's, C301A's, or DV2's in the remaining sockets.

Turn the rheostat knob counter clockwise to the stop. Turn the potentiometer knob counter clockwise. Pull out the battery switch knob. All tubes should light, except the Sodion. Turn the rheostat up to about 90, and the Sodion should light.

Set the right hand condenser dial to 100. Rotate the potentiometer dial slowly to the right until a slight hiss is heard. Now rotate the left hand dial very slowly and at the same time rotate the right hand dial in a clockwise direction keeping just about at its oscillating point, which is indicated by a click. When a station is heard, the volume can be controlled with the potentiometer. If any interference of stations is experienced, an increase in selectivity may be obtained by rotating the loop to different directions, and turning the potentiometer knob clockwise and simultaneously revolving the right hand condenser dial nearer the oscillating point. When searching for stations it is absolutely necessary to turn the loop tuning condenser very slowly as the set is so selective that stations will be passed by otherwise.

Tests made at the Darien Laboratory show that the ease of operating this set, its volume, quality, and range make it one of the types of outfits that professional set builders can make safely for the fussy kind of clients who are, oftentimes, so hard to please.

Vigilance

Leadership

ALL-AMERICAN leadership is confirmed in striking manner by a leading New York magazine, widely noted for the strict censorship which it exercises over advertising claims. The publishers of this magazine learned, through direct replies from 5,072 dealers, that ALL-AMERICANS are by far the most popular Transformers with their customers.

Such leadership is the best possible proof of continued satisfaction given to users of ALL-AMERICANS—and the public confidence which this leadership expresses means confidence, too, in any assembled set in which ALL-AMERICAN Transformers are installed.

ALL-AMERICAN advertising and ALL-AMERICAN precision manufacture have combined their influence to place ALL-AMERICAN Transformers so decisively in the lead.

ALL-AMERICAN RADIO CORP.
E. N. Rauland, President.
2682 Coyne St., Chicago

ALL-AMERICAN
AMPLIFYING TRANSFORMERS
Largest Selling Transformers in the World

CABINETS

We build them
—any design —any quantity

BALDWIN CABINETS

are the product of superior craftsmanship.

Send us your inquiries and specifications. They will receive prompt attention.

Large assortment of stock models. Write for list.

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EASTERN Pickle bottle COILS

TO get the last bit of energy—the bit that makes DX stations come in and ring the bell—use EASTERN Pickle Bottle Coils, designed by M. B. Sleeper. They are endorsed by leading radio editors and engineers as the most efficient low loss winding in existence.

EASTERN Pickle Bottle Coils for the ***ROBERTS*** circuit **$8.50**, for the ***SUPERDYNE*** **$8**, for the ***THREE CIRCUIT*** **$6**, and ***TUNED R. F.***, **$2** each.

At your dealer's or direct, postpaid!

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Type BM

Jones
MULTI-PLUG

THE STANDARD SET CONNECTOR

As essential to the radio as the cord and socket to the electric iron! Neat and simple to install, it provides a plug-in connection between set and batteries, ground and antenna. One pull on the Jones Multi-Plug and the antenna, ground A and B batteries are instantly disconnected from the set. One push re-connects and IT CAN'T BE PLUGGED IN WRONG. The eight-foot cable permits placing batteries in basement or other suitable place.

Used by leading set manufacturers, including

HOWARD, WORKRITE, ZENITH, MU-RAD
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MANUFACTURED AND GUARANTEED BY

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Balloon Tires for Your Tubes

Delicately adjusted springs, at the base of a Benjamin Cle-Ra-Tone Socket, do the same for the radio tube that balloon tires do for the automobile—absorb jars and shocks.

Outside rumbling traffic, inside footsteps, mechanical and human activities amazingly vibrate floors of buildings—as finely adjusted scientific instruments have proved. This comparatively small shaking of the tube develops a very perceptible noise in the filament, and very often breaks this hair-like wire when it is said.

Benjamin Cle-Ra-Tone Sockets "float" above their base and so escape this ever-present trembling. More sensitive experiments are thus possible and distant, faint signals come in much clearer. Stiff bus wiring does not affect the flexibility of Cle-Ra-Tone Sockets. They are adaptable to every hookup and especially desirable in portable sets. No rubber parts to deteriorate. Bakelite is used wherever possible to insure sturdiness and long life. Contact points to tube terminals are perfect and permanent. Terminal lugs for soldering.

Made in two sizes: standard base, and a base for tubes similar in terminals to the UV-199

BENJAMIN
CLE-RA-TONE SOCKET
CLEARER RADIO TONE

Spring Suspended—Shock Absorbing—Accepted by leading manufacturers and radio engineers

Mounted also in gangs on Bakelite shelf, with binding posts and space for resistors. Benjamin Shelf Brackets, Battery Switch and Grid Leak Panel simplify radio receiving set construction. Ask for descriptive folder.

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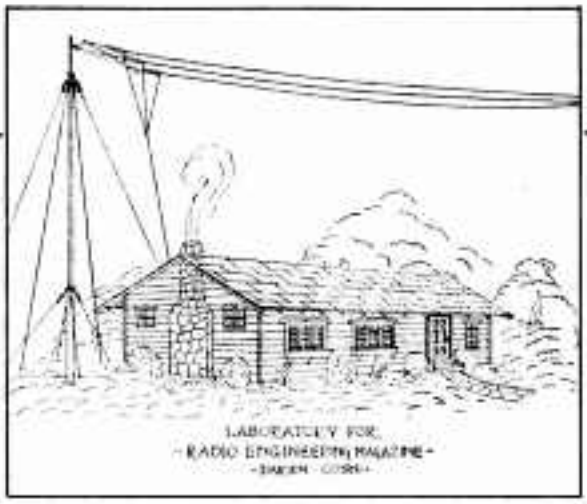

Preliminary Sketch for the New Laboratory at Darien, Conn.

AS ANNOUNCED in the April issue of Radio Engineering, a new $25,000 laboratory, the finest non-commercial radio laboratory in the country, is being designed for use in developing new ideas and equipment to be shown in Radio Engineering Magazine.

Every new subscription, removal, or extension to RADIO ENGINEERING, addressed to Our Laboratory Fund will be entered in the usual way, and the magazine sent out each month, but the two dollars will be set aside for the Laboratory Fund. Therefore, 12,500 new subscriptions or extensions are required to build the laboratory.

Perhaps the first question to come to your mind is—"Suppose I pitch in and help get subscriptions to help build Our Laboratory. What will Our Laboratory do for me?"

Here is the answer—Commercial radio laboratories make the results of their work available to you only in the form of expensive, complete receiving sets, telling you as little as they can about what is inside of them. Our Laboratory will make its results available to you thru RADIO ENGINEERING in the most complete and interesting form, telling you all the details, giving you all the data.

Take the RE 1 receiving set, for example, a totally new type of outfit both as to the design of the tuning and amplifying circuits. This will show you what we have been able to do in new development work even under the handicap of the old laboratory.

SPECIAL ADVANCE INFORMATION

Altho the complete construction data on the RE 1 receiver will not be ready until the September issue of RADIO ENGINEERING, a special blueprint has been made up, giving the circuit and the constants, which we will send to each subscriber, new, extension, or renewal, whose subscription is addressed to Our Laboratory Fund. To get your print for the RE 1, the envelope must be addressed to Our Laboratory Fund or no print will be sent.

LABORATORY SERVICE WITHOUT COST

It is important to mark your subscription "Our Laboratory Fund," because each one so marked will be checked on our records. Then you can have tests and measurements made at the Laboratory without charge up to the value of ten dollars, as shown in the schedule in the December, 1924, issue. In addition, you will be entitled to whatever special assistance the Laboratory can give you.

We are asking you to help us with the construction of the new Laboratory, dedicated exclusively to your own interests, in a way which gives you, without expense, the services of a commercial laboratory.

Checks or money orders should be made payable to M. B. Sleeper, Inc., and sent to OUR LABORATORY FUND

M. B. SLEEPER, INC.

A-52 Vanderbilt Ave., New York City.

SPECIAL ADVANCE LABORATORY DATA
See Page 275
AN ENTIRELY NEW SYSTEM FOR TUNING AND AMPLIFYING

FOR MORE VOLUME

Actual tests show that the volume on the Browning-Drake set is increased, and noises reduced when the D-21 Sodion tube is used for the detector.

MOST sensitive of all detectors, the Sodion tube is now available in a new design, the D-21, built on a standard base to fit in the 201-A type socket. Unlike the S-13 type, the new Sodion does not require a potentiometer.

Therefore, the D-21 can be used in the Browning-Drake receiver as a detector to increase the volume and cut down the tube noises. No changes of any kind are necessary.

Of equal importance is the fact that the D-21 does not oscillate. This means that your Browning-Drake set, equipped with a D-21 detector, will not interfere with reception at your next-door neighbor's set.

The filament, drawing ¼ ampere at 6 volts, is designed for long life. All the elements are of substantial design, well protected against rough usage. Put only 22 volts on the plate.

Put a D-21 Sodion in the detector socket and hear the difference.

D-21 Sodion, made by the Connecticut Telephone and Telegraph Company, price post paid..... $5.00

PARTS LIST, TYPE 7500, BROWNING-DRAKE RECEIVER

Type No.	Name	Price	Type No.	Name	Price
8615	1-Benjamin UV-281A Socket	$1.00	B-D	1-Complete Regenaformer Kit	$22.00
8610	1-Benjamin UV-199 Socket	1.00	B.P.	1-0.001 mfd. New York Coil fixed condenser	.40
TJ	2-Triplechs	2.50		1-0.00025 mfd. New York Coil gridleak condenser	.45
SA	1-Daven Super-Amplifier	13.00	58	3-Phgs. of 25 soldering lugs	.60
45	1-2½ Megohm Daven Gridleak	.50	183	1-Angle bracket	.10
P	1-Black Celoron Panel, 7 x 28 x 3/16 in.	4.50	14	10-Coil mounting pillars	.80
P	1-Black Celoron Panel, 5½ x 23 x 3/16 in.	1.92	62	1-Phg. of 10, ½-in. 6-32 F. H. nickeled screws	.12
001	1-0001 Micadon	.35	63	3-Phg. of 10, ½-in. 6-32 R. H. nickeled screws	.36
E	3-Ensign Binding Posts, plain top	.15	6	1-Phg. of 10, ¾-in. 6-32 R. H. nickeled screws	.14
	1-6-ohm Rheostat	1.50	143	1-Phg. of 10, 1¼-in. 6-32 R. H. nickeled screws	.18
	1-20-ohm Rheostat	1.50	49	3-Phg. of 10, 6-32 nickeled nuts	.24
	1-30-ohm Rheostat	1.50			
W	1-100 ft. spool of Wirit	.90			
MR	9-Lengths No. 7 special varnished tubing	.30			
S	1-Metro Keebak Switch	.25			

If you do not want to buy the complete Browning-Drake kit, you can get any individual parts from DURRANT at the prices given above.

NOTES ON THE BROWNING-DRAKE FIVE

Use a UV199 tube for the R. F. amplifier, a D-21 Sodion or UV201-A for the detector, and three UV201-A's for the amplifiers.

To operate a cone loudspeaker with best results, use a 5 watt power tube for the last amplifier.

A 6-volt storage battery is required for the A battery. Dry cells will not stand up on this set.

Ninety volts is enough for the B battery, with 45 volts for a UV201-A detector or 22 volts for a D-21.

Sharpest tuning is obtained with a short antenna, 25 to 50 ft. long. Many B D sets are doing splendid work on small indoor antennas.

Sometimes results can be improved by using a gridleak of 50,000 ohms on the last tube.

Keep the tubes at the lowest possible brilliancy. The tubes will last longer and you will get greater service from your B batteries.

Do not expect the best results unless you use the real Browning-Drake tuning units, made under license by the National Company. The coils are the heart of the set, and upon them depend the exceptional results obtained with this type of set.

DURRANT RADIO, Ltd.

Supplies to Radio Set Builders and Experimenters

II-52 Vanderbilt Avenue — New York City

I and M REGISTRY

The men whose names are listed below are prepared to handle all emergency work, take care of batteries, and replace tubes. Their charge is $1.50 per hour, not including travelling time except to unusual distances.

The charge for listing in this section is 50c. for one month, $2.00 for six months, $3.00 for twelve months, payable in advance. The * indicates that we have received letters from six set owners stating that the man after whose name the * appears has handled their I and M work satisfactorily.

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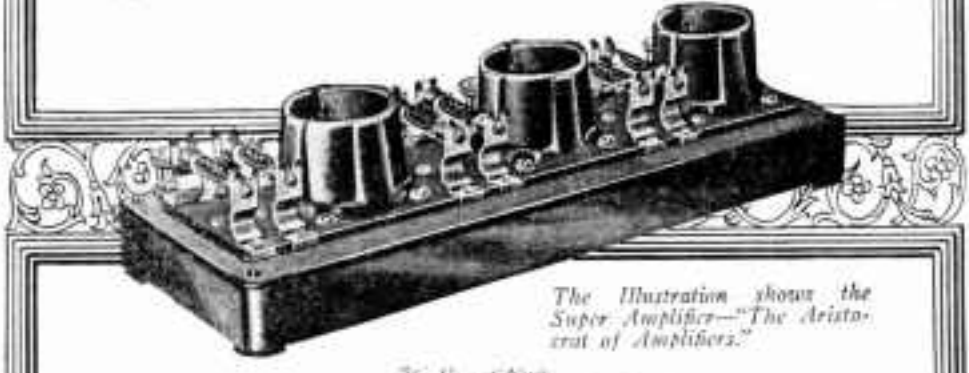

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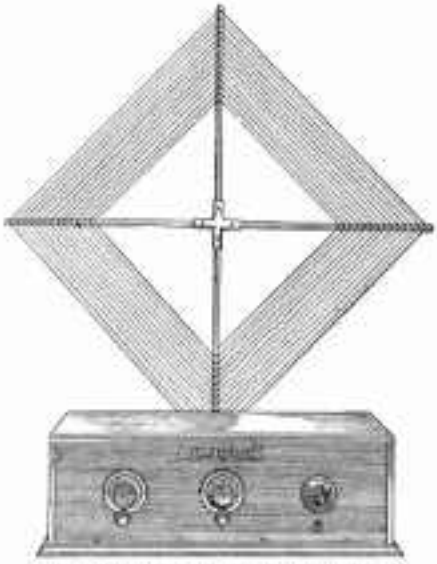

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