RADIO & MODEL ENGINEERING

A Magazine for the Experimenter who builds his own Equipment

Edited by M.B. SLEEPER

THREE-TUBE GRIMES

FULL DETAILS OF THE THREE TUBE GRIMES INVERSE DUPLEX, SHOWING THE LATEST APPROVED DESIGN FEATURES.

A SET TO TAKE THE X FROM DX RECEPTION, USING TUNED RADIO FREQUENCY, AMPLIFICATION.

CONSTRUCTION OF THE CURLEW, A FAST 30-INCH MARCONI RIGGED SLOOP WHICH HAS BEEN GIVEN A SPLENDID ACCOUNT OF ITSELF IN MODEL BOAT RACES.

10¢ a Copy-In England, Sixpence

Vol. 3 No. 8

The "A" Battery's Power in Your Radio Receiving Set

THIS IS NUMBER TWO OF A SERIES

THE sole purpose of the "A" Battery in your Radio Receiving Set is to furnish current to heat the filaments of the tubes.

And this can be done satisfactorily only by an "A" Battery that supplies an adequate steady current.

Anticipating the popularity of the dry cell tube in Radio, and realizing that it required a Dry Cell capable of standing up under service conditions differing from what dry cells are called upon to meet in other fields, the National Carbon Company developed the Eveready Radio Dry Cell specifically for this new use.

A dry cell gives its maximum service only when designed especially for the work it is intended to perform. There are for dry cells several uses which are so alike that one type of cell serves for all. This is the field covered by the ignition or general purpose dry cell.

The conditions encountered in Radio are different from the conditions grouped together under the term "general purpose." And while the general purpose dry cell performs well as an "A" Battery, it was found possible to produce a Dry Cell "A" Battery capable of delivering more service on Radio loads.

Thirty years of dry cell experience and an immense research organization resulted in the superior Eveready Radio Dry Cell. One of the outstanding features of this special cell is that while it will last much longer when used as an "A" Battery, it is no larger than the standard dry cell.

The increased service life of the Eveready Dry Cell "A" Battery greatly offsets the slight increase in cost; so this battery is not only the best, but it is the most economical you can buy. "The Story of Eveready Dry Cell Radio 'A' Batteries," which tells how to use Dry Cells to the greatest advantage with the various dry cell tubes now available, will be sent to you free on request.

* * * *

The "A" Battery gives power to your Radio Receiving Set. Eveready Batteries —especially made for Radio—serve better, last longer, give better results.

Note: This is number 2 of a series of informative advertisements which will appear in this magazine. They are designed to help users get the most out of their Batteries and their Radio Sets. If you have any battery problem, write to G. C. Furness, Manager Radio Division, National Carbon Company, Inc., 112 Thompson Ave., Long Island City, N. Y.

POWER

for Your Radio Set

Eveready Dry Cell Radio "A" Battery (No. 7111)

Directions and wiring diagrams on the jacket tell just how to use this battery with the different dry cell tubes.

This special Radio Cell is also available in two and four cell multiple batteries for receiving sets employing from two to four WD-11 or WD-12 tubes.

Other Radio Batteries

Eveready Storage "A" Batteries — best suited for filament heating of all Radio Tubes not especially designed for dry cells. The quality storage battery with the long life plates, $15 to $20.

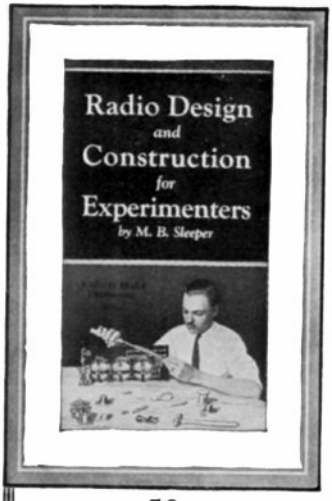
Eveready "B" Batteries—the life of your Radio

Eveready "Three" Battery—3 cells, 3 purposes

Manufactured and guaranteed by

NATIONAL CARBON COMPANY, Inc.

EVEREADY
Radio Batteries
—they last longer

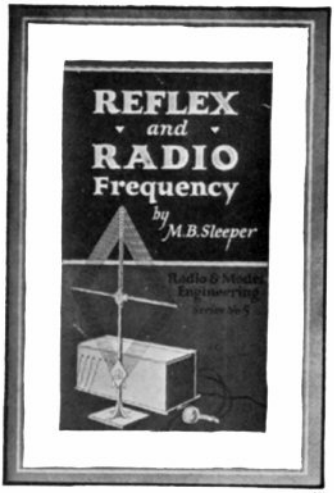


Two New Books

by

M. B. Sleeper

READY *for* DELIVERY



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WHO WROTE THESE TWO NEW BOOKS?

These books were written by M. B. Sleeper, one of the foremost radio design engineers of this country, who has for nine years devoted his time to developing a technic for showing Experimenters how to build their own equipment. Over 500,000 Experimenters have bought Sleeper books because the data in them is absolutely dependable and easy to understand.

WHAT RADIO EQUIPMENT IS DESCRIBED?

Radio Design and Construction is the only book giving quick reading, accurate tables by which you can find the length, diameter, size of wire, or inductance for any coil, and the inductance and capacity required for any wavelength. Detailed photos of banked windings are shown. In addition there is complete construction data on the tuned radio reflex set, the Duotrol, and the three-tube Neutrodyne, 12 half-tones, 12 scale drawings.

Reflex and Radio Frequency is entirely devoted to construction data. Circuits, panel patterns, picture wiring diagrams are given for reflex, radio frequency, and Grimes Inverse Duplex sets. This is the only book in which every Duplex drawing bears the O. K. and signature of Mr. Grimes. Both the two-tube and four-tube sets are shown. Another set is the R. F. amplifier for regenerative receivers. 22 half-tones, 19 scale drawings.

WHERE CAN THE MATERIALS BE OBTAINED?

Only parts of standard make are used in these outfits. They are from such concerns as Dubilier, Eveready, Pacent, Sleeper Radio, Stanley & Patterson, Acme, Fada, and Eby, and are sold in every radio store.

CAN THE SETS BE BUILT IN A KITCHEN TABLE SHOP?

Altho the designs follow standard commercial design practice, the sets are so planned that they can be built on the kitchen table workshop, with the simplest hand tools.

WHERE ARE THESE BOOKS ON SALE?

You can buy these books at any up-to-date radio store. If they haven't got them, they will get them for you. Otherwise, send us a dollar bill and both books will be sent to you by return mail.

ALWAYS REMEMBER TO GIVE THE AUTHOR'S NAME!

When you buy a Sleeper book you can recognize it by the high quality of the printing, the heavy, smooth paper, the clear, sharp illustrations, the scale drawings, and the picture wiring diagrams. When you build a set from a Sleeper book you will appreciate the full, concise information and the step-by-step instructions which provide success insurance for your work.

M. B. SLEEPER, Inc.

A-52 Vanderbilt Ave. **Technical Publishers** **New York City**

The DUBILIER DURATRAN

—Radio-Frequency Amplification on All Wave Lengths

THE DUBILIER Duratran is the supreme radio-frequency transformer.

It amplifies powerfully and uniformly **over all wave lengths** now used by broadcasting stations.

Price $5.00. At all good dealers

DUBILIER CONDENSER & RADIO CORP.
48-50 West Fourth Street, New York City

Dubilier Micadon (Fixed Condenser)

Dubilier Variodon (Mica Variable Condenser)

Dubilier Ducon (Socket-plug)

DUBILIER DEVICES

A New Type of

DX RECEIVER

By using one step of tuned R. F. amplification with a detector and two-step A. F. amplifier, the X can be taken from DX reception

WHEN we were using crystal detectors and very simple audition circuits, the variations in results due to atmospheric conditions, and perhaps other things we do not know about, which affected reception were not particularly noticeable because, if a fairly large amount of energy was received, signals were heard. Otherwise, silence. Moreover, the instruments themselves were out of order so much of the time that they might have been blamed for what the weather was doing.

Now-a-days, a good radio set responds to an amount of energy so small that it is almost nothing. Indeed, a little atmospheric disturbance and the energy becomes nothing. Then signals fade out. That effect, whatever it is, which causes signals to change in strength, might be called the X of DX, or long distance, reception.

A little while ago, when I was in Boston, Dick Cotton, known through New England as one of the most capable extractors of X's in general from radio sets, told me about a set he had built for himself. If I hadn't grown up with Dick Cotton, and others who have operated the set, I might not have believed what they said about it, for the stations they logged ran clear across the continent, and were brought in on an in-door antenna.

However, results obtained with the outfit illustrated in the accompanying photographs confirms their opinion of this type of set for dependable long distance reception. In fact, I believe that no other type of receiver, as simple to build and with as few controls, on which construction data is available, can equal the type 5300 for night-after-night work, thru interference, and in any locality. Reproduction of speech is limited in quality only by the loud speaker.

Details of the Circuit

In the top view, Fig. 1, you can see the various components. The first fixed coupler is connected to the antenna and ground, and to the grid and filament of the R. F. amplifier tube. A condenser of 0.00025 mfd. tunes the secondary. The primary of the second fixed coupler is in the plate circuit of the R. F. tube, while the secondary goes to the detector grid and filament. The R. F. condenser is also of 0.00025 mfd. From then on, the circuit is of the conventional type, altho a little novelty is introduced in the method of using the filament control jacks.

Since the antenna circuit is untuned, the size of the antenna does not affect the calibration of the secondary condenser. You will find that, with a transmitter tuned in, the readings of the two dials will be practically identical. This makes tuning easy, as the knobs can be turned together.

One rheostat controls the detector alone; the other, all three amplifier tubes. When, however, the plug is inserted at the first jack, only the R. F. amplifier and detector light. Plugging in at the second jack, which is intended for the loud speaker, all four tubes light up. Having adjusted the rheostats while using only the first two tubes, it is not necessary to readjust them when the other two are cut in also, as the increase in filament current, for three UV201-A's and

a UV200 detector, is only 40%—not enough to reduce the current through the R. F. tube and detector as long as the battery is in good condition. In fact, we have not changed the rheostats from day to day during tests.

Altering Wavelength Range

Both variable condensers in this set are of 0.00025 mfd. With the fixed couplers they give a wavelength of 150 to 460 meters. If this is not high enough, you can wind up two loading coils of 15 turns of No. 24 S. S. C. wire (22 S. W. G.) on tubes 3 or 3½ ins. diameter and ½-in. long. Put a coil in series with the secondary of each fixed coupler, with the variable condenser around both the secondary and its loading coil. The coils can be mounted behind their respective condensers.

Do not, however, put in loading coils until you have completed the set and tried it out, for variations in inductance and distributed capacity, according to the way the set is wired, may bring the wavelength up sufficiently.

Use of the Type 5300 Set

Many Experimenters build sets for their friends and acquaintances, in that way financing their own work. This design can be counted upon as 100% safe, not only because you can build it without encountering those innumerable X's of radio construction, but because you can be sure that your customer will be thoroughly well pleased. Moreover, it is understood not to infringe any patents.

Standard Parts Required

For the front panel, a Formica sheet 7 by 24 by 3/16-in. is required. The base panel measures 7 by 23 by 3/16-in. It must be cut from a 7 by 24 sheet, as that is the standard size. When you cut off the 1-in. strip, turn your hack saw blade 90 degrees in the frame, so that the frame will not interfere with the panel. Because it was planned to consider quality before cost, Malone-Lemmon variable condensers were selected. Their high efficiency contributes greatly to the sharpness of tuning. The fixed couplers, A. F. transformers, and sockets are from the Sleeper Radio Corporation, the condenser and rheostat knobs from Kurtz-Kash, and the jacks from Pacent. Fada 8-ohm rheostats control the filaments. A Dubilier Micadon of 0.0005 mfd. serves as the grid condenser, with a line of drawing ink across the terminals to act as a leak. Eby binding posts are used for terminals. Any of these instruments or the small parts which you cannot buy locally can be obtained from DURRANT.

Drilling the Panels

Figs. 4 and 5 give the layout of the front panel at one-half scale, while the base panel is shown in Figs. 6 and 7. Because of their size, it was necessary to divide them in this way, as one-fourth scale would make it too difficult to scale off the dimensions accurately.

The easiest way to locate the holes is to draw a line across the center of the panel. Then measure the distances to the right or left of the line, and up from the bottom. This work should be done with a Starrett combination square and pocket scriber. You will also need a pair of 6-in. dividers. For this the type with the round legs, also made by Starrett, is recommended. If you do not want to do this work, get the full-size blue prints, and glue one print at a time on the panel, and mark thru it with a center punch. Remember that concentric circles call for countersinking.

A Formica strip 1-in. wide and 8½ ins. long is needed for the terminal panel. It can be cut from a piece of scrap. Dimensions for this panel are given in Fig. 9.

Features or Design

Arrangement of the parts is responsible for the attractive appearance of this set. The tuning units are laid out so that the condenser and fixed coupler line up center to center. A symetrical arrange-

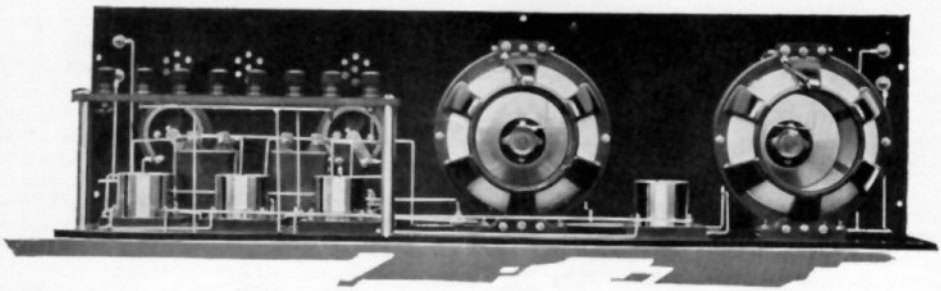

Fig. 2. The terminal panel at the rear carries the eight binding posts for connections to the batteries. You can see how the tuning units are arranged

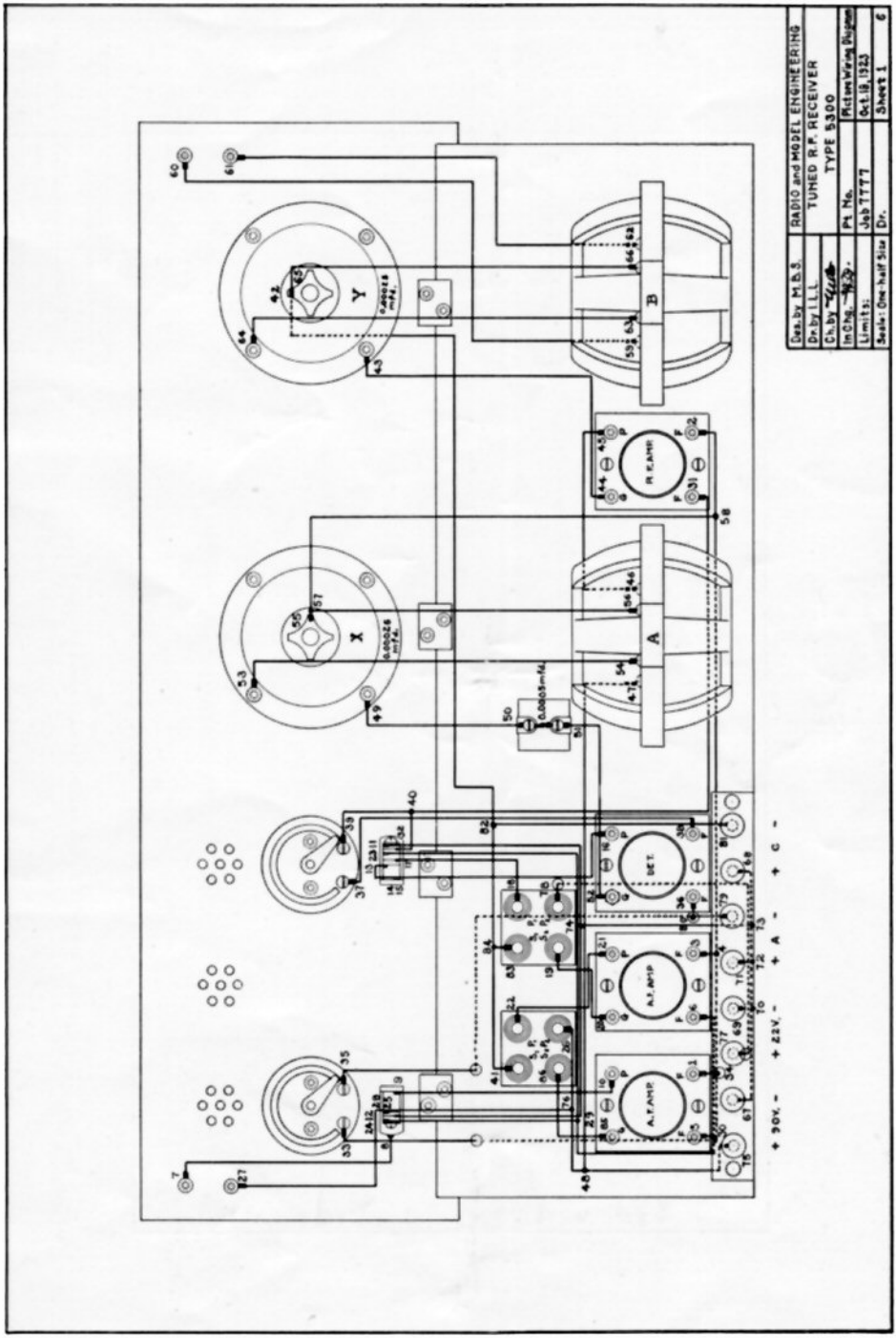

Fig. 8. The wiring is shown as if the base panel were turned down to be on the same plane in the front panel

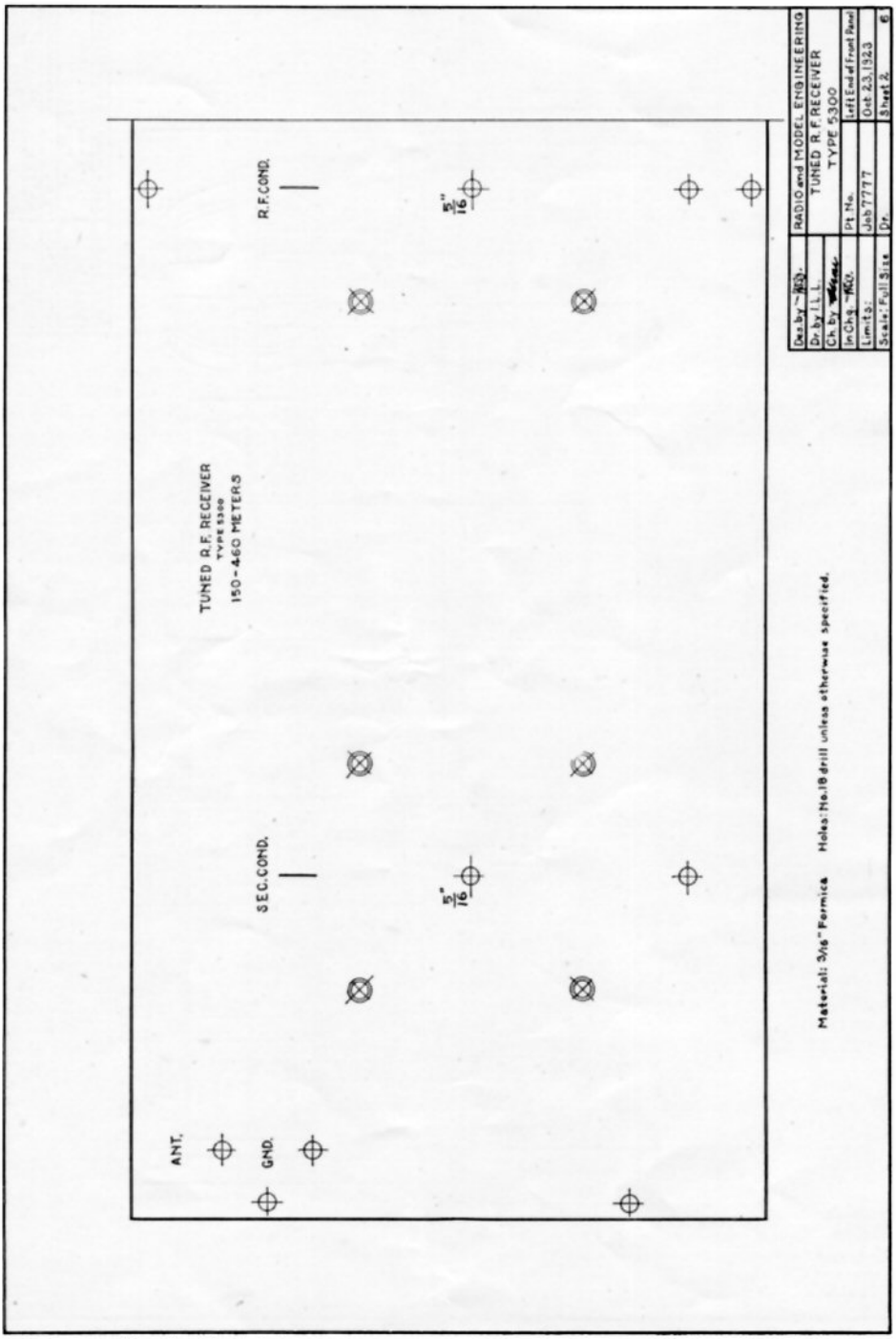

Fig. 4. The left hand half of the front panel, shown at one-half scale

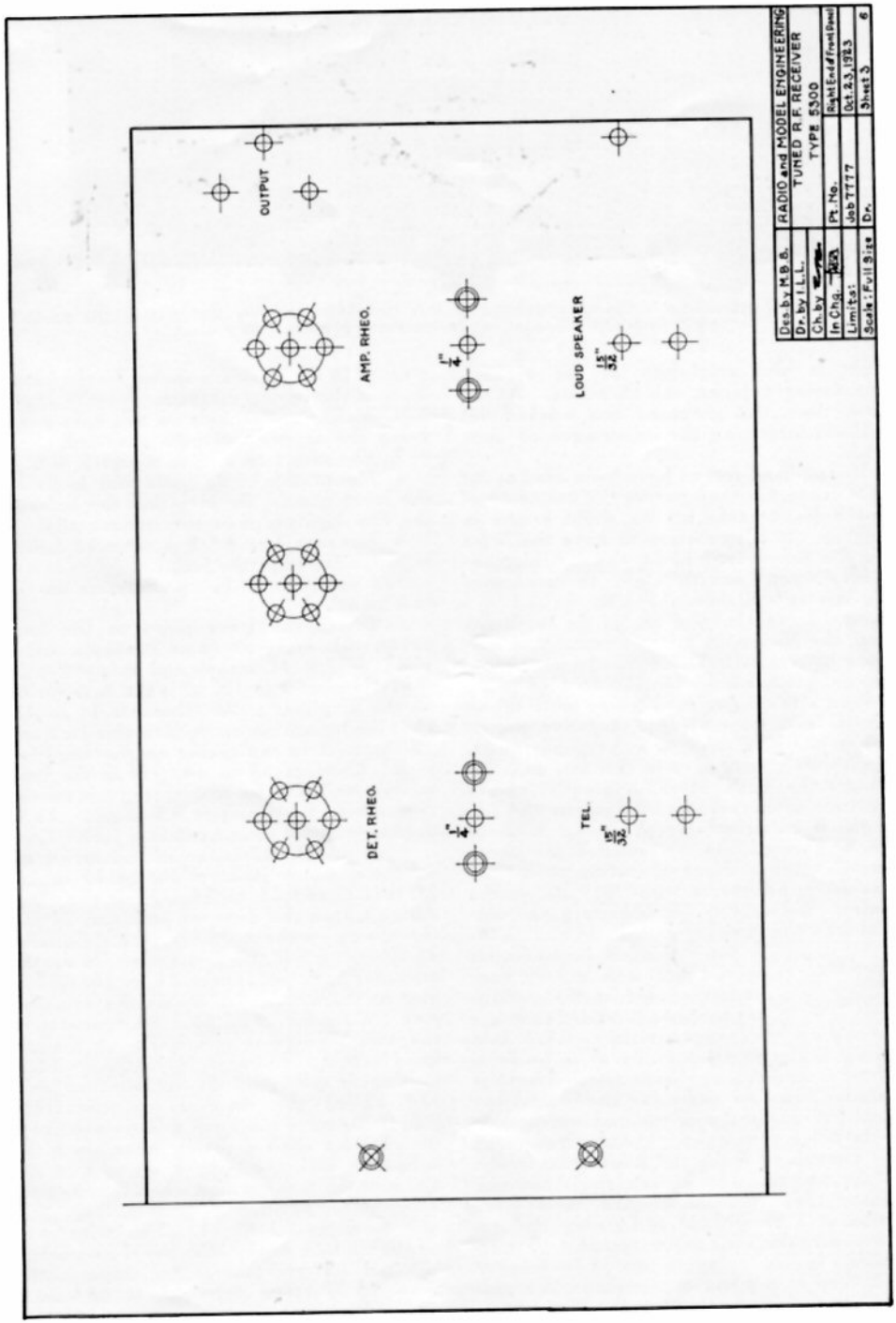

Fig. 5. The right hand half of the front panel, at one-half scale

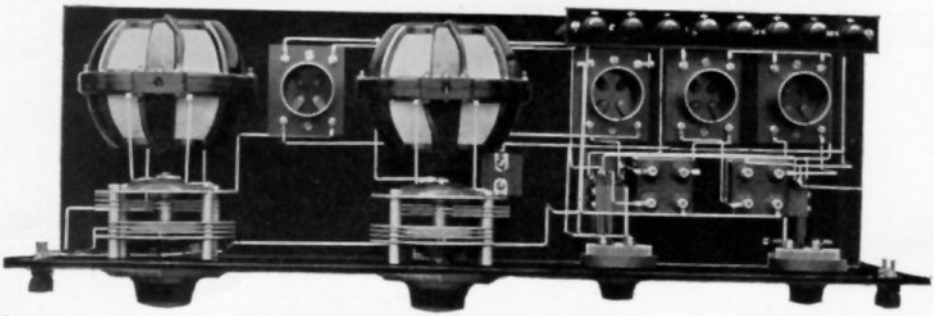

Fig. 1. Very attractive is the arrangement of this four-tube receiver, permitting the parts to be conveniently located while the leads are kept very short

ment is also employed for the sockets, transformers, jacks, and rheostats. At the same time, this grouping was worked out without forgetting the importance of short leads.

Round head screws have been used as far as possible, for they permit the use of oversize holes, to take up for slight errors in drilling. It is important to have the holes and the countersinking for the variable condenser screws exactly right, for otherwise the screws will show the dial.

At the suggestion of one of the engineers from the National Carbon Company, a separate battery is used for the detector plate supply. It has been found advisable to do that on sets employing three or more tubes. The C battery, putting a negative potential on the R. F. and A. F. amplifier tubes, is absolutely necessary in this set, as it increases the signal strength greatly, makes the tuning sharper, and lengthens the life of the B batteries several times. Without the C battery, the current for the three amplifier tubes under operating conditions was 21 milliamperes with 90 volts on the plates. With a 4½-volt C battery, the current was 9 milliamperes.

Assembly and Wiring

Since this set is somewhat spread out, it is a very easy matter to get at the various connections provided they are put on in the proper order. This data should be followed carefully so as to avoid mistakes and wrong connection. Use Nokorode soldering paste for the joints, but the least amount you can put on, as this paste flows very quickly. Have your iron hot enough to make the solder run freely. If you use an electric iron the American Beauty type is recommended as it gives sufficient heat without it burning the tip. Moreover, the tip can be renewed by purchasing a short length of ⅜-in. copper rod, filed at the end to the shape you prefer. Put on the soldering lugs before assembling the parts and have each lug pointed in the direction shown by the heavy lines in the wiring diagram.

1. Mount the sockets on the base panel using the screws and nuts provided.

2. Connect 1 to 2, 3 to 4 and 5 to 6.

3. Mount the binds posts and jacks on the front panel. Be sure that the holes in the Eby binding posts run horizontally.

4. Connect 7 to 8. 8 is soldered directly to the frame of the jack.

5. Mount the A. F. transformers on the base panel.

6. Fasten the front panel to the base panel with the four angle brackets, using ½-in. 6-32 R. H. screws and nuts.

7. Connect 9 to 10. 9 is the base spring on the amplifier jack. Connect 11 to 12. 11 is the top spring on the detector jack and 12 the next to top spring on the amplifier jack. Connect 13 to 14. 14 is the base contact and 13 the first spring up on the detector jack. Connect 15 to 16. 15 is the base contact on the detector jack. Connect 17 to 18. 17 is the second spring up on the detector jack. Connect 19 to 20, 21 to 22, and 23 to 24. 23 is the third spring up on the detector jack and 24 the top spring on the amplifier jack. Connect 25 to 26. 25 is the first spring up on the amplifier jack. Connect 27 to 28. 28 is also on the first spring up on the amplifier jack. Connect 29 to 30. 30 connects to the wire running to terminal 5 on the left hand socket. Connect 31 to 32. 32 is the fourth spring up on the detector jack.

8. Mount the rheostats on the front panel. Remove the knob and pointer from the rheostat shaft and put in its place the indicating dial, fastening it on so that the dial is at the zero division when the rheostat is in the off position.

9. Connect 33 to 34. This wire runs through a hole in the base panel just below terminal 33 and comes up through the panel in front of terminal 1. 34 is a soldered joint on the wire running between 1 and 2. Connect 35 to 36. This wire

also goes under the base panel and comes up in front of terminal 36 which is the F post of the detector socket. Connect 37 to 38, and 39 to 40.

10. Mount condenser Y using ½-in. 8-32 F. H. screws. Put the dial on the shaft so that the zero division is on the line when the plates are totally interleaved.

11. Connect 41 to 42. Connection 42 is made to the contact arm on the shaft next to the panel. Connect 43 to 44.

12. Mount variable condenser X, fastening on the dial as previously instructed.

13. Mount fixed couper A, using the screws and nuts provided. Be sure that you have your soldering lugs pointing outward on the primary or base terminals.

69 to 70. 69 is the fourth binding post and 70 a connection on the wire running from 67 to 68. Connect 71 to 72. 71 is the fifth binding post and 72 a connection on the wire running from 67 to 68. Connect 73 to 74 and 75 to 76. 75 is the first binding post at the left Connect 47 to 48. 47 is the left hand primary terminal. Connect 77 to 78. 77 is the third binding post, from which the wire runs down through a hole in the base panel and up just below terminal 78. Connect 79 to 80. 80 is also on the F binding post of the detector socket. Connect 81 to 82, 83 to 84, and 85 to 86.

This completes the wiring of the receiving set.

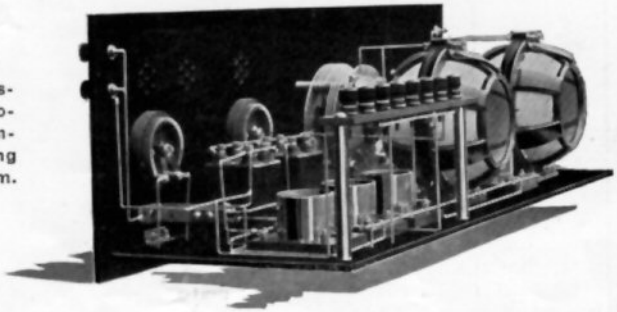

Fig. 3. The sockets, transformers, jacks, and rheostats are built into a compact unit, in the binding posts directly behind them.

14. Conect 45 to 46. 46 is the right hand primary terminal. Conect 49 to 50, and 51 to 52. Terminals 50 and 51 are made by putting ½-in. 6-32 R. H. screws through the condenser holes and fastening on soldering lugs with 6-32 nuts. Scratch the condenser plate and put a little drafting ing across the condenser terminals to serve as a leak. The exact amount can be regulated when the set is in operation. Connect 53 to 54. 54 is the secondary terminal. Conect 55 to 56 and 57 to 58.

15. Mount fixed coupler B.

16. Connect 59 to 60. 59 is the left hand primary terminal. Connect 61 to 62. 62 is the right hand primary terminal. Connect 63 to 64. 64 is a soldering lug under the upper end plate nut of the condenser. Connect 65 to 66. 65 is soldered on to the spring washer at the rear of the condenser.

17. Mount the binding posts on the terminal panel, making sure that the holes are at right angles to the length of the panel. Have the soldering lugs pointing in the proper directions.

18. Connect 67 to 68. 67 is the second binding post from the left and 68 the seventh binding post from the left. Connect

Testing and Operating

Before connecting the B batteries, wire up the A battery, insert the tubes, turn each rheostat to 40 degrees, and see if the tubes light properly when the plug is inserted in the jack. If everything seems all right, put on the C and B batteries and the antenna and ground. Using UV201-A amplifiers and a UV200 detector, you will want 15 to 22½ volts on the detector and 90 to 135 on the amplifiers. The small size, type 763, is satisfactory for the detector, but the amplifiers require the type 767 45-volt batteries. In the illustration showing the complete installation, using the new Brandes Table Talker, you will see a group of the 771 batteries, of 4½ volts each, but, except for laboratory work, the big block is better. A storage battery of 6 volts, 60 ampere-hours is about the right size.

In case you want dry cells for the A battery, you will have to use four UV199 tubes. This can be done by fitting the sockets with Pacent adapters. Use the same C and B batteries, but get six 6-in. dry cells, connected in two parallel sets of three batteries in series. You may need to put a 60-ohm rheostat in series with the lead to the positive A battery post to cut down the

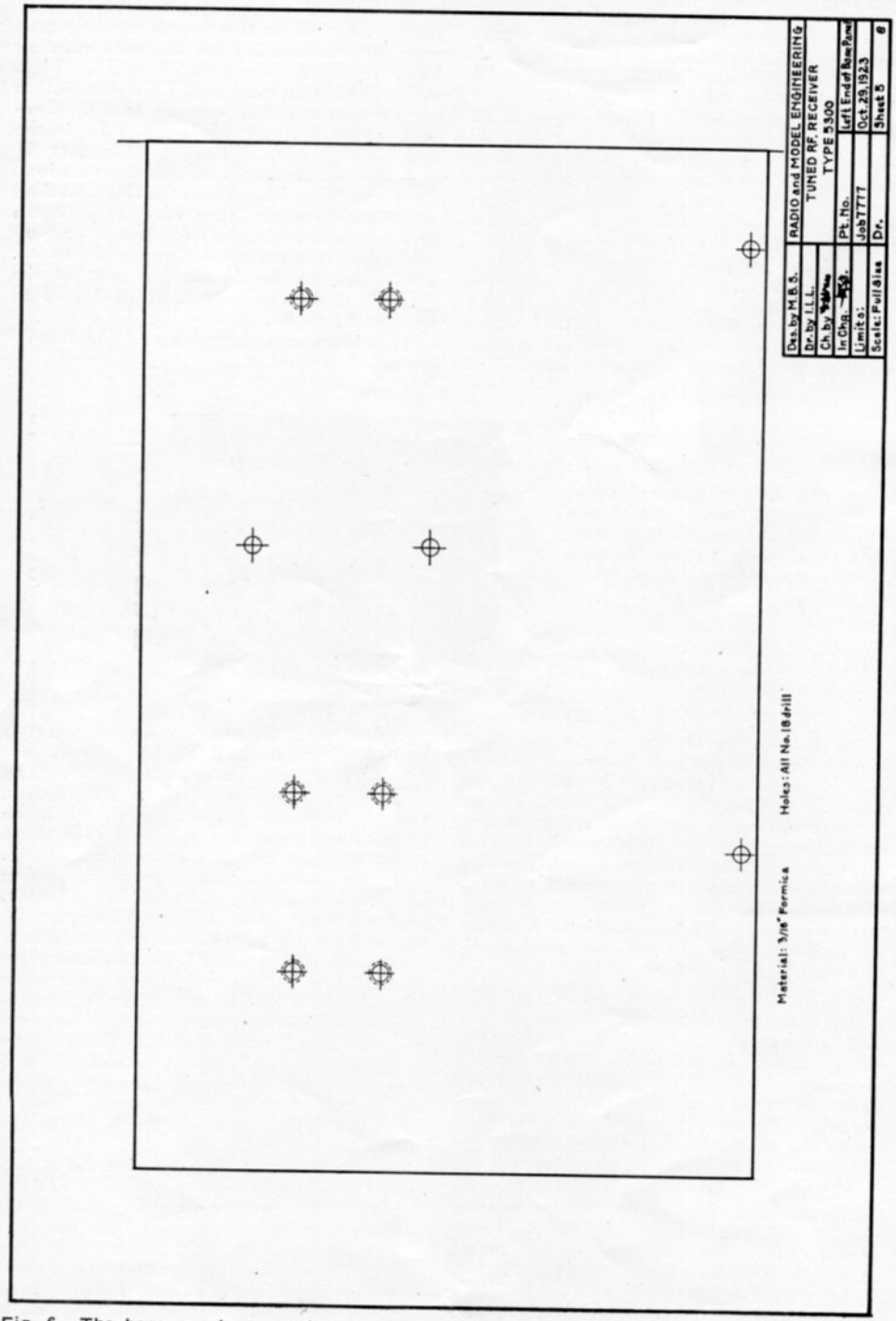

Fig. 6. The base panel, measuring 7 by 23 ins., is cut in half, so that it can be shown at one-half scale

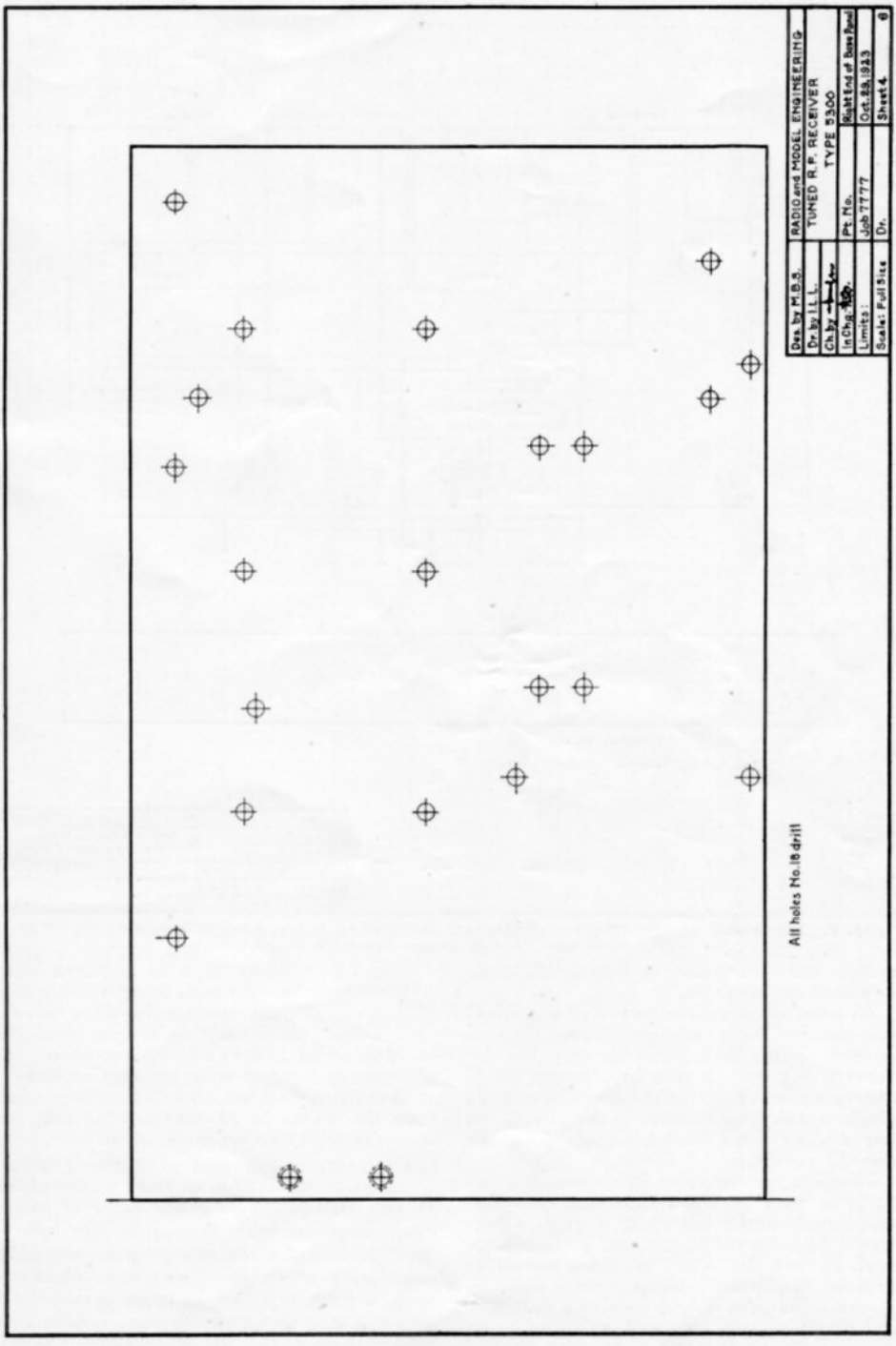

Fig. 7. The right hand half of the base panel. Note that all holes are made in the No. 18 drill

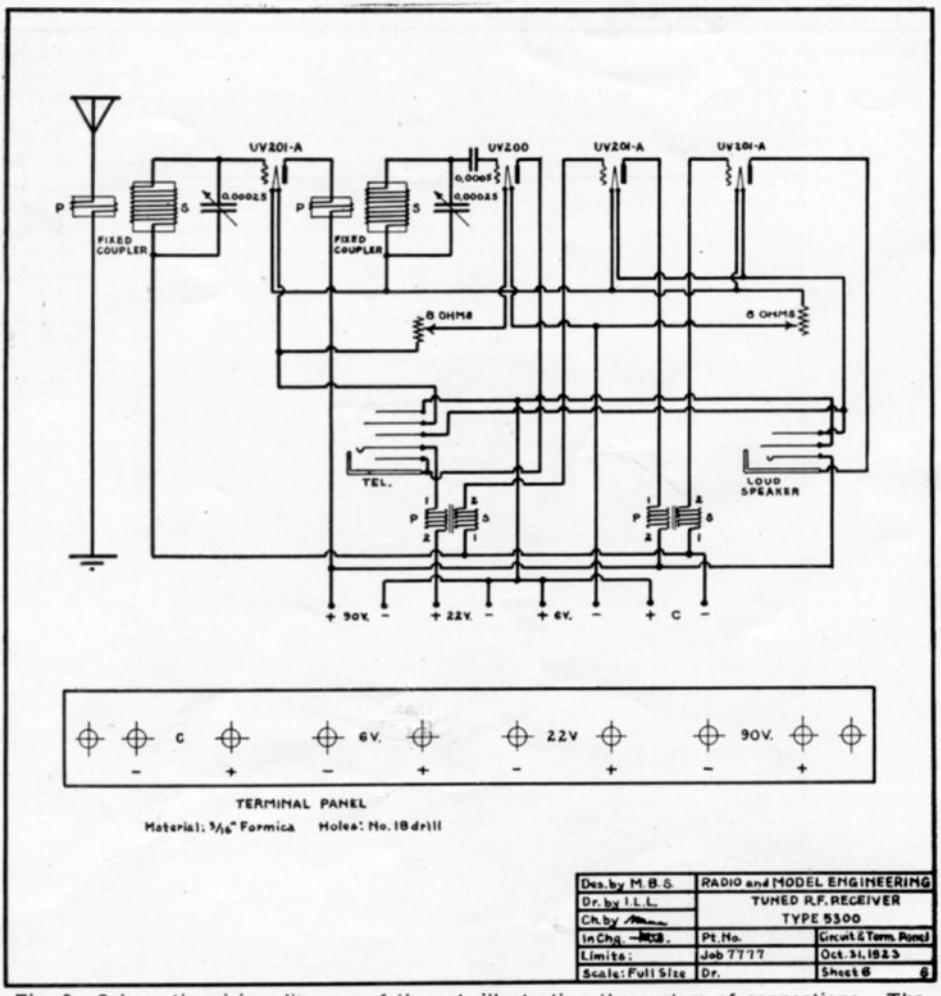

Fig. 9. Schematic wiring diagram of the set, illustrating the system of connections. The terminal panel is shown one-half size

current more than can be done with regular rheostats provided.

As soon as you have tuned in a station, one not too near, try regulating your C battery. With that adjusted, vary the detector B battery. It may help to try the C battery again. Reverse the leads from your telephones or loud speaker to the jack. One way always gives louder signals than the other.

These suggestions are important, for this set is so very sensitive that factors otherwise hardly noticeable make a great difference. An effect that you will probably remark is that the A. F. amplifier seems to increase the detector signals more than on regenerative sets. And you will certainly find that for signal strength and quality of speech under all conditions that this is an unusually fine receiving set.

Antenna and Ground

Any type of antenna can be used with this receiving set, altho the single wire, which may vary in length from 20 ft. in-doors to 200 or 300 ft. out-doors. It is better to use one wire for long antennas, so that its natural period will not be greater than the waves to be received, as may be the case with two or three wires.

Of greater importance is the ground. Connection should be made to water pipes at as many points as possible, or at other metal contacts with the earth. In apartment houses the radiator may be the only connection available. Some experimenters have used a few feet of wire screen laid under a rug and beneath the in-door antena. In fact, this sometimes gives better results than a pipe ground.

RADIO & 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.

EDITORIAL

THE Experimenter who complains that he can't get ahead of new developments far enough to stand still long enough to catch his breath is no worse off than the radio magazines which are expected to keep ahead of the line of advance. But no one who is playing the game for the fun there is in it can really complain about that!

This month finds us moving up again, and truly in the physical sense of moving, for we have packed our editorial bag and baggage and transported ourselves from 88 Park Place, which is very much down town in New York City to 52 Vanderbilt Avenue, right in the center of Manhattan Island. For the benefit of those coming in town who want to find us, Vanderbilt Avenue runs on the west side of the Grand Central Station, or two blocks east of 5th Avenue, and number 52 is just between 44th and 45th Streets. This is in easy walking distance of Times Square. There is also a 42nd Street cross-town car, and the shuttle train in the subway to bring you almost to the door.

Speaking of changes, what would you say in answering letters from R and M readers who say:

"When I buy R and M I get the biggest value for my dime of any of the dimes I spend. However, I'd like to see R and M increased in size, so that there would be more sets described each month to give me a wider choice. Can't you make the magazine thicker and charge a quarter for it?"

To be sure, we can make R and M with so many pages that it will cost a dollar, and worth it, too, but there is, of course, a middle range which must be followed. Won't you take a little time to tell me what you think about this question, so that, in answering these letters, I can give your opinions and not simply my own?

While we have no system for rating sets according to a volume-and-distance-per-dollar scale, the results obtained with the two receivers described in this issue will certainly stand higher than any equipment previously described in R and M. The sets, tho distinctly different in type, are practically equal in results produced and in cost. Mr. William Freeborn, one of the most dyed-in-the-wool Experimenters in New York, who built a tuned R. F. set similar to the one shown in this issue, while we were working on the Magazine model, said that his evening log looked like a call-book. In the three-tube Inverse Duplex we have an ideal design which exceeds in results the expectations of the most optimistic. It is perfectly quiet in operation, and does all the things that are required of a really fine receiver.

And for the model makers we have one of the trimmest sloops that ever sailed a boat pond. More than that, the true form of a racing boat has been maintained in designing a boat to which the same science of sailing can be applied that is required in handling large racing craft. Winter is the model maker's time, and this is the kind of a model that makes the time worth spending. More care and skill in craftsmanship is needed, perhaps in model work than in radio construction, tho both call for the utmost of patience and thoroughness.

The issue of R and M in which the type 5000 four-tube Grimes set was described has been completely exhausted. Consequently there are no more copies to send out with the full-size blue prints. However, that article is reprinted in Reflex and Radio Frequency, advertised elsewhere in this number, so that the assembly details and instructions are still available in that form.

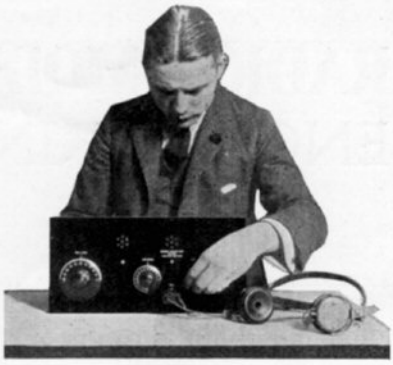
These blue prints, by the way, giving full size panel patterns, are most helpful if you are not good at laying out panels. The print can be glued lightly to the panel and all the holes located with a center punch. Then, after removing the print and washing off the glue, you will have the panel ready to drill.

You will notice that the design method employed for the Grimes set in this issue is quite different from that for other sets which have been shown previously. What do you think of it? I shall be greatly interested in your comments, and, if they are favorable, we shall try it on other equipment. This method cannot be used in every case, of course, but, where it is practical, it offers several obvious advantages. Please tell me what you think about it.

M. B. SLEEPER,
Editor.

Three-Tube GRIMES INVERSE DUPLEX

From the point of view of the radio Experimenter, the three-tube set is the most practical type of Grimes Inverse Duplex



The type 5400 Grimes

NO receiving circuit system which has been brought out during the last seven or eight years has provided as much material for discussion as the inverse duplex. The successful Experimenter swears by it, while those who can't make it work swear at it. Those who like it can prove that it is the best of all radio circuits, while those who don't, or, more often, those who don't want to, believe they can show why it can't be good.

Most enthusiastic reports have been received on the two sets described in Reflex and Radio Frequency.* Some Experimenters have had trouble with howling from the four-tube set, altho that can be overcome by putting a variable grid leak across the grid and filament of the last A. F. amplifier tube, or a small condenser, of 0.001 to 0.003 mfd., determined by experiment, across the primary or secondary of the last A. F. transformer. However, those cases have been the exception, for most of the reports show stations 500 to 2,000 miles away received on loop antennas.

Whatever turn the theoretical discussion may take, actual practice shows the inverse duplex to be decidedly superior to other three-tube sets, either for loop or antenna reception. And if, theoretically, the phase angles ought to run wild and produce unintelligible sounds in the telephones, the fact remains that, properly built and operated, no set will give better or clearer speech than the inverse duplex.

Consequently, the reasonable thing is to get right down to business and get one of the sets in operation. Then it can answer for itself, as it will do creditably if you give it a fair chance by using proper care and the right parts for building it.

*Published by M. B. Sleeper, Inc., New York City. Price 50c.

In planning articles for R and M we must first make sure that the particular combination of parts will work properly. But that is not all the story, for if it were, we would be fulfilling our task by describing a laboratory layout. Radio Experimenters, however, are not simply laboratory workers, nor does an account of an experiment give the whole story. We must carry the work to a point where it is of public and practical use, just as the architect shows us a finished building as the answer to a problem in structural design to which laboratory tests on the strength of materials might have given an answer sufficient for his personal satisfaction.

So it is that, when the design for this three-tube Grimes set was worked out, we tried to make it an outfit to do justice in appearance to the excellence of the circuit. The electrical data presents the very latest developments in the three-tube type, while the mechanical design offers several special features.

In the first place, the instruments are arranged so as to be well protected from dust by the base panel. This is important, as accumulated dust offers paths of low resistance to high frequency currents. By the special arrangement of the sockets and transformers, bringing the connections very nearly to the same plane, the length of the wiring is materially reduced. In fact, there is probably much less wire used than in any other three-tube Grimes set. The front panel arrangement is plain and attractive. You will notice thruout the outfit little features of design or arrangement which give the characteristic touch of scientific equipment which radio apparatus, even tho designed for use by the novice, should have.

You may feel, at first inspection, that this is not an easy set to build. Actually,

(This authoritative information is published with permission of the Sleeper Radio Corporation, licensed for the Grimes Inverse Duplex Inventions)

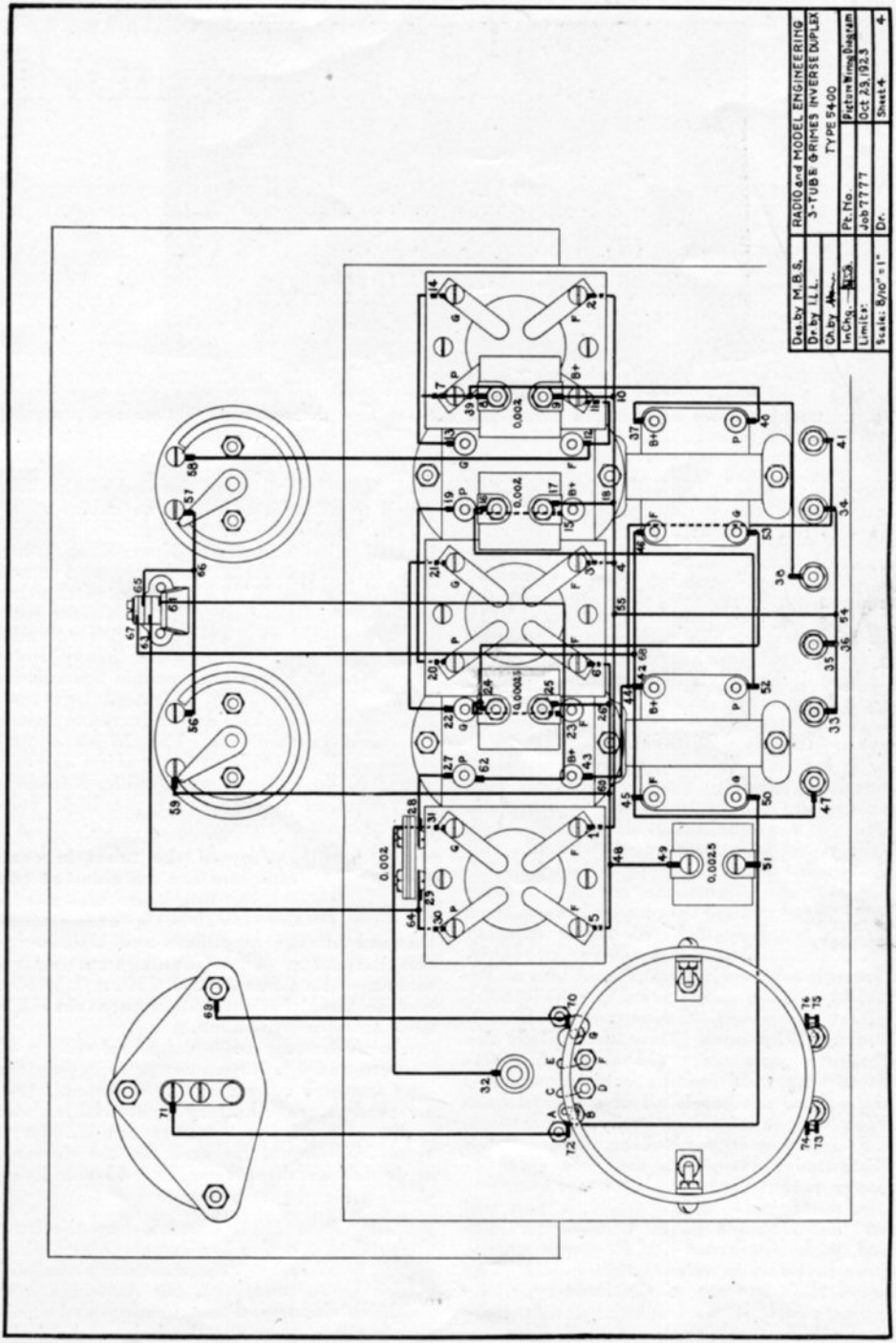


Fig. 7. This picture wiring diagram shows the under side of the base panel dropped down so as to be in the same as the front panel

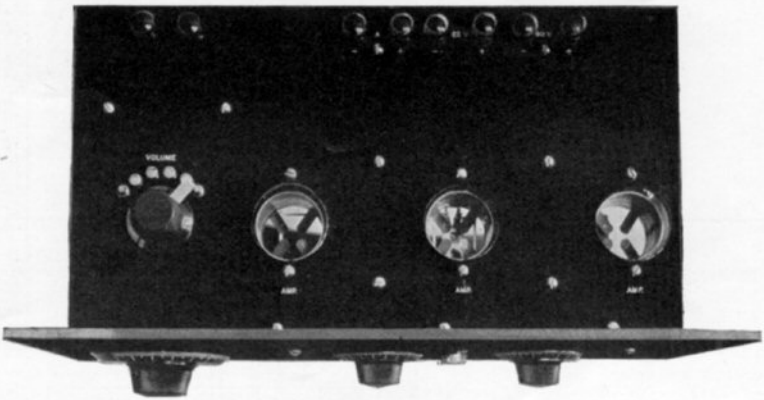


Fig. 1. Looking down on the base panel, you will see how the parts are hidden and protected from dust

however, it goes to-gether without a bit of trouble, and the wiring, when it is being done, is not hard at all.

Construction Work Required

The hardest part of building this set comes in making the three large holes in the base panel. They are 1 9/16 ins. in diameter. Then there are the small holes to drill in the panels, the coil to wind, and the two coil mounting brackets to cut from brass strip 3/8 by 1/16 in. All the parts are standard so that you will have no trouble with them.

As for the cabinet, unless you want something specially arranged for batteries, you can get a 7 by 14-in. size in any radio store. It must be 7 ins. deep inside, and, if the panel is to come flush with the outside it must be of 3/8 or 1/2-in. stock.

Standardized Parts Necessary

Sometimes an Experimenter writes that he built a set from R and M plans, substituting instruments which, probably, a smooth tongued salesman sold him as being just as good as the parts specified. With the set completed, it does not work as it should. Why not? More than likely the substitute parts were old stock that was not moving well, for the equipment called for in these designs is all of standard lines which can be obtained easily. Therefore, there is no need for taking chances with substituted parts which may not give the proper results.

In the Standardized Parts List you will find that Dubilier R. F. transformers are used with Amertran A. F. transformers. These make an excellent combination. The 8-ohm rheostats are of the Fada type, the binding posts, of the insulated design, from Eby, while the panels are of Formica. You will have to get two panels 7 by 14 by 3/16 in., as that is the standard size, but an inch must be cut from the end of the base panel to allow it to fit in the cabinet.

The knobs are of handsomely polished molded bakelite, made by Kurtz-Kash. They are very reasonable in price, and much superior in design and finish to most other makes. Another feature is the Carter jack, a particularly rugged type, with splendid phosphor bronze springs and heavy silver contacts which will not become burned out from breaking the filament current. Sleeper radio sockets and inductance switch are used in this set. The 23-plate condenser, of 0.00055 mfd. capacity, is from the U. S. Tool Company. Dubilier Micadons are required to withstand the high voltages applied to them.

Tubes and Batteries

Any of the tubes in common use are suitable for this set, but to get the best results the UV201-A's are recommended for the amplifiers and UV200 for the detector. The Cunningham equivalents are the C301-A and C300. UV199's can be used thruout, but with a considerable sacrifice in volume.

An A battery of 6 volts and 60 or 80 ampere-hours is large enough to supply the 1 1/2 amperes drawn by the filaments. An Eveready storage battery type 6810 is about right. For the B batteries one 22 1/2-volt type 766 should be used on the detector with two or three type 767 45-volt Everready's for the amplifiers.

Drilling the Panels

Fig. 4 and 5 show the front and base panels at one-half size. By measuring the distances on the drawings, and doubling them, you can quickly and easily locate the centers for the holes. All holes are to be made with a No. 18 drill unless otherwise specified. The three holes for

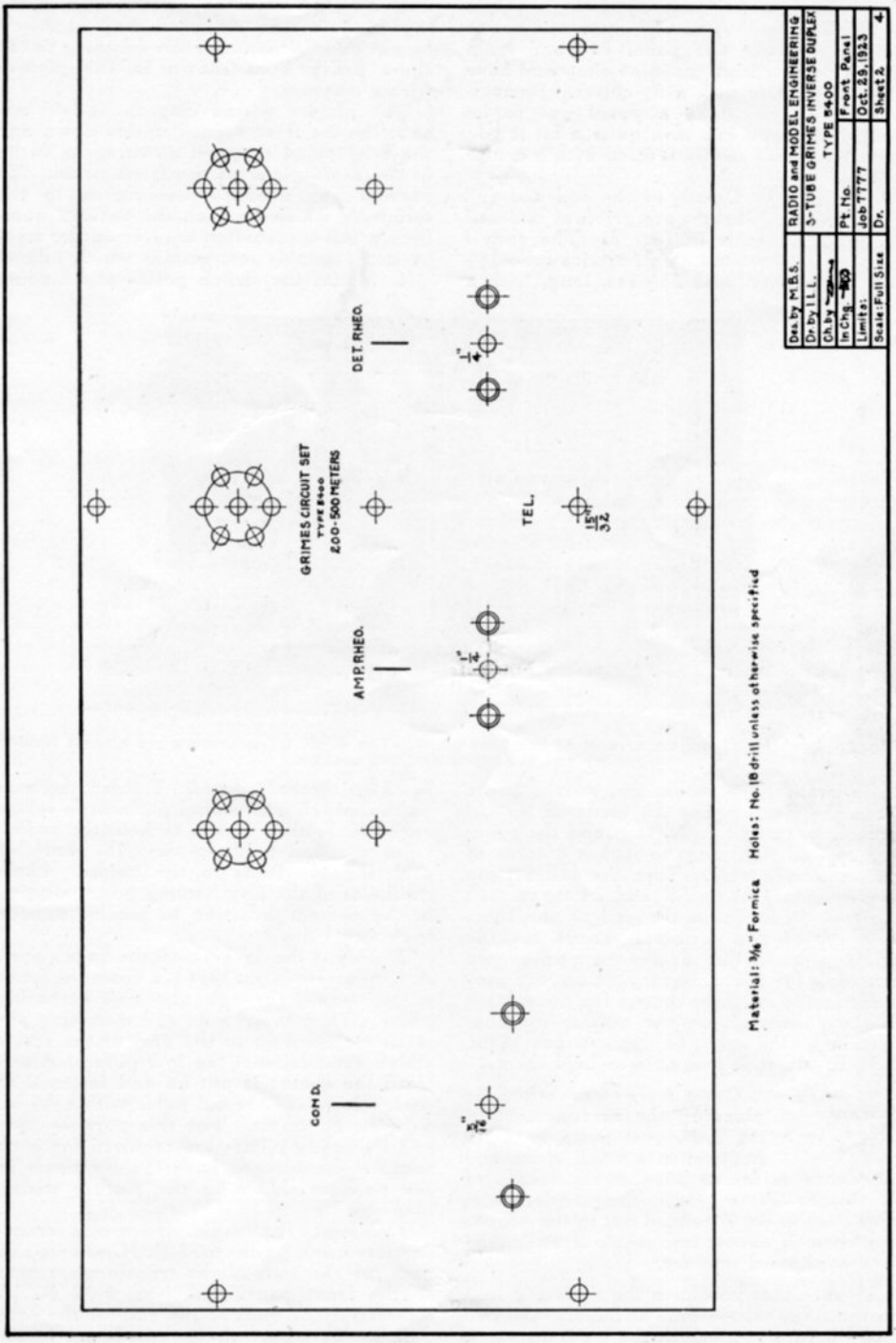


Fig. 4. One-half scale drawing of the front panel, showing the locations of the holes and the engraving

the tubes can be made by drilling circles of small holes. A much better and easier way is to take the panel to your radio dealer or to a local machine shop and have the holes made with a fly-cutter. Remember, when you take a panel out to be drilled that you can save quite a bit if you have each hole neatly located with a center punch.

The Coil and Brackets

Details of the coil and coil brackets are given at one-half scale in Fig. 7. The coil is wound on a Formica tube 3½ ins. in diameter and 2½ ins. long, with a

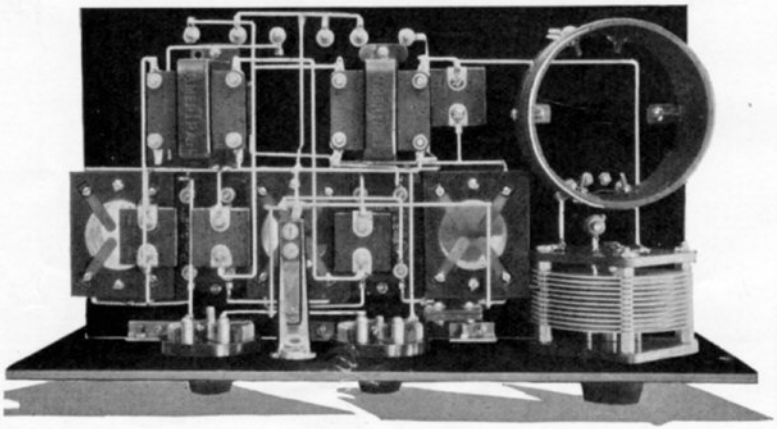


Fig. 2. Looking at the under side of the base panel. The R. F. transformers are almost hidden by the Micadons and the sockets

⅛-in. wall. The secondary, started ¼-in. from the bottom, has 39 turns of No. 24 S. S. C. wire (22 S. W. G.), and the primary, wound right next to it, has 8 turns of the same size wire. Taps are taken from the secondary at 6, 12, and 24 turns. At the top, ¼-in. from the end of the tube, is a set of two terminal screws for the primary, and, 180 degrees opposite, two terminals for the secondary. Lugs are provided inside on these screws for connection to the coils, and, on the outside for connection to the set. The screws are ½-in. 6-32 R. H., with hex nuts to hold them.

Assembly and Wiring

Great care was taken in planning the arrangement of the individual parts so as to fit them in a small space and to reduce as far as possible the length of the leads. As a result, the wiring, altho very easy to do, if carried out in the proper sequence, is almost impossible if attempted in a haphazard manner.

Be sure that you have the soldering lugs on the terminals,—some terminals take two lugs—before you mount the separate parts. Since it is impossible to tighten some of the nuts if they are loosened so as to turn the lugs in the correct direction, the lugs should be put on in a manner corresponding to the short heavy lines shown in the picture wiring diagram.

The picture wiring diagram is laid out as if the set were turned upside down and the base panel dropped down so as to be in the same plane as the front panel. To prevent any misunderstanding as to the terminals which go with the various numbers, a full explanation is given in the step-by-step assembly instructions which follow:

1. Mount the switch points and binding posts on the base panel. Tighten the nuts on the switch points, and put a little solder on each shank. This is to hold the switch point nut and to make easy the work of soldering the leads to the points. Have the holes of the Eby binding posts pointing in the correct direction to receive outside leads.

2. Mount the sockets on the base panel. A 1-in. screw is put through from the front of the panel through one coil mounting pillar. Then the second coil mounting pillar is threaded on to the part of the screw which extends from the first pillar. Afterward the socket is put on and fastened at each side to the second pillar with a ½-in. 6-32 R. H. screw. For this purpose four coil mounting pillars are required for each socket. Be sure to have the terminals in the position shown in the picture wiring diagram.

3. Mount the radio frequency transformers using ½-in. 6-32 R. H. screws and nuts for the ends of the transformers next to the front panel and 1-in. 6-32 R. H. screws for the ends at the rear of the base panel. Make sure the terminals are in the proper position.

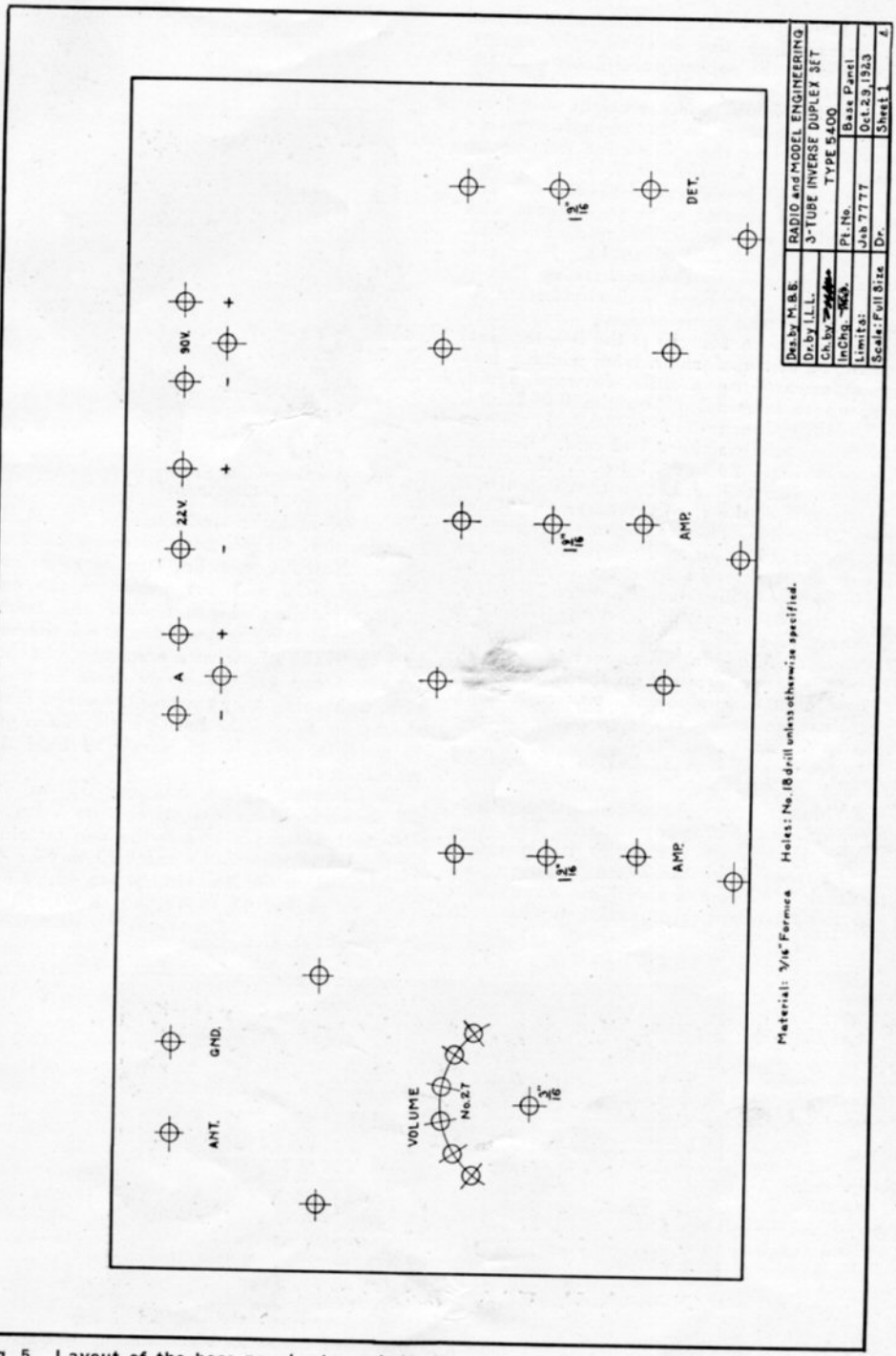


Fig. 5. Layout of the base panel, at one-half size. Note that all holes not otherwise marked are to be made with a No. 18 drill

4. Connect 1 to 2. This wire should be arranged so that it runs right against the sides of the sockets, and flush with the bottoms. Connect 3 to 4, and 5 to 6. This wire should come straight out from the soldering lugs, just far enough from the sockets to clear the connection coming up from terminal 1. Conect 7 to 8. 7 is a lug on the top side of the socket. The wire is bent around so as to connect with terminal 8 on the 0.002 mfd. Micadon. Connect 9 to 10 and 11 to 12. Keep this wire very close to the sockets so that it will not interfere later with connection 37 to 38, from the transformer. Connect 13 to 14 and 15 to 16. 15 is the B+ terminal on the R. F. transformer, from which a lead goes forward, up a little, forward again, and up to terminal 16 on the 0.002 mfd. Micadon. Connect 17 to 18. 17 is the other terminal on the 0.002 mfd. Micadon. Connect 19 to 20 and 21 to 22. Keep this wire close to the socket so that it will not interfere with the rheostats later on. Connect 23 to 24. This arrangement is similar to that of 15 to 16. 23 is the F post of the transformer and 24 a terminal on the 0.00025 mfd. Micadon. Connect 25 to 26. 25 is the other terminal on the Micadon. Connect 27 to 28. 28 is a terminal on the .002 mfd. Micadon. Connect 29 to 30. 29 is the other terminal on the Micadon.

5. Mount the inductance switch, making sure that the collar is giving good connection to the soldering lugs.

6. Connect 31 to 32, 33 to 34, and 35 to 36.

7. Mount the Amertrans with their terminals in the proper positions. The same screws that holds the R. F. transformers at the rear hold the Amertrans on the front side. Remove the 1-in. screws and slip the transformer mounting fin between

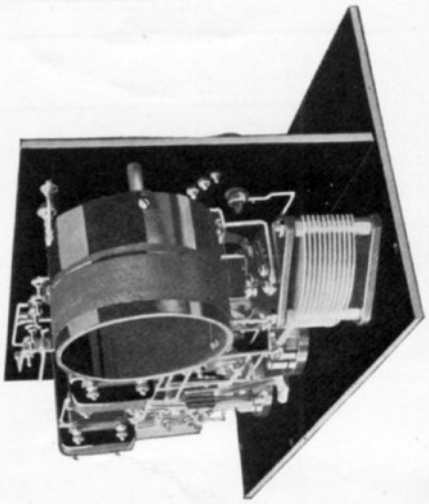


Fig. 3. Another view of the underside of the base panel

the panel and the underside of the R. F. transformer. Then put the screw back in place. Now take another 1-in. screw or rod threaded 6-32 and put a nut on the end of it. Holding the nut over the transformer mounting screw, turn it off the rod and on to the screw with a scriber. In that way you can get the screw down in position, tightening it by turning the screw from the upper side of the base panel. Then put in a ½-in. 6-32 R. H. screw to hold the transformer at the rear.

8. Connect 37 to 38, and 39 to 40. 39 is soldered to the wire from 7 to 8. Connect 41 to 42. 42 is the B+ terminal of the transformer. Connect 43 to 44. 44 is soldered on the lead from 41 to 42. Connect 45 to 46, 47 to 45, 48 to 49, 50 to

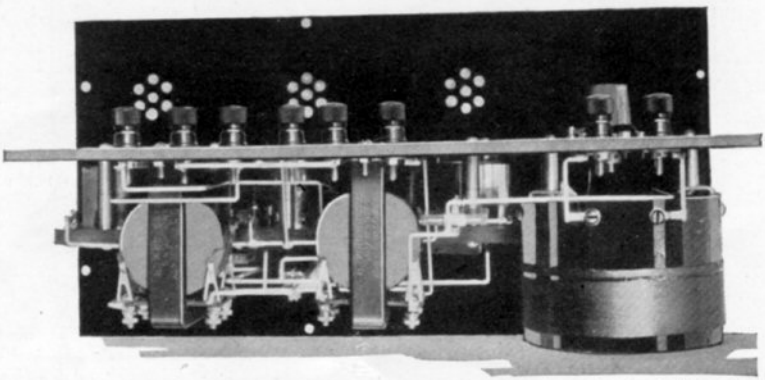


Fig. 1. The rear view illustrates the method of mounting the sockets and the arrangement of the A. F. transformers and coupler

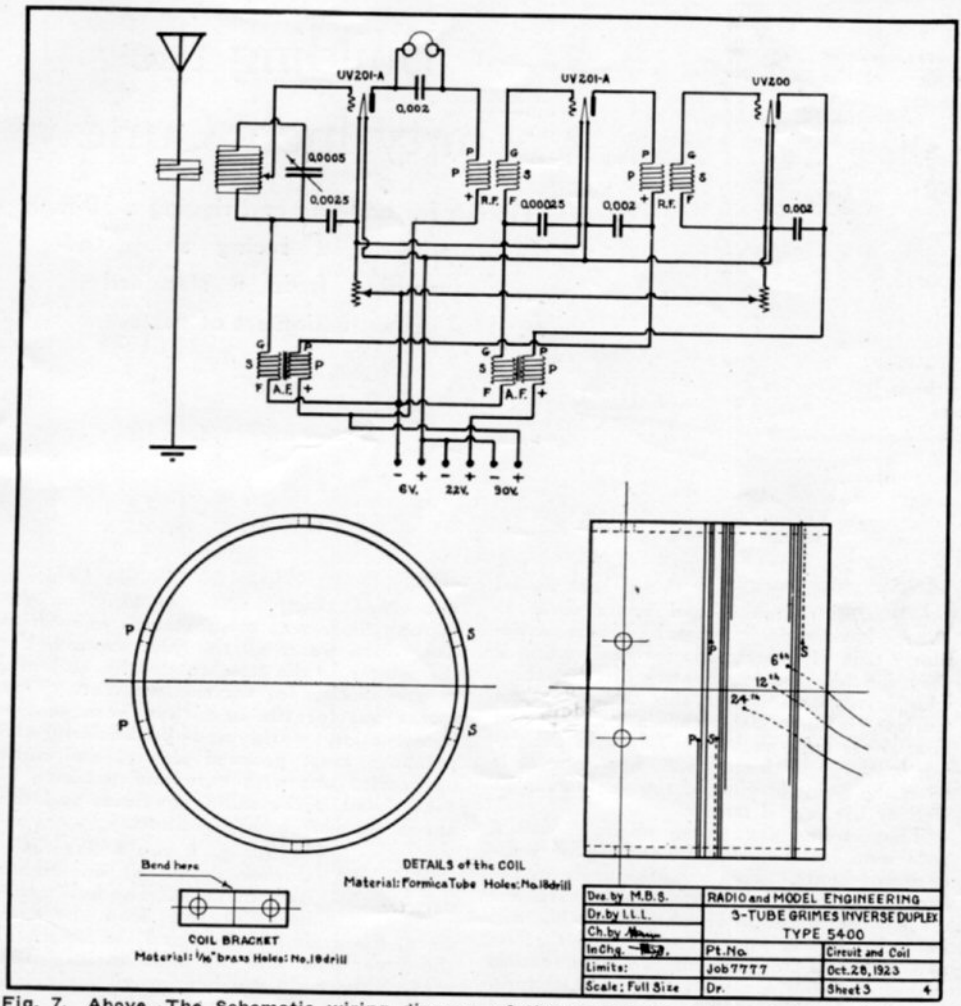


Fig. 7. Above, The Schematic wiring diagram of the three-tube Grimes Set, in which the latest improvements are incorporated. Below, details of the coil and coil brackets

51, 52 to 16, 53 to 24, and 54 to 55.

9. Mount the inductance coil. Fasten the brass angle pieces on the inside of the tube with ½-in. 6-32 R. H. screws. Then secure a coil mounting pillar to each angle, using the same size screws. Finally, mount the pillars to the front panel with ½-in. 6-32 R. H. screws. Connect tap A, from the 6th turn of the secondary, to switch point B, tap C, from the 12th turn, to switch point D, tap E, from the 24th turn, to F, and the end of the coil, which is the 39th turn, going to terminal lug 70, from 70 to G.

10. Mount the variable condenser on the front panel using the ½-in. 8-32 F. H. screws supplied.

11. Mount the rheostats on the front panel, using the screws and nuts furnished. Unscrew the knob and pointer from the shaft and put in its place the 2-in. knob and dial, so that the zero division will be on the line when the contact arm is in the off position as in the picture wiring diagram.

12. Mount the filament control jack.

13. Connect 56 to 57.

14. Fasten the three angle brackets to the front panel, using ½-in. 6-32 R. H. screws. Then fasten the base panel to the angles. If you have trouble in getting the nuts into position, use the same method as is recommended for the transformer screws.

15. Conect 58 to 12, 59 to 60, 61 to 62, 63 to 64, 65 to 66, 67 to 68, 69 to 70 and

(*Concluded on Page 226*)

Building the Thirty-Inch Curlew

Details for building and rigging a 30-inch Marconi-rigged racing sloop, assembled from a standard construction set of parts

OF all the different things that model makers make, sail boats seem to have a special appeal. This is particularly true of boats made for real sailing if they sail like the big boats. Mr. Boucher, who is responsible for the design of the Curlew, is as widely known as a model boat racer as a yachtsman, and, in designing craft for the boat pond, has gone at it from the point of view of the yachtsman as well as the model maker.

That is, the yachtsman wants to see a race won by the skillful handling of well-designed boats. This calls for uniform design. The model maker wants to turn out a scale reproduction of a big boat, that will be attractive in appearance. The Curlew can be made from a standard construction set, comprising a carved and finished hull, keel, spars, sails, and all the rigging and fittings, so that the standard design is thus established. In a race between two boats of this class, if they are assembled with equal workmanship, there is no advantage to either in hull design or sail area. Consequently, racing, as it should be, is a matter of skillful sailing and sportmanlike observation of the yachting rules.*

However, not all boats can be raced in that way, for a model boat must act like a big one if it is to be handled like one. And there the ability of the designer comes into play. A model which will sail before the wind only cannot be run over a course that calls for rounding buoys, and tacking, nor can adjustments be made continually during the race.

*Information concerning the American rules for model yacht racing will be sent upon application to the Model Editor.

During the winter we are not as much concerned about sailing or building, excepting those who are fortunate enough to have open water all the year around, but the winter is the time to do the building, in preparation for warmer weather. That works out for the best, too, because the construction work, and particularly the painting, must proceed slowly, and must be carried out with care and patience in each detail if the sailing qualities and the appearance are to be the finest.

Design of the Curlew

In Fig. 1 you will see the Curlew drawn at one-eighth its actual size. The hull measures 30 ins. from bow to stern, the draft is 8 ins., and the height of the lower mast and top mast 48 ins. The area of the main sail is approximately 462 sq. ins., while the jib measures 144 sq. ins., giving a total sail area of 606 sq. ins.

For convenience in rigging and carrying, the jib halyard and the mast stays are provided with hooks which catch in rings on the bowsprit and on the deck, so that the mast and sails can be removed or put in place quickly.

You will notice that the bowsprit, held to the deck by two wood screws, also acts as a step for the mast. The reason for this arrangement is to permit adjustment of the longitudinal position of the mast. The wood screws are in slots cut in the bowsprit. Therefor, when the screws are loosened, the bowsprit and mast can be shifted forward or to the stern. Provision is made for a movement of 2 ins. In this way, the center of effort of the wind acting upon the sails can be altered to suit the strength of

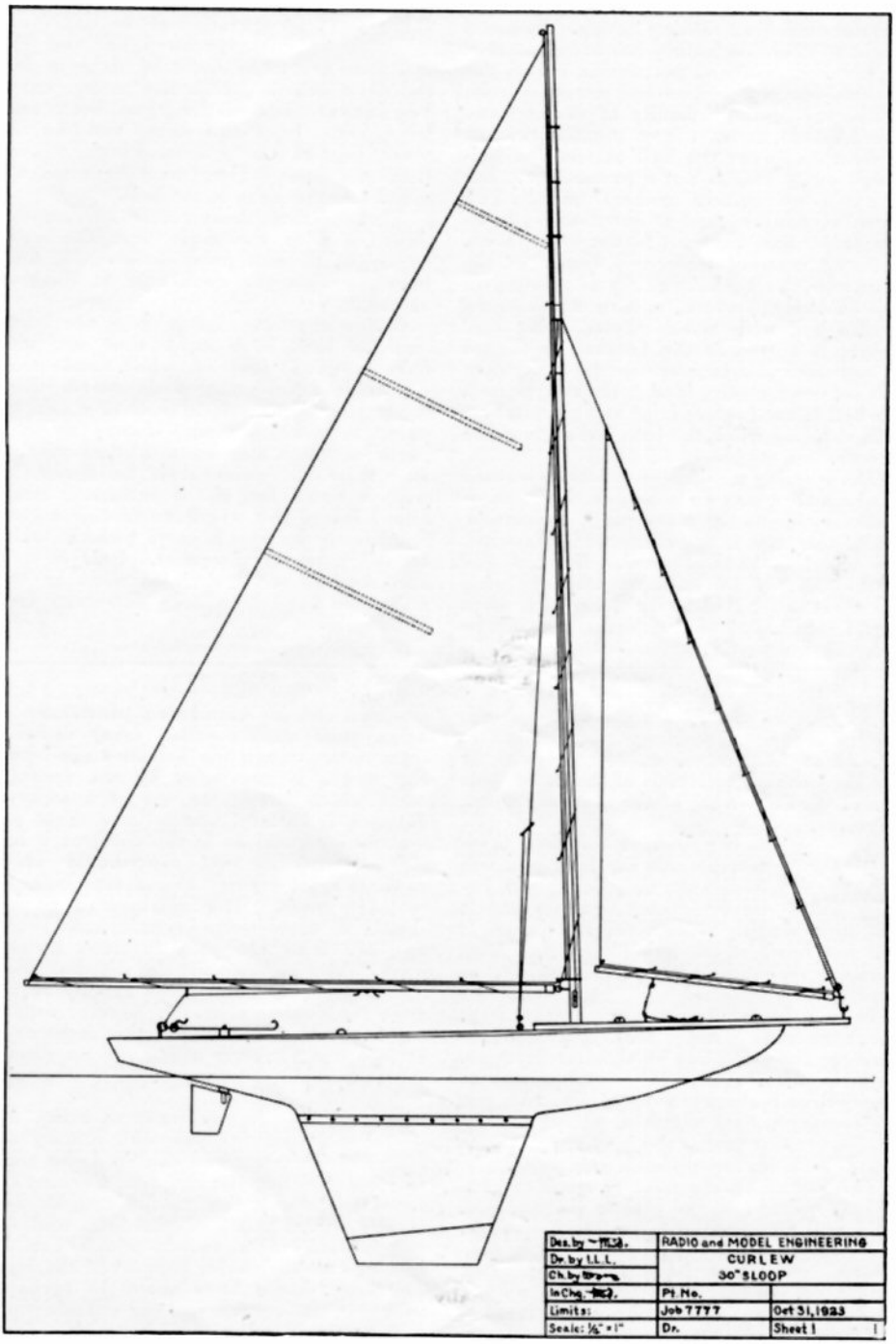


Fig. 1. One-eighth scale drawing of the Curlew, showing the construction and rigging details

the wind. In the section on sailing, complete information will be found concerning the use of the sail shifting device. It should be noted that this feature has been patented by Mr. Boucher, and permission for its use is given for non-commercial purposes only.

Because of the difficulty of shaping and carving boat hulls, it is of great advantage to be able to get the hull carved and hollowed out. This is not a pressed hull, but is cut from pattern makers' pine. You must, of course, sand it down and put on the paint, but that part is not hard to do.

An interesting feature is found in the design of the keel. The fin is rivetted to two angle strips which, in turn, are fastened to the hull with wood screws. The lead weight is cast onto the fin, and is shaped so as to act as a support for the boat when it is set down on dry land. Thus supported, the hull is not in danger of being scratched, as is the case when the boat is put down on its side.

The steering mechanism has been worked out in such a way as to be practically automatic, so far as the main sail is concerned. When the boat is travelling with the wind, the sheet is hooked to the forward end of the tiller, or for sailing against the wind the sheet is secured to the other end, as in Fig. 1. Instructions for adjustment will be given in a subsequent section.

Preliminary Work on the Hull

The first part of the assembly is concerned with the preparation of the hull. Two deck beams, ¾-in. and 1¼-ins. wide are to be fitted in place to hold the deck and to give it the proper curve. The forward side of the ¾-in. beam must be 4¾-ins. from the stern, and the forward side of the 1¼-in. beam, 6⅝-ins. from the bow. They must be fitted and glued into the sides of the hull.

That done, the beams must be smoothed down, and at the same time the upper edges of the hull must be given a slight bevel so that the deck will fit flush all around.

Before anything else is done, the beams and the hull, both inside and out, must have a good coat of white lead paint, rubbed into the grain of the wood with a fairly stiff brush. It is well to strain the paint to take out any lumps or solid particles which may be in it. Remember at all times that paint must be applied in smooth coats, for, if the surface is rough after drying, you will have trouble in rubbing down the rough spots without taking off too much of the paint. Bear in mind also that all wood surfaces must be varnished or painted to keep the water from soaking in.

(To be concluded)

Three Tube Grimes—(Continued from Page 223)

71 to 72. 70 and 72 are the terminal lugs for the secondary winding. Connect 72 to 51, 73 to 74, and 75 to 76. 74 and 76 are the primary terminals of the coil. This completes the wiring of the Inverse Duplex Reveiver.

Testing and Operating

If you have followed these instructions carefully you will have a set thoroughly well behaved in every particular. It will tune sharply with a single control, it will not howl at all, it will give you long distance reception with perfect quality at loud speaker volume.

In case the set does not behave that way, check up your wiring, with particular regard for the polarities on the transformers. Test the transformers for open circuits or short circuits between windings, and test the condensers for shorts or wrong capacities. If an irregular, scratching noise is heard, look for excess soldering paste.

The switch on the base panel is to control the voltage on the grid so that the first tube will not overload on local stations. You will probably vary this switch very seldom, once you have found where it should be. If you run the switch up too far on loud signals distortion will occur, but the correct adjustment is easy to determine. If there is local interference, put the switch on the first or second point. This helps to sharpen the tuning. B battery troubles can be eliminated practically by using good quality cells. Any difficulty from noises, when the batteries are nearly run down, is prevented by the arrangement which allows the use of a separate detector B battery. Sometimes these sets are quite critical as to the detector B battery voltage, so that you should use a variable type, trying various taps from 15 to 22½ volts. The amplifier B battery should be of 45 volts for telephone reception or 90 to 135 volts for loud speaker work. You must adjust the detector rheostat carefully so as to get it exactly on the most responsive point. It is surprising to see how much difference the detector B battery and rheostat will make on distant stations.

Using a Loop

If you want to make this set for use with a loop antenna you can do so by omitting the coupler. Connect the two leads which run to the coupler secondary to the ends of the loop and the switch lead to a switch which can be mounted on the center support of the loop. The loop should have about 15 turns of wire 2½ ft. square for the outside turn, running in, in a flat pancake, with a spacing between the wires of ¼-in. Four taps should be taken off at the 2nd, 5th, 9th and 15th turns for the volume control switch.

Standardized Parts List

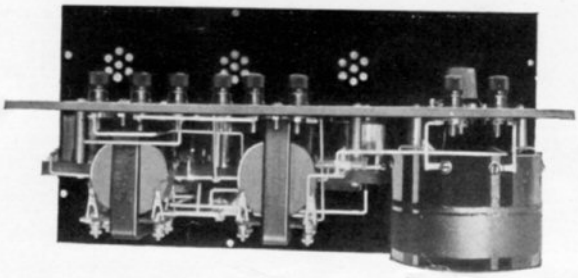
The materials used to make up the sets described in this issue were supplied by the following companies. The manufacturers whose names appear below will be glad to send you bulletins describing other products which they make. Please mention R & M when you write them.

PARTS FOR THE TYPE 5300 R.F. RECEIVER

Type	Name	Price
	F. A. D. Andrea, Inc. 1581-S Jerome Ave., New York City	
153-A	2—8-ohm rheostats	$2.00
	Dubilier Condenser & Radio Corp. A-48 W. 4th St., New York City	
601	1—0.0005 mfd. Micadon	.35
	H. H. Eby Mfg. Co. X-701 Chestnut St., Philadelphia, Pa.	
Ensign	12—Ensign binding posts	2.40
	Kurtz-Kash Co. Dayton, Ohio	
A-218	2—3¾-in. tapered knobs & dials	2.40
A-212	2—2-in. tapered knobs and dials	1.20
	Pacent Electric Co. A-22 Park Pl., New York City	
66	1—5-spring filament control jack	1.00
65	1—3-spring filament control jack	.90
	Malone-Lemon Laboratory 342-R Madison Ave., N. Y. City	
A-44	2—0.00025 mfd. balanced condensers	8.00
	Sleeper Radio Corp. 88-F Park Pl., New York City	
A-14	2—A. F. transformers	10.00
A-1-X	4—Standard base sockets	3.20
A-209	2—Fixed couplers	8.00
	MISCELLANEOUS PARTS	
156	2—Formica panels 7x24x3/16 in.	8.36
58	2—Pkg. 25 small tinned lugs	.40
47	8—2-ft. lengths sq. tinned copper bus bar	.40
185	2—Angle brackets, left hand	.20
22	2—Angle brackets, right hand	.20
72	1—Pkg. 10 ½-in. 8-32 R. H. nickeled screws	.14
75	1—Pkg. 10 ½-in. 8-32 F. H. nickeled screws	.14
63	2—Pkg. 10 ½-in. 6-32 R. H. nickeled screws	.24
49	3—Pkg. 10 6-32 nickeled nuts	.24
131	2—Terminal panel supports, polished nickel	.60
	Cost of complete set of parts	50.37

PARTS FOR THE TYPE 5400 INVERSE DUPLEX

Type	Name	Price
	American Transformer Co. 178-L Emmet St., Newark, N. J.	
A-82	2—1 to 5 A. F. transformers	14.00
	F. A. D. Andrea, Inc. 1581-S Jerome Ave., New York City	
143-A	2—8-ohm rheostats	2.00
	Dubilier Condenser & Radio Corp. A-48 W. 4th St., New York City	
601	3—0.002 mfd. Micadons	1.20
601	1—0.0025 mfd. Micadon	.40
601	1—0.00025 mfd. Micadon	.35
A-43	2—Duratran R. F. transformers	10.00
	Carter Radio Co. G-209 South State St., Chicago, Ill.	
103	1—Open circuit filament control jack	.90
	H. H. Eby Mfg. Co. X-701 Chestnut St., Philadelphia, Pa.	
Ensign	8—Ensign binding posts	1.60
	Kurtz-Kash Co. Dayton, Ohio	
A-213	1—3-in. tapered knob and dial	.75
A-212	2—2-in. tapered knobs and dials	1.20
	Sleeper Radio Corp. 88-F Park Pl., New York City	
A-1-X	3—Audion sockets	2.40
A-9	1—1-in. radius switch	.50
	U. S. Tool Co., Inc. 117-T Mechanic St., Newark, N. J.	
CS114	1—23-plate condenser	2.80
	MISCELLANEOUS PARTS	
154	2—Formica panels 7x14x3/16 in.	4.98
58	1—Pkg. 25 tinned soldering lugs	.20
47	5—2-ft. lengths sq. tinned copper bus bar	.25
22	3—Right hand nickeled angle brackets	.30
63	2—Pkg. 10 1-in. 6-32 R. H. nickeled screws	.24
143	1—Pkg. 10 ½-in. 6-32 R. H. nickeled screws	.14
49	2—Pkg. 10 6-32 nickeled nuts	.16
A-13	4—Switch points, polished nickel	.16
A-28	2—Stopping points, polished nickel	.08
14	14—Coil mounting pillars, nickeled	1.12
174	1—Formica tube, 3½ ins. diam-2½ ins. long, ⅛-in. wall	.56
114	1—Brass strip ⅜x1/16x12 ins.	.15
40	1—¼-lb. No. 24 S. S. C. wire	.75
	Cost of complete set of parts	50.11
	AUXILIARY EQUIPMENT	
	National Carbon Company Long Island City, N. Y.	
763	Small 22½-volt B battery	$1.75
766	Large 22½-volt B battery	3.00
767	Large 45-volt B battery	5.50
771	4½-volt variable battery	.70
6810	50-amp. storage battery 6 volts	15.00
	Stanley & Patterson West & Hubert Sts., New York City	
843	Deveau Gold Seal Phones, 2200 ohms	6.00
844	Deveau Gold Seal Phones, 3200 ohms	8.00
	C. Brandes, Inc. 237-M Lafayette St., New York City	
	Brandes Table Talker	10.00
	Pacent Electric Co. A-22 Park Pl., New York City	
40	Universal phone plug	.50
51	Twinadapter for two plugs	1.00
20	Adapter for UV199 or C299 tubes	.50



Parts for the Grimes Set $50.00

The most efficient 3-tube circuit ever devised. You can assemble this set in your kitchen table shop, using only the simplest tools, from the complete set of parts which DURRANT can ship you the day your order is received. DURRANT can also supply all the instruments and supplies for building any set described in R and M at the prices given in the standardized parts lists.

EXPERIMENTERS IN NEW YORK

can now buy parts at the new DURRANT office, but service facilities for assembling and testing cannot be provided at the present time.

DURRANT RADIO, Ltd.

AS NEAR AS YOUR MAIL BOX

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Where Can I Buy Genuine Sleeper Parts?

David Grimes, Chief Engineer of the Sleeper Radio Corporation has been asked this question by thousands of amateurs who have read his three great feature articles on the Sleeper Monotrol published in the New York Sun-Globe and Chicago Daily News afterwards reprinted by dozens of newspapers all over the country.

Buy Them of Your Nearest Dealer

When using the Grimes Inverse Duplex System in any combination, use the parts called for by Mr. Grimes himself. Use Sleeper transformers, fixed couplers, sockets, etc. Your own home dealer can supply them quickly.

ROLL CALL OF SLEEPER DISTRIBUTORS

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Clark & Tilson
Manhattan Electrical Supply Co.
Radio Stores Corporation
Stanley & Patterson
Times Appliance Co., Inc.

ALBANY, N. Y.
Albany Radio Corp.

NEWARK, N. J.
North Ward Radio Co.

PHILADELPHIA, PA.
Elliott-Lewis Electrical Co., Inc.

PITTSBURGH, PA.
Ludwig Hommel & Co.
Union Electric Co.

BALTIMORE, MD.
Southern Electric Co.

RICHMOND, VA.
Southern Electric Co.

NORFOLK, VA.
Southern Electric Co.

CHARLOTTE, N. C.
Carolina Radio Co.

TOLEDO, OHIO
The F. Bissell Co.

CINCINNATI, OHIO
Post-Glover Electric Co.

MONTREAL, QUE.
Perkins Electric, Ltd.

TORONTO, ONT.
Perkins Electric, Ltd.

LONDON, ONT.
Towe & Towe

WINNIPEG, MAN.
Perkins Electric, Ltd.

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DETROIT, MICH.
Detroit Electric Co.

CHICAGO, ILL.
Commonwealth Edison Co.
Manhattan Electrical Supply Co.

MINNEAPOLIS, MINN.
*Twin City Radio Sales
Hall Hardware Co.
Warner Hardware Co.

ST. PAUL, MINN.
Pioneer Electric Co.

ST. LOUIS, MO.
Manhattan Electrical Supply Co.

LINCOLN, NEBR.
American Electric Co.

DENVER, COLO.
Reynolds Radio Co.

PHOENIX, ARIZ.
Nielsen Radio Supply Co.

DALLAS, TEX.
C. C. White Electric Co.

SAN ANTONIO, TEX.
Alamo Radio Electric Co.

SEATTLE, WASH.
*George H. Maire

PORTLAND, ORE.
*H. A. Killam

SAN FRANCISCO, CAL.
*A. S. Lindstrom
Alexander Lavenson Electric Supply Co.

LOS ANGELES, CAL.
*Electric Sales Co.
Cook-Nichols Co.
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"DEVEAU GOLD SEAL" HEAD SETS are electrically and mechanically,—as well as from a radio standpoint,— as perfect as the highest-priced Head Set on the market,—yet, with all their perfection, they retail at only $8.00 for 2200 Ohm and $10.50 for 3200 Ohm.

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