THE DUOTROL—WHAT IT IS AND HOW TO MAKE IT

Vol. III No. 5

RADIO & MODEL ENGINEERING

Edited by ~ M.B.Sleeper

10 Cents a Copy $1.00 Per Year

A Magazine For The Experimenter Who Builds His Own Equipment

PEANUT
DETECTOR TUBE
W. T. 501

TWO DOLLARS
Immediate delivery

The W. T. 501 tube is designed for use, with an adapter, in any radio receiving set provided with a filament battery of 4 to 6 volts. For local reception good judgment indicates its selection because of its noiseless operation, ease of adjustment, and its low price.

Buy a W.T. 501 as an auxiliary, to save your expensive detector tube, and you will find yourself working with it almost all the time, except for long distance reception.

Not only is the price of the W. T. 501 far lower than that of other tubes, but the current drawn from the plate battery is 75% less than with any other type. Dry cells can be used for the filament, since only 0.3 ampere is required.

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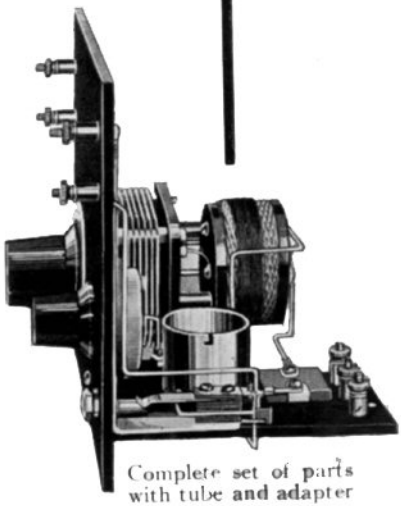
Complete instructions are furnished with each tube showing the very simple arrangement by which you can make a crystal outfit into a tube set using the W. T. 501. There is nothing to discard and just a few parts to add. Don't worry around with sensitive spots and buzzer tests—Use a W.T. 501.

W.T. 501, shipped with full instructions	$2.00
Nickel plated socket, molded base, double springs	.40
Adapter for standard V.T. socket	.75

If not at your dealer's, send his name and address with your money order and we'll see that you are supplied. Include 10c. extra for registration.



Complete set of parts with tube and adapter
$14.95

Radio Research Guild

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A Revolution *in* Rheostats

New Triumph of Filament Control

The Sleeper Radio Corporation endorses the Ermco-Stat as an absolute definite advance in filament control. A rheostat that gives a vernier control on any type of tube—a constant current at any setting—a rheostat that has no wires, no plates—that will not wear, or break, or overheat.

The Sleeper Radio Corporation recommends the Ermco-Stat to every user of radio, to every manufacturer, jobber and dealer.

The Sleeper Radio Corporation has added the Ermco-Stat to its family of Construction Parts and is handling its distribution for the United States and Canada.

Orders or inquiries from any source will be given immediate attention. Write for further information.

Type A—For A Battery Control

The Ermco-Stat is made with 75 ohms, to carry 1 ampere, or 30 ohms, to carry 5 amperes. The former type is made particularly for detector tubes. It is suitable for any make of tube operating on 1½ to 6 volts. Moreover, when this rheostat is used 1½-volt tubes can be operated on a 6-volt battery without danger of burning out.

For amplifiers the 75-ohm Ermco-Stat can be used to control several low-current tubes, as, for example, four or five UV 199's or three or four UV 201-A tubes, but the the total current should not exceed 1 ampere.

The 5-ampere Ermco-Stat is designed for power amplifiers and vacuum tube transmitters where a heavy filament current is drawn.

Both of these Ermco-Stats give zero resistance when in the full on position, and are entirely open at full off.

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You will have a new and most pleasing experience when you use the B battery control Ermco-Stat. This is connected in the plate circuit of the detector, in series with the B battery. Varying from 50 to 10,000 ohms, it adjusts perfectly the action of the detector, and more accurately than is possible either with a tapped battery or a potentiometer.

PRICES:

Type A, 1 ampere, 75 ohms	$1.80
Type A, 5 amperes, 30 ohms	2.25
Type B, 50 to 10,000 ohms	1.80

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THE FIRST RADIO CRUISE

Even if it calls for a little sacrificing on something else you should take this opportunity to combine the finest vacation you ever had with an experience which is a financial asset to every radio engineer, manufacturer, dealer, or experimenter.

AS A VACATION

Oh, man, when you hear those tugs a-puffing, the whistle lets out the long blast, and you wave until your arm's tired—There's a real thrill! And then, when you've watched 'em drop the pilot, you take a look over the ship. That's when you get acquainted with comfort raised to the nth degree.

The bugle for lunch—a table covered with such delicacies as you've never seen, a trained steward to anticipate every need, or help you select from a menu of infinite choice. Another steward to serve you at your stateroom, one to adjust your bath to the proper temperature, the deck steward to bring your bullion and tea, and so it goes—deck sports, dancing, music, everything to make you comfortable and happy during those wonderful days at sea.

Then Liverpool, the puffy English trains, days in the country, London with its age old buildings, the fascinating Science Museum. The Croydon Airdrome, propellers humming. "Switch on!" and you are climbing into the clouds, crossing the English Channel. On the ground again and on the way to Paris—the Paris that we all must see. Having seen, you are on board again for New York —Could there be a better vacation?

The Finest Ships

of the Cunard line have been selected—the Franconia, 20,000 tons, and the Aquitania, 46,000 tons. With the assistance of Thomas Cook & Sons careful plans have been made to assure the best accommodations on the trains and in the finest hotels of London and Paris.

AS AN EXPERIENCE

We assume that we lead the field in the development of radio equipment, in radio broadcasting, and in radio merchandising. But do we? Do you know what is really being done in England and France? Since they cannot use regeneration what have they got for DX reception? They think nothing of hearing American stations. How have they solved their broadcasting problems? They believe that their programs are superior to ours.

In what way are goods distributed? What is a jobber? Do they have "gyps"? Are they selling parts or sets? What kind of advertising are they doing? There certainly must be many things done by the hundreds of companies in England and France which we ought to know about, for they have developed their business methods and their apparatus designs quite independently of ours.

Can you, as an Experimenter or Engineer, design equipment with a knowledge of international practice? Are you, as a dealer, depending only on what you learn at home to develop your trade, and can you tell your customers of things abroad as well as in your own town? Will you be able, as a manufacturer, to shape the policies of your business on a basis of international understanding of coming problems which must soon be solved if radio is to continue?—Here is your opportunity.

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Aug. 4th. Sail from New York for Liverpool. Special arrangements for radio tests and experiments on board.

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

16th. Arrive at London. Visits to radio factories and laboratories, Croydon Airdrome, Marconi plant at Chelmsford, Science Museum, Internation meeting and conference with English experimenters and manufacturers.

25th. Leave by airplane for Paris. Visits to radio plants, the Museum, and Versailles.

Sept. 1st. Sail from Cherbourg.

7th. Arrive at New York.

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

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

Do not wait any longer to make your reservations—There are only five weeks to the date of sailing.

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

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

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A Receiving Set That Anyone Can Build

Here is a design for a receiving outfit that is almost as easy to assemble as it is to operate. This outfit incorporates several new and unusual features.

Description of the Set

FREQUENTLY would-be Experimenters are discouraged from undertaking the construction of their outfits because they cannot find a design easy enough to start in on. More than that they do not wish to make the investment required for most receiving sets until they have had sufficient experience to be certain that they will be successful. Many experimenters, too, like to have something very neat and handy to keep as a standby receiving set for local reception, either for purposes of checking or demonstration, for it so often happens in the Experimenter's laboratory that he is working on new things so much of the time, putting together and tearing down, that, when a friend drops in to hear radio, he has nothing to use for listening in.

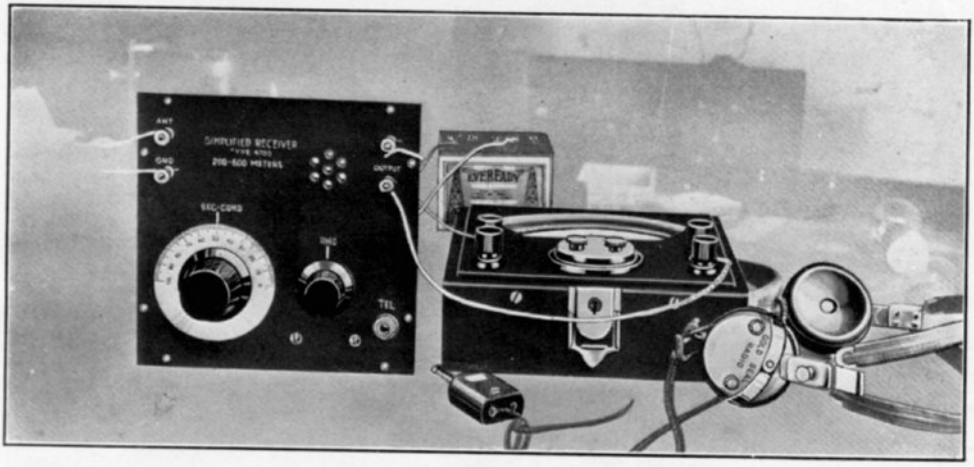

Fig. 1. The set as it was hooked up for measuring the plate current of the W. T. 501 tube. A Rawson micro-ammeter was used to indicate the current

The outfit described here is, like most designs, a compromise. That is, it is not possible to get the features of low cost, simplicity of construction, sharp tuning and long distance reception in one outfit. Since the complete parts, including the vacuum tube, batteries, a first class headset, and other accessories comes to less than $20.00 the outfit is unquestionably low in price for a vacuum tube set. The tuning is very sharp indeed for a one-control receiver. For example, at the Magazine laboratory, which is a very short distance from WEAF and just across the river from WOR, it is possible, when those stations are going and also WJY and WJZ, to tune in any one of the four at will. A little farther away, the tuning is so sharp that a very careful adjustment of the secondary condenser is necessary.

There is really only one control for this outfit because the rheostat, once set, requires no further attention. All the tuning is done with the variable condenser. A jack is supplied for plugging in the telephones or, in case a plug is not available, the telephones can be connected to the two output binding posts. The real purpose of the output terminals, however, is to permit the addition of one or two steps of amplification.

You will note that this outfit is specially designed for use with W. T. 501 tubes. There are several reasons for this. The W. T. 501 can be used on dry cells or a storage battery of 3 to 6 volts, when an 8-ohm rheostat is employed. The filament current consumption at 4 volts is 0.3 ampere, just the least bit more than is consumed by the W. D. 11 tubes. The plate current, on the other hand, is very much lower, 0.00025 ampere or ¼-milliampere. This means that small size Everready B batteries type 763 can be used indefinitely, very nearly as long as the battery would last if it were simply lying on the shelf. The W.T. 501 is much less critical than

any other tube and will stand much more abuse both from excessive filament current and rough handling. Moreover, it gives none of the usual squeals and hisses which are heard in other tubes.

It is true that this type of tube is not as sensitive as others nor can it be used in regenerative circuits, but in the standby set or for the inexperienced enthusiast it is ideal.

The tuning circuits are made up of a fixed primary winding over a U. S. 75 Duo-lateral coil which serves as a secondary. Shunted around the coil is a 11-plate condenser giving a wavelength range of approximately 210 to 520 meters. Consequently all the broadcasting wavelengths come within the range of the set.

You will notice that the picture wiring diagram in Fig. 6 calls for only 27 connections, a number much lower than will be found in almost any other set. A particularly commendable feature in the outfit is that there are no switch points to solder.

Standardized Parts Employed

As in other sets which have been described, the panels and coil ends are of Formica, all cut from 3-16 in. stock. The front and base panels are of standard sizes, available almost everywhere. A single circuit Pacent jack, type 61, is provided for the telephone connections. In parallel with it are the output binding posts. A Dubilier Micadon of 0.00025

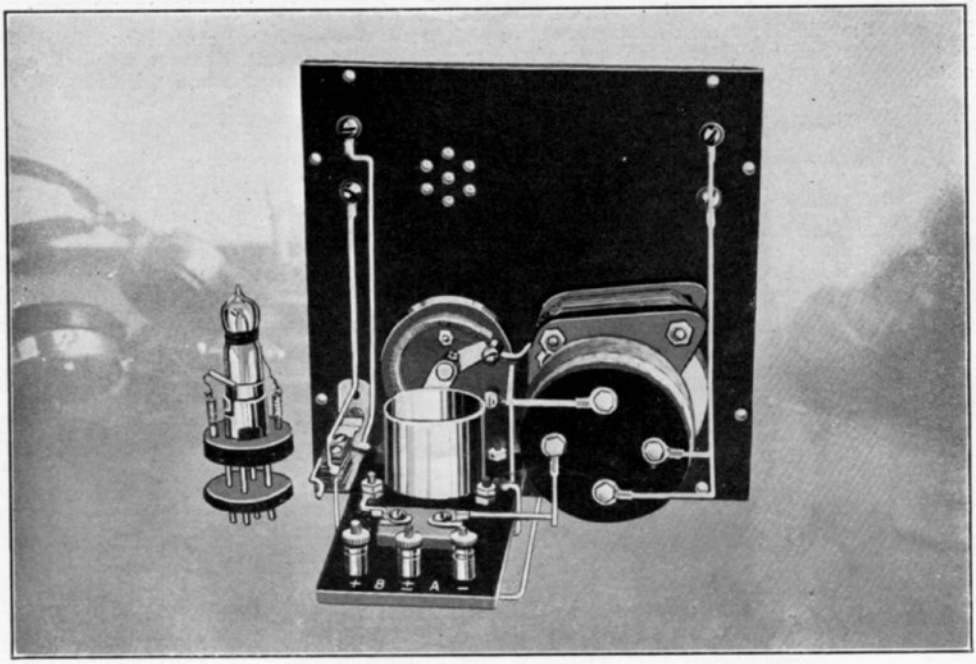

Fig. 2. A rear view of the Simplified Receiver, showing also the W. T. 501 tube mounted in the adapter

Construction Work Required

A little care but very little skill is required to assemble this regenerative set. The panels are of standard dimensions and can be bought completely drilled and engraved if you desire. You will probably find it necessary to cut out the coil ends, but that is not hard. They simply serve to hold the Duo-lateral coil and the connections. The front disc carries the coil mounting pillars, too, by which the inductance unit is secured to the condenser. The front panel, 7 x 7 ins., is a standard size so that you can probably buy a cabinet from your local dealer. If not, it is easy enough to put together a cabinet to carry the set. An allowance of $\frac{3}{8}$-in. has been made around the panel so as to fit a cabinet of $\frac{3}{8}$-in. stock.

mfd. is connected in the grid circuit. It is not necessary to use a gridleak altho, if you want to try the effect of a leak, you can do so by roughing the upper surface of the condenser and marking it over with a pencil between the terminals. The socket, variable condenser, and knobs are of the Sleeper Radio Corporation design. The standard socket was chosen for the reason that it permits a regular tube to be used for purposes of experimenting or comparison and the tube adapter is so inexpensive that it does not add appreciably to the cost. The rheostat, of 8 ohms resistance, is the Fada type 153-A. For the secondary inductance a Pacent Duo-lateral coil, U. S. 75, is employed. These standard parts can be purchased from practically all radio dealers.

Laying out the Panels

In Fig. 5 you will find one-half scale drawings of the panels, coil ends, and the condenser end-plate on which the holes for the coil mounting pillars are indicated. The front panel measures 7 x 7 x 3-16 in. and the discs 2⅜ ins. in diameter. That is the outside diameter of the Duo-lateral coil.

Since the drawings are exactly one-half size you can measure distances on the drawing with a pair of dividers and transfer them, doubled, to the panel. Almost without exception dimensions have been chosen in steps of ⅛ in. altho it is necessary, sometimes, to employ sixteenths. This is done so as to simplify the work of laying out the panels.

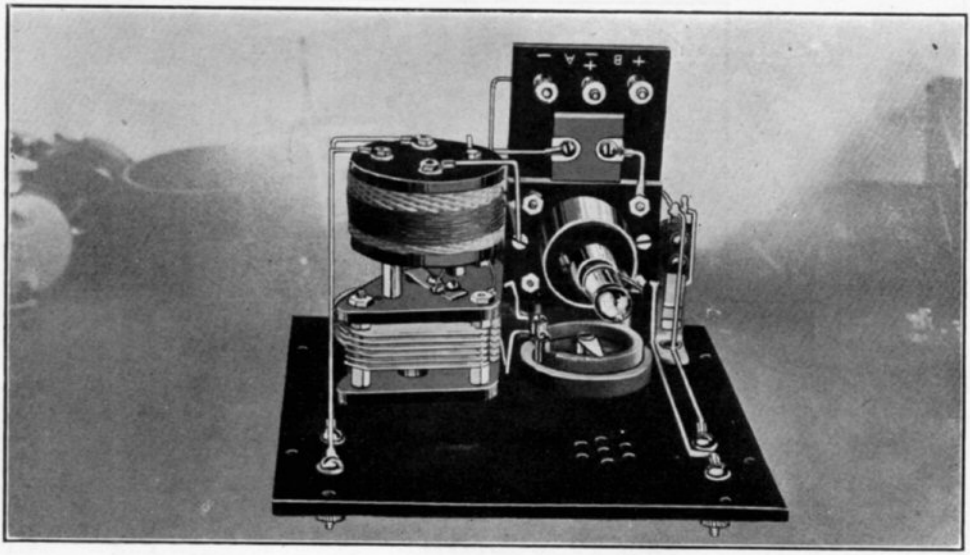

Fig. 3. Looking down on the set, with the tube in place. This shows clearly the tuning unit, as well as the other fittings

All holes, unless otherwise marked, are to be made with a No. 18 drill. You will see that, in the case of the holes for the rheostat and condenser shafts, an oversize drill is specified. This is done so that there will be no binding of the shaft against the side of the hole. The holes to take screws for fastening the panels to the cabinet are 3-16 in. in from the edge so as to bring the screws in the center of the ⅜-in stock of which the cabinets should be made.

Note that the holes for the coil mounting pillars on the rear condenser end plate are in line with the screws which hold the condenser together. The holes are 1½ ins. apart.

Some experimenters prefer to use flat-head screws where they show on the front of the panel. Countersinking has been indicated only for screws which come under the knobs for the reason that Experimenters do not always have a suitable type of countersink to make a depression neat enough to stand inspection. Moreover, a round-head screw, is a little easier to handle.

The Tuning Unit

The tuning unit, consisting of the variable condenser, Duo-lateral coil, and the outside primary winding should be assembled completely before the general assembly of the outfit is started. First wind the primary coil over the secondary inductance. This winding is made up of 15 turns of No. 24 S. S. C. wire, (No. 22 S. W. G. gauge). This occupies a space of approximately ⅜-in. Since the secondary coil is 1-in. wide, the primary winding should be started 3-16-in. in from the edge. To secure the ends of the winding a short narrow strip of gummed tape should be wound two or three times around the coil right at the point where the ends come out. Be very careful in handling the inductance that you do not scrape off any insulation which might cause a short circuit between the two coils.

With the winding completed, set the coil on the front disc and insert the four 1½-in. 6-32 R. H. screws. Put a soldering lug on each screw and then turn down a nut so as to hold the lug tightly. It is also necessary to put lugs on two of the screws at the outside of the coil ends. They are to provide connection from the secondary terminals to the two terminals of the variable condenser. Bring the leads from the primary coil to the inside and solder them to the lugs. Be sure that you have the secondary leads going to the screws which are provided with lugs on the outside. You must also fasten the coil mounting pillars in the two extra holes

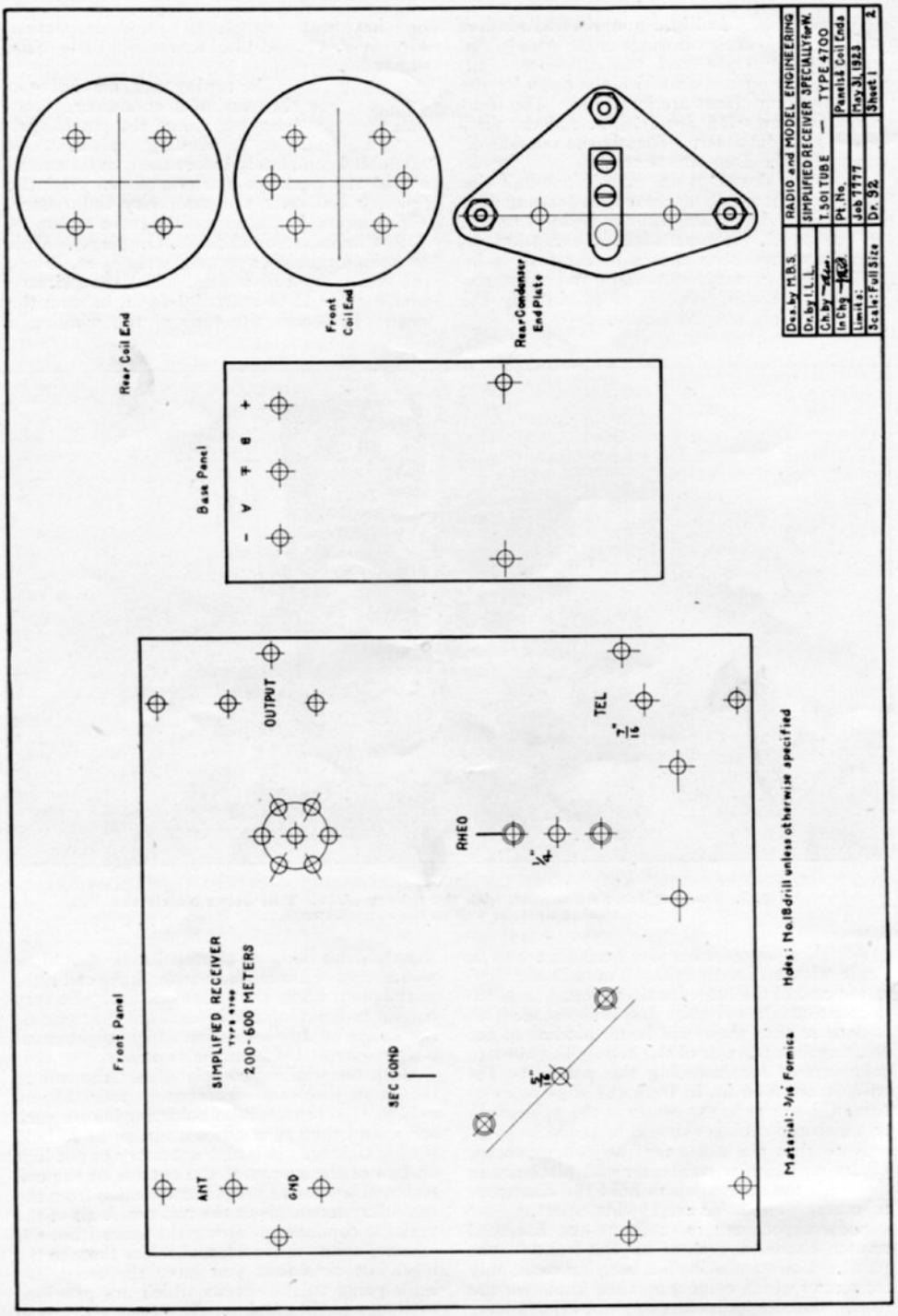

Fig. 5. One-half scale drawing of the front and base panels and the coil ends. The view of the condenser and plate indicates the position of the holes for the coil mounting pillars

on the front coil end. Use ½-in. 6-32 R. H. screws for that purpose. Then put the rear coil end in place. The screws will protrude just enough to leave room for a washer, lug, and nut. These are for connections to the various circuits outside.

Next remove the rear condenser end plate and fasten it to the coil mounting pillars with ½-in. 6-32 R. H. screws. Then put the plate on the condenser again and connect the secondary terminals to lugs on the terminals of the rotary and stationary plates. In Fig. 6 the stationary plate connection is 14 and the secondary lug is 15. Seventeen is the rotary plate terminal and 16 the coil lug. Then 18, 20, 25 and 27 represent the four lugs on the outside of the rear coil end.

With this assembly completed and the panels drilled you will be ready to do the wiring and the balance of the assembly work.

Assembly and Wiring

Fig. 6 shows a picture wiring diagram of the receiver and also a schematic circuit. The former is furnished so that you can follow the wiring as it is actually done in the finished set. Soldering lugs are indicated by short heavy lines. Where the wiring is concealed, as is the case where it runs under the base panel, it is indicated by dotted lines. The base panel is shown as if it were dropped down so as to disclose the wiring in greater detail.

1. Mount the binding posts marked 7, 12, 24 and 26 on the front panel, putting a soldering lug between each screw head and washer.

2. Mount the rheostat on the front panel, making sure the terminals are in the direction indicated. Put soldering lugs on each terminal pointing in the direction shown.

3. Mount the binding posts on the base panel, putting a soldering lug between each screw head and washer. Make sure that, in every case, the lugs point as indicated in Fig. 6.

4. A Sleeper Radio Corporation knob is shown on the rheostat in the illustrations for the reason that it matches the knob and dial on the condenser. If you substitute this knob for the one supplied with the Fada rheostat you must unscrew the Fada knob from the shaft, fasten the contact arm to the threaded end of the shaft, put the contact and shaft in position and fasten the other knob on the shaft so that, when the contact arm is in the position shown in Fig. 6, the white line of the knob will coincide with the line on the panel. This should be done before the socket is mounted or the socket will interfere.

5. One-inch 6-32 R. H. screws fasten the socket to the panel, with coil mounting pillars to hold the socket back from the panel. You can see this arrangement in the photographs and in Fig. 6, where the pillars are marked Base Panel Support. If you have any trouble in getting the screws into the bushings molded in the socket base, clean them out with a 6-32 tap.

6. Using screws provided with the socket, fasten the base panel to the underside of the socket. The screws will be a little too long but they can be cut off readily. If you file down the ends of the screws, be very careful not to leave any brass chips. Make sure that you have the base panel tightly against the front panel as this gives additional support. This makes a very strong mounting, in addition to which there is the bracing supplied by the bottom of the cabinet on which the base panel rests.

7. Connect terminal 1 to 2. In preparation put the very slightest amount of Nokorode soldering paste on the lugs at 1 and 2. Then fit with great care a short length of square tinned copper bus bar between the terminals. It is not necessary to put any additional paste on the wire for the paste will run up on it as soon as the joint is heated. Use only a little solder but heat it enough so that it runs freely. The amount of paste should be so small that there is neither sizzle nor smoke from it when the iron is applied. In the same way connect 3 to 4, 5 to 6, and 7 to 8. These wires are put on first as they are difficult to get at when other assembly work has been done afterward.

8. Mount the jack in the position shown. Three washers are provided with Pacent jacks. All three should be put at the front of the panel under the clamping nut. The purpose of these washers is to allow various thicknesses of panels to be used.

9. Connect 9 to 10, 11 to 12, and 11 to 13. You will see that two connections are to be made at 11. That is the upper spring on the jack. Terminal 10 is the terminal which makes connection with the frame of the jack.

10. Mount the tuning unit using the screws furnished with the variable condenser.

11. Put on the knob and dial so that the line on the panel will coincide with the 100-division mark on the dial when the condenser plates are totally interleaved.

12. Connections 14 to 15, and 16 to 17 should have been made already, before the tuning unit was put in place.

13. Connect 18 to 19, and 20 to 21. Terminals 21 and 22 are made to lugs under the heads of ¼-in. 6-32 screws clamped in place by nuts. Connect 22 to 23, 24 to 25 and 26 to 27. This completes the wiring of the outfit.

Testing and Operating

It is advisable to test the set before it is finally mounted in the cabinet. First the W. T. 501 tube must be mounted in the adapter. You will notice that there are two springs on the adapter, one of copper and the other nickel plated. Also the grid wire on the tube is copper and the plate wire nickel plated. Therefore, the grid should be connected to the copper spring and the plate to the nickeled spring. Make sure that you solder these joints but do not allow any paste to run down the springs. Connections to the filament are obtained by the two contacts inside the base. With this work completed, put the adapter in the socket and connect two cells of a storage battery or three batteries across the A battery

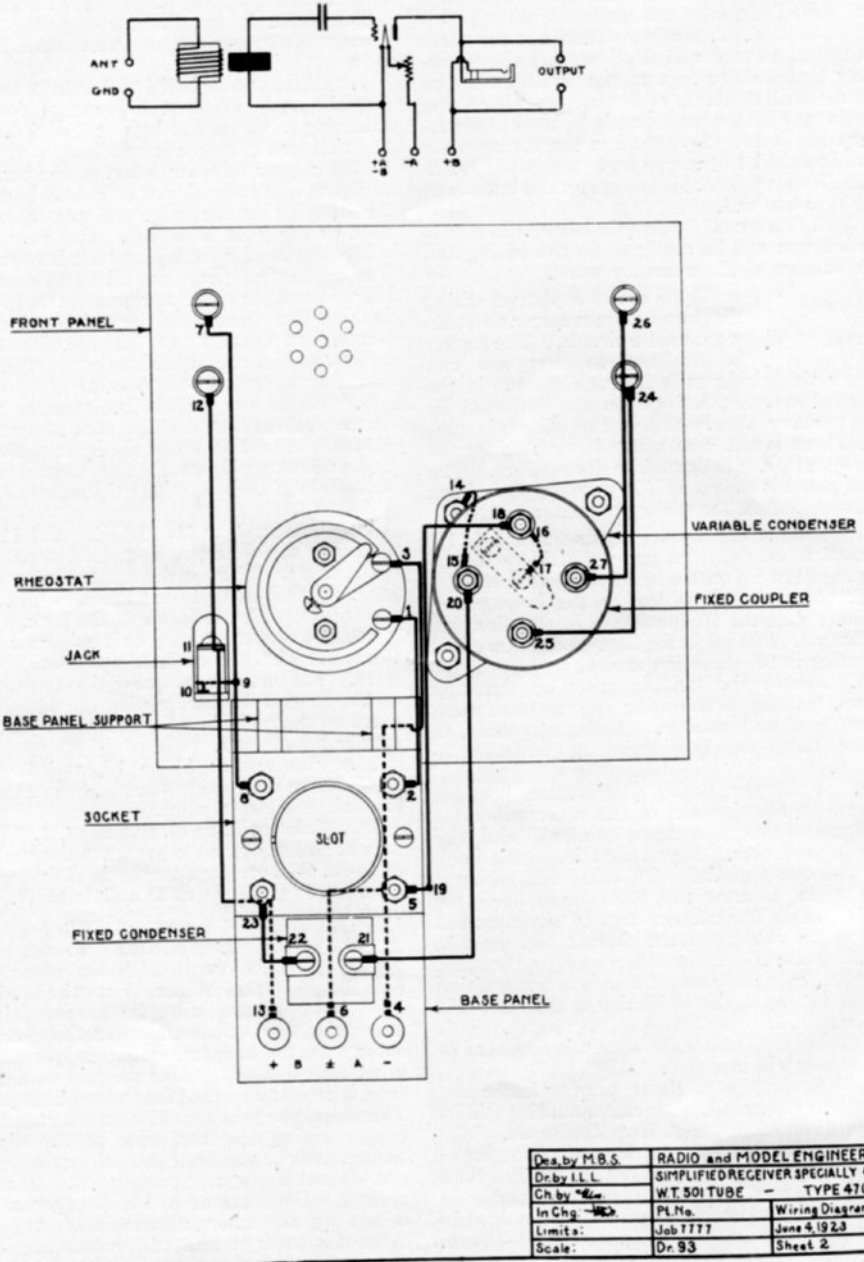

Fig. 6. Schematic and picture wiring diagrams of the receiving set. Note that there are only twenty-seven soldered connections

terminals on the base panel. When using dry cells remember that the carbon or center binding post is positive and the zinc or outside binding post negative. The tube should light with normal brilliancy as soon as the filament rheostat is turned up slightly. Six volts can be used but the signal strength is not increased, and the life of the tube shortened.

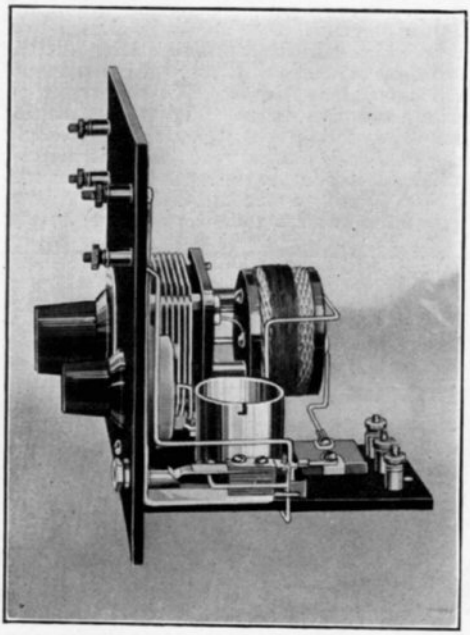

Fig. 4. In this side view you can see the details of the jack, socket, and grid condenser

If the filament lights properly connect the B battery of 22 volts. The tapped type is strongly recommended for often times the best results are obtained with these tubes when as little as 16 volts are employed. When you connect your telephones there should be a sharp click indicating that the plate circuit is complete. If you do not hear this sound go over the wiring to find out the reason for the open circuit. Connect a buzzer and battery across the antenna and ground terminals to make sure that that circuit is properly closed and also across the terminals of the variable condenser. This circuit should be closed also.

An antenna of one wire about 30 ft. high and 100 ft. long is satisfactory altho the signals may be increased somewhat by using a greater stretch, up to 300 ft. No. 14 hard drawn copper wire is entirely satisfactory for stretches of that length. Be sure that your ground connection is made to a water pipe which has water in it at all times for the ground is perhaps more important than the antenna.

If you have not used the W. T. 501 tube before you may think that the circuit is so quiet that there is something wrong but actually the absence of tube noises is a characteristic of this type. Varying the plate voltage from 16 to 22 and adjusting the filament rheostat may improve the signals slightly altho it is possible to assume that the tube is in operating condition under almost any adjustment. The signals will be found very sharp and clear. Moreover, the tuning is so fine that you are bound to be pleased with the outfit. So far as distance is concerned this set is not intended for any but local reception up to a range of 25 or 30 miles. It is possible, within this range, to add an amplifier so that local stations can be heard on a loud speaker, but the set is not recommended for Experimenters who require a receiving range of several hundred miles.

The UV-199 Tube

The model UV-199 Radiotron vacuum tube has a new tungsten filament. This new tungsten filament is as great an advance over the old tungsten filament for vacuum tubes in radio work as the tungsten lamp is over the carbon lamp in the field of electrical illumination.

The UV-199 Radiotron requires so little filament energy that the ordinary No. 6 dry cells will give long service. In the case of portable sets using three cell flashlight batteries, it is recommended that one set of three flashlight cells be used for each tube in the set, while for home use, larger dry cells should be employed. It is immaterial whether each tube is wired separately to one of the batteries or whether they are all placed in parallel, provided separate rheostat control is made for each tube. If separate rheostat control is not employed for each tube and only a common rheostat provided the batteries should be connected in parallel.

The proper grid bias must be used, depending in amount upon the plate voltage employed. The proper values of negative grid bias battery are 0.5 to 1.0 volt for 40 volts on the plate, 1.0 to 3.0 volts for 60 volts plate, 3.0 to 4.5 volts for 80 volts plate. Under some conditions of small interference, slight static and weak signals, a grid leak resistance as high as six to ten megohms can be employed with success. With strong signals and heavy interference or static a lower grid leak resistance down to possibly two megohms might be advantageous. In general, a five megohm grid leak resistance is satisfactory.

On account of the low filament current required by this tube it is very necessary to have the filament rheostat of sufficient resistance. For operation from three dry cells the filament rheostat resistance should be at least thirty ohms per tube. If a six volt storage battery is used the resistance should be at least sixty ohms.

Standard Radio Design Practice

Data on panels, cabinets, tubing, and variable condensers, giving the accepted design features.

The Value of Standard Methods

DESIGNERS of radio equipment and manufacturers have gradually evolved certain standards, developed not, perhaps, as we would plan them if we were to start again at the beginning, but entirely satisfactory as a working basis. Most of the accepted standards, as a matter of fact, came into general use simply because new companies copied, often in great detail, products of older concerns. While that may not have been strictly ethical it has worked out for the good of the industry.

may not be satisfied with the rheostat they are using. Because panels are already drilled and knobs purchased they can only change to a type which calls for the same drilling and the same size of hole in the knob. It is a matter of self protection, therefor, that they start off with a standard design. The concern making an odd type of rheostat, on the other hand, cannot sell his product, even tho it is superior and lower in price, to the set manufacturer who is already using a standard design.

In other words, standard practice serves as a

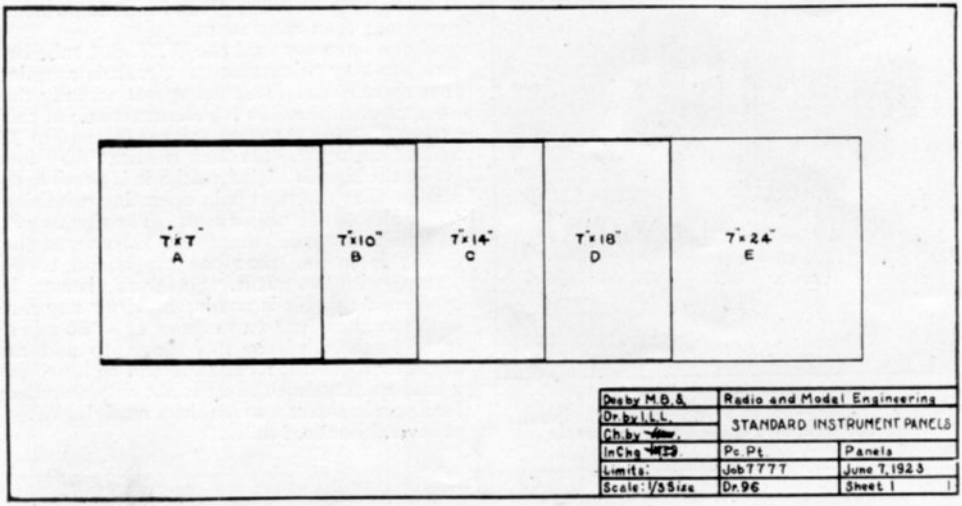

Fig. 1. One-sixth scale drawing of standard instrument panels used for receiving sets

In compiling this data on standard design practice care has been taken to include only such features as are widely used by a number of manufacturers. In some cases the method of a particular company may be superior to that in general use, but is not shown for the reason that this data is not presented for the purpose of establishing standards—it is to collect for purposes of reference those now existing.

Particularly since the manufacture of parts has been taken up by companies equipped for large and economical production, concerns building complete apparatus have found it advisable to buy the components outside, rather than to make them themselves. This is entirely reasonable, for a large factory and production machinery cannot be maintained on radio parts alone.

Standardization has come as a matter of necessity. A company building complete sets protection to those buying parts as well as to those selling them. Consequently this data on accepted methods should be of considerable assistance to both sides concerned.

Instrument Panel Sizes

It is not possible to account definitely for the origin of panel sizes now in use, tho it is likely that they were evolved in accordance with economical cutting from full sheets, the dimensions of which were long ago determined. Practically all equipment is now built on panels 7 ins. high and 3-16 ins. thick. Heights of 5 ins. and 10 ins. have been abandoned because the former imposes too definite limits upon the interior arrangement of the parts, while the latter is wasteful of space. Moreover, 5 ins. makes the cabinet look too low. A height of 7 ins. balances well with practically any length.

In length, panels are made 7, 10, 14, 18 and

24 ins. Occasionally an intermediate size is found, but the lengths listed cover all requirements, for anything from a crystal set to the most elaborate outfit.

The thickness of 3-16 ins. is almost universally employed, as it is sufficient to support fairly heavy parts, and not too thick to be excessively expensive. Only on very cheap sets are ⅛-in. panels used.

Instrument Panel Color

Black panels are generally preferred because that color harmonizes with all others. Brown is seldom used now because the color is not even, and requires the maintenance of a definite color standard for the cabinet finish.

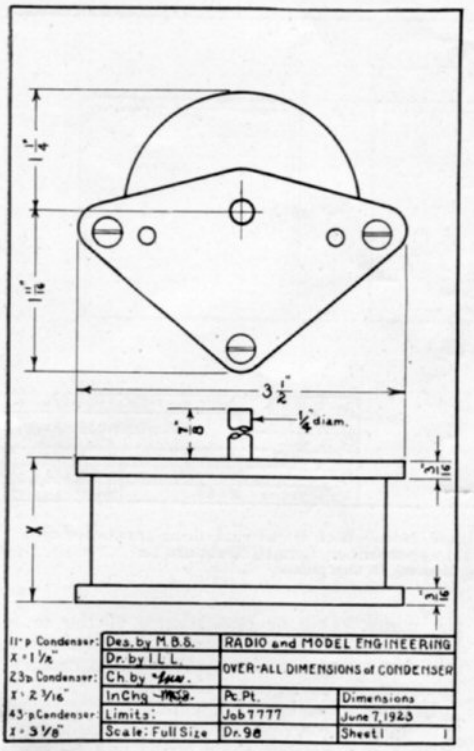

Fig. 4. Maximum dimensions for standard condensers, one-half scale, which should not be exceeded

Instrument Panel Finish

As we do many things, we have been until recently putting a grain finish on panels without knowing just why. In fact, the original reason has been so long forgotten that many men never knew the reason. It is this: When hard rubber only was available for panels it was found necessary to remove the original polish for the reason that the tin foil used in finishing the sheets left an invisible coating which greatly increased the surface leakage. Therefor, the surface was sanded or sanded and polished again. With the introduction of phenolic products we kept on graining the panels.

Formica, Bakelite, Condensite, and similar products, on the other hand, do not require resurfacing. Actually the surface leakage is increased by graining, for it then holds the dust. The best finish is the natural polish on the sheet, for it does not catch the dust. Moreover, highly polished panels maintain their color, while grained panels are apt to turn gray or brown.

It is not possible to say at this time which finish is more widely used, but it is certain that another year will see the last of graining, as it is an expensive process and accomplishes no end.

Instrument Cabinet Sizes

Such a variety of cabinet designs now appear that it is only possible to indicate the most satisfactory type and to recommend its use. Fig. 2 shows the design, with a table of dimensions suitable for different standard panels. The cover, fitted with an anti-warping strip at each side, does not extend all the way to the front. That is arranged so as to give a supporting strip across the top to keep the sides from warping and to allow the panel to be fastened on at the top. Thus the cover fits more accurately than when the sides are not maintained in position. It is not safe to depend upon the panel to hold the sides because of the difficulty in locating wood screws exactly.

No dovetail joints are required. The method by which the sides, rear, and bottom are fitted together is shown in the illustration. Glue and very small nails hold the joints. Such a cabinet is well suited to production manufacture.

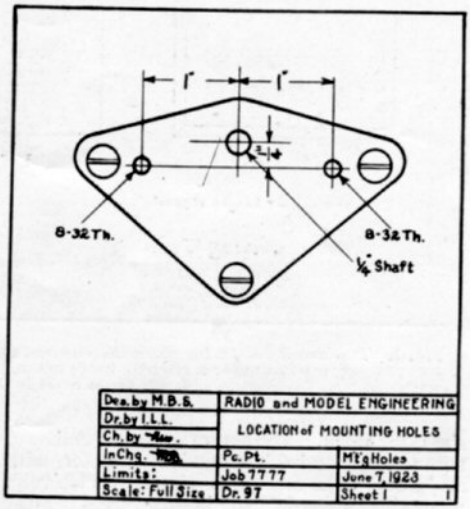

Fig. 3. Illustrating at one-half scale the standard arrangement of mounting screws

Instrument Cabinet Finish

Practically all cabinets are made of mahogany or given a mahogany finish. Now that the appearance of radio sets must be considered in relation to home furnishings, mahogany is the safest color. A piano finish has been attempted by some concerns but that has, in almost every case, been abandoned in favor of a dull finish, usually composed of a coat of stain, one of shellac, and two of varnish.

Tubing for Inductances

Tubing for inductances has become standardized from necessity. While a large variety of sizes are listed by manufacturers of this material, they cannot keep all those practically all have a hole depth of at least ¾-in.

Variable Condenser Mountings

Fig. 3 shows the correct location for condenser mounting screws. They are 2 ins. apart, center to center, and on a line ¼-in. from the center of the shaft. The mounting holes in the condenser end plate should be threaded for 8-32 screws. Some condensers have threaded inserts in the end plates, while others have threaded holes in the plates themselves.

When the end plate does not fit flush against the rear of the panel it is not safe to depend upon those two screws alone for bearing against

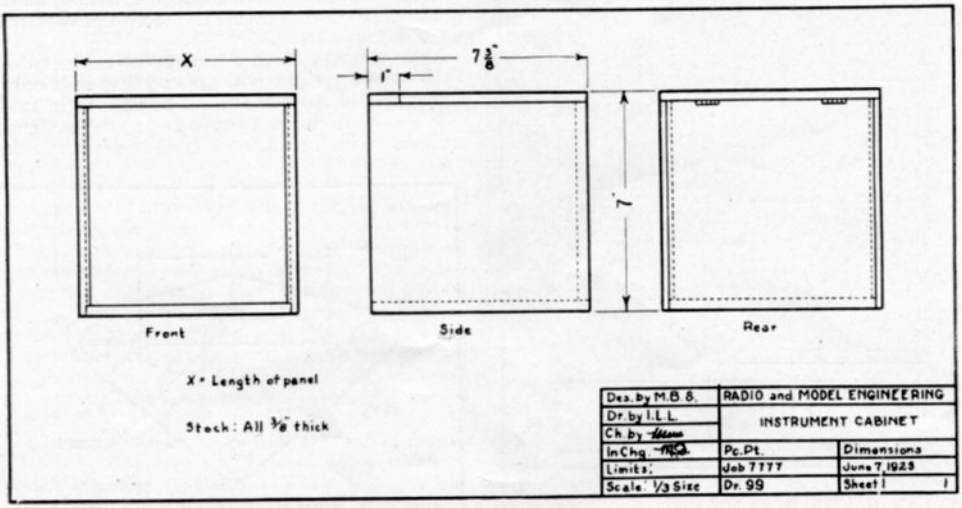

Fig. 2. The usual design for plain instrument cabinets, from which slight variations are sometimes made to give a slightly more ornamental appearance. Length X should be 7, 10, 14, 18 or 24 ins. according to the panel

sizes in stock. To assure prompt delivery, tubes 3, 3½ and 4 ins. outside diameter, with a ⅛-in. wall, are used almost exclusively. Since this tubing is made in long pieces it must always be cut to length. Consequently no definite standard of length had been established by manufacturers. However, for the sake of convenience it is well to select a length of 2½ or 5 ins., as those lengths are stocked by many dealers and distributors.

Variable Condenser Shafts

It is very important to use a standard shaft for variable condenser design. The correct diameter is ¼-in. There seems to be no accepted length for the shaft extension, tho it is safe to have the shaft extend ⅞-in. from the outside of the upper end plate. All dial knobs are made for ¼-in. shafts, and the panel. One or two bosses, of the same height as the threaded bosses, are required as addition contact surface. It is not necessary, however, for them to be threaded.

In case a special arrangement for mounting is required the screws must at least be located in such a way that their heads will be completely covered by a 3-in. dial.

Variable Condenser Dimensions

The majority of condensers now on the market and in use by manufacturers of complete sets have the dimensions given in Fig. 4. In designing a new type of condenser, while it might be necessary to use different shapes it would be well to keep within the limits of these outside dimensions. Also in Fig. 4 the maximum heights, from the top of the front plate to the bottom of the rear plate, are given.

RADIO AND MODEL ENGINEERING

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

This issue describes work done in the R and M laboratory during the month of June.

EDITORIAL

ONCE in a while a letter comes in from a man who wants to build a real good set but he complains that new designs come out so fast that he is not given a chance to decide upon the set he wants to make.

The articles in R & M are not planned with the idea of bringing out each month designs for sets which are better than those previously described but to illustrate designs for various purposes and of different types. Tastes in radio equipment vary as widely as in clothes or automobiles. Therefore, we try to point out clearly the particularly distinctive features in the different outfits. Obviously you cannot build every set shown. However, you should be familiar with the general design of equipment employing new circuits. Studying their construction, too, is helpful in making up original designs as they serve as a working basis. A great many of the experimenters who read R & M earn the money that they spend on their own work by building sets for other people. The illustrations are very helpful in making these sales because they give the purchaser such a clear idea of what he is going to get.

A new series of articles starts with this issue. Standard Radio Design Practice will be devoted chiefly to mechanical design practice. The subjects to be taken up will be limited to methods already standardized and accepted. Strangely enough, with hundreds of books written on radio, there is nothing available to serve as a guide for stabilizing design practice. Each designer will always put his individual interpretation on details. At the same time there is no excuse for using odd arrangements for variable condenser mountings and similar details of parts and radio equipment.

Any attempt of this sort is liable to meet with criticism from those who do not follow accepted practice. However, to make the series most helpful, only methods in common use will be shown, and no attempt will be made to originate standards.

We are particularly pleased to announce that the coming issue will be a Grimes inverse duplex number. The equipment to be described discloses features which have not been shown in any other publication, and exclusive permission has been granted to R and M by Mr. Grimes, who is now Chief Engineer of the Sleeper Radio Corporation, to make them public. A notice concerning advance blue prints for the two-tube set appears elsewhere. The designs and the finished sets were checked over by him after the construction and testing was completed in the Magazine laboratory.

A great many inquiries are being received concerning sets which do not pick up the distant stations as they should. Without exception these inquiries were found to come from people who had just taken up radio work and were comparing the results of their equipment in the summer time with the results obtained by others last winter. Obviously the comparison is most unfair for conditions at this time of year do not permit the long distance reception that can be obtained in the winter. Moreover, some manufacturers have intimated in their advertisements that anyone can reproduce the records established under exceptional conditions, reception which cannot be contributed to the set but rather to unusually favorable weather.

No manufacturer can give a real guarantee for any type of receiving set now on the market of more than 100 miles receiving range for twenty-four hours in the day and three hundred and sixty-five days in the year. It may be that the concern would take back the set if it did not cover their guaranteed range but that is not a real guarantee. This is particularly true on loop receiving sets for there are some towns which are not favorably located for radio reception. It has been found possible to receive 1500 miles using a small inductance 3 ins. in diameter for a loop. Thorough testing shows, however, that this was done at a station where the equipment was set up near an antenna and the real receiving was being done on the antenna while the coil picked up what appears to be reradiation from the antenna.

In buying a set or building one, remember that the best set made will not give absolutely dependable reception at all times and under all conditions of more than 100 miles, and in making comparisons with other equipment bear in mind that one set may have been operating under different conditions from those encountered by the other.

M. B. SLEEPER,
Editor.

The Duotrol Receiver

The first improvement on the two-variometer regenerative receiver, a standard design for several years now, is shown in this set.

The Two-Variometer Receiver

THE first three-circuit regenerative receiving set using two variometers and a variocoupler was made so long ago that it deserves a place in the museum of radio equipment. Strangely enough, however, this type of receiving set has maintained its place particularly among relay operators, nor has it been displaced by the dozens of new kinds of circuits developed during the last three years.

Since the fixed coupler was introduced a short time ago in RADIO and MODEL ENGINEERING we have been making tests on the two-variometer receiver using the fixed coupler instead of the ordinary type, to develop a design which would, in every way, be equivalent to the other set yet possess the advantage of requiring no primary switches or secondary coupling adjustment. The outfit described here, so far as range is concerned, is in every way equal to the other type, while the tuning, if different, is somewhat sharper. In addition, the wavelength range is not limited as is the case in most sets but goes to 1,000 meters as a maximum. Another important feature of the set is that it can be quite accurately calibrated for various wavelengths and the calibration will not change when the set is used on antennas of various sizes. Altogether, it is a splendid set from the point of view of the operator, since it requires the adjustment of only two controls. Hence the name Duotrol. At the first wavelength range, which is intended primarily for amateur reception, this receiver is particularly efficient both on CW and spark signals.

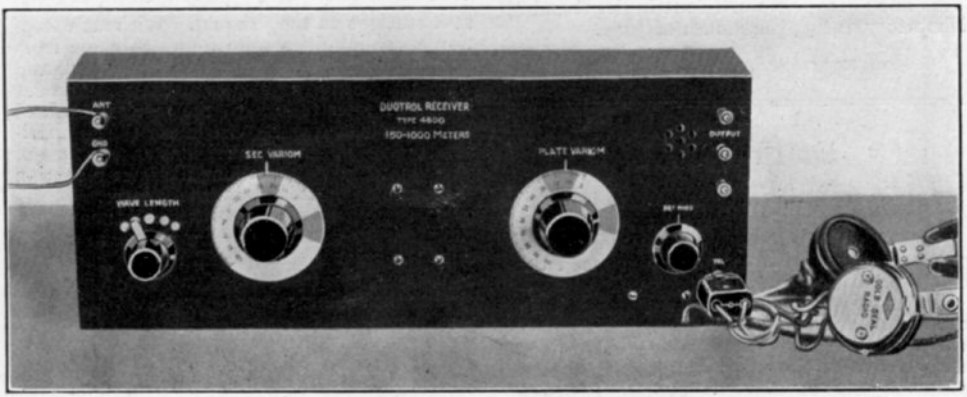


Fig. 1. While the three-circuit regenerative tuner has a limitation of efficiency beyond which no receiver of that type can go, the Duotrol does all that any receiver of that type can do, and more than most

Experimenters who are anxious not to cause interference by the radiation from regenerative receivers need have no concern on that score when using the Duotrol set, for the reason that the extremely loose coupling employed and the fact that, for best operation, the set must be in a non-oscillating adjustment precludes interference from that source.

The wavelength range of 150 to 1000 meters covers not only the present broadcasting stations but takes care of any changes which may be made later and permits reception from commercial and government transmitters which cannot be heard on the ordinary outfits of limited wavelength range.

A filament control jack is used with this set in a circuit arranged, as in the case of the type 4600 radio frequency set, for the addition of either a filament control amplifier or the plain type.

In appearance this is probably the most attractive set that has been constructed in the RADIO and MODEL ENGINEERING laboratory. The symmetry of design at the front, and of the equipment behind the panel will appeal to Experimenters who take a special pride in the design of their equipment.

General Description of the Set

On the front of the panel you will see that there are four controls. The wavelength range switch at the left, in the first position, gives the lowest range, 150 to 400 meters, at the second point a Dubilier Micadon of 0.0001 mfd. is cut in, increasing the range from 300 to 600 meters. The third step cuts in a 0.0005 mfd.

condenser, making the range approximately 500 to 1000 meters. The actual tuning is done by means of the grid variometer, controlled by the left hand knob and dial. At the right is the plate variometer by means of which regeneration is obtained. Then come the rheostat control, and the telephone jack. Binding posts at the left are for the antenna and ground and at the right for the amplifier. When the plug is removed from the jack the plate circuit of the detector is connected to the two upper binding posts while the lower binding post permits the addition of a filament circuit jumper to the amplifier. This arrangement is illustrated in Fig. 9.

You will find in this set an excellent demonstration of the value of efficient variometer and coupler design for any losses in the variometers or coupler appear more quickly in the two-variometer set than in any other circuit.

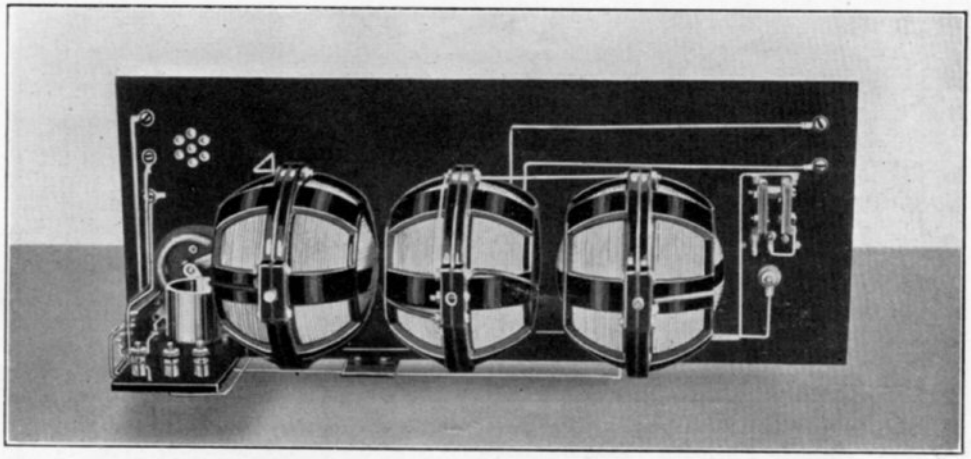


Fig. 2. Even this illustration does not do full credit to the handsome appearance of the set. When you make it up you will agree that the design is exceptionally attractive

Construction Work Required

As far as possible special construction work has been avoided so that you can assemble this set from materials readily available without having to do very much mechanical work. The general assembly is similar to that employed in other outfits which have been described.

A great deal of time was spent in designing this set as as to simplify, as far as possible, the wiring and assembly. In the finished set the connections are as short and direct as they can possibly be made.

The front panel, 7 x 18 ins., is a standard size for which cabinets can be obtained at practically all the radio stores.

Standarized Parts Employed

It is not only necessary to make the design simple but the parts required must be such that they are readily obtainable. The components of this receiving set are available almost anywhere.

Dubilier Micadons, of 0.0001 and 0.0005 mfd. are employed for the wavelength control and grid condenser. No separate gridleak was used for the reason that we simply scratched the surface of the condenser plate and rubbed it with a pencil until the correct resistance was obtained. It is an easy matter, however, to mount on a separate gridleak if you desire. The variometers, coupler and socket, as well as the knobs and dials, are of Sleeper Radio Corporation manufacture. A Pacent Type 67 filament control jack with a Pacent type 50 or 40 telephone plug provides connection to the plate circuit. During the tests, while two men were checking the results, a Pacent Duo-Jack was employed. This is inserted in the jack and two-pairs of telephones plugged, in turn, into the Duo-Jack.

The rheostat is of Fada manufacture, the 8-ohm type, which can be used with the U. V. 200 detector tube. It will also be correct for the new low current detector tube which is to be on the market shortly.

Both front and base panels are of Formica. Altho the panels have been left with their original polished surfaces, they can be rubbed down if you prefer the oil finish.

Laying out the Panels

Because of the extra length, it was not possible to show the front panel at one-half scale on a single page. Therefore, Fig. 5 shows the left end and Fig. 6 the right. Putting these together give the complete panel. The front panel measures 7 x 18 x 3-16 in., one of the most commonly used sizes; the base panel is 2½ x 5 x 3-16 in.

When you buy your panel insist upon having the edges perfectly straight and square for

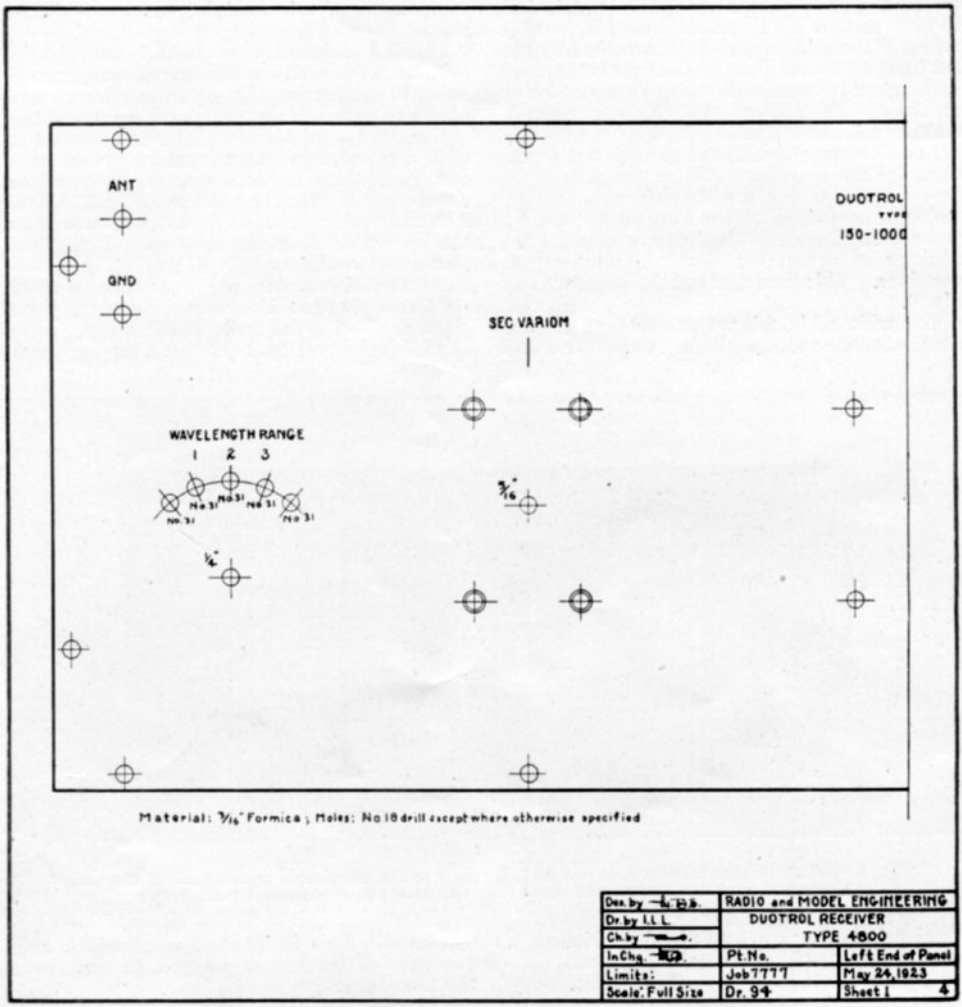


Fig. 5. Because of the extra length of this panel, the drawing was divided into two parts. This shows the left hand half at one-half scale

otherwise you will have trouble in locating your holes. Since the drawings are exactly one-half size, the dimensions can be taken off by finding the distances on the drawings and transferring them, doubled, to the panel. If your panel is not exactly 18 ins. long, draw a line across it at the center and make all measurements to the left and to the right from that center line rather than from each end.

You will note that No. 18 holes are used even in places where 6-32 screws are to go through. This is to give a little tolerance so that the parts will fit together even if there is a slight error in the location of the holes. For that reason, too, round head screws are recommended, for flat head screws do not set flush with the surface of the panel unless the holes line up perfectly.

After you have drilled the seven peep holes, to give them a neat appearance, countersink them very slightly to take off the rough edge.

Assembly and Wiring

The following instructions have been worked out carefully so as to make the assembly work as easy as possible and to avoid the difficulties which so often arise when connections cannot be reached because parts were mounted before they should have been put on. Read these instructions through carefully before you start your assembly work and then follow them to the letter so that you will make

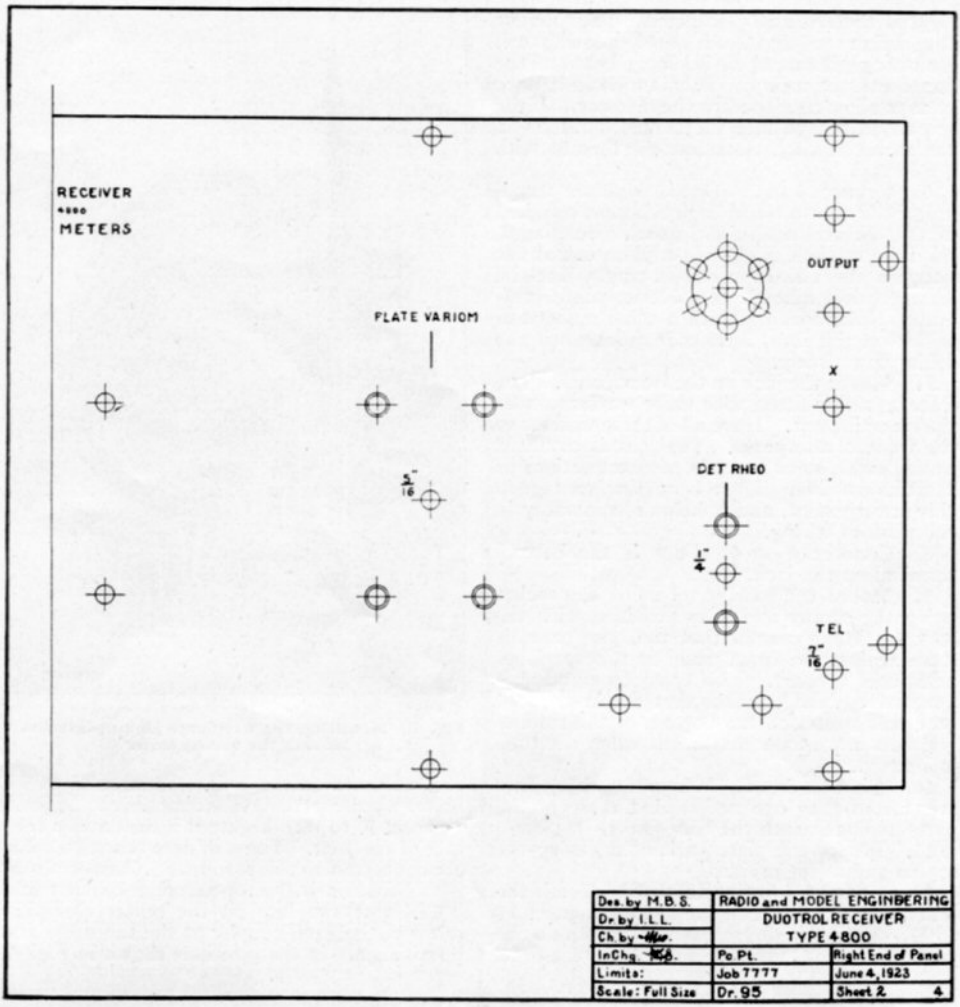


Fig. 6. The right hand half of the front panel, at one-half scale. Contentric circles indicate countersinking for flat head screws

no mistakes. The numbers referred to are in Fig. 8, the picture wiring diagram.

1. Mount the binding posts marked 13, 15, 17, 26 and 28 on the front panel, putting a soldering lug between the head and washer of each screw. Always have the lugs pointing in the direction shown in Fig. 8 as this helps considerably in the work of wiring the set.

2. Put in place the switch points and the two stopping points marked X. Only two of the points require soldering lugs for no connection is made to the other switch point. Put the switch in place, making sure that a firm contact is established by the switch arm and between the washer and soldering lug at the rear.

3. Mount the rheostat with the screws and nuts provided. Be sure that the terminals are to the right, as shown in Fig. 8. Fig. 1 shows a Sleeper Radio knob on the rheostat, substituted for the one supplied with it, so that it will match the other controls in design. If you make this change unscrew the original knob and pointer from the shaft and put the other one in place, tightening it by means of the set screw. Have the white line on the knob coincide with the line on the panel when the rheostat is in the off position.

4. Mount the binding posts, 6, 12 and 20 on the base panel, putting a soldering lug between the washer and head of each screw.

5. Make sure that the soldering lugs on the socket are pointing in the proper directions and

tighten them securely in place. Then mount the socket on the front panel, putting coil mounting pillars, 11-16 in. long, between the panel and the socket. This is to hold it back so as to allow clearance for the rheostat. If the screws do not go into the threaded inserts in the socket readily, clean out the threads with a 6-32 tap.

6. Connect 1 to 2. One is the lower terminal of the rheostat and 2 the filament terminal of the socket next to the panel. Bending it carefully at right angles, fit a piece of bus bar between the two connections, apply just the least possible amount of soldering paste, preferably Nokorode, and with a small amount of solder on the iron, heat each joint until the solder flows freely.

7. Mount the jack on the front panel. The Pacent jack is fitted with three washers under the clamping nut. Have all of these washers at the front of the panel. The jack is mounted upside down so as to make the connections as short as possible. There is no disadvantage in this arrangement, and it helps considerably in the work of wiring.

8. Connect 3 to 4. Four is the bottom terminal on the jack.

9. Mount the base panel under the socket using the screws and nuts provided with the socket. Make certain that the base panel is flush against the front panel as this furnishes additional support. This type of mounting is very strong and the fact that the base panel practically rests on the bottom of the cabinet prevents any excess movement when the tube is inserted.

10. Connect 5 to 6. Where the wiring lines are dotted they are run behind some of the parts or underneath the base panel.

11. Mount the plate variometer, using the screws and nuts provided.

12. Connect 7 to 8 and 9 to 10. Ten is the fourth contact down on the jack. Connect 11 to 12. Eleven is the second contact up on the jack. Connect 13 to 14. Fourteen is the third contact down on the jack. Connect 15 to 16. Sixteen is the second contact down on the jack. Connect 17 to 18. Eighteen is the bottom contact of the jack. You will note that two wires are connected to this terminal. Connect 19 to 20. Nineteen is the top terminal on the jack.

13. Put two lugs on the center clamping screw of the fixed coupler at the top when the terminals are in the positions shown in Fig. 8.

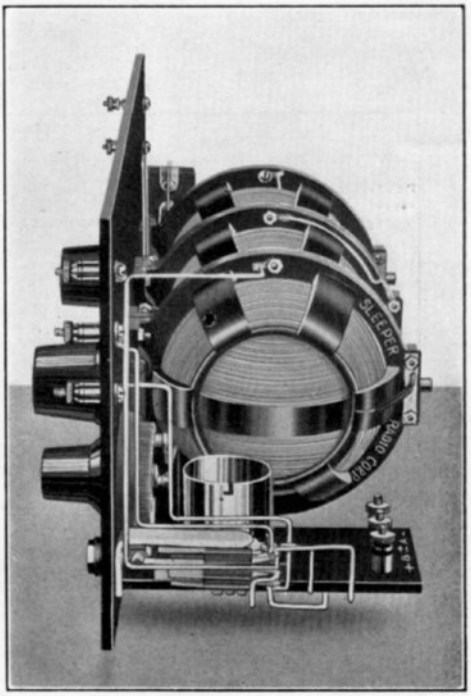


Fig. 4. Mounting the telephone jack upside down makes the wiring easier

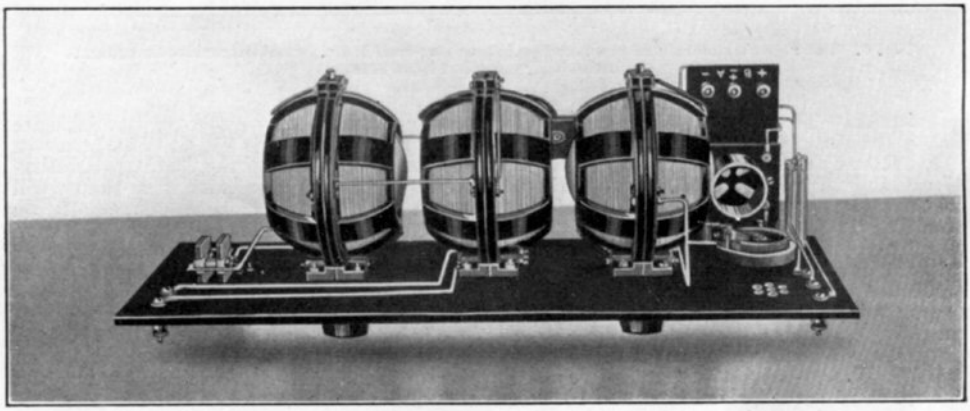


Fig. 3. The fact that so little wiring shows is due to the careful arrangement of the connections, rather than to the simplicity of the circuit

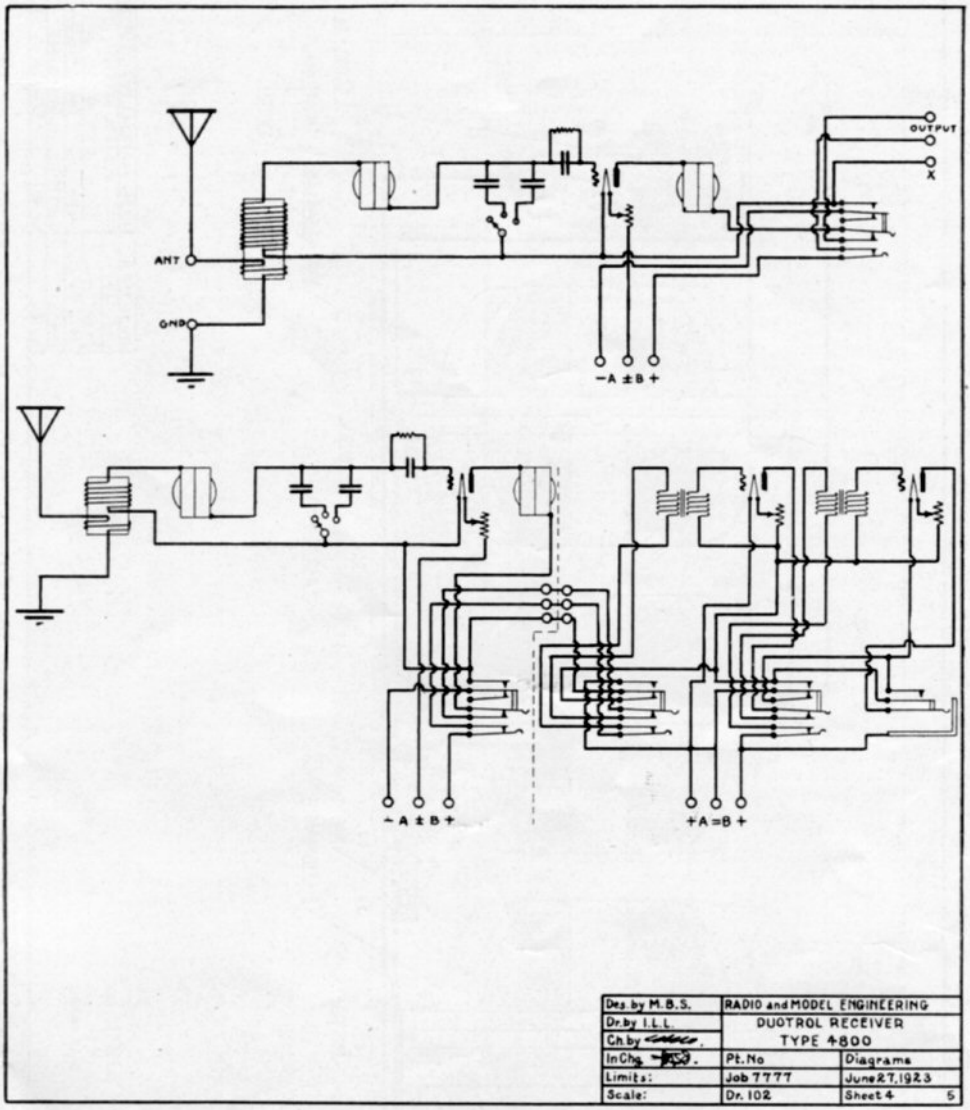


Fig. 9. A schematic diagram of the set, and below a complete diagram of the set and a separate filament control amplifier

These lugs should be on each side of the center section. Put two lugs on the lower center clamping screw, both at the left of the center section. Then connect 21 to 22 and 23 to 24.

14. Mount the fixed coupler on the panel making sure that the primary terminals are at the right. Screws and nuts are provided for that purpose.

15. Connect 25 to 26; 27 to 28; 29, which is the other lug on the same screw, to 30; and 31 to 32.

16. Mount the grid variometer using the screws provided.

17. Connect 33 to 34, 35 to 36, and 37 to 38. Terminals 36 and 37 are made by means of soldering lugs put under the heads of 3-8 in. 6-32 screws and held in place by nuts.

18. Fasten the fixed condensers together with a 1-in. 6-32 R. H. screw and nut, spacing them with a binding post base. Put lugs under the head of the screw and under the nut and also lugs under the nuts holding 3/8-in. 6-32 R. H. screws to each of the other terminals on the condensers. Make sure that the 0.0001 mfd. condenser is on the right and the 0.0005 mfd. condenser on the left. Otherwise the

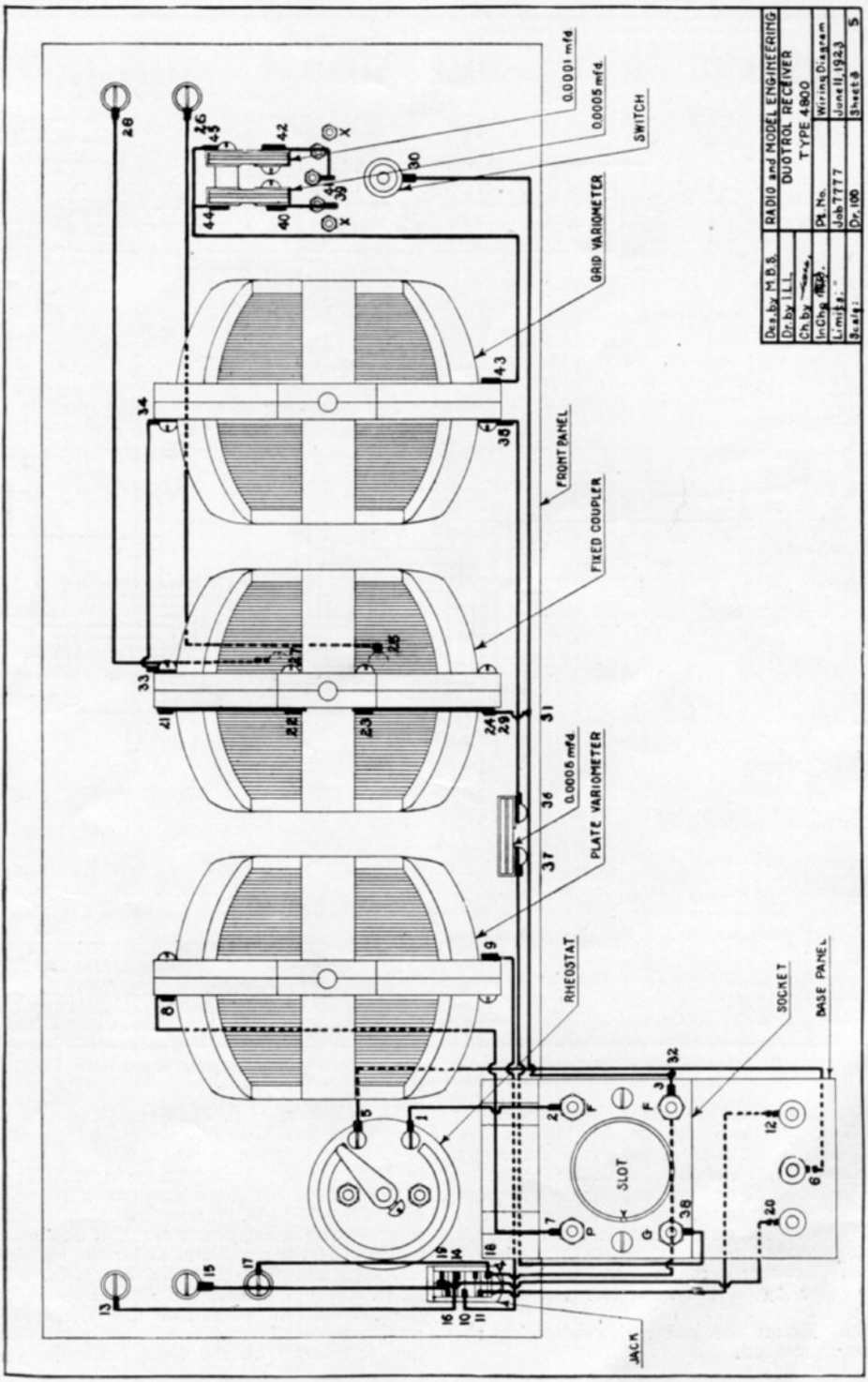


Fig. 8. The wiring as it is actually done. Numbers on the connections are those referred to in the step-by-step assembly instructions

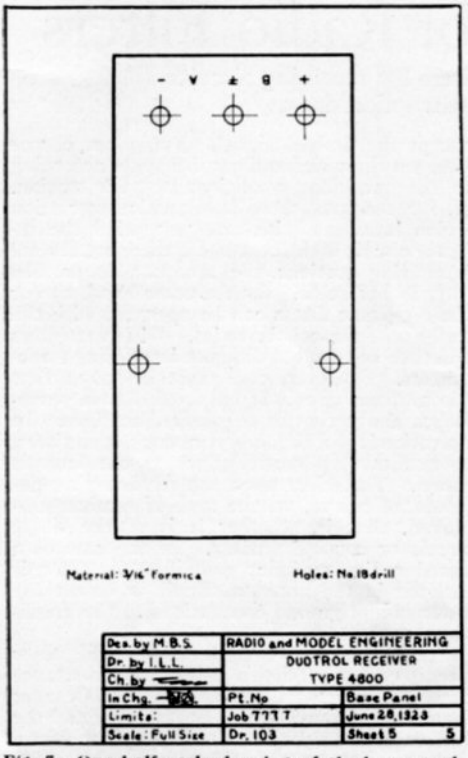


Fig. 7. One-half scale drawing of the base panel, showing the location of the holes

wavelength range at tap 2 will be greater than that at tap 3. Connect 39 to 40, 41 to 42, and 43 to 44 and 45.

This completes the wiring of the receiving set. Check over the connections carefully to make sure that you have made no mistakes.

Testing and Operating

Before the outfit is mounted in the cabinet, connect the antenna and ground, fit a U. V. 200 tube in the socket, put a 6-volt A battery across the center and right hand terminal, looking at the set from the rear, and a 22½-volt B battery across the center and left hand binding posts. Then plug in your phones and turn up the rheostat. The filament should light or go out when the plug is inserted or removed. If you hear a regular clicking sound, scratch the clamping plate of the grid condenser with a scriber and rub the surface of the plate with a soft lead pencil. Make sure that you scratch right up to the terminals and get the pencil marks up to that point also so that contact will be established with the terminal clamps.

If you use a W. D. 11 or W. D. 12 tube, put only 1½ volts on the filament battery terminals.

It may be that the dials are not correctly located with respect to the rotors but that can be checked up later when the set is working. Put the wavelength range switch on the first tap, set the plate variometer at zero and rotate the grid variometer. As soon as a signal is heard turn the plate variometer toward 100. The signal strength should be increased as this is done. To test the set for oscillations touch the grid terminal of the socket. This should cause a strong plucking sound when the circuit is oscillating. If the receiver does not seem to be functioning properly, go over your connections and check up for errors, short circuits, or poorly soldered joints. Possibly some of the wires have been bent out of place and are touching where they should not. Make sure that the contacts of the jack are making perfect connections. If these tests do not discover the trouble, loosen the connections from the plate variometer and turn it around 180 degrees.

To check the position of the dials get two stations with which you are familiar, one of greater wavelength than the other, and see whether, when you increase the inductance of the grid variometer according to the dial, the wavelength is also increased. If not, move the dial around 180 degrees on the rotor shaft. The regeneration should increase as the dial is turned toward the upper end of the scale. If it does not, turn that dial around 180 degrees also.

With the U. V. 200 detector tube you may find it necessary to adjust the plate voltage. For that reason it is advisable to use the Eveready type 767 B battery. When the voltage is too low the circuit seems to oscillate too readily but with a higher voltage the oscillations do not start as quickly.

In tuning in a station you will find it necessary to work both dials at the same time, turning the grid variometer back and forth on each side of the point at which the station is heard, while the plate variometer is very slowly increased to produce regeneration. To receive broadcast stations set the plate variometer so that the set oscillates and turn the grid variometer back and forth until a whistle is heard. Then, noting the position of the grid variometer, turn the knob and dial back and forth a little to do each side of that reading while you bring the plate variometer from zero up to a point just below that at which oscillations occur.

The simplicity and also the selectivity and sensitiveness of this outfit is quire surprising to those who have never used the fixed coupler type of circuit and the results obtained show more convincingly than ever that the ordinary type of variocoupler will soon join the old loose coupler in the ranks of things we use no more.

If, in addition to an audio frequency amplifier, you want radio frequency amplification, the type 4300 one-step radio amplifier is recommended. This instrument, described in Reflex and Radio Frequency,* is of the tuned plate design, so far the most efficient circuit for use with a regenerative receiver.

*Published by M. B. Sleeper, Inc., A-88 Park Place, New York City. Price 50c.

An Explanation of Radio Filters

Interesting notes on radio filters for receiving circuits with design and construction data.

Filters for alternating current circuits have been carried to an astonishing degree of perfection and accuracy by the Western Electric Company. A most complex technique of filter design has been worked out since it is necessary under various circumstances to eliminate all but a narrow band of frequencies or to pass all but a narrow band in telephone circuits.

In the English Navy, during the War, acceptor and rejector circuits were used, in the first case to by-pass all but one frequency and in the latter to absorb the unwanted frequency band. Fig. 1 shows the connection of the acceptor and rejector circuits. You will see that the acceptor circuit presents a theoretically infinite impedance to the wanted signal, to which it is tuned but offers a resistance which decreases with an increased difference in wavelength to unwanted signals. The rejector circuit is tuned to the wavelength of the interfering station and offers a theoretically infinite resistance to its passage. Here again the resistance of the circuit decreases with an increased difference from the unwanted signal frequency.

The acceptor-rejector circuit is made up of a single turn of copper conductor about a foot in diameter, shunted by a high capacity mica condenser, generally adjustable in fairly small steps up to 0.1 mfd. A rolling contact on an arm moved by the control knob changes the part of the single turn which is connected in the circuit.

This is not a particularly satisfactory type of filter, however, nor is it easy to construct with materials generally available. In addition it helps very little in preventing interference from spark signals while the C. W. interference which can be cut out readily, is not difficult to tune away from anyway.

While there are a number of ways to design radio filters for receiving sets the absorption circuit is the most effective and can be made from parts which you probably have in your shop. Moreover, the two types of filters to be described are effective in the event of spark interference from amateur or commercial stations and in some cases cut out or reduce local interfering noises, such as induction from lighting current lines or arc light systems.

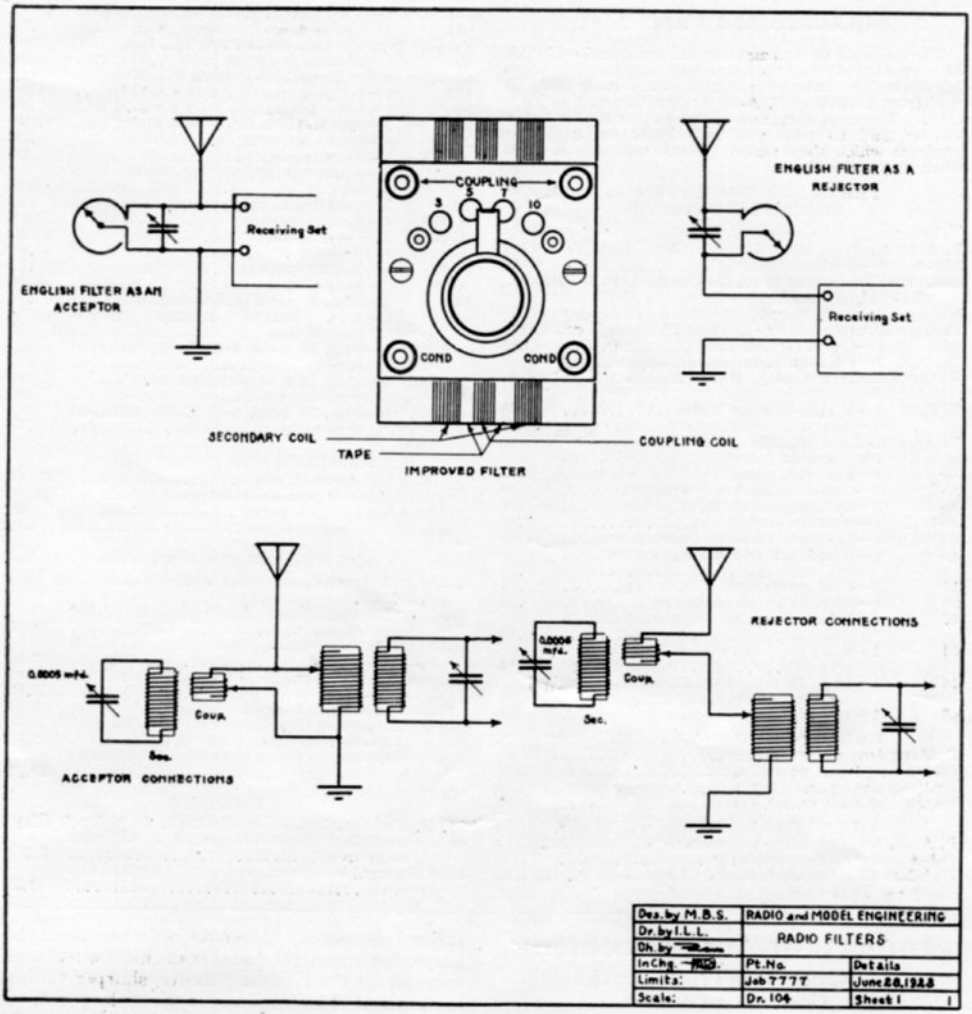
The series filter circuit, Fig. 1, consists of a coil cut into the antenna lead to the receiving set coupled to a small inductance shunted by a variable condenser. This serves as a rejector type of filter. When the closed circuit is adjusted to the wavelength of the interfering station those waves are largely absorbed in the auxiliary circuit.

The construction details of the series and parallel filters, which will be given later on, are identical. The parallel filter is different in operation, however, for it absorbs everything except the desired signal. You must choose between the series and parallel types according to the particular conditions at your station. If, for example, there is a particular station which interferes with your reception the rejector circuit is the best but if there are several interfering stations the acceptor or parallel filter is preferable. On the other hand, two or three rejector filters can be operated with the series antenna coil in series. Different filters will then be tuned to different interfering transmitters. However, care must be taken that the antenna circuit is not loaded to a wavelength above that of the desired stations. In operation it will be found necessary, sometimes, to readjust the receiving set as the filter is tuned. The effect upon the receiving set depends, of course, on the type of receiver employed, that is, whether it is of the single circuit or coupled variety. In the case of a tuned radio frequency amplifier the filter is inserted in the antenna circuit or across the antenna and ground connections to the amplifier just the same.

For special wavelength ranges the filter circuit can be designed using the inductance capacity wavelength tables in the October issue of Radio and Model Engineering and the Inductance Tables in the November issue. From the former table the proper value of inductance and capacity for the wavelength required can be determined and the exact dimensions in number of turns for a coil to give the correct inductance can be found from the latter.

For a wavelength range of 190 to 400 meters the condenser should be of 0.0005 and the coil shunted around it of 0.1 mh. A coil of 0.3 mh. will give a wavelength range with the condenser specified of 325 to 730 meters. To get these values the coil should be wound on a tube 3½ ins. in diameter and 2½ ins. long, wound with 53 turns of No. 24 S. S. C. wire, (No. 22 S. W. G.) with a tap taken off at the 27th turn. This will give 0.1 mh. at the tap and 0.4 mh. with the full coil. The primary coil, which is connected in series with the antenna lead or across the antenna and ground binding post of the set should have 10 turns tapped at 3, 5 and 7. This coil should be directly over the secondary winding separated from it by a layer of tape or varnished silk.

It is very likely that further developments in the design of filter circuits will take place but so far comparatively little work has been done on the development of this type of interference preventor. We should be very much interested to know what success you have with the series and parallel types of filters when you have tried them out as well as other experiments which you may make.



Top, left, the English acceptor connected across the antenna and ground posts of a receiving set. Right, the rejector similarly connected. Center, the assembled improved filter, ready for use. Below, left, a new type filter used as an acceptor. Right, the filter as a rejector. Similar connections can be used for any type of receiving set

Back Issues of R and M

The following numbers of Radio and Model Engineering can still be supplied. The months and feature articles are listed below. Take this opportunity to complete your files. Price 11c. each.

June 1921, Design of loose couplers.
Oct. 1921, Radio frequency amplifier and tuner.
Dec. 1921, Rectifier for short wave transmitter.
Feb. 1922, Variometer tuning unit—Detector and 2-step amplifier.
May 1922, Regenerative set with detector and 2-step.
July 1922, Super-regenerative receiver.
Aug. 1922, 2-step amplifier—Laboratory oscillator.
Oct. 1922, Loop receiver—Wavelength inductance, capacity tables.
Nov. 1922, 2-tube telegraph or telephone transmitter—Inductance tables.
Dec. 1922, Short wave receiving tuner—150 to 2600-meter receiver.
Jan. 1923, Non-regenerative receiving set with detector and 2-step amplifier—Super range receiver.
Mar. 1923, 150 to 700-meter regenerative set—Sleeper circuit set.

Standardized Parts List

The materials used to make up the sets described in this issue were supplied by the following companies. You can buy these parts from your local dealer or order them by mail from DURRANT, A-36 E. 49th Street, New York City. The manufacturers whose names appear below will be glad to send you bulletins describing other products which they make. Please mention R & M when you write them.

PARTS FOR THE TYPE 4700 SIMPLIFIED RECEIVER

Type	Name	Price
F. A. D. Andrea, 1581-S Jerome Ave., New York City		
153-A	1—8-ohm rheostat	$1.00
Dubilier Condenser & Radio Corp., A-48 W. 4th St., New York City		
601	1—0.00025 mfd. Micadon condenser	.35
Pacent Electric Co., A-22 Park Pl., New York City		
61	1—Open circuit jack	.60
75	1—US Duo Lateral coil, unmounted	.60
Radio Research Guild, B-40 Clinton St., Newark, N. J.		
WT501	1—Welsh Peanut Tube	2.00
	1—Adapter for standard socket	.75
Sleeper Radio Corp., 88-F Park Pl., New York City		
152	1—Formica panel 7 x 7 x 3-16 in.	1.37
30	1—Formica panel 2½ x 5 x 3-16 in.	.33
A-2	1—100-division knob and dial	1.00
A-10	7—Binding posts, R. H. screws	.70
A-1-X	1—Audion socket	.80
A-15	1—11-plate variable condenser	3.25
A-88	1—Rheostat indicating knob, 3-16 in. hole	.35
14	2—Coil mounting pillars	.16
58	1—Pkg. 25 small soldering lugs	.20
47	3—2-ft. lengths square tinned bus bar	.15
61	1—Pkg. 10 ¼-in. 6-32 R. H. nickeled screws	.11
143	1—Pkg. 10 1-in. 6-32 R. H. nickeled screws	.18
49	1—Pkg. 10 6-32 nickeled nuts	.08

DRILLING AND ENGRAVING

Drilling front panel, extra	$1.45
Engraving front panel, extra	4.02
Drilling base panel, extra	.25
Engraving base panel, extra	.30

TYPE 4800 DUOTROL RECEIVER

F. A. D. Andrea, 1581-S Jerome Ave., New York City		
153-A	1—8-ohm rheostat	$1.00
Dubilier Condenser & Radio Corp., A-48 W. 4th St., New York City		
601	1—0.0001 mfd. Micadon condenser	$ .35
601	2—0.0005 mfd. Micadon condenser	.70
Pacent Electric Co., A-22 Park Pl., New York City		
67	1—Special 7-spring jack	1.00
Sleeper Radio Corp., 88-F Park Pl., New York City		
155	1—Formica panel 7 x 18 x 3-16 in.	3.14
30	1—Formica panel, 2½ x 5 x 3-16 in.	.33
A-2	2—100-division knob and dial	2.00
A-10	8—Binding posts, R. H. screws	.80
A-1-X	1—Audion socket	.80
A-88	1—Rheostat indicating knob, 3-16 in. hole	.35
14	2—Coil mounting pillars	.16
A-209	1—Fixed coupler	4.00
A-101	2—Variometers	13.00
A-9	1—Switch	.60
A-13	3—Switch points	.12
A-28	2—Stopping points	.10
58	2—Pkg. 25 small soldering lugs	.40
47	5—2-ft. length square tinned copper bus bar	.25
141	1—Pkg. 10 ⅜-in. 6-32 R. H. nickeled screws	.12
49	1—Pkg. 10 6-32 nickeled nuts	.08
8	1—Binding post base	.04
143	1—Pkg. 10 1-in. 6-32 R. H. nickeled screws	.18

DRILLING AND ENGRAVING

Drilling front panel, extra	$2.40
Engraving front panel, extra	5.76
Drilling base panel, extra	.25
Engraving base panel, extra	.30

AUXILIARY EQUIPMENT

Stanley & Patterson, West and Hubert Sts., New York City		
843	Deveau Gold Seal Phones, 2,200 ohms	$8.00
844	Deveau Gold Seal Phones, 3,200 ohms	10.50
Pacent Electric Co., A-22 Park Pl., New York City		
40	Telephone plug	.50
53	Duojack, for two phones	1.50
National Carbon Co., Long Island City, N. Y.		
767	45-volt variable B battery	5.00
6860	6-volt, 90-ampere-hour storage battery	18.00

BLUE PRINTS

M. B. Sleeper, Inc., A-88 Park Pl., New York City	
4700 Simplified Receiver, set of 2 full size blue prints	$ .50
4800 Duotrol Receiver, set of 5 full size blue prints	1.25

Important Announcement

Advance Blue Prints for the Grimes Circuit Set

In the next issue of R and M you will find the first complete construction data on the Grimes Inverse Duplex Receiver. This outfit, constructed in the R and M Laboratory, has been tested and approved by Mr. Grimes, personally. For the first time, the real circuit is revealed, showing the loop volume control, and other important features. No potentiometer, grid bias, grid condenser or leak is employed.

The set to be described is of a type which can be adapted for portable or station use, as the loop is mounted directly behind the front panel. Two UV201-A tubes are required, giving two steps of radio and two steps of audio amplification, with a crystal detector.

While this set is not presented with any claims for obtaining the maximum efficiency of which the Grimes Circuit is capable, it is much superior to any other set, made of standard parts readily obtainable, which has been described elsewhere. Moreover, thru the use of the loop volume control, another of the new features covered by the Grimes patents, sharper tuning is obtained than with any type of loop set.

Construction blue prints, including scale drawings and schematic and picture wiring diagrams are now ready. The set of five prints will be sent upon receipt of $1.25. Address your order to the Blue Print Department, M. B. Sleeper, Inc., A-88 Park Place, New York City, N. Y.

Hazeltine Neutrodyne Set

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

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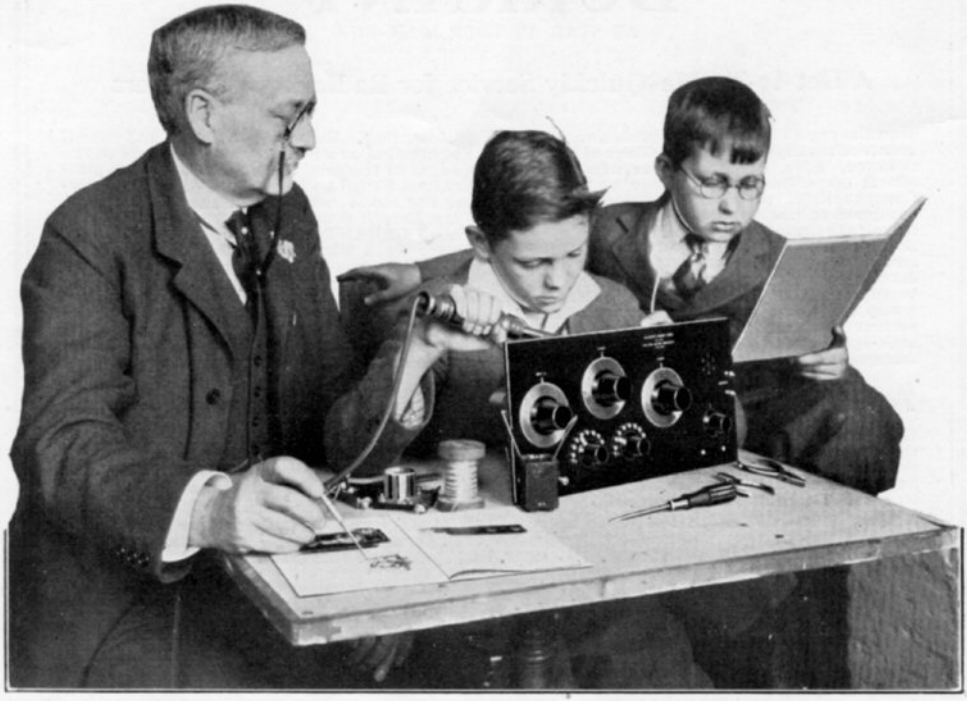

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