Formerly RADIO & MODEL ENGINEERING

RADIO ENGINEERING

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

Edited by M.B.SLEEPER

NO-LOSS REGENERATIVE SET

ELIMINATION OF LOSSES AND THE USE OF A SPECIAL CIRCUIT MAKE THIS OUTFIT OF INTEREST TO DX OPERATORS.

DATA ON THE R-A-R REFLEX CIRCUIT, GIVING AMPLIFICATION AT AUDIO AND RADIO FREQUENCIES AND FROM REGENERATION.

DESIGN OF THE BOONTON LIGHT FOUR PORTABLE RECEIVER.

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AUGUST, 1924
Vol. 4 No. 7

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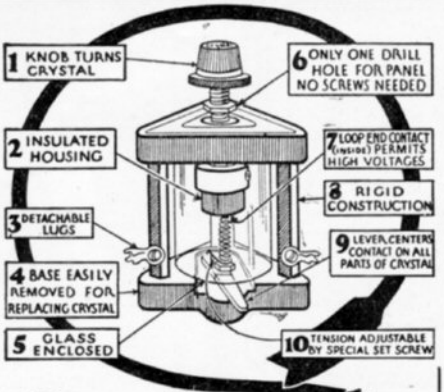

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.0003	.35	.006	.75
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.0005	.35	.008	1.00
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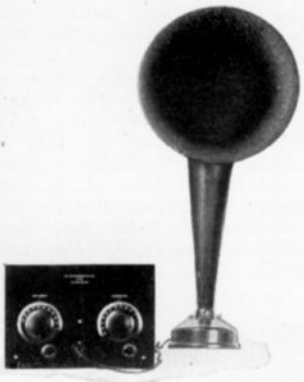

No-Loss Regenerative Set

The condenser-tickler feed back circuit, giving a perfect control of the regeneration, is used with a mechanical design in which losses are at a minimum, making the selectivity and sensitivity unusually high

IN spite of the popularity of reflex and tuned radio frequency receivers there is still a persistent demand for improvements in regenerative receivers, and particularly, judging from requests, for 2-tube outfits, capable of giving loud speaker volume from stations within a moderate radius and telephone reception over an almost unlimited range.

With these ideas in mind, we have worked for some time to develop an outfit meeting those requirements plus several refinements which most regenerative receivers lack. The two-variometer outfit is much too large for convenience, and rather expensive to build. The one-variometer and coupler, with condenser tuning for the secondary, is good altho it, too, requires a fairly large panel, and too often trouble is experienced in making the set regenerate properly over the entire wavelength range. It is not practical to use the single circuit receiver in congested areas. More than that, it has two defects which appear in the operation, that is, the wavelength is altered when the tickler is rotated and the circuit breaks quite sharply into oscillation.

Description of The Type 6300 Receiver

In the type 6300 receiver we believe that the three-circuit regenerative outfit has been made up into a set embodying practically all of the refinements brought out so far in appearance, operation, and efficiency.

The circuit, shown in Fig. 6, is one which has never been used in any manufactured equipment, probably because it is known to very few radio men. You will see that an untuned primary is used coupled to a secondary coil controlled by a variable condenser. The fixed tickler, also coupled to the secondary, is in series with another variable condenser which runs to the filament of the detector tube. From the plate a radio frequency choke coil is connected to the telephones and on to the detector plate battery.

Because of the radio frequency choke coil, no R. F. currents pass in the telephone circuit but, instead, flow through the tickler coil and the condenser to the filament. When the regeneration condenser is at minimum capacity, the impedance is so high that the tickler does not feed back sufficient energy to make the circuit regenerate or oscillate, but regeneration and oscillation take place when the impedance is reduced by increasing the capacity. A fixed condenser of 0.00025 mfd. is shunted around the variable because the working capacity range from no regeneration to full oscillation is 0.00025 to 0.00075 mfd. A larger variable condenser could have been used but the addition of a Micadon served the purpose just as well.

By this arrangement, a perfectly smooth regeneration control is obtained, without any tendency for the set to jump into oscillation as the regenerative action is increased. Therefore, the adjustment can be brought right up to the point of maximum regeneration without distortion.

A pickle bottle coil is used for the inductance unit. This form of wiring practically eliminates the losses in the secondary and not only makes the tuning sharper but gives a slight increase in the signal strength.

As for the mechanical arrangement, it worked out so as to give a symmetrical arrangement, thoroughly workmanlike in appearance.

Standard Parts Required

A Formica sheet 7 by 10 ins., serves as the front panel, while two panels 3½ by 9 ins. are used for the sub and tube panels. All are 3/16 in. thick.

The instruments themselves comprise two 0.0005 mfd. vernier variable condensers from the General Instrument Company, two Marshall-Gerken sockets, two

type 1A Amperites, a Carter 3-spring filament control jack, 1 to 4½ ratio Thordarson A. F. transformer, six Eby binding posts, two 0.00025 mfd. Micadons, and two 3-in. Kurz-Kasch knobs and dials.

In addition, there is the inductance unit to make up as well as the R. F. choke coil. For hardware, three panel support pillars, 3¼ ins. long by 3/8-in. diameter, threaded for 6-32 screws at each end, two left hand and two right hand angle brackets, and four coil support pillars, 11/16-in. long by 5/16 in. diameter, threaded clear through for 6-32 screws, are necessary.

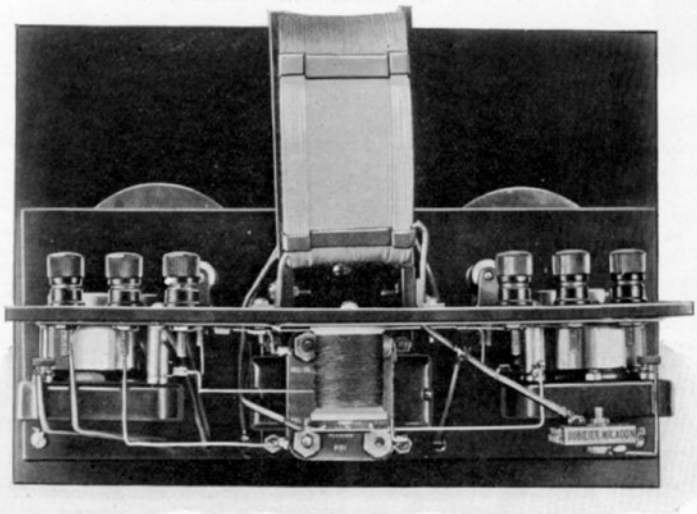

Fig. 1. A rear view of the No-loss receiver. The choke coil is directly underneath the inductance unit and in front of the audio transformer

Drilling The Panels

Since the drawings of the panel layouts in Figs. 4 and 6 are at one-half scale, each dimension must be doubled when it is transferred to the panel. When you lay out the holes, work entirely from the bottom edge of the panel and of the drawing, measuring upward from the bottom and to the right and to the left of the center line. This is the most accurate way because no errors will be introduced if the panel is not cut perfectly.

The holes for the socket tubes are made with a 1½-in. Stevens panel cutter. A 3/16-in. center hole, to start the panel cutter, must be made first. Then the large hole can be cut out very quickly. This is far more satisfactory than drilling a circle of small holes.

It improves the appearance of the set to have the panels engraved. If, however, you do not have this work done, it is advisable to use binding posts with the terminal indications on the tops so that no errors will be made in connecting the batteries.

Winding the Choke and Coil Unit

The R. F. choke is wound on an ordinary thread spool, with about 250 turns of No. 38 silk or enameled wire. The exact size is not important so that the wire can be taken from a 75-ohm telephone receiver or an old spark coil secondary. Just be sure that the insulation is not damaged. For terminals, we simply drove short pieces of Wirit into the end of the wooden spool and soldered the leads to these wires.

If you have wound any pickle bottle coils already you will have no trouble with these units. Be sure, however, that you understand how the extra turns are put on which serve as leads.

The coil should be wound on a bottle 2¾ to 3 ins. in diameter. Twelve strips of gummed paper tape are required, measuring 3/8 by 4 ins. The secondary, of 45 turns of No. 20 D. C. C. wire, is put on first, and the ends of the tape bent over on to the coil and stuck down in the usual manner. This completed, two turns are put around the bottle a little distance from the end of the secondary winding, and the wire brought back on to the coil again at a point directly opposite that at which the secondary was started. Then, turning the bottle in the same direction, eight turns are wound on top of the secondary. Paper strips should be put under this coil, directly on top of the strips which already hold the secondary. After eight turns have bee

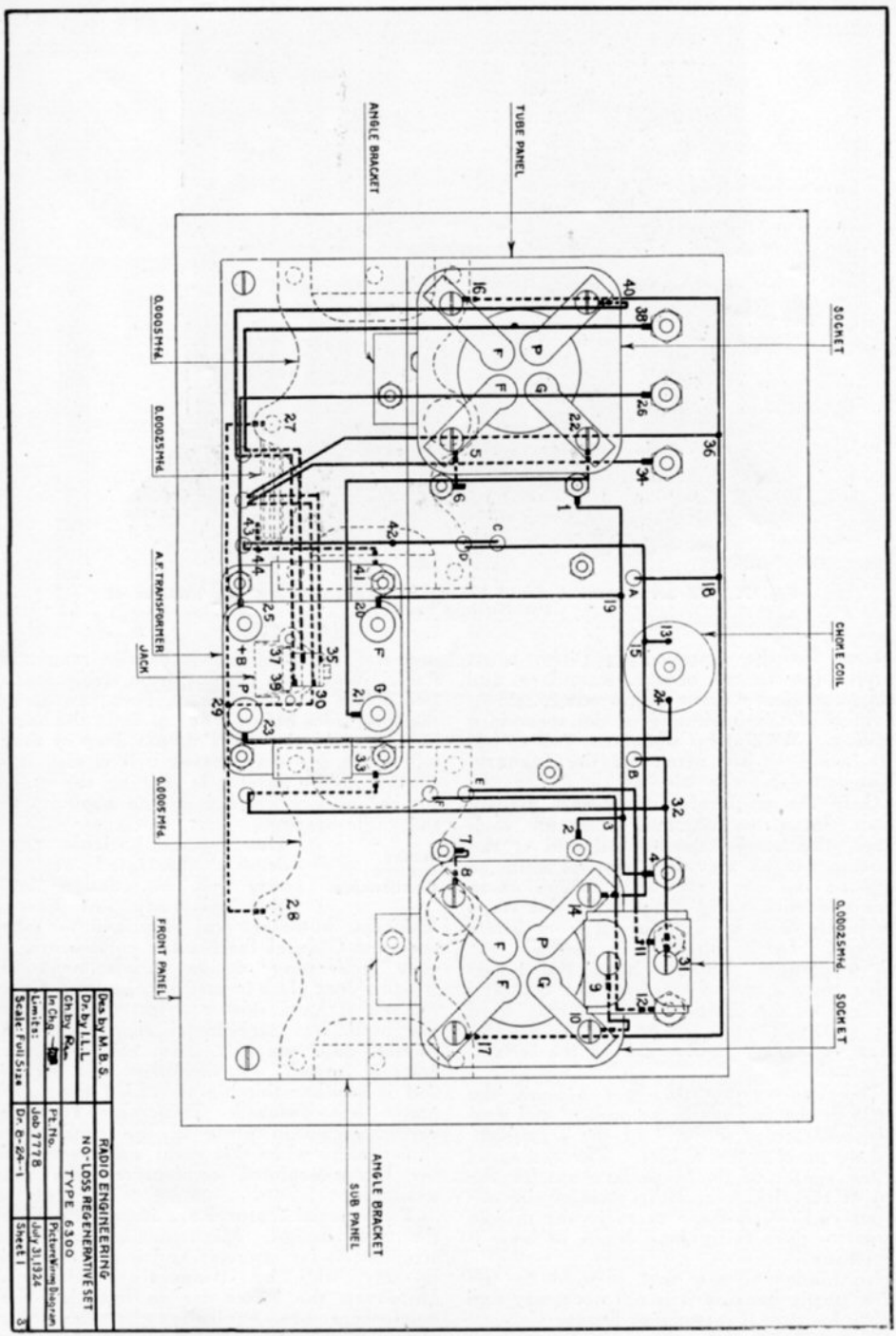

Fig. 2 Picture wiring diagram of the set. The tube panel has been turned upward to show the wiring as it appears underneath

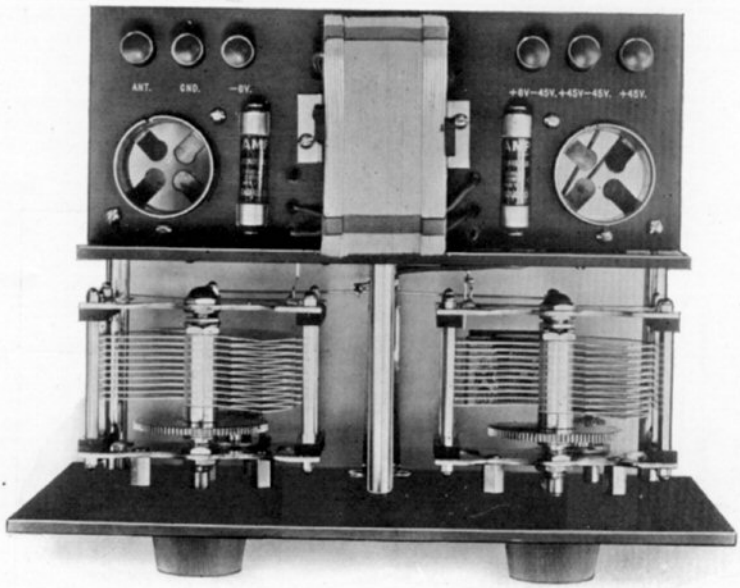

Fig. 3. No arrangement could be more attractive than the interior of the No-loss receiver

put on for the plate coil put two turns around the center of the secondary and bring the wire over to within one-fourth of an inch of the beginning of the secondary winding. With strips under the coil as before, wind on six turns for the primary. That completes the winding.

Only the work of cutting and sticking down the strips remains. Cut off each outer strip at the tickler coil and at the antenna coil so that they are not quite as long as the coils are wide. Bend them over and stick them down. At this stage the bottle must be broken out from inside the coil. Do it carefully or you will cut the insulation. Finally, bend the inside strips toward the outside of the coil and around to the inside. This sounds hard but you will see just how it works out when you are actually making the inductance unit.

The two extra turns put around the bottle at the end of the secondary coil provide leads from the end of the secondary and the start of the tickler. The two turns at the center of the secondary are for the end of the tickler and the start of the antenna coil. Cut these turns in the middle so as to leave fairly long leads, at least 8 or 10 ins.

No binder of any sort is used on the wire, partly because it is not necessary and partly because it introduces losses.

The coil supports, shown in Fig. 6, are arranged so as to have as little insulating material as possible within the magnetic field. When you cut out these strips, make two pieces 1 in. by 4 ins. Then saw down the long sides before you cut in at the base. Do not make the coil slots too deep or they will make the strips crack. It is also important to be careful in drilling the holes for the screws which hold the supports to the angle brackets.

Notes On the Condensers

The vernier variable condensers illustrated are of very efficient design and give extremely low losses. This set, however, was arranged to take the new General Instrument condensers, a very interesting design development in which Pyrex glass is used for the insulation. Instead of hard rubber strips, metal strips are used, but each metal strip carries a thimble into which a short rod of Pyrex glass is forced. At the other end of the rod is another thimble to which the fixed plates are secured. This new type is recommended in place of the condensers shown altho when this outfit was assembled the Pyrex-insulated condensers were not available.

Two special features are incorporated in the new design. Mechanically the construction is far stronger and is not effected in any way by temperature changes. Moreover, the losses are so low that the condensers are equivalent to the very elaborate quartz-insulated types used by the Bureau of Standards.

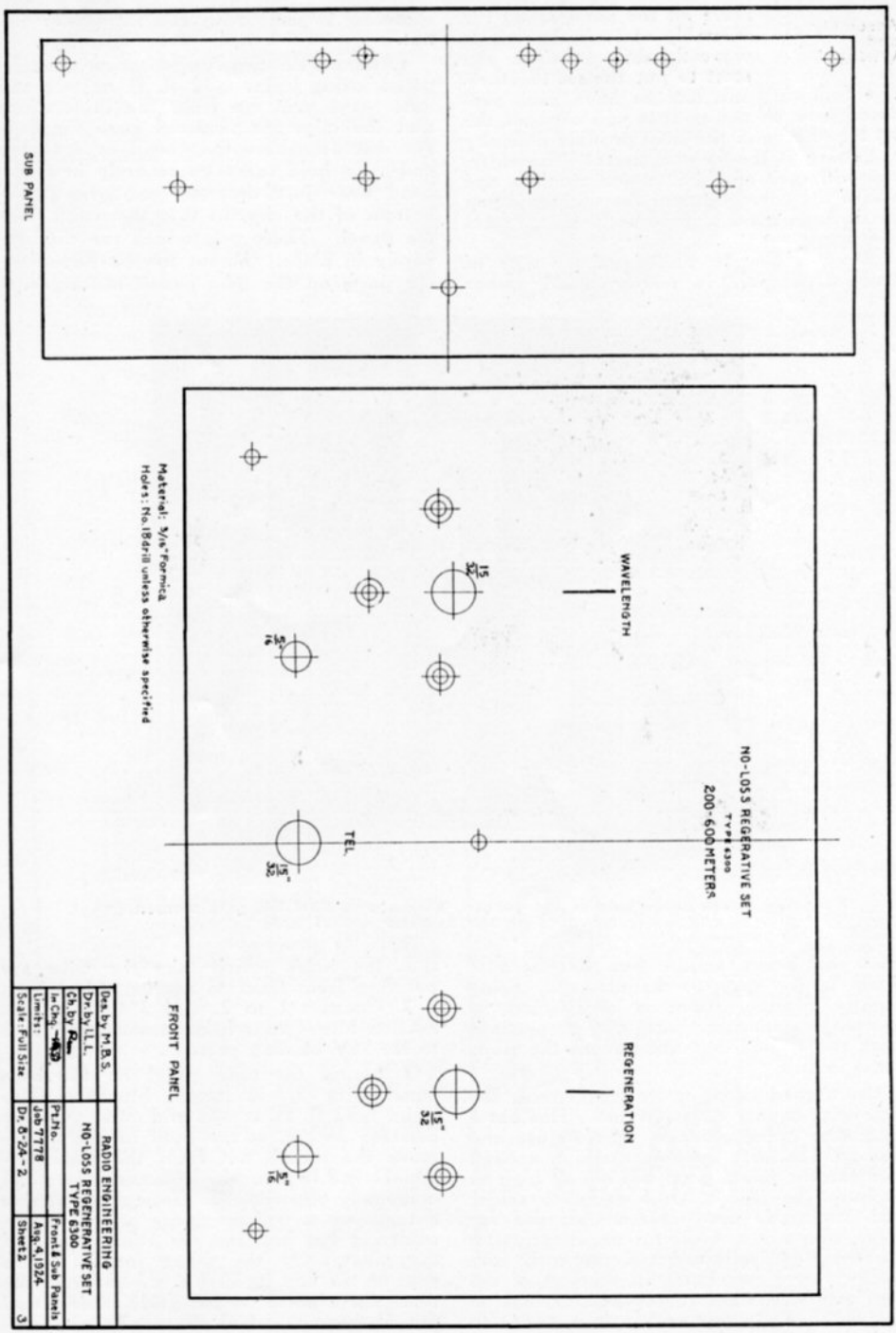

Fig. 4. One-half scale drawing of the front panel and sub panel. Concentric circles indicate counter sinking for flat head screws

Assembly and Wiring

Have all the parts ready for assembly and all the panels correctly drilled before you start to put the set together. The following instructions have been prepared in such a way that you can put the set together with the least possible difficulty in getting at the various parts. Therefore, you will save much time and trouble, and assure the correctness of the wiring, if you go through these steps exactly as they are laid out.

Wirit, a No. 18 tinned copper wire of medium temper, is recommended rather

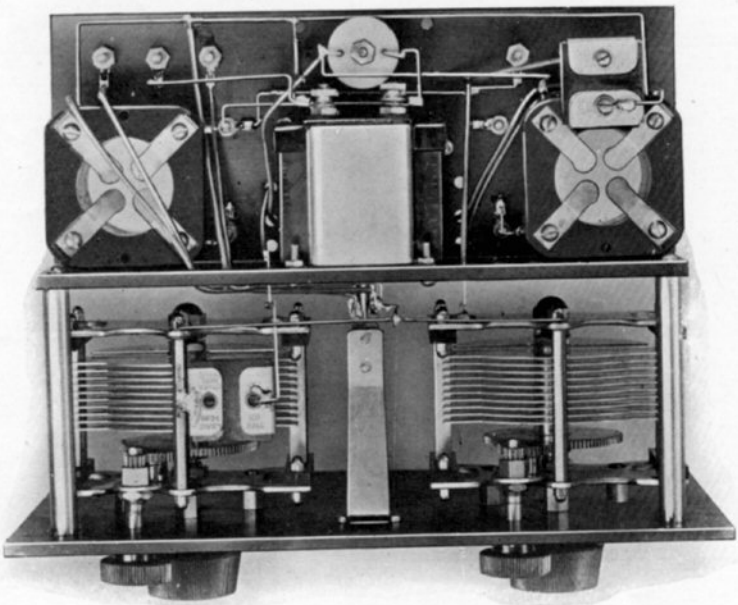

Fig. 5. The underside of the outfit. This shows how the grid condenser is mounted on the detector socket base

than the heavy square bus bar because Wirit is so easy to handle and, being slightly flexible, there is no danger of breaking soldering lugs or connections from the strains that are put on the parts while in use.

Use a good soldering iron, preferably the American Beauty electric type. This has a long slim point which is easy to use and maintains an even temperature high enough to make the joints good but not so high as to burn the iron. Altho ordinary solder with Nokorode paste is recommended for those who are not skillful at soldering, it is better electrically to use Kester rosin core solder. In either case, fill the lips of the lugs with solder before you put the lugs on the nuts. For some reason it is easier to make the solder take hold when this is done and less heat is required than when the soldering is done with the lug under the nut.

1. Mount the two Amperites on the tube panel, using ½-in. 6-32 R. H. screws and nuts. You will see from the illustrations that the clips are removed from the base and cut off where they bend over at the end. To hold the clips securely in place, bend over just the very corners of the bottom of the clip, so that they stick into the panel. These points lock the clips securely in place. Mount the six Eby binding posts on the tube panel, making sure that the holes which take the wire are pointing from front to rear.

2. Connect 1 to 2, and 3 to 4. Connection 3 to 4 runs from connection 1 to 2 to the -6V binding post.

3. Mount the tube panel on the base panel with 3/8-in. angle brackets. Use ½-in. 6-32 R. H. screws and nuts. On the detector socket, at the right in Fig. 2, remove the thumb nut from the plate terminal and from the filament terminal diagonally opposite. In place of the thumb nut put on a coil mounting pillar, with a soldering lug between the round nut and the pillar. On the other socket, which goes on the left, looking at the set from the rear, put a pillar on the grid terminal and the filament terminal diagonally opposite. Mount the sockets under the base panel, putting ½-in. 6-32 R. H. screws through

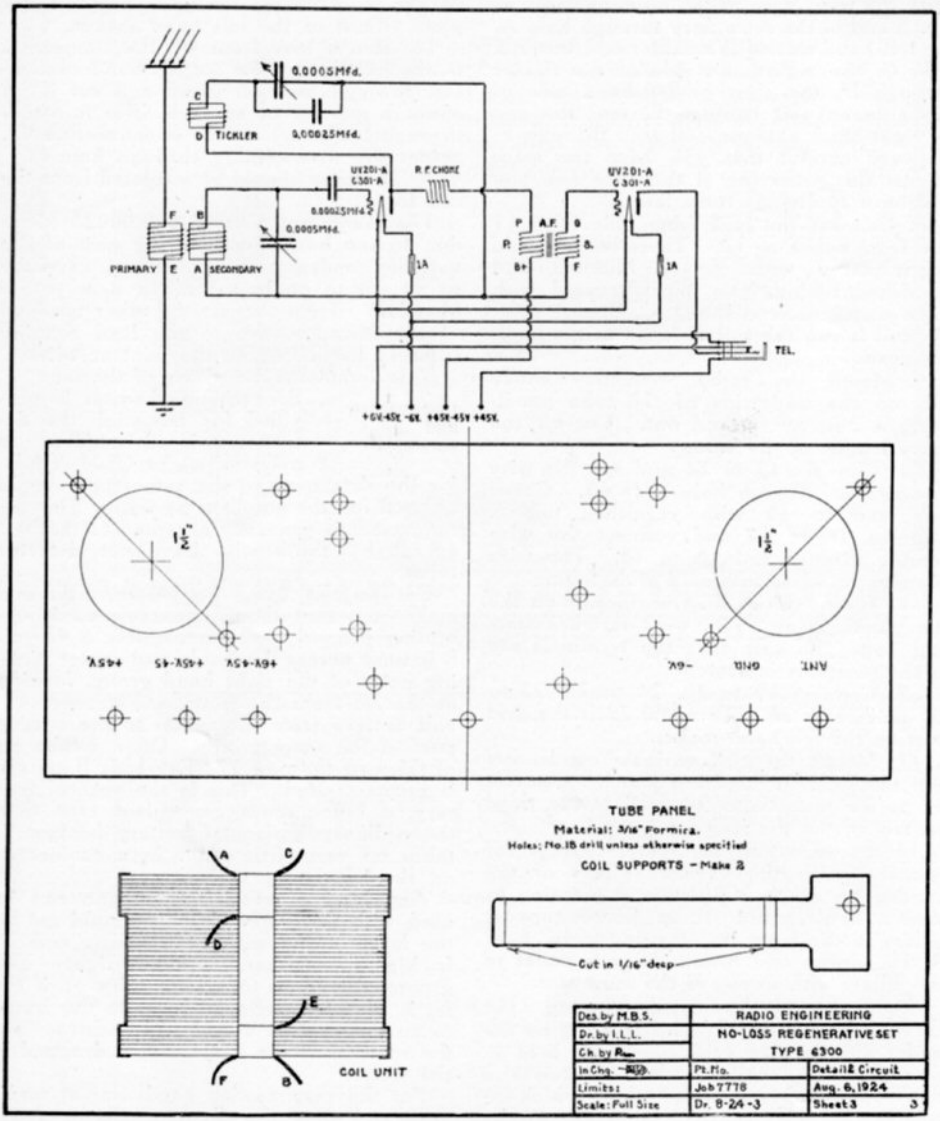

Fig. 6. One-half scale drawings of the tube panel, coil unit, and coil supports, as well as a schematic wiring diagram illustrating the circuit system

the panel and into the upper ends of the pillars.

4. Connect 5 to 6, and 7 to 8.

5. Mount the 0.00025 Micadon on the detector socket base, putting a 1-in. 6-32 R. H. screw through one terminal of the Micadon and the mounting hole in the socket.

6. Connect 9 to 10. 10 is the grid binding post on the socket.

7. Fasten angle brackets to the upright strips which hold the tuning inductance, using ½-in. 6-32 R. H. screws and nuts. Then fasten the angle brackets to the tube panel with the same size screws, and put the coil in position between the uprights. Put the leads from the inductance unit through the holes in the tube panel, but do not put varnished tubing on the leads until later. You will see that the start of the secondary, on the right looking at the set

from the rear, goes to the hole indicated as B, the end of the secondary through hole A, the left-hand side of the tickler coil through hole C, the right-hand side of the tickler through D, the start or left-hand side of the antenna coil through E, and the end or right-hand antenna coil lead through F. Be very careful that you have the leads in just this order for, if they are not, you will have to change them later.

8. Connect the lead from hole E to 11 and from hole F to 12. These leads should be insulated with No. 7 Mitchell-Rand varnished tubing. No Wirit is used with these connections as the D. C. C. wire from the coil is run the full distance to the binding posts.

9. Mount the radio frequency choke coil on the underside of the tube panel, using a 2-in. screw and nut. Cut off the extra length of the screw.

10. Connect 13 to 14 and run the wire coming out through hole D to 15. Cover this lead to 15 with varnished tubing. Connect 16 to 17 and connect the wire coming through hole A to 18. The wire running to 18 is insulated with tubing.

11. Mount the A. F. transformer on the sub panel, using ½-in. 6-32 R. H. screws and nuts. Be sure that the terminals are in the positions indicated.

12. Connect 19 to 20, 21 to 22, 23 to 24, and 25 to 26. Terminal 22 is the grid post on the left hand socket.

13. Mount the two variable condensers and the jack on the front panel. Connect 27 to 28 and 29 to 30. 30 is the third contact up on the jack.

14. Be sure that the soldering lugs for connection to the variable plates of the condensers are in position and pointing as shown. Fasten the three panel support pillars to the front panel, using ½-in. 6-32 R. H. screws and fasten the sub panel to the pillars with screws of the same size.

15. Connect the wire coming out through hole B to 31. This is a lug on the under side of the grid condenser held in place by a ½-inch. 6-32 R. H. screw and nut. Make a break in the tubing which insulates this lead so that joint 32 can be made. Connect 32 to 33. 33 is the terminal for the fixed plates on the right hand condenser. This lead was insulated with tubing from 32 as far as the rear of the sub panel, altho that is not necessary. Connect 30 to 34, insulating the wire with tubing. Be careful not to melt off the lead 29 to 30. Connect 35 to 36. This lead should be insulated. Terminal 35 is the top contact on the jack. Connect 37 to 38. This lead should be insulated. Terminal 37 is the second contact up on the jack. Connect 39 to 40. This lead should be insulated. Terminal 39 is the bottom contact on the jack and 40 the plate circuit of the left hand socket.

16. Run a wire from 41, the connection to the fixed plates on the left-hand condenser, through the sub panel and cut it off about a quarter of an inch after it passes through the panel. This is connection 42. Solder the wire coming through hole C 42. The wire should be insulated from the coil to 42.

17. Solder one side of a 0.00025 Micadon to the bottom supporting post of the variable condenser. Do this very carefully so as not to apply too much heat to Micadon. Then connect the other terminal of the Micadon, 43, to the lead running from 41 to 42 making the joint at 44.

This completes the wiring of the set.

Installation and Operation

Because no rheostat is provided for adjusting the detector, it is advisable to use a UV201-A or C301-A tube for the detector and the same type should be used for the amplifier as well. This arrangement is generally accepted as the best except by those who have pet detector tubes.

Put on the 6-volt A battery first and make sure that the filament circuit is operating properly. Then connect a 45-volt B battery across the inside and center binding posts of the right hand group, looking at the set from the front, and another 45-volt battery from the center to the outside post of the same group. On a 2-tube set of this sort the new 772 Eveready B battery is recommended. This is the vertical battery, a much more convenient type than the ordinary horizontal battery because it takes up very little space in a cabinet or on the laboratory table.

Any kind of receiving antenna can be used with this outfit altho it should not be too large. One wire 100 ft. long and 20 ft. high at each end is about right. The ground should go to a water pipe or, if the set is used for portable work, to the frame of an automobile, a large spike driven into the roots of a tree, or to a cam dropped in the water.

Put the regeneration condenser at maximum and see if the circuit oscillates. as indicated by a double plucking sound when the grid terminal of the tube is touched. If your finger is dry, moisten it slightly. In case you are not able to make the set oscillate, reverse the leads from the tickler coil.

When signals have been brought in by adjusting the wavelength condenser, reduce the capacity of the regeneration condenser until oscillations cease. Then get a close adjustment of the wavelength and increase the capacity of the regeneration condenser until the signals are at maximum volume without distortion.

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EDITORIAL

WITH this issue the name RADIO and MODEL ENGINEERING which, during the last three years has become so well known to radio men, is changed to RADIO ENGINEERING. This change, important in itself, indicates another step in the steady advance which has been maintained in developing the usefulness of the Magazine. There is a real surprise in store for you — the September issue in which the plans on which we have been working all summer will be realized. I won't tell you about it now, but you'll see for yourself and, I think, you'll be very much pleased.

Last month, while the final work was being done on the type 6200 resistance coupled amplifier, we had an experience which answered one of the most frequent of radio questions in a most convincing way. The question, if you haven't guessed it, is, "What is wrong with my set? Everything is exactly right, but I can't get good reception." The easiest answer is that everything can't be exactly right or the set would work, but the average man can't be convinced when he has already made up his mind that the fault is not his.

However, a set made right works right — as was the case with our amplifier. The circuit was drawn correctly, the constants were worked out accurately, and the set was wired in accordance with the diagram. But it didn't work. Because of the limited time before publication, photographs were taken, for we knew that there was just some little bug that would be found. Yet we couldn't locate it. The picture wiring diagram had to be drawn. Still, we hardly dared to make it up from a set that wasn't working. As a matter of fact, the signals were louder at the first step than at the fourth step — with everything exactly correct, just the kind of situation that is so frequently encountered in radio experimenting.

At last, because no time was left, it seemed as if we would not have to assume that the poor results were due to some peculiarity of this particular unit, and would not be encountered in another duplicate amplifier. Our job, tho, isn't to sidestep troubles; we're here to straighten them out. It seemed like a hopeless situation, everything O. K. except the results, wiring tested thru, no opens, no shorts, no errors, and — no amplification. And then it occurred to us wonder about the first jack. We thought that adjacent terminals were connected together when the plug was removed, but, as we discovered on testing it, opposite terminals worked together.

When this change was made, or when the set really was wired correctly, the results were even better than we expected. All of which proves that it is only safe to say that a set is right only when it works. This explains also the difference between the wiring of the first jack as shown in the rear view of the set and in the picture wiring diagram, and illustrates the thoroughness with which articles are prepared for Radio Engineering.

A very practical comment is often made now-a-days concerning low-loss condensers. They don't seem to affect the tuning or the signal strength when they are substituted for the cheaply made types. As usual, there is a good reason. If there is a leak around the packing in a steam engine, it won't help much to clean the boiler tubes. The losses in a tuning circuit are not limited to the tuning condenser. Frequently, the losses in the inductance are many times greater. Consequently, if only ten per cent of the circuit losses are in the condenser, a perfect condenser will not help much.

The value of a low-loss condenser can be realized only when it is used with low-loss inductances, an inductance of the lowest possible high frequency resistance. For this purpose the pickle-bottle coil, first shown in the March 1924 issue of this publication, is not only the most efficient type of winding but the only type which shows up, in actual operation, the real worth of well-designed condensers.

M. B. SLEEPER, Editor.

The Boonton Light Four

An unusually well designed portable receiver employing two steps of R. F. amplification with Ballantine Vario-transformers. The weight of the complete outfit, with batteries, is only nineteen pounds.

THE design of a portable receiver is largely a question of good judgment on the part of the engineer in charge of the work, for a portable set may range from a pocket outfit to something that is carried on a truck. Some outfits sacrifice genuine usefulness for light weight, while others, however well they may perform, are of no value to the man who wants a radio outfit as an incidental part of the luggage that has to be taken on an automobile or camping trip.

In the matter of electrical design, the Boonton Light Four is planned to do just about anything that is required of a radio set, to bring in distant stations on the telephones and from transmitters within 50 to 500 miles on a loud speaker. In other words, it is a useful and interesting adjunct to the camping outfit. This is as it should be for people take radio sets so that they can enjoy the broadcast entertainment while they are camping rather than to go camping so that they can listen to radio in the woods.

Mechanically the outfit is equally good. As the illustrations show, the installation is divided into two parts which can be carried separately and then set up together. Of course, the entire outfit can be carried in one hand since, with the batteries and telephones, the total weight is less than 20 lbs., but it is easier to carry a section in each hand so as to make a balanced load.

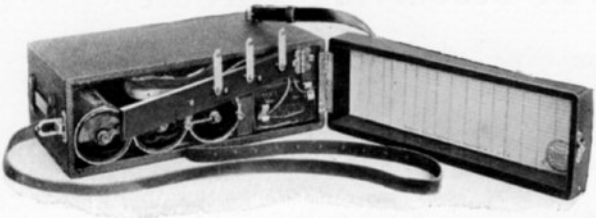
Each section measures 4½ ins. high, 8 ins. deep, and 12¾ ins. long. You will note that the front of the receiver cabinet turns upward. This gets it out of the way while the outfit is in operation. The battery case, however, has a cover hinged at the side, but this is never opened except for removing the phones or changing the batteries.

The receiving circuit, shown in the wiring diagram opposite, is of a type designed to give the best results with the Ballantine variotransformers, two of which are used to give two steps of radio frequency amplification, followed by a detector and one step of audio amplification. This makes a most efficient type of receiver for bringing in transmitters operating on 250 to 550 meters.

A special adjustment is provided on the primary of the fixed coupler, particularly to adapt the set for home use where, usually, sharper tuning is required than off in the woods at some distance from the nearest broadcasting station. The antenna and ground are connected to binding posts A and G. With the antenna lead connected to the binding post marked X on the coil, the full primary is in the circuit. This gives maximum signal strength with slightly broad tuning. When sharper tuning is necessary, the connection should be made to Y. Then only a part of the primary is in the antenna circuit.

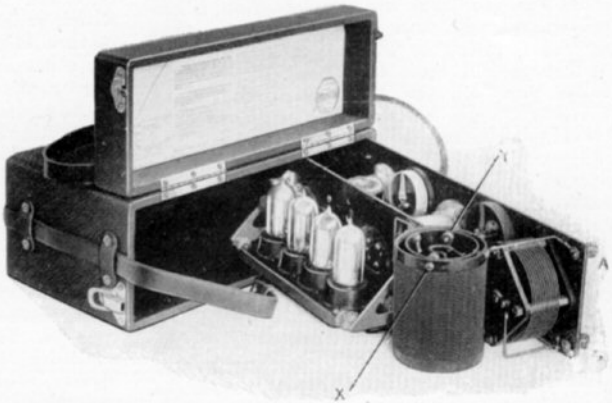
Current and voltage are supplied to the UV199 tubes by means of three 6-in. Eveready dry cells type 7111. The two B batteries are of the small 22½-volt size, type 763. These batteries provide sufficient energy for operating the outfit over a considerable period of time, much longer than is usually spent on most camping trips. At the same time the weight is very small, making the power unit easy to carry.

For fairly long distance reception the antenna wire should be about 100 ft. long, of bare wire or annunciator wire. The latter is a little easier to handle since it is less liable to become tangled. The height at each end need not be more than 15 ft. above the ground. Any good receiving antenna can be employed for home operation. Out in the country the ground con-

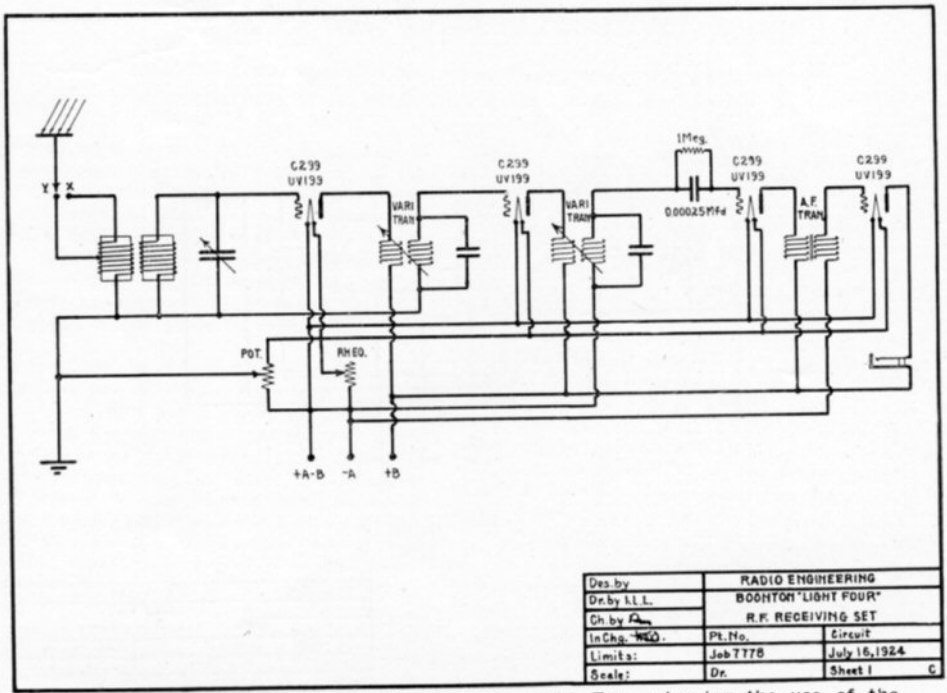


Left: The battery case. It holds three 6-in. Eveready dry cells and two 22½-volt B batteries. Phones are kept in the upper part of the A battery compartment. This is a complete power plant for the four UV199 tubes.

Right: A second case, of the same dimension as that for the batteries, houses the receiving equipment. Notice how the panel swings out to make the sockets accessible. The tube socket unit is mounted on shock absorbing springs to eliminate microphonic noises.



nection can be made to a metal plate or can dropped into the water or the frame of an automobile can be employed. In that case, it is well to stretch the antenna above the car, for then the latter acts as a counterpoise ground.



Complete wiring diagram of the Boonton Light Four, showing the use of the variotransformers

The R-A-R Receiving Circuit

A New Idea for Experimenters to Think About

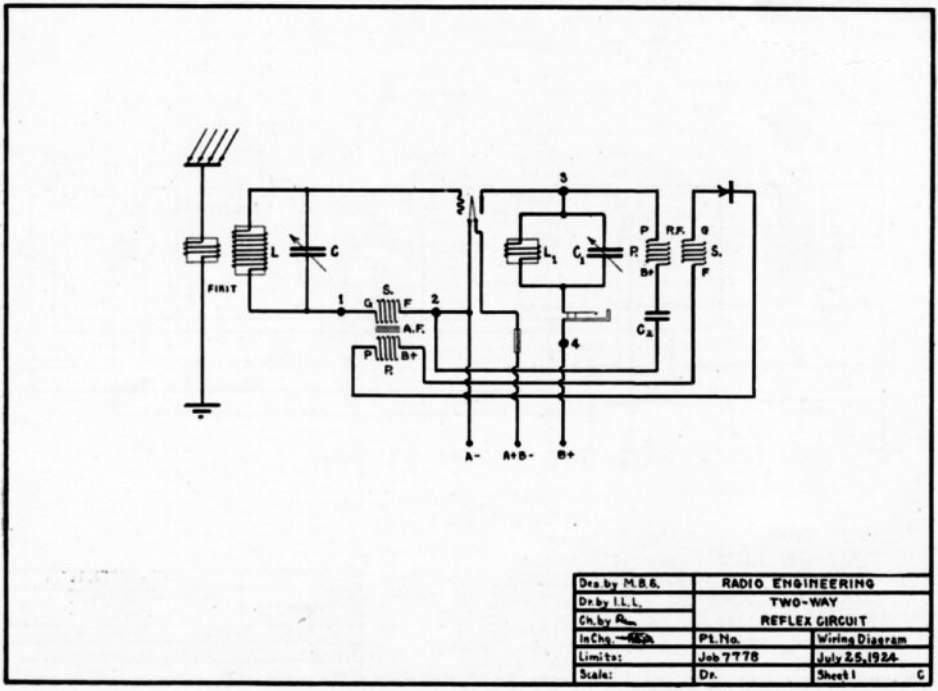
ALMOST interesting possibility for experimental work is illustrated in the wiring diagram below, showing the two-way reflex circuit which we have called the R-A-R hook-up. The name is derived from the fact that the amplification is obtained at radio and audio frequencies and by regeneration as well.

If you will look over the circuit carefully, you will see that, from the plate, there are two paths for the current to travel, one through the inductance L1 and the variable condenser C1, on to the telephones and the B battery, and another path from the plate through the R. F. transformer, condenser C2, and back to the filament. This arrangement was used for the reason that, in the average one-tube reflex receiver, the vacuum tube acts as a detector rather than an R. F. amplifier, while the crystal does no work at all. Frequently there is no audio frequency amplification, and the set operates simply as a one-tube regenerative receiver.

In the two-way reflex the set cannot act that way for, because of condenser C2, only radio frequency current can go through the primary of the R. F. transformer, and in the telephone circuit only audio frequency can pass since the combination L1 and C1 is tuned to the incoming wavelength, at which point the impedance to R. F. circuits is, theoretically, infinite. Moreover, L1 and C1 serve as a tuned plate arrangement for regeneration. This circuit can be adapted to any ordinary receiver by making the connections indicated at points 1, 2, 3 and 4. Coil L and condenser C should have the same dimensions as L1 and C1. Condenser C2 will vary from 0.0001mfd. to 0.001mfd.

In the original testing circuit, an Eastern Coil fikit was used with two Veldar geared condensers for tuning. The crystal detector was the Freshman double adjustable type, a Brooklyn Metal Stamping R. F. transformer, Modern 1 to 4 A. F. transformer, with an Amperite for the filament control.

Try out this circuit and see what you are able to do with it.



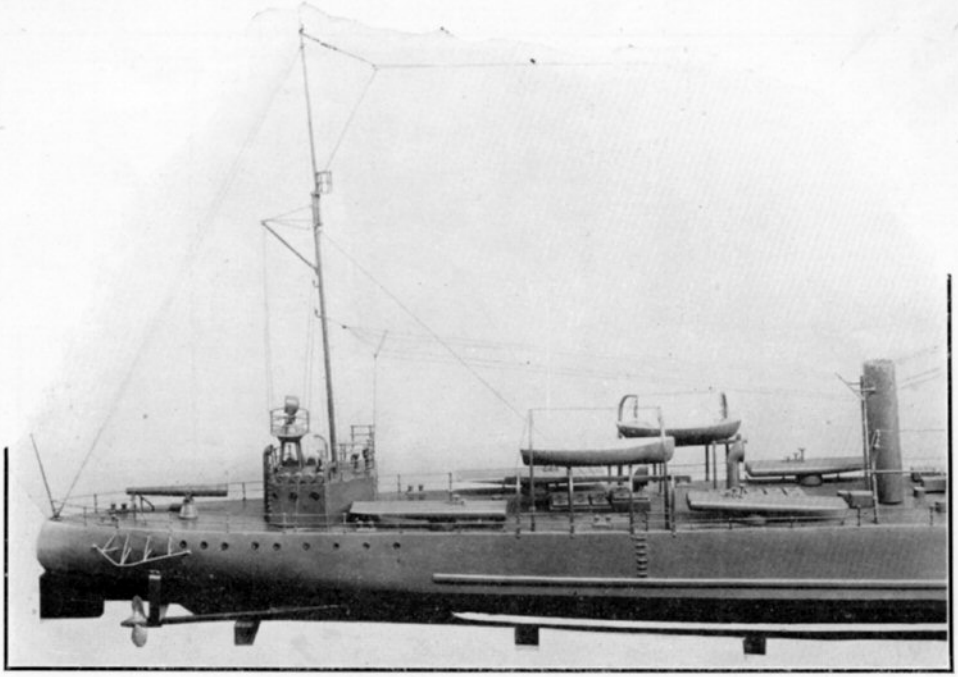


Fig. 12. This illustration is most helpful in interpreting the scale drawings

Construction of a One-Eighth-Inch Scale Model 310-Foot U.S. Destroyer

Part 6. Final installment, describing special features of construction on the after part of the destroyer.

IF you have carried out the construction work on the model destroyer in the order in which the data has been given, the last part of the work is fitting and finishing the parts on the after half of the deck. To make this as clear as possible, the accompanying photographs are given to show the exact appearance of the original model as built by H. E. Boucher, Inc.

Comparing Fig. 11, the scale drawing of this part of the destroyer with Figs. 12 and 13, you will find some slight discrepancies altho these are not important as they only affect details of arrangement, the essential features remaining the same. The deck house should be cut from a small block of pattern-makers' pine and finished up in accordance with the dimensions which can be scaled from Figs. 4 and 11. The overall height is 1 in. and the greatest width 1-7/8 ins. by 2¼ ins. long. The center line for the port holes is 3/4 in. up from the deck. The holes should be drilled out very carefully and fitted with eyelets or with regular scale port holes which can be bought ready made. The staunchions should be purchased unless you have the facilities for handling the very fine work of turning them out. On the starboard side you will see the depth bombs. These are 3/16-in. in diameter by ¼-in. long, just little pieces of wood which can be glued or fastened down with very fine wire brads.

For the search light mounting, four lengths of brass rod, 1/16-in. in diameter and 1-1/8 ins. long should be used. This allows an extra 3/8-in. so that the rods can be forced into the deck house ond into the search light platform. The platform itself is 3/4-in. in diameter, turned from a small piece of wood. Dimensions for the search light have been given already.

The torpedo tubes are 3¼ ins. long over all by ¼-in. in diameter. They are mounted on a wooden disc ½-in. in diameter and 7/32-in. thick.

The main mast stands 6⅛ ins. above the deck house and is 3/32-in. in diameter. An additional length should be allowed for it to set into a hole drilled in the deck

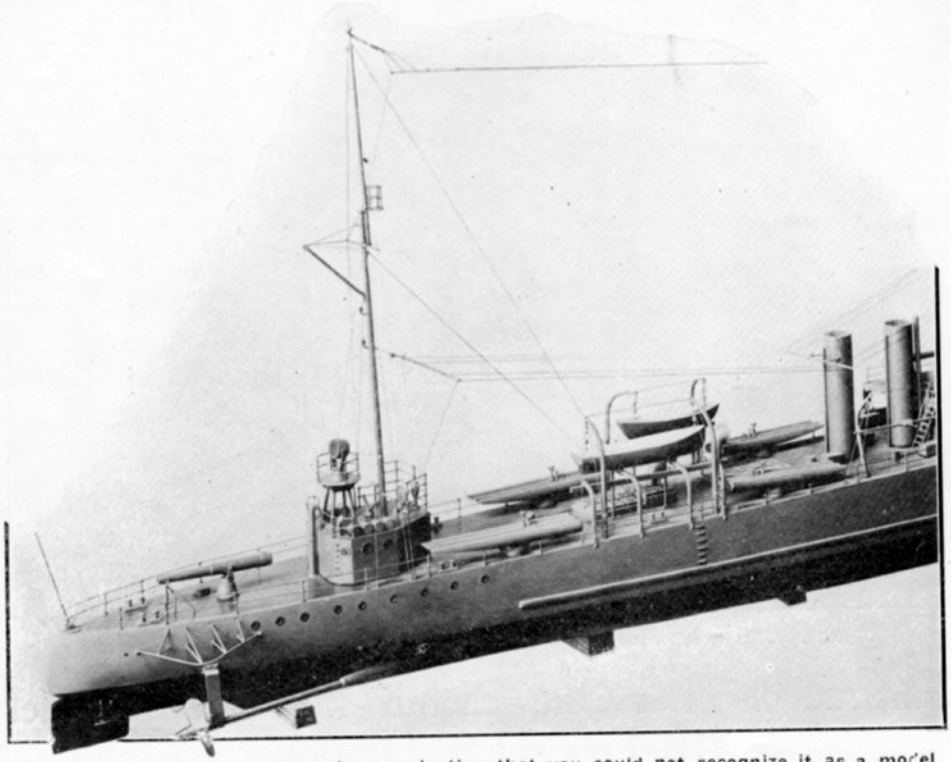


Fig. 13. So perfect is this scale reproduction that you could not recognize it as a model if it had been photographed in the water

house. Another rod 1/8-in. in diameter by 3¾ ins. long is required for the top mast. An overlap of ¾-in. is taken care of in these dimensions for fastening the two masts together.

A brass tube 5/16-in. in diameter and ¾-in. long, cut down at an angle at the top, will serve as a crows nest. Because of the ease with which these parts can be soldered together, it is much better to use brass rod and sheet or tubing than to use wood, for even the slightest strains of the halyards will cause the wooden mast to warp out of shape.

The engine room hatches can be seen in Figs. 11 and 12, and dimensions for them are shown in Fig. 4. To save work, you can use plain, solid pieces of wood altho a more realistic appearance will be produced if the solid pieces are grooved to correspond to the construction as shown. Another illustration of these hatches is given in Fig. 3.

Other details, such as the controls on the torpedo tubes, the signal lights, antenna insulators, and similar fittings can be put on or left off according to your skill and your desire to include all the special items.

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ANY set can be improved by replacing fixed condensers with GRID-DENSERS. Distance just naturally follows GRID-DENSER.
GRID-DENSER, with its microscopic variations of capacity, makes for stability by controlling oscillation and regeneration perfectly.
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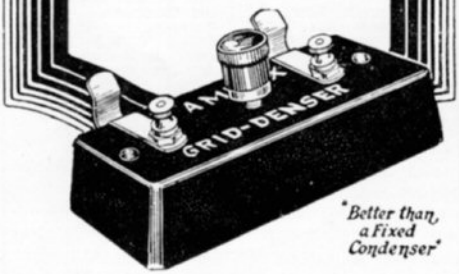

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The SUPER-TRIODYNE uses no B battery on the three intermediate amplifiers, yet the volume and clarity are superior to any other Super set. UV-201-A tubes are recommended, altho others can be used. Parts required can be obtained from your local dealer — nothing difficult about the construction.

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Terminal posts spaced to fit the standard grid condensers.

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And at no extra cost! Fil-ko-stat gives perfect control of any type tube in any hook-up—maximum signal strength—longer tube and battery life. Stops tube noise. Brings in DX stations you never heard before. Switch attaches to regular "Stat" mounting screws.

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SCIENTIFICALLY CORRECT RADIO RHEOSTAT

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Protects your set from lightning or we pay you $100 or repair the set. That's our guarantee. "Umbrella" shield keeps dust, moisture, etc., from the hermetically sealed Bakelite insulation. Maximum reception assured, because all radio impulses reaching antenna reach your set. No leakage losses.

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During the past three years, Radio Engineering has developed a system of making panel patterns and picture wiring diagrams which, as success insurance to the radio set builder, are superior to all others. Below is a selection of blueprints giving the designs of the finest sets which have been shown in Radio Engineering. Each is one hundred per cent good in its class.

1. DX receiver, a four-tube non-oscillating tuned R. F. set which has an unlimited range, coupled with sharp tuning, making it an ideal outfit for the man who wants the best for loud speaker reception. Set of six blueprints, type 5300..... **$1.50**

2. Portable tuned R. F. set, using four UV199 tubes. This is similar to the type 5300, but smaller and less expensive. It also operates a loud speaker, with perfect quality, up to several hundred miles. Set of three blueprints, 5800..... **$.75**

3. Circuits come and go, but the famous X-1900 three-circuit regenerative set is as popular as ever. Equipped with one tube, this is a splendid outfit for those who play radio golf and want a record score. Set of three prints, type X-1900.. .. **$.75**

4 T. C. Circuit set—Twenty-five cities for twenty-five dollars—it is a one tube UV199 outfit that runs rings around any other outfit at the same cost. With an amplifier it brings in everything that's on the air. Set of three blueprints, type X-4000..... **$.75**

5 Rasla Reflex is the choice for one-tube reflex sets, for it is sharp, has only one tuning control, and works with a UV201-A, making a storage battery unnecessary. The crystal is of the fixed Rasla type. Set of three blueprints, type 5900.... **$.75**

6. Two-step amplifier, a unit which can be added to any receiving set. Takes any type of vacuum tubes. Jacks permit plugging in at each step. This is the most popular and practical amplifier to use. Set of three prints, type 3100..... **$.75**

7. Resistance coupled amplifier, the perfect, distortionless amplifier for any receiving set. Uses one step of transformer coupling followed by three steps of resistance coupling. Set of three blue prints, type 6200 ..... **$.75**

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Two B.M.S. Winners

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An accurate reproduction of the Cape Cod boats, 18 ins. overall, 6 in. beam, 200 sq. in. sail area.

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Racing sloop, 30 ins. overall, 7½ in. beam, 590 sq. ins. sail area. The most popular model among model racing enthusiasts.

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The Boucher line includes both sail and power boats, sold complete or as construction sets. They are described in catalog 507, a copy of which will be sent without charge upon request.

BOUCHER, INC.,

Retail Store and Show Room,
415 Madison Ave., New York

Standardized Parts List

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

PARTS FOR THE TYPE 6300 NO-LOSS RECEIVER

Type	Name	Price
	Carter Radio Co., G-209 So. State St., Chicago, Ill.	
103	1—3-spring filament control jack	$0.90
	Cornish Wire Co., R-30 Church St., New York City, N. Y.	
1	¼-lb. spool No. 20 D. C. C. wire	.40
	Dubilier Condenser & Radio Corp., A-48 West 4th St., New York City, N. Y.	
601	2—0.0005 mfd. Micadons	.70
	H. H. Eby Mfg. Co., X-40 So. 7th St., Philadelphia, Pa.	
Ensign 6	Ensign binding posts	1.20
	General Instrument Co. 423 Broome St., New York City, N. Y.	
47D	1—.0005 mfd. Low-loss condenser with gear vernier	8.00
	James Goldmark Co., B-83 Warren St., New York City, N. Y.	
W	1—100 ft. spool of Wirit	.92
	Kurz-Kasch Co. South Broadway, Dayton, Ohio	
A213	2—3-in. knobs and dials	1.50
	Marshall-Gerken Co. Toledo, Ohio	
MG	2—201-A sockets	1.50
	Poster & Co. 26 Barclay St., New York City, N. Y.	
153	1—7 by 10 by 3/16 in. Formica panel	1.81
98	1-3½ by 22½ by 3/16 in. Formica panel	2.75
	Radiall Co. 320 West 42nd St., New York City, N. Y.	
1A	2—Amperites for 201-A tubes.	2.20
	Miscellaneous Parts	
58	2 Pkgs. of 25 tinned soldering lugs	.40
22	2—right-hand nickeled angle brackets	20
185	2—left-hand nickeled angle brackets	.20
14	4 coil support pillars	.32
151	3—nickeled panel supports	.90
63	2 Pkgs. of 10½-in. 6-32 R. H. nickeled screws	.12
49	1 Pkg. of 10 6-32 nickeled nuts	.08
178	1 Pkg. of 10 1½-in. 6-32 R. H. nickeled screws	.18
	COMPLETE SET OF PARTS..	$24.29
	BLUE PRINTS	
6300	Set of three full-size blue prints for the 6300 receiver.	$.75
	AUXILIARY PARTS	
	Chas. Freshman Co., Inc. 106 Seventh Ave., New York City, N. Y.	
DA	Double adjustable crystal detector	1.50
	National Carbon Co. Long Island City, N. Y.	
763	Small 22½-volt B battery	1.50
766	Large 22½-volt variable B battery	2.00
772	Large 45-volt vertical B battery	3.75
771	4½-volt variable battery	.60
6810	50-amp. storage battery 6-volts	15.00
	Stanley Patterson West and Hubert Sts., New York City	
843	Deveau Gold Seal Phones, 2200 ohms	6.00
	Deveau Gold Seal Phones, 3200 ohms	8.00
	Dictograph Products Corp. A-220 West 42nd St., New York City	
R6	Dictogrand loud speaker	15.00
	Clark & Tilson, Inc. 1-A East 42nd St., New York City	
W	Automatic drilling template	1.00
	Pacent Electric Co. A-22 Park Pl., New York City	
40	Universal phone plug	.50
51	Twinadapter for two plugs	1.00
	Stevens & Co. 395 Broadway, New York City	
T-71	Set of 3 Spintite wrenches for hexnuts	1.00
T-825	Set of 3 Spintite wrenches for round nuts	1.00
T-580	Reamer for ⅛ to ½ in. holes	1.50

Back Issues of R & M

If you have missed any issues of RADIO and MODEL ENGINEERING for this year, check over the following list and order those that you did not get so as to make your file complete. Until September 1st a special price of 10c. a copy will be allowed for these back numbers.

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

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

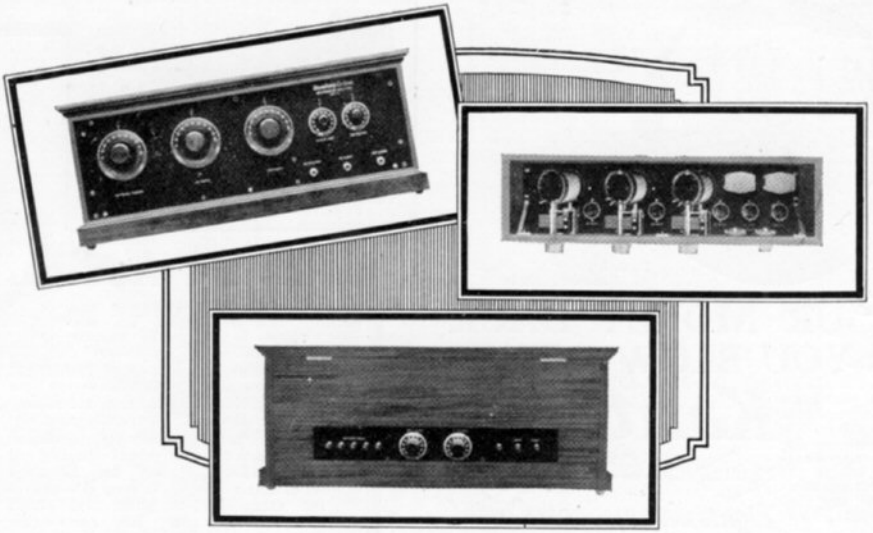
March-April—Portable tuned R. F. set using UV199 tubes, Harkness circuit for Diode or crystal detector.

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

June—Sodion reflex set using UV201—A amplifier, the Bestone V-60, tuning filter for cutting out interference.

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

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



The photographs show the Formica front panel, Formica base panel and Formica back panel used in the Stromberg-Carlson Neutrodyne set

For more distance and more volume, Use more Formica!

DESIGNERS and builders of sets incorporating radio frequency amplification—neutrodyne, superheterodyne, and reflex—have found that the best possible parts will give far less than maximum results unless the greatest care is taken to prevent current leakages.

They are using Formica front panels, Formica baseboards for mounting the instruments, and in some cases Formica back panels for the battery terminals. The remarkable new Stromberg-Carlson Neutrodyne set is an example of what can be accomplished in this way.

There is often a difference that means loud speaker volume on stations that would otherwise come in only on the phones; it means logging new DX stations that would have been impossible before.

Insist on Formica. It won't warp. Binding posts won't loosen up because the material cold flows. The insulating quality is certain and uniform—and the finish the best there is.

Dealers who wish to give real service to their customers are urging the use of Formica base panels in these sets.

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585 Mission St., San Francisco, Calif.
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516 Caxton Bldg., Cleveland, Ohio
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Made from Anhydrous Bakelite Resins

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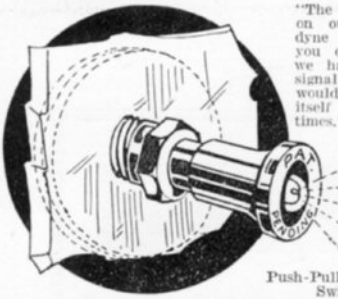

"The Kant-Blo Switch on our Super-Heterodyne does all that you claim for it. If we had installed this signal long ago it would have paid for itself hundreds of times."

(Copy of letter on request.)

Push-Pull "A" Battery Switch Style

YOUR MONEY BACK IF YOU BLOW A TUBE

When your radio set is equipped with a Kant-Blo

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

Kant-Blo SIGNAL

SWITCH — BINDING POST

"Lights on any Short Circuit"

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

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

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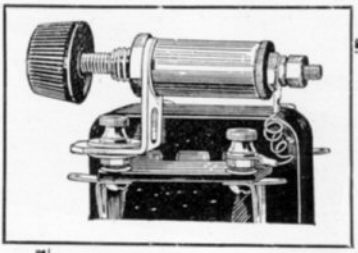

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C. P. HILDEBRAND said:—
"This is certainly the Missing Link in Radio—To Express it Mildly, it is Marvelous."

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

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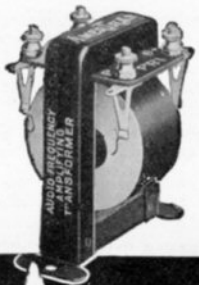

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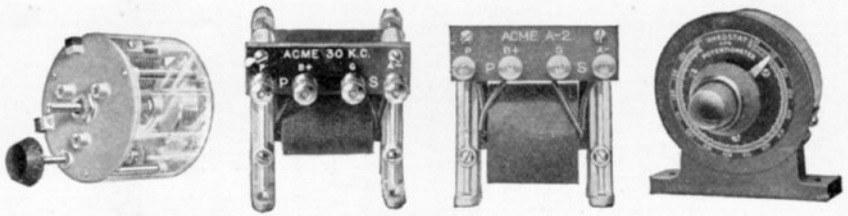

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