

RADIO Engineering

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



Edited by
M.B.SLEEPER



MAY 1925

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RADIO ENGINEERING

Edited by M. B. SLEEPER

Associate Editor, Alfred A. Ghirardi

Fifth Year

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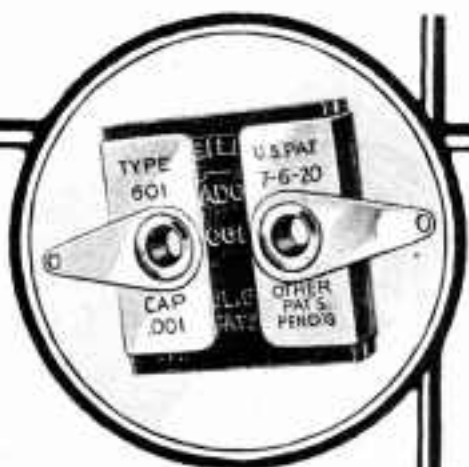
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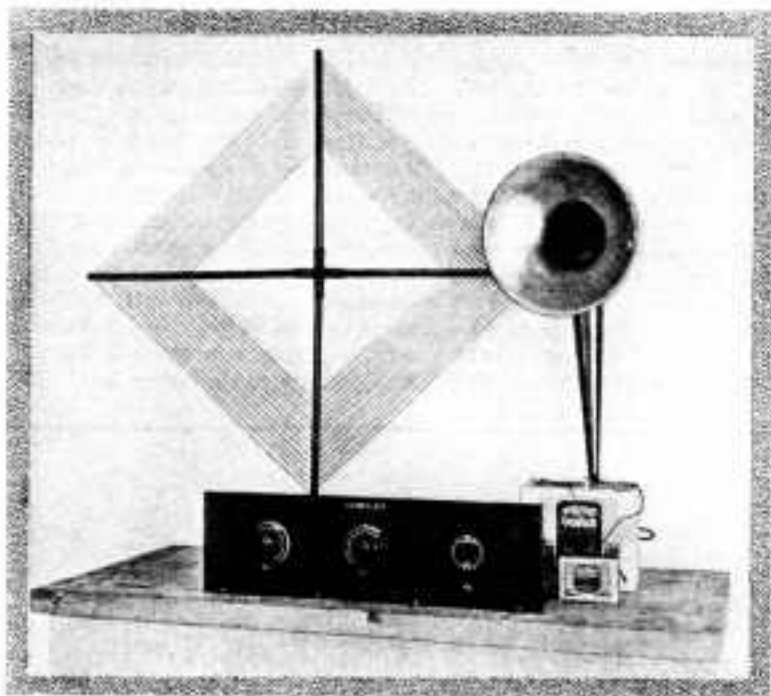


Fig. 1. This is practically a one-control receiver, as the wavelength is controlled entirely by the left hand dial

How to Build the New Acme Cabot Circuit Receiver

Assembly Instructions for the Acmelex 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 Acmelex 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 Acmelex 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 Sodian tube. This gives a multi-tube loop receiver with only one critical tuning control.

Design 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-

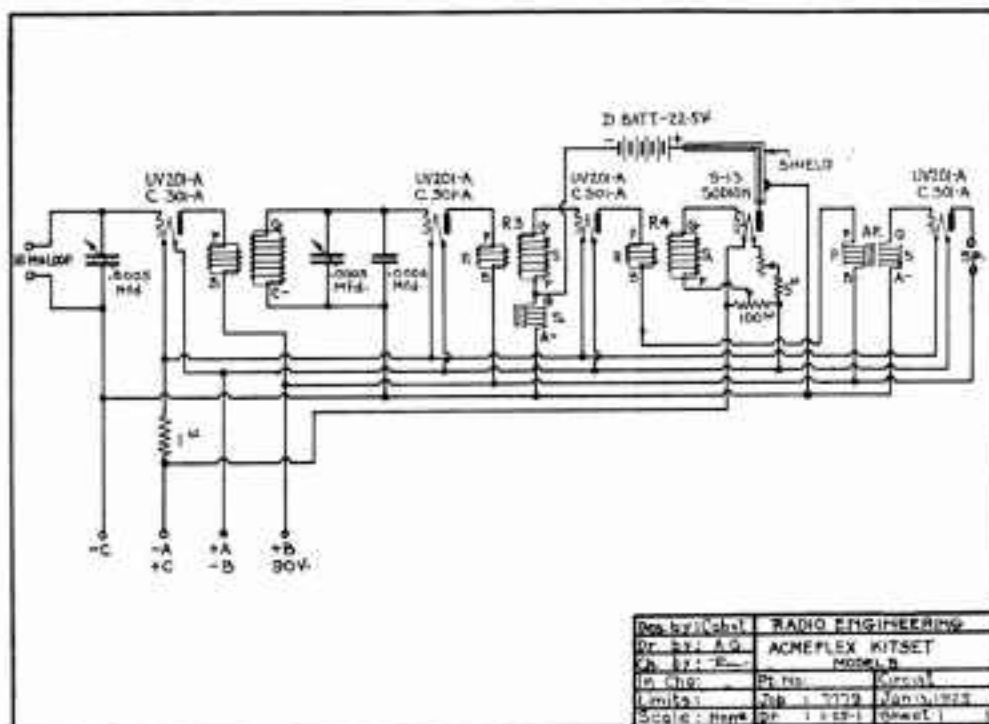


Fig. 2. Schematic wiring diagram of the Acme Cabot receiver. Note the connections to the shielded wire.

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 Sodian 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 The parts required for this outfit are: An Acme D-coil Required 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 Dabifier 1 mfd. by-pass condenser, eight engraved Eby binding posts, one Connecticut Sodian 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 $\frac{3}{32}$ in. aluminum panel, and a 7 by 23 by $\frac{1}{2}$ -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.

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 $\frac{3}{8}$ -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 $\frac{1}{2}$ -in. R. H. wood screws, placing R-3 on the right

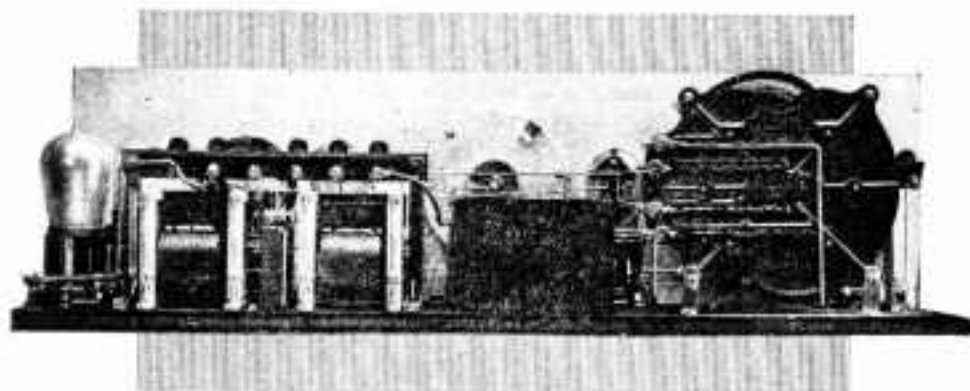


Fig. 3. Here you can see the rear of the automatically tuned D-coil radio frequency transformer, mounted on the loop condenser.

Assembly and Wiring Figs. 4 and 5 show a picture and 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

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 $\frac{3}{8}$ -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

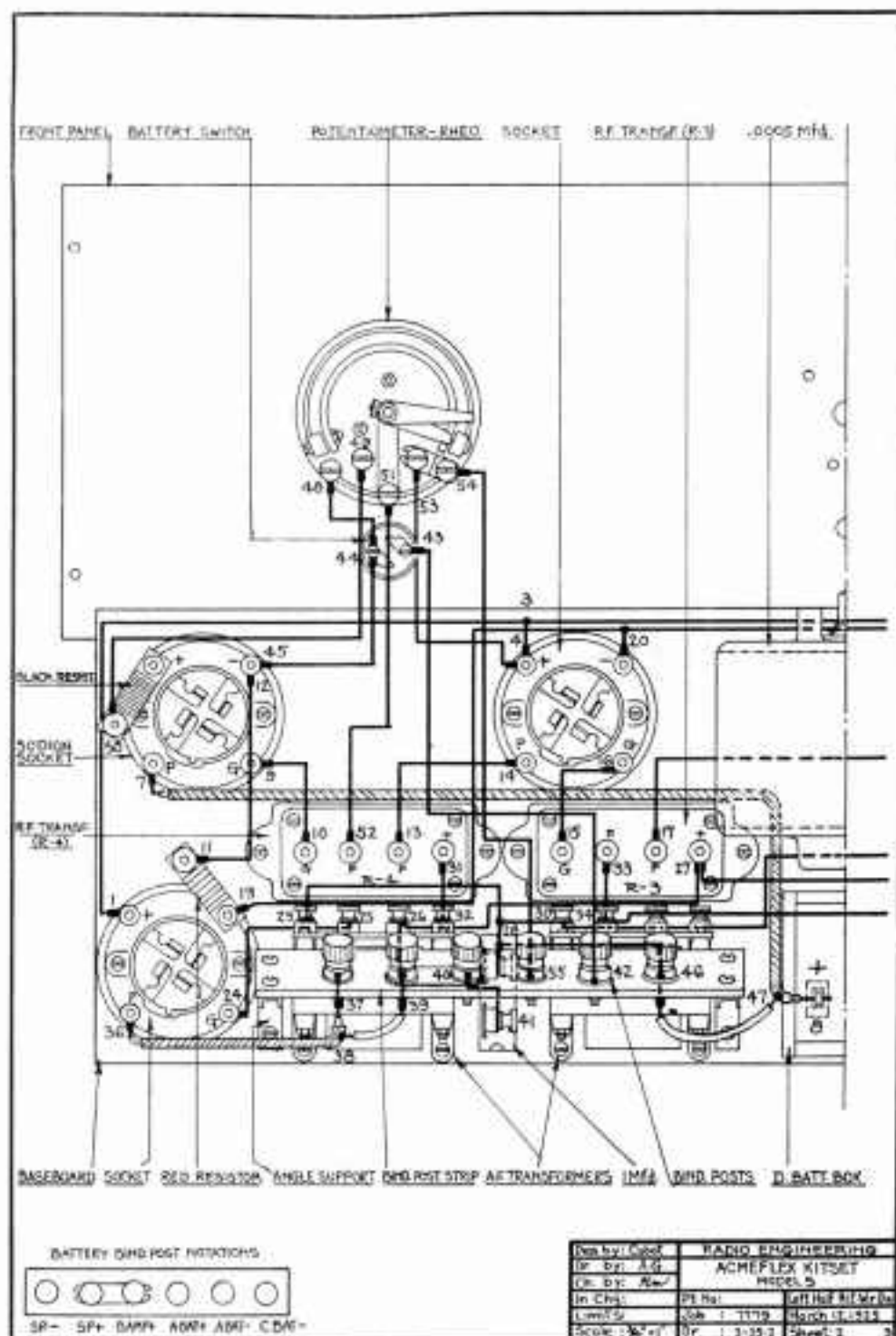


Fig. 4. Left hand half of the Cabot receiver. The base panel is tipped down to show the connections

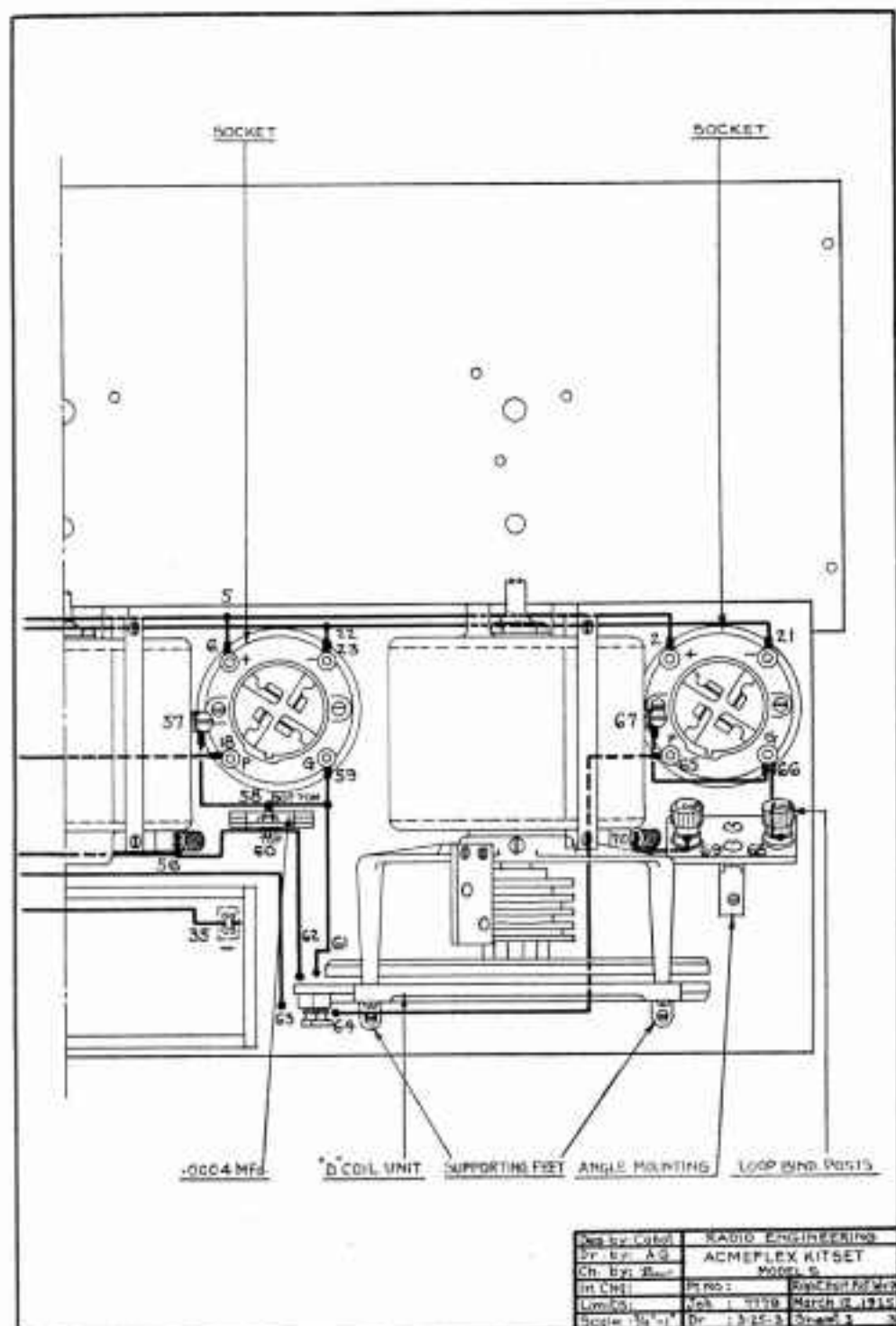


Fig. 5. Right hand half. This picture wiring diagram shows the wiring as it was done on the original set.

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 $\frac{1}{2}$ -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. Con-

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 $\frac{1}{2}$ -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 $\frac{3}{4}$ -in. washer in back of the panel and be

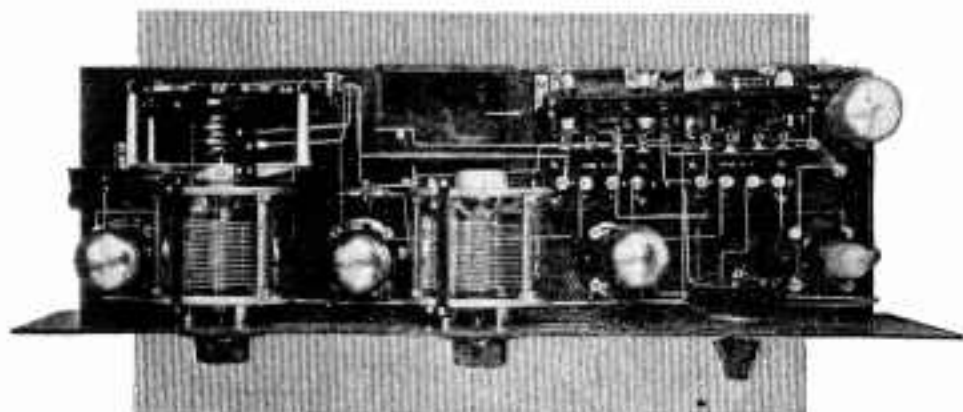


Fig. 6. Top view of the outfit. The D battery has been removed from the box, but the wires are run up in position for the battery clips.

nect 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 +

supply 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 $\frac{1}{2}$ -in. R. H. wood screws.

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 $\frac{1}{2}$ -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 $\frac{3}{8}$ -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 $\frac{1}{64}$ -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 $\frac{3}{8}$ -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 $\frac{3}{8}$ -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 $\frac{1}{2}$ -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 $\frac{3}{8}$ -in. 6-32 R. H. machine screws and nuts. Fasten the unit to the baseboard with two $\frac{1}{2}$ -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 C₁ 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-

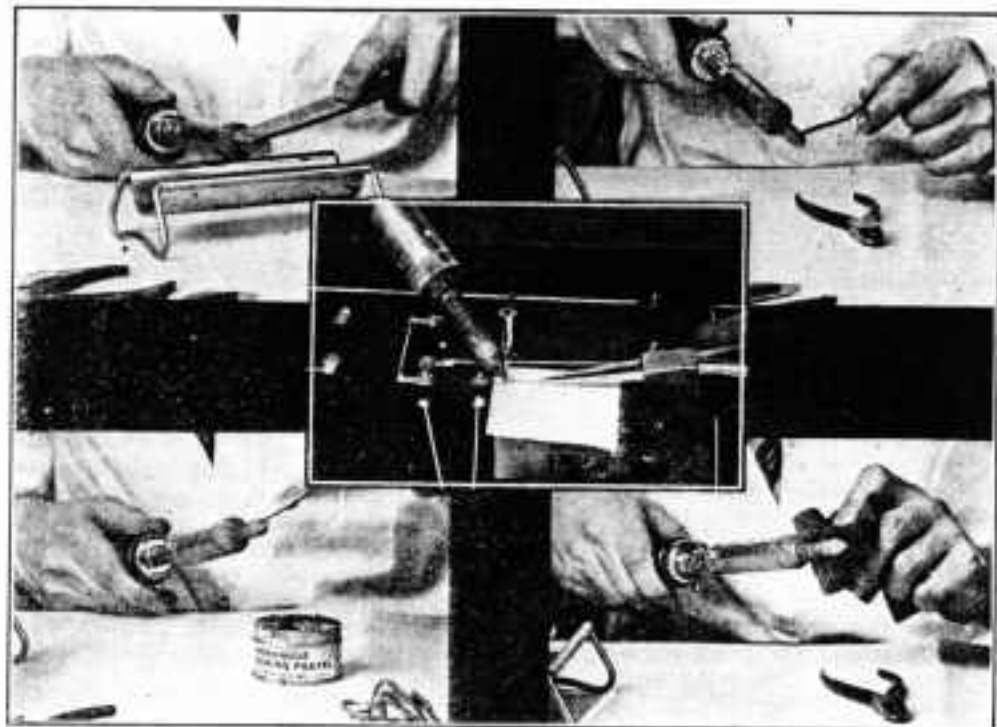
(Continued on page 268)

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, manu-

facturers 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.

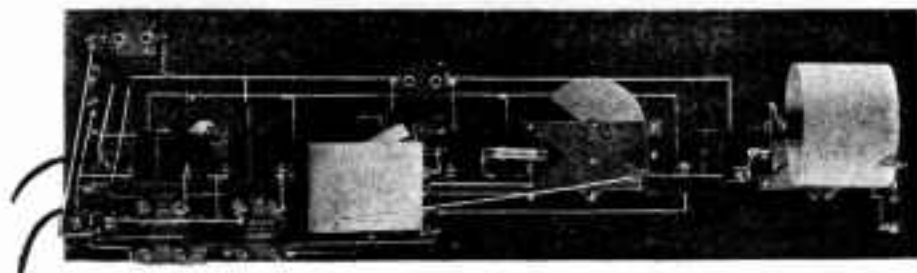


Fig. 1. All the parts are mounted on the front panel, doing away with the need for a tube panel

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 trans-

fer 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

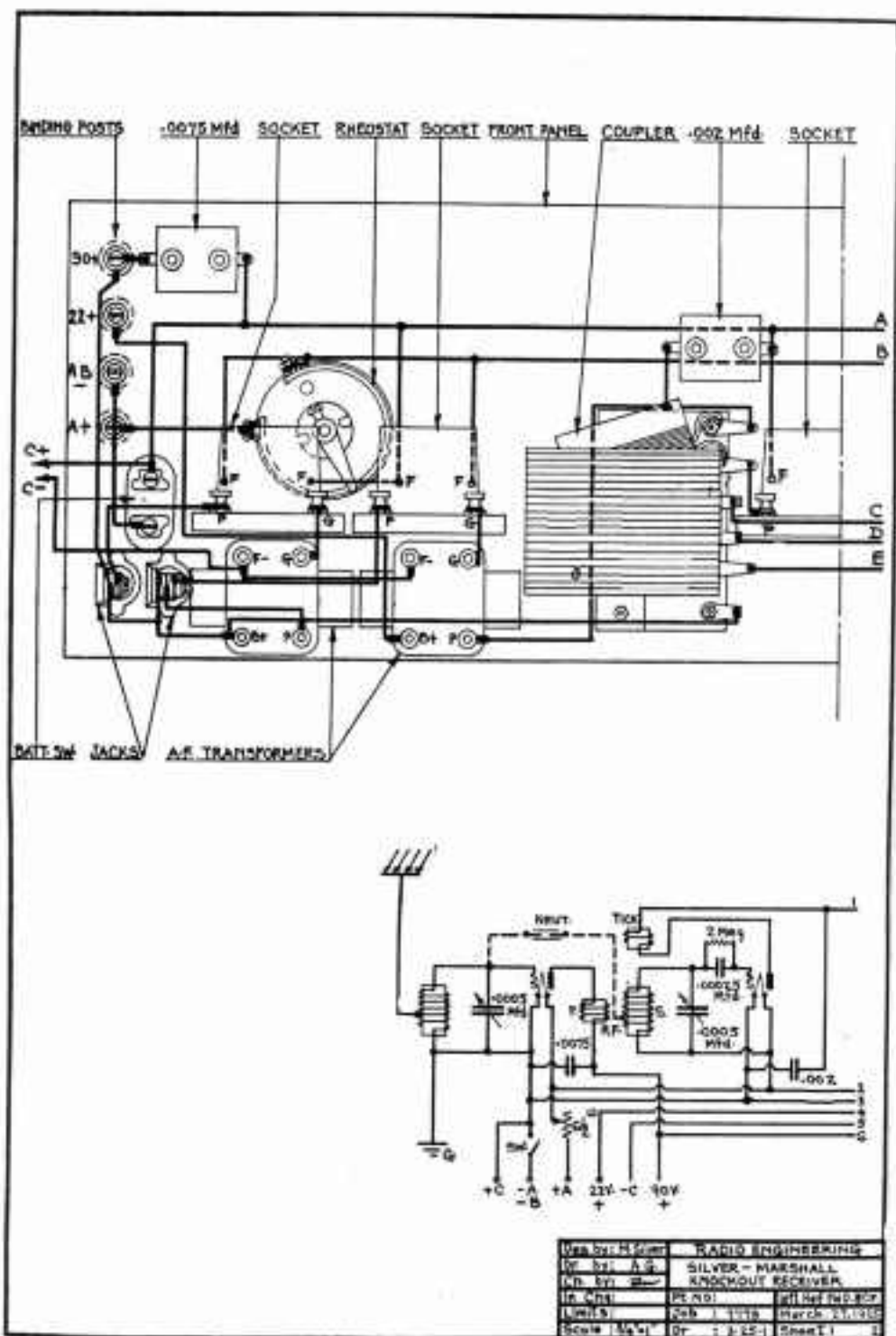


Fig. 2. Picture wiring diagram showing the left hand half of the Silver-Marshall four-tube receiver

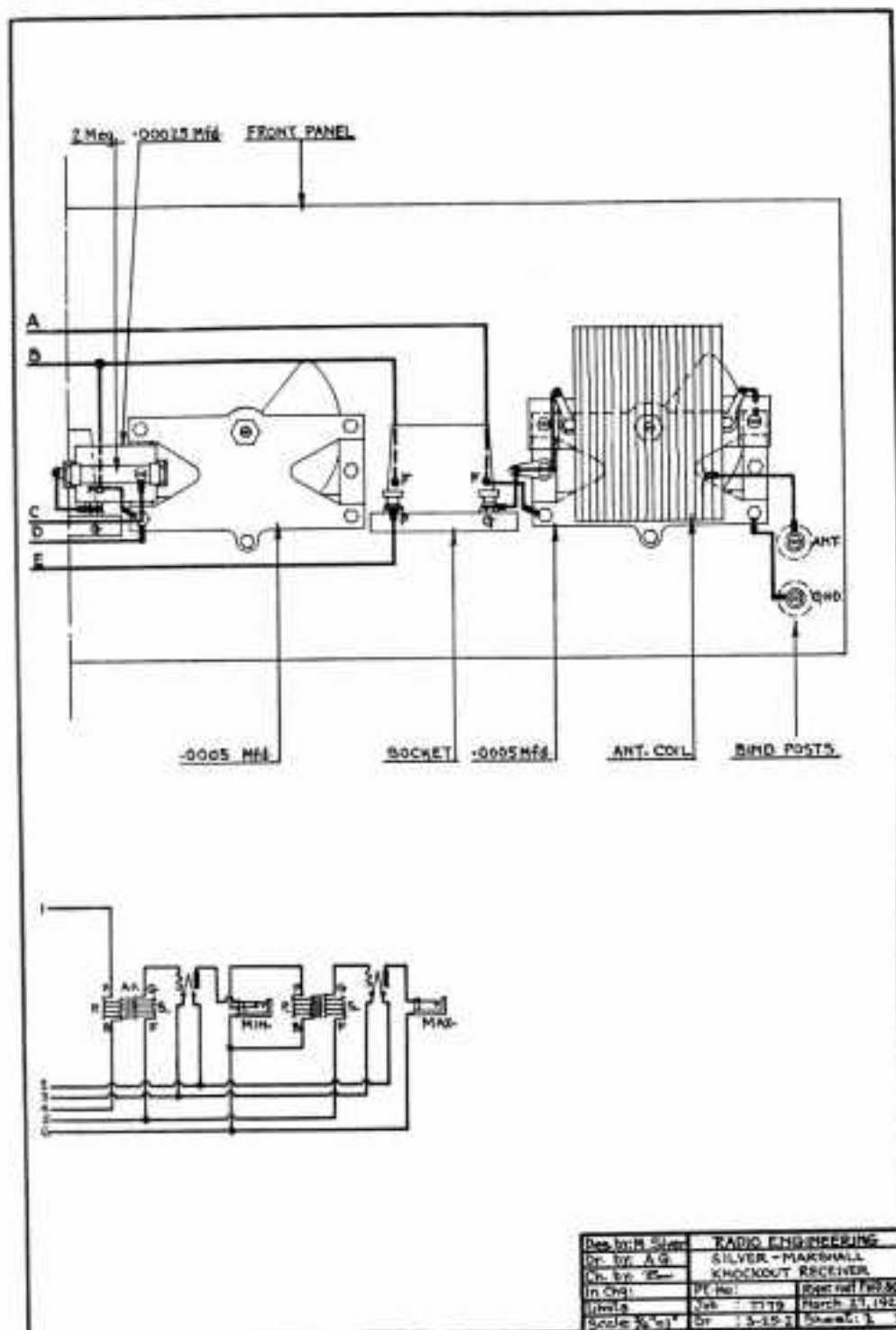


Fig. 3. Right hand half of the set. Numbers and letters on the wires merely indicate connections



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 $3\frac{1}{2}$ 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 $\frac{3}{16}$ -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 rut 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 $\frac{1}{4}$ -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 nut 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 diagram. 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

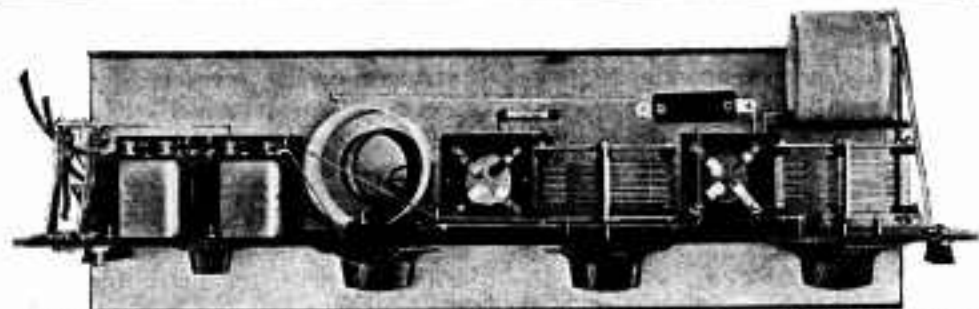


Fig. 5. A bottom view of the set, showing the location of the A. F. Transformers beneath their corresponding sockets

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 con-

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.

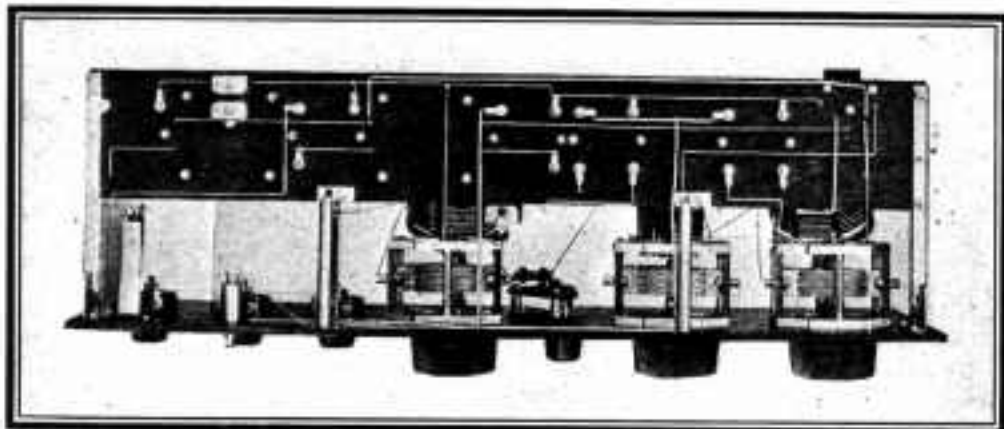


Fig. 5. This view will help you in checking against the step-by-step instructions and the picture wiring diagram

trols 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

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 $\frac{1}{2}$ -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 $\frac{1}{2}$ -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 connec-

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 $\frac{3}{4}$ -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

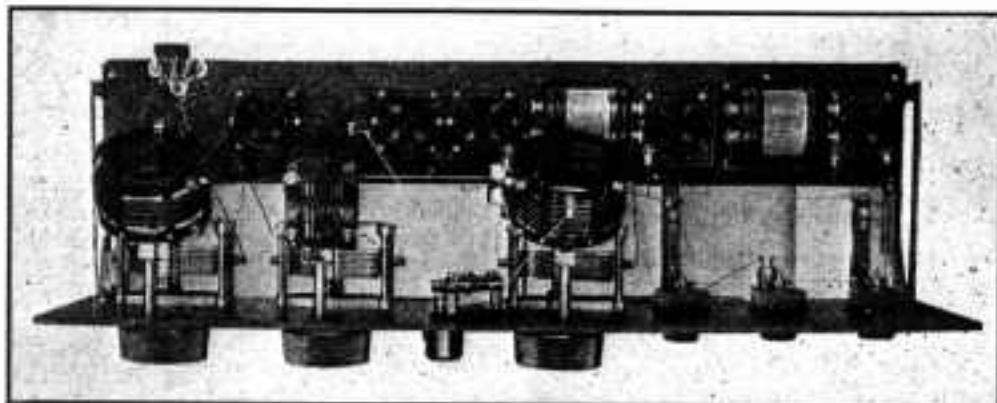


Fig. 6. This view shows the Karas Harmonic transformers, a new type which employs a rather unusual type of mounting

tion 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.

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 $\frac{3}{4}$ -in. screws put in on the +, -, and grid binding posts, while the left hand socket should have the $\frac{3}{4}$ -in. screws put in on the + and - terminals only.

Fasten the Benjamin support brackets to the ends of the tube panel with $\frac{1}{2}$ -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

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 $\frac{1}{2}$ -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 $\frac{1}{2}$ -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 $\frac{1}{2}$ -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 $\frac{1}{2}$ -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 $\frac{3}{4}$ -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 $\frac{1}{2}$ -in. 6-32 R. H. screws and nuts, and fasten the two pillars to the front panel with $\frac{1}{2}$ -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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M. B. SLEEPER, Editor
F. A. SKELTON, Managing Editor

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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

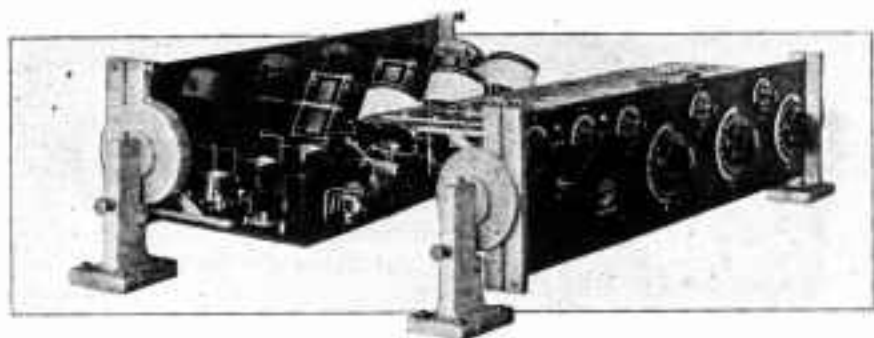


Fig. 1. The device employed for holding the set while the assembly work is being done

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 half-round 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.

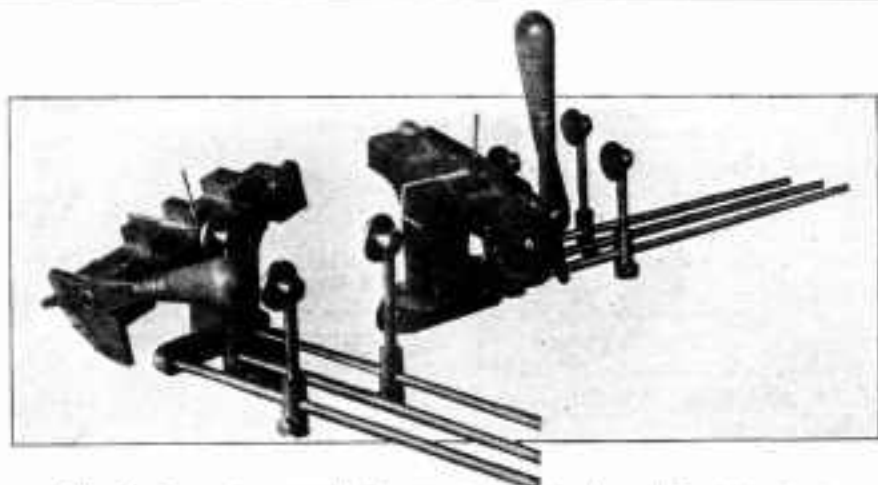


Fig. 3. Three stops permit the operator to make three different bends at angles determined by the stops on the sector

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.

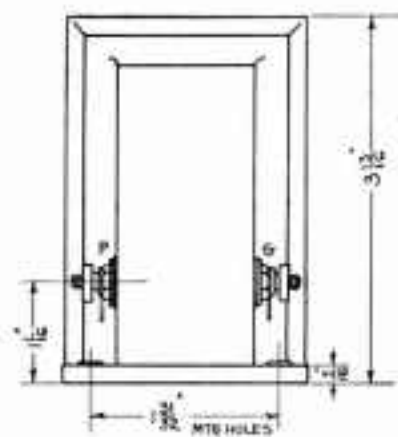
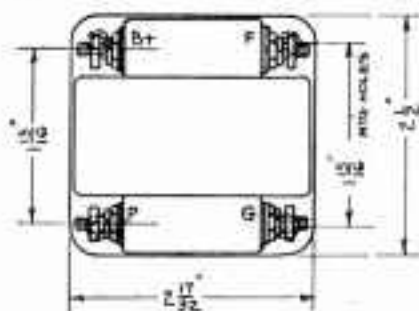
In the meantime, it is interesting to speculate as to whether or not any of the

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.

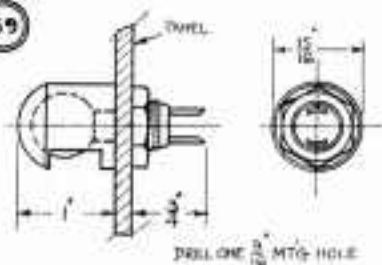
Those familiar with patent laws know that suits have been thrown out of court repeatedly when the public has been allowed to use a patented device or method over a period of years without opposition from the inventor. It certainly looks as if Latour has given away such rights as he may have.

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.

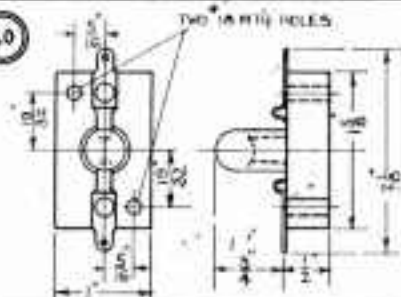
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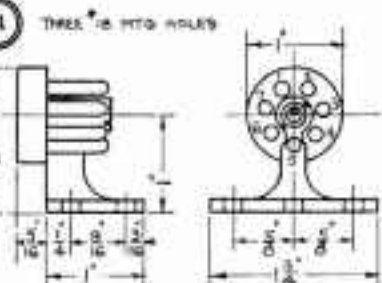
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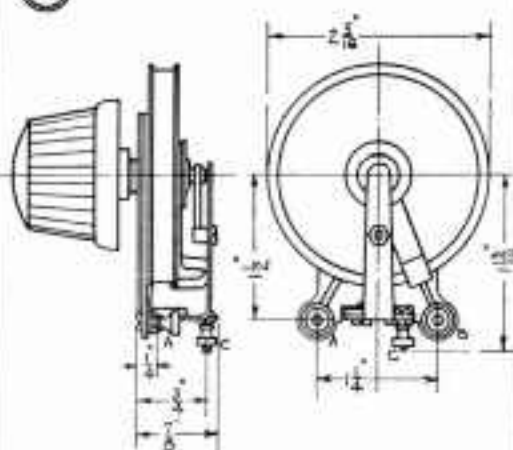


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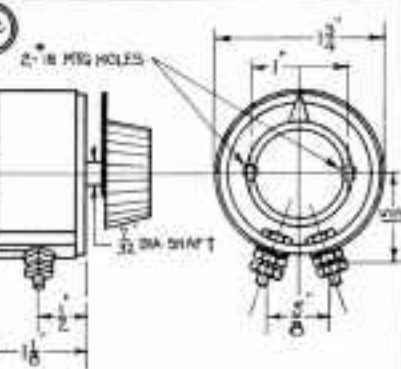


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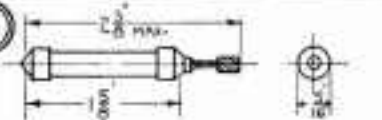
DRILL ONE 1/8" MTG HOLE



62



63



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 nicked. 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 nicked 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 RHEO-STAT:** 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 nicked 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 GRID-LEAK:** 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 Sodyon, 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 Splittorf 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 Splittorf 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.

ERLA

Lowest loss! The Erla Miniloss Variable Condensers embody all outstanding improvements in scientific condenser construction. Dielectric leakage losses are almost entirely eliminated.

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Literature, prices and data on request.

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and dealers who build sets

WE will shortly begin a series of newspaper advertisements, featuring the work of individuals and dealers who build sets using Cardwell Condensers.

If you build to specification or from original design, it will be to your interest to communicate with us immediately.

*Ask for details of plan.
Be sure to give name of
your jobber.*

**ALLEN D. CARDWELL
MANUFACTURING CORP.**

81 Prospect Street, Brooklyn, N. Y.

1. No loose threads, dielectric strands, or film pores.
2. No unrolling tendency to nullify the stabilizing effect and by retentive pressure, change the capacity.
3. Capacity fixed and invariable.
4. Metal case protects against accidental injury.
5. Direct connection to copper plates avoids losses through inefficient contact points.

6. Absorption of moisture from atmosphere will affect performance.

All capacities from 150. mm. At all dealers.

Chas. Freshman Co.
118 W. 4th St., N. Y.

**6
Exclusive
Features**



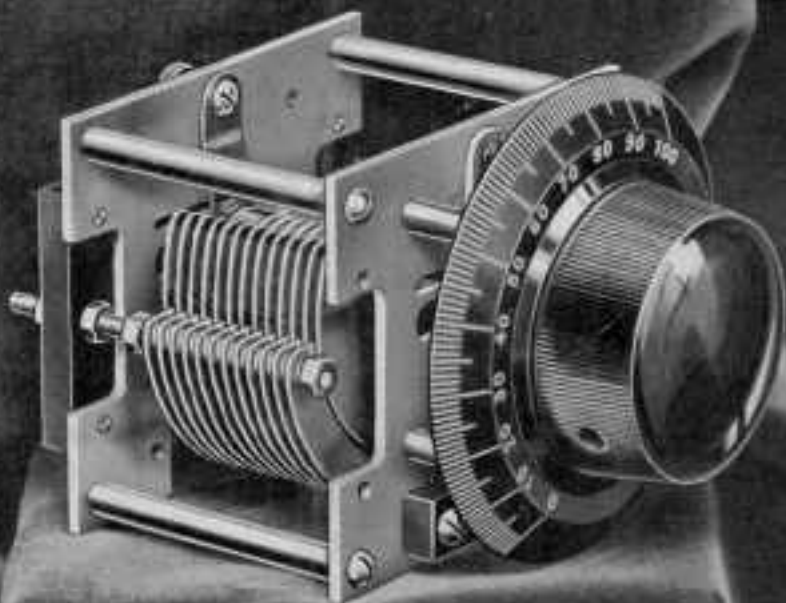
COMPLETE FILE OF RADIO PRODUCTS

For complete data on radio products of all kinds, keep Radio Engineering on file March, 1925, Data on A. F., R. F., and Super-Heterodyne transformers, April, 1925, Rheostats, Potentiometers and Resistances.

These back issues 20c each.

NATIONAL

VELVET CONDENSERS VERNIER AND DIALS



"By merit valued by an admiral!" - Milton

NATIONAL Velvet Vernier CONDENSERS and DIALS

are used by Lieutenant Frederick H. Schull (Traffic Manager, American Radio Relay League) for communication with stations on wave lengths from 20 to 120 meters from the Pacific Fleet during the cruise to Australia and return. High honor!

NATIONAL COMPANY, Inc., 110 Brookline Street, Cambridge, Mass.
Sole licensees for the manufacture of the National Regenerative under
the Houshing-Drake patents



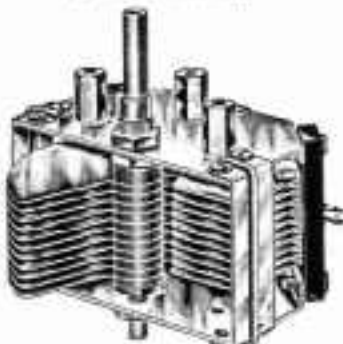
ABOVE ALL—

what counts is the way the condenser works when it is in the assembled set.



LOW LOSS CONDENSERS

are made with a precision that assures perfect performance whether the set is built at home or by a manufacturer.



Type CVI

- (1) Brass end plates
- (2) Aluminum plates
- (3) Hard rubber insulation
- (4) Single plate vernier

CAPACITIES

(Standard and straight line types)

11 plate	.0002
15 plate	.0003
17 plate	.00045
21 plate	.0005
41 plate	.001

Vernier or Plain

ORDER FROM YOUR DEALER

Or
 These Sales Representatives
 Manufacturer's Distributing Co., Boston
 New York Phila.
 United Autoware Company,
 21 W. 60th St., New York.
 Factory Sales Agencies Co.,
 693 Mission St., San Francisco, Cal.
 Expert
 Miranda Brothers, Incorporated,
 132 Nassau St., New York.



EAGLE CONDENSERS, Inc.
 763 BEDFORD AVENUE
 BROOKLYN, N. Y.

"The Last Word in Selectivity—"

Chicago Evening Post

"Owners of the 'NAMELESS' properly built, possess the last word in selectivity on an outside antenna," says the well-known radio authority, Freund, in the Chicago Evening Post of April 2nd.

"Wonder Circuit of 1925"

New York Telegram—Mail

"Out of the Windy City has blown the wonder circuit of 1925. The entire Middle West has been shaken by the veritable tornado of popularity attending its introduction, and now New York radio opinion is beginning to shake under the gale of approval that has greeted this circuit. 'This veritable wizard of the ether is the Bremer-Tully 'NAMELESS'."

For the last word in radio build a "NAMELESS".

Kits may be purchased from any reliable dealer.

Bremer-Tully MFG. CO.

532 S. Canal St., Chicago, Illinois



At your dealer
\$1.25

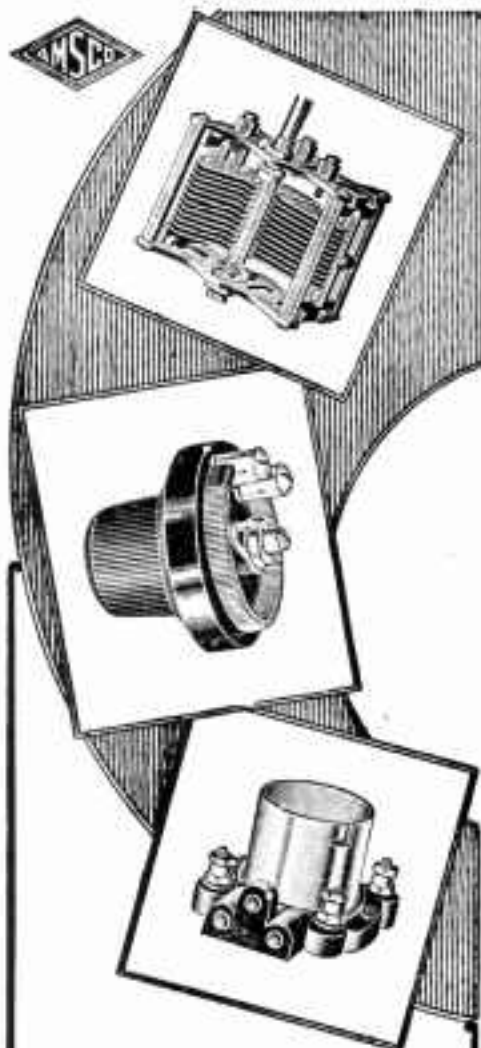
TUNES-IN

Hard-to-get-stations

THOSE elusive distant stations so often missed when tuning with ordinary dials are quickly, easily and clearly tuned-in by means of the

WALBERT
UNIVERNIER

WALBERT MFG. CO., CHICAGO



Amsco Quality Parts

The standard of excellence by which all others are judged. Used by many of the leading set manufacturers as well as by foremost radio engineers. They are laboratory instruments.

*At dealers everywhere.
Free literature on request.*

AMSCO PRODUCTS, Inc.
418 Broome Street New York

Radion parts improve every condenser

TO REDUCE condenser losses to the smallest possible point, all insulating parts must be of the highest efficiency. Built to order exclusively for radio purposes, Radion meets the most exacting tests for high insulating qualities.

Radion's 5 points of superiority

RADION excels in these 5 most important characteristics required of an insulating material:

- Lowest angle phase difference.
- Lowest dielectric constant.
- Highest resistivity (megohms cm).
- Lowest power factor loss.
- Lowest absorption of moisture.

THE makers of the best condensers are utilizing Radion to a greater and greater extent every day. We manufacture Radion parts for nearly all the leading condensers now made.

We invite manufacturer's inquiries

SET manufacturers also find Radion "the supreme insulation" for panels, dials, sockets, etc. We invite manufacturers to send us samples and specifications of panels and all other insulated parts of radio instruments or radio sets. We are always glad to cooperate fully in meeting their requirements.

AMERICAN HARD RUBBER COMPANY
Dept. MNI, 11 Mercer St., New York City

RADION

The Supreme Insulation

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 variable. Dimensions are given in the order, width, length 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	Variable Screw
Adams Morgan Co., Inc.	Rotary	Colomn	.00055 infd.	Colomn	Washers	3 1/2 x 3 1/2 x 2 1/2	3/4 x 1 1/2	Aluminum	Separate, on dial
Allen-Brodley Co.	Rotary	H. R.	.00025-.00035-.00045-.001	Metal	Soldered	2 1/2 x 2 1/2 x 1 1/2, 1 1/2, 2 1/4, 3 1/4	5/8 x 7/8	Brass	None
Amesbury Sales Co., Inc.	Rotary	H. R.	.00055	Metal	Staked	4 x 2 1/2 x 3 1/2	3/4 x 5/4	Aluminum	None
Amoco Products, Inc.	Rotary	Radion	.00032-.00055-.001	Metal	Staked	3 1/2 x 3 1/2 x 3 1/2	3/4 x 1 1/2	Aluminum	None
Avi Craft Mfg. Co.	Rotary	H. R.	.00017	N. P. Brass	S. & W.	3 1/2 x 3 1/2 x 2 1/2	3/4 x 5/4	Al. or Alu.	None
Audio Radio Co.	Rotary	Bakelite	.000125-.00025-.00035-.0005-.00075	Metal	Washers	3 1/2 x 3 1/2 x 2 1/2	3/4 x 5/4	Alu. or Alu.	None
Bremer-Tully Mfg. Co.	Rotary	Bakelite	.000725	Die cast	Die cast	3 1/2 x 2 1/2 x 2	3/4 x 1 1/2	Aluminum	None
Buell Mfg. Co.	Rotary	H. R.	.000225-.000482	Die cast	Die cast	3 1/2 x 2 1/2 x 2	3/4 x 1 1/2	Aluminum	None
Cardwell Mfg. Co.	Rotary	H. R.	.00025-.00035-.00045-.00055-.001	Brass	S. & W.	4 1/2 x 2 1/2 x 1 1/2, 2, 2 1/4	3/4 x 5/4	Aluminum	Special 360° dial
Carlson Saunders Co.	Sliding	Radion	.00025-.00035-.0005	Brass	Soldered	3 1/2 x 2 1/2 x 3 1/2, 2 1/4, 2 1/2	3/4 x 1 1/2	Aluminum	None
Chelton Electric Co.	Rotary	H. R.	.00025-.00035-.0005	Aluminum	S. & W.	1 1/2 x 1 1/2 x 1 1/2	5/8 x 1 1/2	Aluminum	None
Chelton Midway type	Rotary	H. R.	.00027	Aluminum	Staked	—	—	Aluminum	None
Cruver Mfg. Co.	Rotary	H. R.	.00025-.00035-.0005-.00087	Aluminum	Washers	—	—	Aluminum	S. P.
Du-Kast Condenser Corp.	Rotary	H. R.	.00028-.00058	Die cast	Die cast	3 1/2 x 2 1/2 x 2 1/2, 2 1/2	3/4 x 5/4	Die cast	Gear
Duplex Cond. & Radio Corp.	Rotary	H. R.	.00028-.00038-.0005-.001	Brass	Cast & St.	4 x 2 1/2 x 2 1/2, 2 1/2, 2 1/2, 3 1/2	3/4 x 5/4	Aluminum	S. P.
Duplex Cond. & Radio Corp.	Rotary	Bakelite	.00025-.00034-.00058-.00084	Aluminum	Cast & St.	2 1/2 x 2 1/2 x 2 1/2, 1 1/2, 1 1/2, 1 1/2	3/4 x 1 1/2	Aluminum	S. P.
Duplex Cond. & Radio Corp.	Rotary	H. R.	.00025-.001	Metal	Soldered	3 1/2 x 2 1/2 x 2 1/2 to 4	3/4 x 1	Brass	None
Electrical Research Lab.	Rotary	H. R.	All standard capacities	Brass	Washers	—	—	Aluminum	S. P.
Elgin Radio Corp.	Rotary	Bakelite	.00025-.00035-.00055-.00055-.001	Die cast	Staked	3 1/2 x 2 1/2 x 1 1/2, 2 1/2, 2 1/2, 2 1/2, 4	3/4 x 1 1/2	Aluminum	None
Elgin Radio Corp.	Rotary	Bakelite	.00025-.00035-.00055-.00055-.001	Die cast	Washers	3 1/2 x 2 1/2 x 1 1/2, 1 1/2, 1 1/2, 1 1/2, 1 1/2, 1 1/2, 1 1/2	3/4 x 1 1/2	Aluminum	S. P.
Elgin Radio Corp.	Rotary	Bakelite	.00025-.00035-.00055-.00055-.001	Metal	Staked	3 1/2 x 2 1/2 x 1 1/2, 1 1/2, 1 1/2, 2 1/2, 2 1/2, 2 1/2	3/4 x 1 1/2	Alu. or brass	None
Elgin Radio Corp.	Rotary	Bakelite	.00025-.00035-.00055-.00055-.001	Metal	Washer	3 1/2 x 2 1/2 x 1 1/2, 1 1/2, 2 1/2, 2 1/2, 2 1/2	3/4 x 1 1/2	Alu. or brass	None
Federal Tel. Mfg. Co.	Rotary	Bakelite	.000275-.000325-.001	Bakelite	Washers	—	—	Aluminum	None
Freshman Co., Inc.	Rotary	Bakelite	.00025-.00035-.00055-.001	Brass	Soldered	—	—	Aluminum	None
Cardner & Hephburn, Inc.	Rotary	Radion	.00025-.00035-.00055-.001	Metal	Cast	4 x 2 1/2 x 2 1/2, 2, 3, 4 1/2	3/4 x 5/4	Aluminum	None

VARIABLE CONDENSERS — Continued

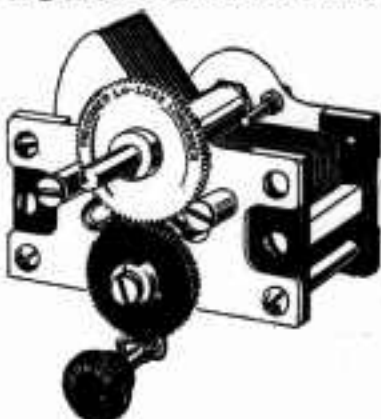
Manufacturer	Movement	Insulation	Maximum capacity	End plates	Assembly	Overall size	Length and diam	Shaft	Plates	Venturi
Gardner Midget type.....	Rotary	Radiolite	.000022	Metal	Wash. & St. Washers	1 1/2 x 1 1/2	4 1/2	Aluminum	None	
Garrod Corp.....	Rotary	H. R.	.0003	Metal	Washers	4 1/2 x 2 1/2	3 1/2	Brass	None	
General Instrument Co.....	Rotary	H. R. Pyrex Inselenite	.00025-.0003-.00035-.0005-.001 Br. or Alu. St. & W.	Aluminum	Die cast	3 1/2 x 2 1/2 x 2 1/2, 2 3/4, 2 1/2, 2 1/4, 2 1/4, 4 1/4	3 1/2	Aluminum	Gear	
*General Radio Co.....	Rotary	H. R.	.00025-.00035	H. R.	Soldered	—	3 1/2	Brass	Gear	
Greiner & Sons Co.....	Rotary	H. R.	.00025-.00035-.0005-.00075-.001	Aluminum Cast	Aluminum Cast	—	3 1/2	Aluminum	None	
*Hammerlund Mfg. Co.....	Rotary	Radiolite	.00025-.00035-.0005-.00075-.001	Aluminum Soldered	Soldered	4 x 2 1/2 x 2 1/2, 2 3/4, 2 1/4, 2 1/4, 2 1/4	3 1/2	Brass	None	
Inspection Elect. Mfg. Co.....	Rotary	H. R.	.00025-.00035-.0005-.00075-.001	Aluminum Washers	Aluminum Washers	—	3 1/2	Aluminum	Friction	
Kodak Radio Corp.....	Book	Mica	.0003	Metal	—	2 1/2 x 2 1/2 x 2 1/2	1 1/2	Phos. bronze	4-turn dial	
Lorenz Radio Corp.....	Rotary	H. R.	.00035	Metal	Die cast	4 1/2 x 2 1/2 x 2 1/2	3 1/2	Aluminum	None	
Manhattan Elect. Supply Co.....	Rotary	H. R.	.00025-.00035-.0005-.00075-.001	Metal	Soldered	4 x 2 1/2 to 4 1/2	1 1/2	Brass	Friction	
Marine-Copeland Co.....	Rotary	H. R.	.00025-.00035-.0005-.001	Brass	Soldered	2 1/2 x 2 1/2 x 2 1/2, 3 1/4, 2 1/4, 2 1/4, 2 1/4	1 1/2	Brass	None	
Martin-Copeland Co.....	Rotary	H. R.	.00025-.00035-.0005-.001	H. R.	Washer	2 1/2 x 1 1/2 x 1 1/2, H. 3/4	1 1/2	Brass	None	
Metrix Instrument Co.....	Rotary	Bakelite	.00025-.00035-.0005-.00075-.001	Brass	Staked	3 1/2 x 2 1/2 x 2 1/2, 2 3/4, 2 1/4, 2 1/4, 2 1/4, 2 1/4	1 1/2	Brass	20-1 friction	
*National Company.....	Rotary	Radiolite	.000125-.00025-.00035-.0005-.00075-.001	Aluminum Washers	Aluminum Washers	3 1/2 x 2 1/2 x 2 1/2, 2 3/4, 3, 3 1/4, 4 1/4	1 1/2	Aluminum	3-turn dial	
Nelson Tool Co. (See Stag Sales Co.)	Rotary	Formica	.00025-.00035-.0005	Metal	Soldered	2 1/2 x 2 1/2 x 2 1/2	1 1/2	Brass	None	
New York Coil Co.....	Rotary	Bakelite	.00025-.00035-.0005	Metal	Washers	3 1/2 x 2 1/2 x 2 1/2, 2 1/4, 2 1/4, 2 1/4	1 1/2	Aluminum	None	
New York Coil Co.....	Rotary	H. R.	.00025-.00035-.0005	Metal	Washers	3 1/2 x 2 1/2 x 2 1/2, 2 1/4, 2 1/4, 2 1/4	1 1/2	Aluminum	None	
New York Coil Co.....	Rotary	Bakelite	.00025-.00035-.0005-.001	Metal	Washers	3 1/2 x 2 1/2 x 2 1/2, 2 1/4, 2 1/4, 2 1/4	1 1/2	Aluminum	None	
*Phonix Radio Corp.....	Rotary	H. R.	.0003-.0005	Molded	Special	3 1/2 x 2 1/2 x 2 1/2, 3 1/4	1 1/2	Brass	None	
Preferrad Radio Prod. Co.,	Rotary	Bakelite	.00025-.00035-.0005	Die cast	Die cast	3 1/2 x 2 1/2 x 2 1/2, all sizes	1 1/2	Brass	20-1 dial	
Premier Electric Co.....	Rotary	Radiolite	.00025-.00035-.0005-.001	Aluminum Staked	Aluminum Staked	—	3 1/2	Aluminum	Gear	
Radio Development & Mfg. Co.....	Rotary	H. R.	.0001-.00025-.00035-.0005	Brass	Soldered	3 x 2 1/2 to 4	1 1/2	Brass	Var. dial	
Spalding Electrical Co.....	Rotary	Bakelite	.00025-.0005	Molded	Die cast	3 1/2 x 2 1/2 x 2 1/2, 2 1/4	1 1/2	Die cast	Gear	
Stag Sales Corp.....	Sliding	Bakelite	.00025-.00035-.0005	Metal	Die cast	4 1/2 x 2, 2 1/4, 2 1/4, 2 1/4, 2 1/4	1 1/2	Brass	300° dial	
Triangle Atlantic Corp.....	Rotary	Radiolite	.0003-.0004-.00045-.001	Aluminum Staked	Aluminum Staked	4 x 2 1/2 x 2 1/2, 2 1/4, 2 1/4, 2 1/4	1 1/2	Brass	20-1 gear	
*Turn-It Radio Sales, Inc.,	Special glass enclosed type, fitting standard grid leak mounting.	—	0.0001 to 0.008 capacity.	—	—	—	—	—	—	
United Scientific Sales, Inc.,	Rotary	Radiolite	.00025-.00035-.0005-.001	Aluminum S. & W.	Aluminum S. & W.	2 1/2 x 2 1/2, 2 1/4, 2 1/4, 2 1/4	1 1/2	Br. or Alu.	Cam	
Viking Tool & Mch. Co.....	Sliding	Radiolite	.000125-.00025-.0005	—	Soldered	2 1/2 x 2 1/2, all types	1 1/2	Brass	10-1 dial	
Wade Mfg. Co. (See Viking Tool & Mch. Co.)	Sliding	Radiolite	.000125-.00025-.0005	—	Soldered	2 1/2 x 2 1/2, all types	1 1/2	Brass	10-1 dial	

FIXED CONDENSERS

Manufacturer	Mounting	Mounting material	Capacities	Dielectric	Thickness:		Terminal	Grid leak
					Smallest cap	Largest cap		
Aerovox	Open	Bakelite Plates	.0001 to .01 mfd.	India mica	1/8 in.	3/8 in.	Leads	Yes
Aerovox Wireless Corp.	Open	Bakelite Plates	.0001 to .01	India mica	5/16 in.	3/4 in.	Leads	Yes
Carrier Radio Co.	Closed	Bronze	.01-.01-.1	Linen tissue	—	—	Wires	No
Dawson-Jones	Open	Aluminum	.00005 to .00015	Ruby mica	1/4	3/8	Leads	No
DeWitt Condenser & Radio Co.	Open	Cermet Bakelite	.00005 to .000	India mica	5/16	5/8	Leads	Yes
Electrical Research Labs.	Open	Metal	.0001 to .004	Mica	1/4	5/8	Leads	—
Electrical Research Labs.	Open	Metal	.005 to .006	Mica	5/16	5/8	Leads	No
Kodak Radio Corp.	Open	—	.00025	Mica	—	5/8	Leads	—
Manhattan Elect. Supply Co.	Enclosed	Molded Case	.001	Paper	—	5/8	B. T's	No
Muter Company	Open	Bakelite Plates	.00015 to .01	Mica	1/4	5/8	Leads	Yes
New York Coil Co.	Open	Cermet Bakelite	.0001 to .004	Mica	5/16	5/8	Leads	Yes
Spillburgh Electrical Co.	Open	Bakelite	.0001 to .01	Mica	5/16	5/8	Leads	Yes

Preferred By Those Who Know

PREFERRED Lo Loss CONDENSERS



A really good low-loss condenser at a moderate price. PREFERRED LoLoss condensers have brass rotor and stator plates sweated into brass posts, adjustable cone bearings, grounded rotor, etc. Made in plain and vernier models.

Notice to manufacturers—
We can give you a real price on a real quantity. Our plant is capable of producing 10,000 condensers a day.

PREFERRED MIDGET CONDENSERS



Maximum capacity,
.000045 mfd.

Price
\$1.25

A small, single-hole mounting condenser, for use as vernier, regeneration control, etc. Equipped with terminal nuts and solder lugs.

For information on other Preferred Radio Apparatus write to
PREFERRED RADIO PRODUCTS CORP.
408-412 East 93rd Street
New York, N. Y.

What Last Season PROVED TO Radio Manufacturers!

It proved that there is mighty little market for cheap looking radio equipment.

It proved that good material and workmanship are every day more essential to secure the confidence of the dealer—and build real business.

Service trouble ate up what little profit the dealer made on many really cheap sets—and he will sell no more of them!

The season proved that cheap substitutes for Formica panels are one of the most costly things a manufacturer can use.

Such expedients create a sales resistance that is far more costly in the end than good panels are in the beginning. That's why so many manufacturers who tried them are giving them up. Last year was the biggest Formica ever had in radio.

This year the volume will be done on sets that have Formica base panels—as well as Formica front panels, with their wonderful finish and permanent beauty!

Formica is one of the most lasting and unchanging materials in the world.

THE FORMICA INSULATION COMPANY

4653 Spring Grove Ave., Cincinnati, Ohio

Sales Offices

50 Church Street.....New York, N. Y.
 8 South Clinton St.....Chicago, Ill.
 810 Canton Bldg.....Cleveland, Ohio
 1143 Granite Bldg.....Rochester, N. Y.
 433 First Avenue.....Pittsburg, Pa.
 6 Beacon Street.....Boston, Mass.
 55 Calle Obispo.....Havana, Cuba

289 Victoria St.....Toronto, Ontario, Canada
 1070 Sessell Avenue.....Minneapolis, Minn.
 725 Bulletin Bldg.....Philadelphia, Pa.
 704 Title Building.....Baltimore, Md.
 585 Mission Street.....San Francisco, Cal.
 413 Ohio Building.....Toledo, Ohio
 337 Plymouth Bldg.....New Haven, Conn.
 Whitney Central Bldg.....New Orleans, La.

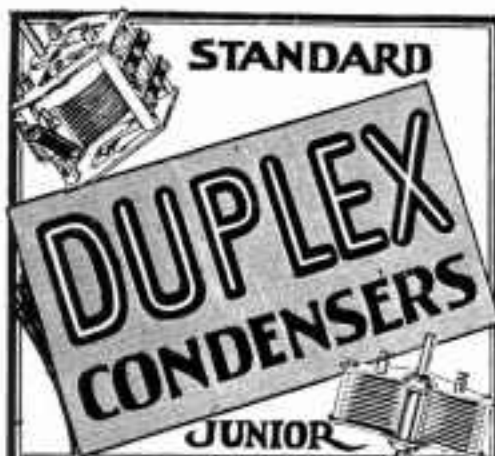
Write for Booklet "What Formica Is"

- 1 Formica is used by 125 leading makers—and has for years been used by more makers than all other materials.
- 2 Formica will last forever.
- 3 Formica, in appearance, is the finest of all panel materials and always remains so.
- 4 Formica's electrical qualities of never kind far exceed any possible requirement.
- 5 Formica has high mechanical strength and will not break in use.
- 6 Formica will not sag from heat or cold flow under pressure. It retains its dimensions. Knocking you down to it stays tight and protects where you put it.
- 7 Formica panels are sold in neat craft razor envelopes which assure you that you are getting the genuine.
- 8 Formica is one of the most widely approved materials in radio.

FORMICA

Made from Anhydrous Bakelite Resins
SHEETS TUBES RODS

Hear the Formica orchestra every Tuesday evening from 9 to 10 Central Standard Time over WLW.



Matched Condensers Are Necessary for Best Results!!!!

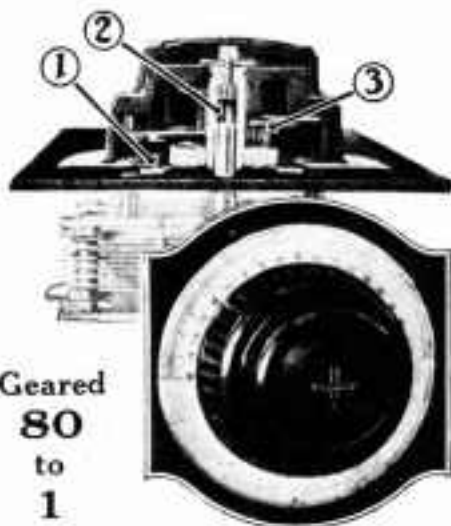
TO IMPROVE your set, replace its condensers with **DUPLIX Matched condensers**—the supreme achievement in the art of condenser building!

Only one number to log, the simplicity of single dial tuning—or you can cut out logging and dial by call letters or wave lengths.

Each matched kit contains three **DUPLIX Standard** condensers, specially selected, matched, packed and sealed, to remain *unopened*, untouched, unchanged until ready to be placed in your set. **DUPLIX Standard** condensers are the accepted standard of condenser excellence. They are used in the famous Thermodyne, where matching is absolutely essential. They are made in strict accordance with Bureau of Standards specifications.

Insist on **DUPLIX Matched** condensers for better radio reception—stronger signals—greater distance.

Write for instruction literature
DUPLIX CONDENSER & RADIO CORP.
 44 Park Ave. Extension, Brooklyn, N. Y.



Gear'd
80
 to
1

For Natural Reproduction

Even a genius cannot draw flawless music from an untuned violin. Just so—even the best radio receiver cannot reproduce clear, natural music if it is not sharply tuned.

Every detail of **Accuratune Micrometer Controls** is designed for extremely close, precise tuning . . . with perfect ease! Sensitive sets are simpler to handle—DX stations can be tuned-in easier—locals much clearer with more volume. Replace ordinary dials without set alterations.

At your dealers, otherwise send price (\$5.50) and you will be supplied postpaid.

Write for descriptive folder.

(1) Friction Clutch — the heart of Accuratune Controls. Automatically locks gear train for coarse adjustment and throws train into operation for fine adjustment.

(2) Large water bushing gives maximum shaft bearing surface and prevents all wobble.

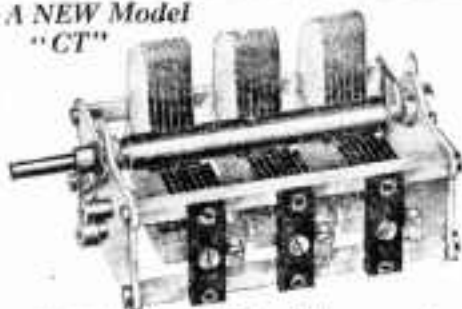
(3) New gear mesh corrects perfect alignment of the new base gear train.

MYDAR RADIO COMPANY
 9-E Campbell St., Newark, N. J.

Canadian Representatives: Radio Ltd., Montreal
 European Branch Office: Gustav E. Marklin,
 27 Arning St., London, E. C. 2

ACCURATUNE
 MICROMETER CONTROLS

A NEW Model
"C T"



Hammarlund Multiple Condensers have every feature of the famous Model "C". Single Soldered brass plates, cut back for easy tuning on low waves. Full bearing adjustable screw. Clipping plates. Metal end plates. Minimum dielectric. Non-warpage construction. The product of twenty years' experience, making the highest grade precision instruments.

The Multiple For Better Radio **Hammarlund** PRECISION CONDENSER

One condenser, two condensers, three condensers. Separate or all together. Hook them up any way you like.

The new model "C T" Multiple Hammarlund is a great convenience for the experimenter. Like all Hammarlund Condensers, it is an accurately balanced instrument of laboratory precision, containing all the well-known Hammarlund features and fine workmanship.

"C T" means model C-Triple. You can have, if you prefer, type "C D", meaning model C-Double.

If you are experimenting with, or manufacturing some circuit in which multiple condensers are advantageous, let us discuss your requirements and point out why Hammarlund Condensers are safest to use.

Write for Descriptive Literature

HAMMARLUND] MANUFACTURING CO.

424-438 West 33rd Street, New York



Pat. Pending
Bridge mass. max. cap.
200045 MCL. Frequency
range. max. cap. \$1.50
JAN 27 MCL. . . .

For Hair-Line Tuning

If you want finer adjustment than you've been able to get with ordinary verniers, shunt a Chelten Midget across the terminals of your main condenser. It can be mounted anywhere on the panel without introducing additional losses.

CHELTEN

Low Loss Midget Vernier

Used also as a STABILIZER
in most radio circuits.

The CHELTEN is the ORIGINAL midget variable condenser. All others are IMITATIONS.

At Your Dealer's or Direct by Parcel Post

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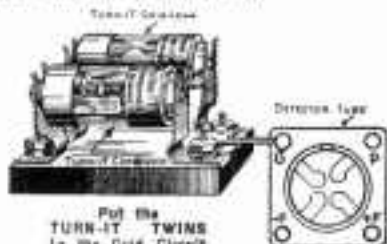
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Fig. 1. Micro photos showing the surface of ink-coated, pencil-coated, and fully impregnated grid leak paper, enlarged 200 times

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 lead. 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 comparatively, 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 ¼-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 The standard parts used are:
Required 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 1 1/2-in. diameter holes for the socket shells can be cut out very easily with a Stevens panel cutter or Pawood adjustable circle cutter.

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

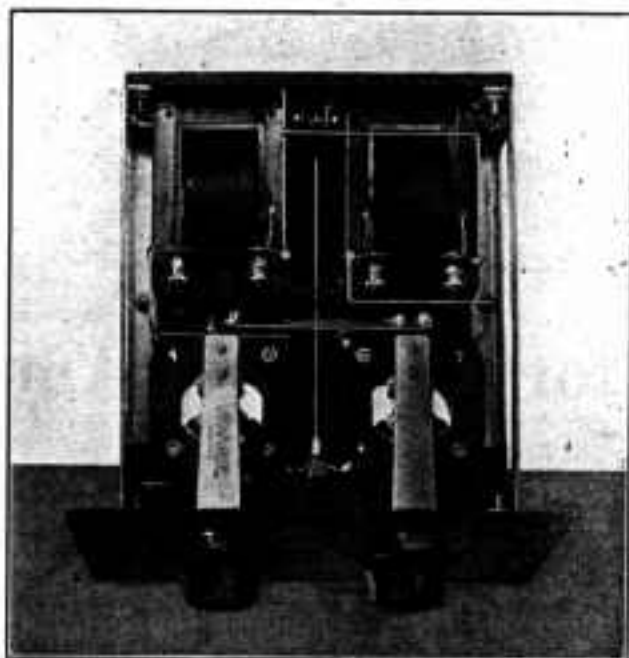


Fig. 2. The bottom of the instrument, illustrating the arrangement of the jacks, sockets, and transformers

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 1/2-in. 6-32 R. H. brass machine screws, four 3/4-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

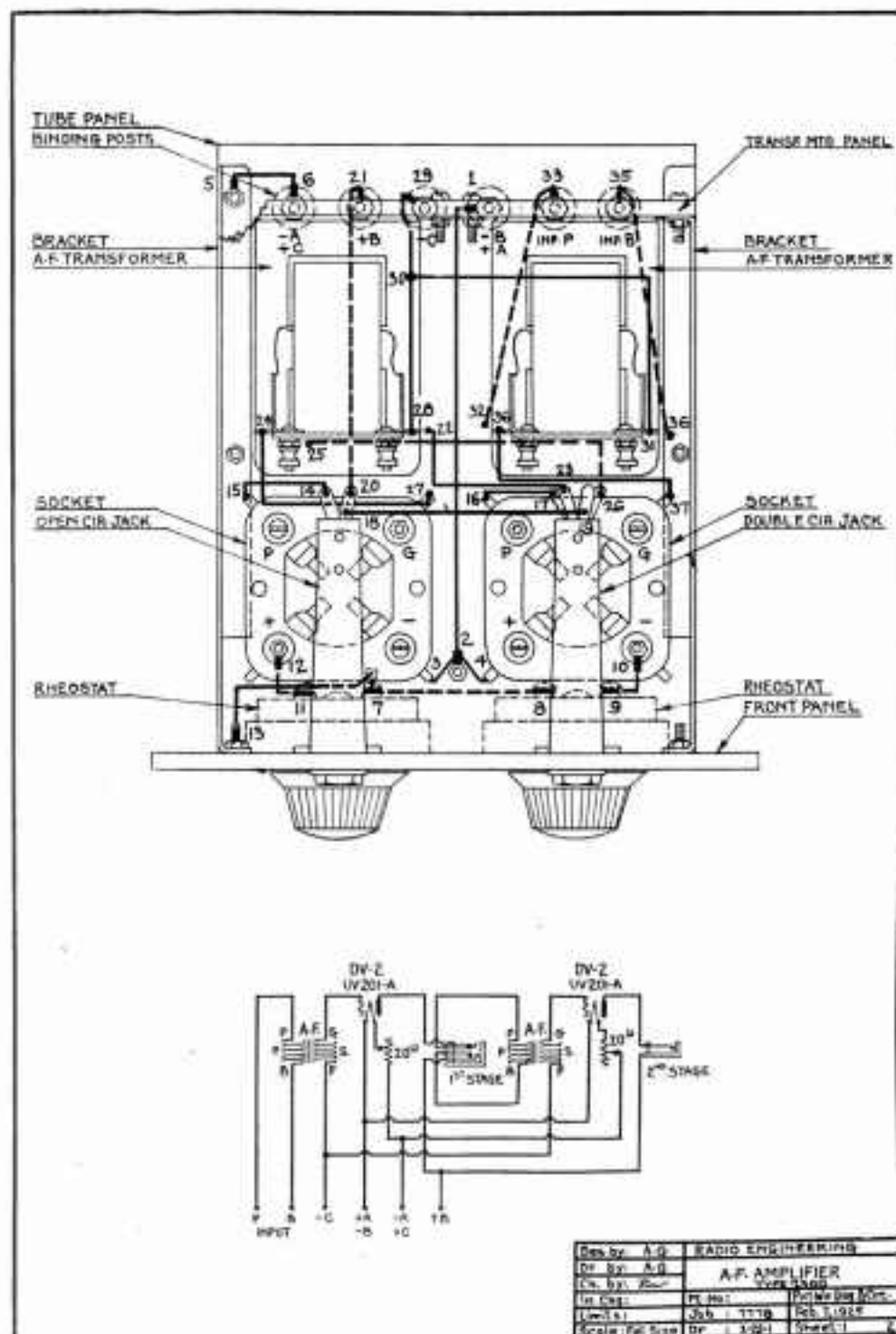


Fig. 3. Schematic and picture wiring diagrams of the two-step amplifier

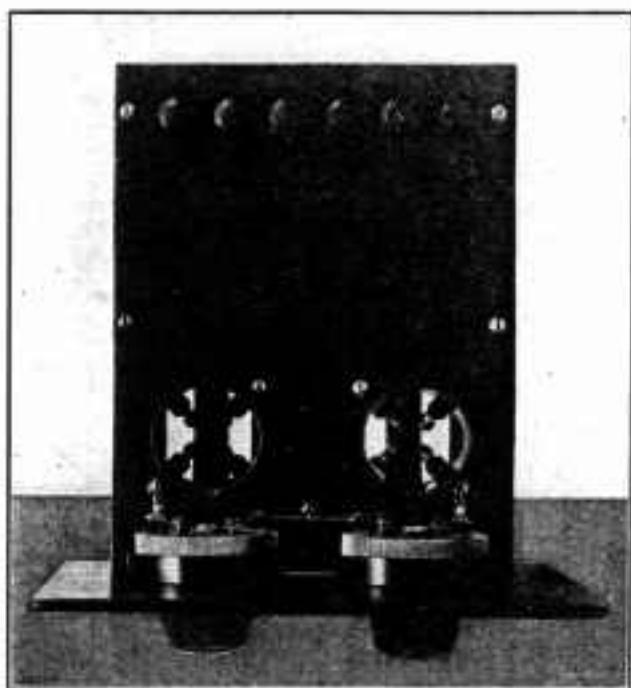


Fig. 4. The very plain appearance of the panel makes the amplifier both attractive and simple in appearance

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 $\frac{3}{4}$ -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 $\frac{1}{2}$ -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 $\frac{1}{2}$ -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 $\frac{1}{2}$ -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 $\frac{1}{2}$ -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.

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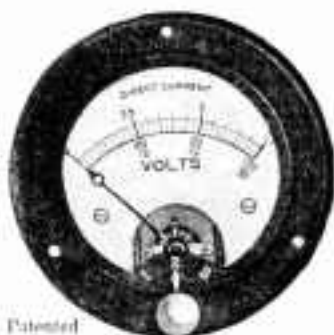
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Unmounted — CBS — 5127
34 other types for
every set. Ratios
1-1 to 4-1.

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—1 volts.. \$1.35
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

FIL-KO-LEAK

SCIENTIFICALLY CORRECT
VARIABLE GRID LEAK



Fils
Standard
Components

its calibrated

Get your FIL-KO-LEAK just as you do your other tuning parts. Get stations you never heard before. Clear up distortion and increase volume. You need FIL-KO-LEAK substitute in exact terms of the original (1/2 to 3/4 inch) through a hole-hole in the panel. It's also certified for base-board mounting. Insulation does not affect by weather, wear of time. **Unconditionally Guaranteed.**

\$2.00

\$2.90

in
Canada

FIL-KO-STAT

SCIENTIFICALLY CORRECT RADIO RHEOSTAT

with Battery Switch



Turn your tube filament with FIL-KO-STAT and never again will you never heard before. Get greater distance, louder signals, sharper tuning, freedom from tube noise. It is the only rheostat that enables you to use maximum sensitivity with any type of tube in any hook-up (full or half wave, 20 ohms). The new and improved model is fitted with battery switch that attaches to the regular mounting screws. **Unconditionally Guaranteed.**

\$2.00

\$2.90

in
Canada

FIL-KO VARIABLE RESISTOR

SCIENTIFICALLY CORRECT
ABSOLUTELY GUARANTEED IN USE



Stop distortion and increase volume when connected across the secondary of audio frequency transformers. Also for use in resistance coupled amplification. Individually calibrated from 5,000 to 250,000 ohms. Comes with brackets for base-board or transformer mounting. **Unconditionally Guaranteed.**

\$1.50

\$2.10

in
Canada

FIL-KO-ARRESTER

SCIENTIFICALLY CORRECT
RADIO LIGHTNING ARRESTER

with the 100% Guarantee



It is damaged through faulty operation of the arrester. Absolutely warranted to protect your set from lightning, with a guarantee to pay you \$200 or to repair your set, should the "umbrella" shield become dust, moisture, etc., from the Bakelite insulation, preventing leakage losses from aerial to ground. This makes certain that all radio signals reaching the antenna pass through your set, assisting maximum reception.

Listed as Standard under the re-examination service of the National Board of Fire Underwriters' Laboratories.

\$1.50

\$2.10

in
Canada

Send 2c stamp to Dept. RE 525 for interesting literature on improved reception.

D. X. INSTRUMENT CO., Harrisburg, Pa.

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 Place the four loop arms in of the the metal cross-shaped casting. Loop ing, and fasten them with four 1/2-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 22 1/2 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

*With the Famous Impregnated
Resistance Element*



Your Own Name or
Trade-Mark if Desired

LEAD-INS

*With the Copper Riveted Fahstoch
Type Clips*

TRIDOT LEAD-IN



No more loose eye-
let clips to contend
with—all clips are
copper riveted

Write for Price List

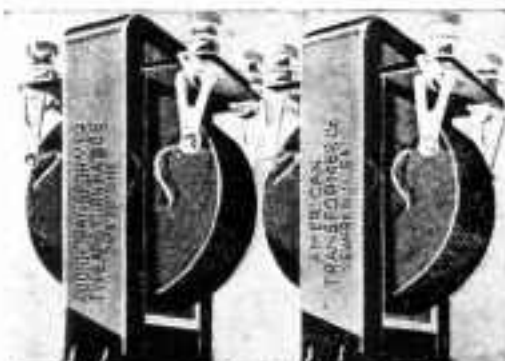
TRIDOT

ELECTRIC CO., INC.

16 HUDSON ST., NEW YORK CITY

WHOLESALE ONLY

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



Build or Rebuild with AmerTrans

ONE of the reasons why AmerTrans are preferred for fine sets is their strong, even amplification. They are made to be used by the pair as smooth working twin transformers.

AmerTrans amplify extreme tones with naturalness and uniformity. They are high in quality, produce great volume and can always be depended on to deliver the utmost in audio amplification.

AmerTrans is made in two types, one quality—AF6, ratio 5:1 and AF7, ratio 3½:1. Price either model, \$7.00 at your dealer's.

Buy them by the Pair!

AMERICAN TRANSFORMER
COMPANY

173 Emmet St., Newark, N. J.
"Transformer builders for over 24 years"

A New System of Radio Reception!

Francis R. Hoyt, inventor of the Hoyt System of Signal Amplification, has specified AmerTrans for use in this new system. We have a limited number of Blue Printed copies of Mr. Hoyt's original laboratory notes on this new system of radio reception, together with nine circuit sketches, which will be sent free to you upon receipt of this coupon and 4 cents for postage.

NAME

ADDRESS

AMERTRANS
THE AMERICAN TRANSFORMER COMPANY

(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 Sodian 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 Sodian. Turn the rheostat up to about 90, and the Sodian 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, often times, so hard to please.

BMS Fantail Jacks

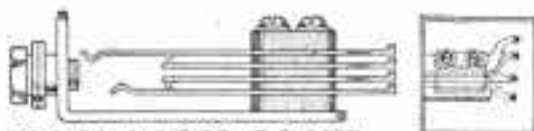
The easiest soldering jacks made!

B. M. S. JACKS have the exclusive cupped fantail lugs, which make soldering easy. The jacks are made of solid brass, while the springs are of phosphor bronze.

Manufactured by

**Brooklyn Metal Stamping Corp.,
718 Atlantic Ave., Brooklyn, N. Y.**

who also make B. M. S. TRI-COIL, (\$2) TRI-JACK, (90c), and TRI-PLUG (75c).



204 DOUBLE CIRCUIT CLOSED

**Made in 9
styles. At all
good dealers.**

Whatever Your Question



Be it the pronunciation of vitamin or marquisette or soviet, the spelling of a puzzling word—the meaning of over-head, novocaine, etc., this "Supreme Authority"

Webster's New International Dictionary

contains an accurate, final answer, 407,000 words, 2,700 pages, 8,000 illustrations. Constantly improved and kept up-to-date. Copyright 1924. Regular and India Paper Editions. Write for specimen pages, prices, etc. Cross Word Puzzle workers should be equipped with the New International, for it is used as the authority by puzzle editors.

FREE Pocket Maps if you name Radio Engineering.

**G. & C. MERRIAM COMPANY,
Springfield, Mass., U. S. A.**

The Most Efficient Inductance System For Tuned R. F.



The results obtained from tuned R. F. circuits incorporating Aero Coils cannot otherwise be equalled. The Aero system.

35% air dielectric and absence of core or winding eliminate resistance losses. Proper air spacing between turns eliminates capacity losses.

Large wire (No. 22 D. C. B.) minimizes circuit resistance.

Wide air spacing of primary and proper separation between primary and secondary allow full transfer of energy.

RESULTING IN:

Extreme sensitivity; high amplification of even low frequencies and such selectivity as was never thought possible with the principle of tuned R. F. (Manufacturers) look into our proposition. Please! You will find complete satisfaction and will be amazed at the results obtainable from this inductance system sold by leading dealers and jobbers, or direct.

Set of three Aero Coils \$18.50. Single set \$12.50.

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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.

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AMPLIFYING TRANSFORMERS

Largest Selling Transformers in the World

GABINETS

We build them
—any design—any quantity

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are the product of superior craftsmanship.



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



Large assortment
of stock models.
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Telephone: Sterling 2644

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!

EASTERN COIL CORP.

22 Warren St. Dept. R. E. New York



TYPE DM

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 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
PFANSTIEHL and APEX

MANUFACTURED AND GUARANTEED BY

HOWARD B. JONES

614-18 South Canal Street

CHICAGO

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—our 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 cold.

Benjamin Cle-Ra-Tone Sockets "float" above their base and so escape this ever-present rumbling. More sensitive experiments are thus possible and distant faint signals come in much clearer. Shif has 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 shell, with binding posts and space for work. Benjamin Shelf Brackets, Battery Switch and Grid Leak Panel simplify radio receiving set construction. Ask for descriptive folder.

Benjamin Electric Mfg. Company

120-128 S. Sangamon St., Chicago, Ill.
247 W. 17th Street, New York

448 Bryant Street, San Francisco



Get Distance With Howard "Low Loss" Parts

Cost is secondary in the making of Howard "Low Loss" Parts.

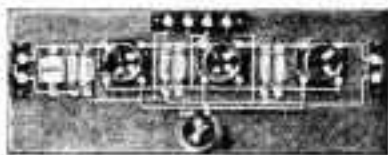
The first consideration is in the building of the best in order to give you the satisfaction and long life you have a right to expect. All Howard parts are so guaranteed.

Rheostats,
Potentiometers,
Fixed Condensers,
Binding Posts,
Switch Levers,
Sockets,
Plugs, etc.

Those dealers who specialize in the better grade parts feature those marked Howard.

Write for circulars

HOWARD RADIO COMPANY
451-469 East Ohio Street, Chicago



NEW!

Resistance-Coupled
Amplifier Kit \$5⁰⁰
for only..... \$5

Electrad 3 stage Resistance
Coupled Amplifier Kit No. 1
Price \$5.00

*Write for free diagrams
and instructions*

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428 Broadway
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KESTER Radio SOLDER



Oh boy! it sure is
Safe & Simple

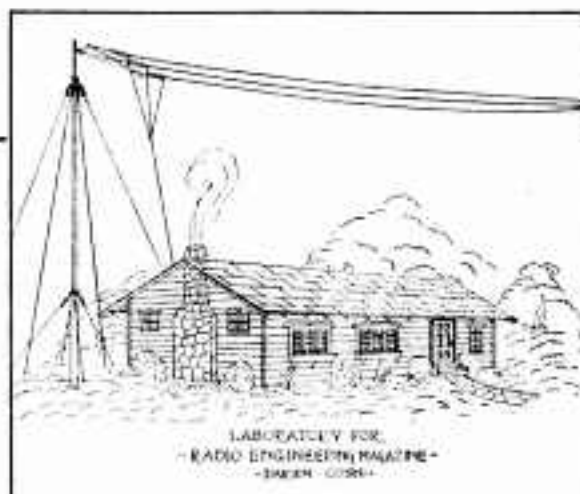
Here's the solder that contains the flux recommended by radio engineers! The pure rosin core inside of Kester Radio Solder is a natural flux and our base has no harmful chemical in electrical action on delicate parts or joints. It requires only heat.

In developing radio frequency, it was found that all fluxes, except rosin, spatter, fumes and run over delicate parts and joints. This causes leakage and makes the best insulation as poor as a grid leak.

Solder with Kester Radio Solder. You will have no need to go over and wipe away surplus flux. Leave what rosin core remains — it is a good insulator!

There you have it: Kester Radio Solder is a safe and simple solder with which your set can be quickly, neatly, safely and substantially soldered. Get a handy can of Kester from your dealer.

CHICAGO SOLDER COMPANY
4224 Wrightwood Ave.
Chicago—U. S. A.



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.

Be Fair To Your Radio Set

You may have the finest set made, yet, if your speaker or phones haven't **CLEARNESS**, your set is no better than one of the cheapest kind.



N & K IMPORTED LOUD-SPEAKER offers the sound of a horn & specially designed voice chamber built of burlin, a lightweight scientific material which eliminates false tone, is in high class of artistic value effects. Price \$27.50.



N & K IMPORTED PHONOGRAPH UNIT. Attached to Victor or other standard phonograph, it gives the equivalent of a wonderfully clear, rich-toned loudspeaker. Responds to series of special attachment devices. Price \$7.50.



N & K IMPORTED PHONES are more slightly larger than ordinary phones, but not heavier. Give the rare better, it more sensibly and that you mean more. Superior leather covering on head bands. 2 for cost. Price \$4.50.

N & K Imported Phones, Loudspeaker and Phonograph Unit differ from all other radio reproducers on the big point of clearness. Made especially to reproduce music, they bring out every tone—every delicate, high one, every soft low one—clearly, naturally, beautifully. No harshness, no blasting loudness.

Sold by best dealers everywhere on the basis of your money back if N & K Imported Phones, Loudspeaker or Phonograph Unit do not make your set sound clearer and mellower in tone than with any reproducers you ever used.

So be fair to your radio set—use an N & K reproducer. Ask at your regular radio dealers. And write for Free Folders describing N & K Imported Phones, Loudspeaker and Phonograph Unit.

THE GOLDSCHMIDT CORPORATION
Dept. K 5, 35 William St., New York



INC. U. S. PAT. OFF.

Imported

**PHONES LOUDSPEAKER
PHONOGRAPH UNIT**

Obsolete

Take
the
"GUESS"
Out of Tube
Control

**\$ 1.10
Everywhere**

with

AMPERITE—the Self-Adjusting rheostat, takes care of tube current better than any expert operator could regulate it. No more hand rheostats or filament meters necessary. Brings the most out of each individual tube automatically. Simplifies wiring, doubles tube life, lowers net cost. Approved by all leading laboratories. Used in every popular construction circuit.

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Dept. R.E., 9, 50 Franklin St., New York City

Write for
FREE
Hook-ups

AMPERITE
REG. U. S. PAT. OFF.
"means right amperes"

fits Grid Leak any mounting

**FRESHMAN PLUNGER
TYPE VARIABLE GRID LEAK**

was designed especially for the non-technical set owner who can replace in an instant the standard grid leak with this new, efficient cartridge type Variable Grid Leak without requiring the change of a single wire.

*At your dealer
or by mail post-
paid. Write for
free catalogue.*

65c

203 W. 40th St.,
New York

**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 Sodian tube is used for the detector.

MOST sensitive of all detectors, the Sodian 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 Sodian 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 $\frac{1}{2}$ 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 Sodian in the detector socket and hear the difference.

D-21 Sodian, made by the Commercial Telephone and Telegraph Company, price post paid. \$5.00

PARTS LIST, TYPE 1509, BROWNING-DRAKE RECEIVER

Type No.	Name	Price	Type No.	Name	Price
8E15	1-Benjamin UV-201A Socket . . .	\$1.00	B-D	1-Complete Regenerator Kit \$72.00	
8G10	1-Benjamin UV-100 Socket . . .	1.00	B.P.	1-0.001 mfd. New York Coil fixed condenser . . . . .	.40
TJ	2-Trijucks	2.50		1-0.0025 mfd. New York Coil gridleak condenser . . . . .	.45
SA	1-Daven Super-Amplifier	15.00		3-Plugs, of 25 soldering lugs . . . . .	.60
G	1-2 1/2 Megohm Daven Gridleak . . . . .	.50	58	1-Angle bracket . . . . .	.10
P	1-Black Celoron Panel, 7 x 28 x 3/16 in.	4.50	14	10-Coil mounting pillars . . . . .	.40
P	1-Black Celoron Panel, 5 1/2 x 2 1/2 x 3/16 in.	1.97	62	1-Plg. of 10, 1/2-in, 6-32 F. H. nickel screws . . . . .	.12
401	1-0001 Micondon . . . . .	.35	63	3-Plg. of 10, 1/2-in, 6-32 R. H. nickel screws . . . . .	.30
K	3-Ensign Binding Posts, plain top . . . . .	.45	6	1-Plg. of 10, 1/2-in, 6-32 R. H. nickel screws . . . . .	.14
	1.0-ohm Rheostat	1.50	143	1-Plg. of 10, 1 1/2-in, 6-32 R. H. nickel screws . . . . .	.18
	1.50-ohm Rheostat	1.50	49	3-Plg. of 10, 6-32 nickel nuts . . . . .	.24
W	1-100 ft. spool of Wire . . . . .	.90			
MR	3-Lengths No. 7 special var- nished tubing . . . . .	.30			
S	1-Metro Koolok 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 UV100 tube for the R. F. amplifier, a D-21 Sodian or UV201-A for the detector, and three UV201-A's for the amplifiers.

To operate a cone loudspeaker with best results, use a 0 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 15 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

15-52 Vanderbilt Avenue

New York City



They Turn SMOOTHLY

No jumping! No back lash! No sticking or binding! Pacent Rheostats and Potentiometers turn smoothly and freely.

The contact arm is set right at the factory, so that the tension always remains the same. Note, also, the convenient OFF and ON dial.

Over 35 leading set manufacturers use Pacent Rheostats and Potentiometers in their sets. You can have the same models and the same splendid results.

Write for catalog of complete Pacent line.

PACENT ELECTRIC COMPANY, Inc., 91 Seventh Ave., New York City

San Francisco
Chicago
Washington

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RADIO ESSENTIALS

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Detroit
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Philadelphia
Jacksonville
Minneapolis

Canadian Licensees: R. H. White Radio Company, Hamilton, Ont.

DON'T IMPROVISE - PACENTIZE



At your dealer
50c

LOCK Your Set!

with this compact
-noiseless- shock-
proof and easily in-
stalled BATTERY
SWITCH.



WALBERT MFG. CO., CHICAGO

SCREW MACHINE PRODUCTS & SPRINGS

Wm. STEINEN & CO.

297 Washington St.

NEWARK - - N. J.

TEL. MARKET 9077

We specialize in STAMPING SILICON STEEL LAMINATIONS

Why worry with this expensive operation when we do it cheaper? Prompt deliveries guaranteed.

FUNK & SHORE

50 Church St.,
New York, N. Y.

Tel. Cortlandt 1921.

Iⁿd 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.

A REGISTRY OF RADIO INSTALLATION and MAINTENANCE SERVICE MEN WHO INSTALL, MAINTAIN, and REPAIR RADIO EQUIPMENT

Conn., South Norwalk—A. GHIRARDI*
Rowayton. Tel. Nor. 2724

D. C., Washington—A. C. BURG
U. S. Soldiers' Home. Tel. Col. 750 Br. 41

Ill., Chicago—WEILAND & CO.
6711 Stewart Ave. Tel. 1124 Normal

Md., Baltimore—OTTO U. JAHIELKA
3710 No. Rd., Walkbrook. Tel. Liberty 1202

Mass., Boston—H. A. NICKERSON
201 Devonshire St. Tel. Cong. 5156

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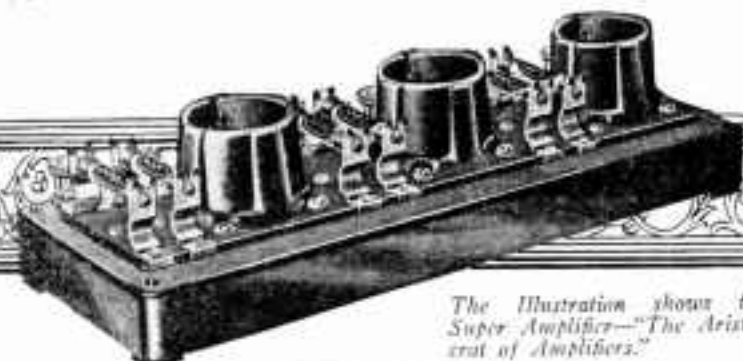
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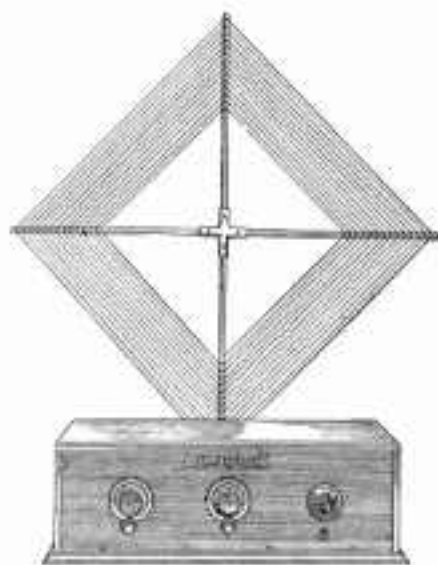
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