RADIO Engineering

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

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Edited by
M.B.SLEEPER

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RADIO ENGINEERING

Edited by M. B. SLEEPER

Associate Editor, Alfred A. Ghirardi

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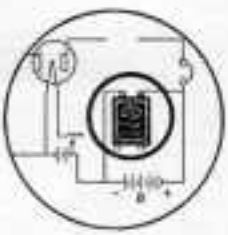

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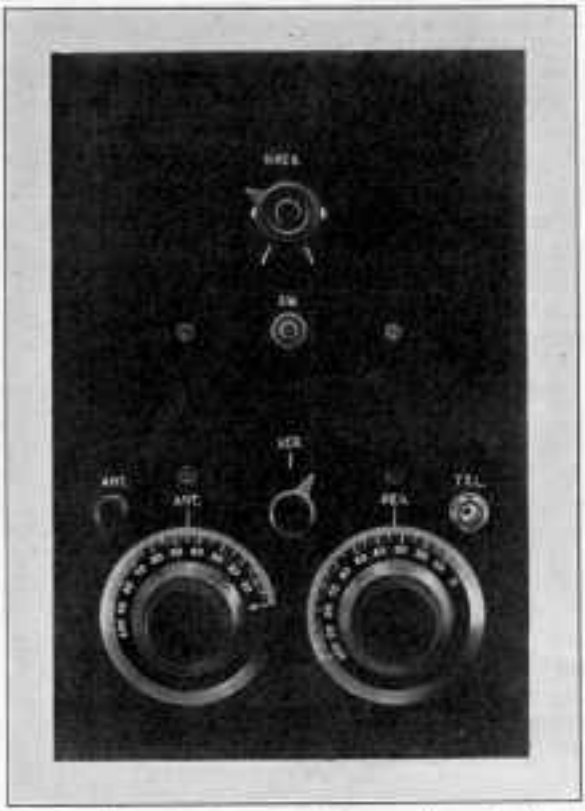


Fig. 1. With the high panel design, the controls are located conveniently at the center.

Summer Camp Set

A Set Designed to Meet the Special Summer Requirements Which Our Readers Have Specified

WITH the advent of warm weather, special sets appear automatically—types which, in most cases, reflect the ideas of the designers as to the way in which they think radio sets should be used, rather than the way most people want to use them.

Bearing this in mind, the type 7600 set was planned in accordance with specifications which we obtained from our readers. From the information and suggestions received, it appears that the most popular use for a radio set in the summer time is as a semi-permanent installation in a summer camp. Apparently the photographs showing people dancing to radio music on the beach, listening in on picnics, and installations for automobiles are simply posed for news pictures.

There is a real use for radio sets at summer camps where, out of touch with news from the cities and at some distance from the theatres, radio does serve a real useful purpose.

Design of the Type 7600 Receiving set

In RADIO ENGINEERING for December 1923 was a description of the X-4000 receiver, a 2-variometer outfit with a vacuum tube detector. We have had most enthusiastic reports on this set because of the long distance results obtained from it with loud speaker reception. A number of requests have been received for data on this type of outfit with the addition of

a 2-step audio amplifier so that distant stations can be brought in with loud speaker volume.

Consequently, we chose this circuit for the summer camp set as it is capable of bringing in distant stations, even with the dry cell tubes, with splendid volume.

The set is not recommended for use in the city because it is of the single circuit regenerative type and radiates considerably. Out in the country this is not an objectionable feature as it is not liable to interfere with reception at other stations.

As you will see from the accompanying illustrations, two variometers are provided for tuning, one to regulate the wavelength and the other to make the set regenerative. On the tube panel are sockets for three UV199 tubes with the A. F. transformers mounted below. Instead of using a vernier dial for the tuning variometer, a vernier condenser of the low-loss type is connected across the variometer for fine adjustment. A single rheostat controls all three tubes.

The antenna for this set can be a single wire perhaps 100 ft. long and 10 to 40 ft. high. A fence will serve admirably as an antenna, or a length of insulated wire, 50 to 100 ft. long, can be thrown up into a tree. To allow the use of such a wide variety of antennas a 0.0001 mfd. Micadon is put in series with the antenna lead inside the set. This is shown in Fig. 4.

The ground must be the best you can get. If there is a pump handy, a wire can be run to it, fastened with a ground clamp on the pipe where it has been thoroughly scraped of rust or paint. Otherwise a wire should be soldered to several tin cans dropped in the water. If there is a fence nearby in which the horizontal wires are not connected together, the top wire can be used for the antenna and the bottom wire for the ground.

A medium size 45-volt B battery is recommended, with four dry cells connected in series for the A battery. Usually only three dry cells are used, but, for this set, four are better. The rheostat, of 20 ohms, takes care of the extra battery. If there is any place where a storage battery can be recharged every two or three weeks, it may be more satisfactory to use the little 4-volt Philco glass case battery. This is a small light unit designed specially for 199 tubes. The Philco battery is equipped with two small colored balls. When the battery is fully charged, both of the balls are at the top of the electrolite, when the battery is partly discharged, one ball drops, and at full discharge, the second ball drops. In this way ample warning is given that recharging is necessary.

No cabinet is shown for this set because the individual builder may want to incorporate the batteries in the cabinet or put them up in a separate box. Both the batteries and the set should be protected from moisture particularly if the outfit is to be operated near salt water. This factor has been considered in working out the details of the design. Moreover, the construction is very rugged in order

For the Set Builder

The parts listed below are those which have been chosen for use in the Type 7600 set. They are not recommended to the exclusion of other good, equivalent parts, but are listed for the benefit of those working from our construction blue prints which show the correct panel drilling for the original set as it was built at the Darien laboratory.

1—Panel 8 by 12 by 3/16-in.
1—Panel 3½ by 14 by 3/16-in.
2—General Radio variometers
1—National 1—3½ A. F. transformer
1—National 1—6 A. F. transformer
1—Vernier condenser
1—General Radio 20-ohm rheostat
3—Naald 199 sockets
1—Open circuit jack
2—Naald tube mounting brackets
1—0.0001 mfd. Micadon
1—0.00025 mfd. Micadon with gridleak clips
1—0.0005 mfd. Micadon
2—Kurz-Kasch 3-in. dials
1—Walbert lock switch
1—2-megohm tubular gridleak
6—Eby Ensign binding posts
1—Length No. 7 varnished tubing
30—small 6-32 nuts
20—½-in. 6-32 R. H. screws
10—½-in. 6-32 F. H. screws
10—¾-in. 6-32 F. H. screws
10—¾-in. 6-32 R. H. screws
50—Small soldering lugs
1—100-ft. spool of Wirit

that the set may withstand a reasonable amount of rough handling.

The General Radio variometers work very nicely into this circuit because of their small size. If you change the construction of this set, be sure to keep the variometers about the same distance apart, for the operation of the set depends in part upon a coupling effect between the antenna, variometer, and the plate variometer. Also, metal objects should be kept away from the open end of the stator coils.

The New Mechanical Design Following up the announcement of the new panel sizes, this set has been worked out in accordance with the two-level plan. That is, a panel 12 ins. high is used, with the tubes in one row across the top, the transformers below, and the tuning instruments on the lower level. This makes the arrangement much easier to work out, and allows the location of the tuning dials at the center of the panel instead of at the left hand side, where they are ordinarily placed. Thus they can be easily regulated with the right hand.

On this particular set, a sub panel, 3½ ins. wide, is used to carry the transformers and tube panel supports. Then the sub panel is fastened to the front panel with only four screws. This is done simply to reduce the number of screws showing on the front panel.

Other sets of various types, built on the 2-level system, will be described subsequently.

Standard Parts Required A complete list of the standard parts is given separately. Special makes have been specified wherever other makes of similar

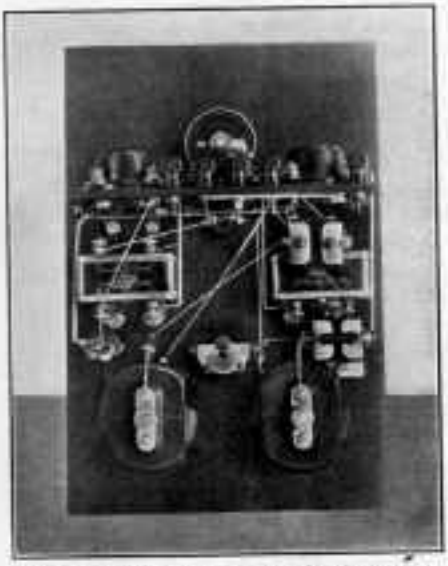


Fig. 2. Illustrating the two-level arrangement, the tubes and transformers across the top, with the tuning instruments below. Among other things, this system reduces the length of the leads and the panel area required.

instruments would require special drilling. The set as made originally at the Darien laboratory was made up on Radion panels for we wanted to find out whether or not, on a set of this sort, there would be any difficulty from warping. Of course, any insulating material is liable to warp if it is subjected to a considerable strain. In this outfit we tried to arrange the design so that the load was well distributed and, we were glad to see, the hard rubber did not warp at all. The front panel measures 8 by 12 by 3/16-in., while the tube and sub panels, each 7 ins. long, were cut from a strip 3½ by 14 by 3/16-in. Strips of this width have become practically standard for tube panels.

For instruments, there are two General Radio variometers, 1 to 3½ and 1 to 6

National A. F. transformers, a 20-ohm General Radio rheostat, three Naald UV-199 sockets, Walbert lock switch, six Eby Ensign binding posts, 0.0001 and 0.0005 mfd. Micadons, a 0.00025 mfd. Micadon with gridleak clips, 2-megohm Durham gridleak, Continental Junior vernier condenser, open circuit Carter jack, and two 3-in. Kurz-Kasch knobs and dials. Two Naald tube brackets are used to support the tube panel.

Drilling the Panels The picture wiring diagram, in Fig. 4, is drawn to a scale of —in. to the inch. You can scale off the dimensions from that drawing or, if you want the full size dimensions, you can get the blue print panel patterns for the type 7600 receiver. In the blue prints all holes which are not marked otherwise are to be made with a No. 18 drill. Concentric circles indicate that the hole must be countersunk for a flat head screw. Holes of special sizes are marked accordingly.

To transfer the dimensions from the blue prints to the panels, hold the print in position on the panel and mark through with an automatic center punch. This is more satisfactory than a plain punch and hammer, and since it requires only one hand, the other hand is free to keep the blue print in position. Radion or Bakelite panels are made with such a highly polished surface that most people prefer to leave them bright. If you want to rub down the panels, use No. 1 sandpaper and oil. The oil prevents the sandpaper from becoming clogged up with dust.

Suggestions for Wiring The assembly and wiring instructions have been planned so carefully, in conjunction with the picture wiring diagram, that there is no excuse for not making a neat job of the wiring. The connections should be made with Wirit. Do not use this wire as it comes from the spool, but unwind 10 or 15 ft. and stretch it until all the kinks are taken out. Then cut it up into 18-in. lengths. With this clean, straight wire, even a beginner should be able to make the connections look attractive.

Use tinned lugs, not the nickel plated kind. Tinned lugs are stamped from copper or brass sheet which is tinned before stamping. Put the lugs on each instrument as it is assembled, and make sure that each lug is pointing in the right direction, as shown by the short heavy lines in Fig. 4 before the nuts are tightened.

Fig. 3. Looking at the set from the left hand side. Note the condenser mountings.

Assembly and Wiring Altho the real purpose of the sub panel is to carry the transformers and panel supports, so that only four screws will appear at the front of the front panel, the arrangement helps greatly to simplify the wiring of the set because the sub panel and tube panel can be put together and wired up before the sub panel is fastened to the front panel. The instructions follow this procedure, covering first the assembly and wiring of the sub and tube panels and then the additional work of mounting and wiring on the front panel.

1. Fasten the center socket to the tube panel, using ¾-inch 6-32 R. H. screws. Then fasten the two outside sockets and the Naald mounting brackets on the underside, putting ¾-inch 6-32 R. H. screws through the socket, panel, and bracket. Looking at the set from the rear a lug

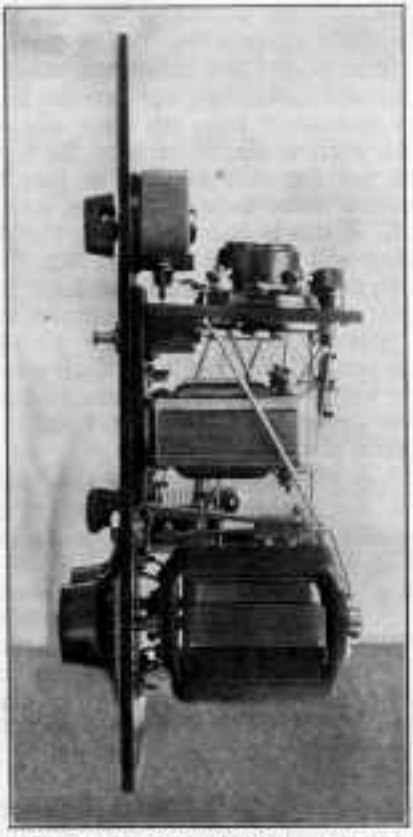


Fig. 5. The right hand side. The tube panel tips down slightly because of the angle of the brackets

should be put under the head of each left hand socket mounting screw, pointing directly toward the plus socket binding post. Also, lugs pointing to the rear should be put under the nuts of the three socket mounting screws on the underside. These are numbered 1, 2, and 3.

2. In the picture wiring diagram, Fig. 4, the tube panel is shown tipped up in order to make the wiring more clear. The lugs under the heads of the socket mounting screws are numbered 4, 5, and 6. Put lugs under each plus terminal on the sockets, and solder them to the lugs under the heads of the socket mounting screws. This makes connection 4 to 7, 5 to 8, and 6 to 9. Run a wire from 1 to 3, on the underside of the panel, and connect lug 2 to this wire. Put lugs on each minus socket binding post. These are numbered 10, 11, and 12. Run a wire from 10 to 12 and solder it to lug 11.

3. Mount the five Eby binding posts on the tube panel, having the lugs point in the direction shown by the short heavy lines in the picture wiring diagram. Note that the A + and A — binding posts require two lugs.

4. Connect 13, on the A + post, to 14, on the GND post. This wire must be insulated with varnished tubing.

5. Fasten the sub panel to the supporting brackets with ½-inch 6-32 F. H. screws but do not put screws through the lower inside legs of the transformers. See that the 3½ to 1 transformer goes to the left, looking at the set from the rear, and the 6 to 1 transformer on the right.

6. Connect 15, and G post of the socket, to 16, the G post of the transformer. This wire goes through a hole in the tube panel. Connect 17, the P post on the socket, to 18, the P post on the transformer. This wire also goes through a hold in the tube panel. Connect 19, the G post on the socket to 20, the G post on the transformer. This wire goes through a hole in the tube panel. Connect 21, on the A — binding post, to 22, the F— terminal of the right hand transformer, and also to 23, the F— terminal on the left hand transformer. Connect 24, on the + 45V binding post, to 25, on the + B transformer terminal. This wire must be insulated with varnished tubing.

7. Mount the rheostat on the front panel, putting a lug on the center binding post, pointing straight to the rear, and a lug on the left hand binding post, pointing to the side. Mount the open circuit jack with the frame at the top, put the vernier condenser on the panel, and mount the two variometers, using ½-in. 6-32 R.H. screws. Make sure that the terminals of the variometers are at the top. Put a lug under the nut of each upper variometer mounting screw. You can see these connections in Fig. 2.

Put a ¾-in. 6-32 R.H. screw through one terminal of a 0.0001 mfd. Micadon and secure a lug, pointing to the side, under the nut. Then put the antenna binding post on the front panel, fasten it with a nut, then put the other terminal of the Micadon on the binding post screw, and clamp the Micadon with a nut at the top. This arrangement can be seen in Fig. 3. Finally, mount the lock switch with the terminals as shown in Fig. 4, but do not bend out the soldering tabs.

8. Connect 26, on the variometer mounting screw, to 27, the rear lug on the vernier condenser. Put a lug on the front terminal of the variometer, pointing upward, and bend it to the right. This is terminal 28. Connect 28 to 29, the forward terminal of the vernier condenser which is connected to the fixed plates. Connect 28 to 30, the lower lug of the Micadon, and solder the left hand terminal of a 0.00025 Micadon with gridleak mounting clips to 28. This arrangement can be seen in Figs. 2 and 3.

9. Mount the sub panel on the front panel by putting ¾-in. 6-32 F.H. screws through the front panel, the sub panel, and the inside holes of the mounting brackets, and through the front panel, sub panel, and lower inside legs of the A.F. transformers.

10 Bend the terminals of the lock switch outward and connect 31, on the A+ binding post, to 32 on the lock switch; connect 32 to 27; connect 33, a connection on the wire running from 1 to 3, to 34, on the lock switch; and 35, the P terminal of the socket, to 36, the upper contact of the jack. This last wire must be insulated with tubing.

Connect 37, the +90V binding post, to 38, the lower terminal on the jack, soldering the wire to 39, the +B post on the transformer; 40, on the rheostat, to 41, the other lug on the A— binding post, insulating the wire with tubing; 42, a point on wire 10 to 12, to 43, the center terminal of the rheostat; 44, the P terminal on the socket, to 45, the lug on the upper mounting screw of the variometer; 46, the P terminal of the transformer, to 47, the top terminal of the variometer; and 48, to G post on the socket, to 49, on the grid condenser.

Solder 1-in. lengths of wire to the B+ and P terminals of the 6 to 1 transformer, pointing straight to the rear. Then, solder these wires to the terminals of a 0.0005 mfd. Micadon, making connections 50 and 51.

Set the rotors of the variometers exactly inside the stators so that the lead from the rotor winding to the shaft at the front of the left hand variometer is at the left, and the lead on the right hand variometer from the rotor winding to the shaft at the front is at the right. Then put the dials in place so that the zero lines coincide with the lines on the panel. If this is done, increasing the dial reading will increase the wave length or the regeneration. Fasten the knob and pointer to the vernier condenser so that the pointer is up when the variable plates are half way inside the fixed plates. Have the pointer of the rheostat down and to the left when the contact arm is in the open circuit position.

When you have completed this work, check the wiring carefully against the schematic circuit shown at the bottom of Fig. 4.

Testing and Operating

Every set builder should have a good voltmeter reading up to about 10 volts. It must be of the high resistance type, not the ordinary pocket voltmeters, for they draw more current than a vacuum tube. An instrument such as the Jewell model 53 type has 600 ohms resistance, so that at 3 volts the meter draws only 5 milliamperes.

Connect the A battery to the set and adjust the rheostat until the voltmeter, connected directly to the filament binding posts on the socket, reads 3 volts. At this setting you will not overload the tubes. The importance of this test is indicated by the fact that an overload of 0.15 volt reduces the life of the tube 50%, while an overload of 0.3 volt reduces the life of the tube 75%.

Next, with the switch closed, connect the A battery from the A— terminal to +45V. and then to +90V. If the tubes light at either of these connections there is a mistake in the wiring.

Put the A battery connections back

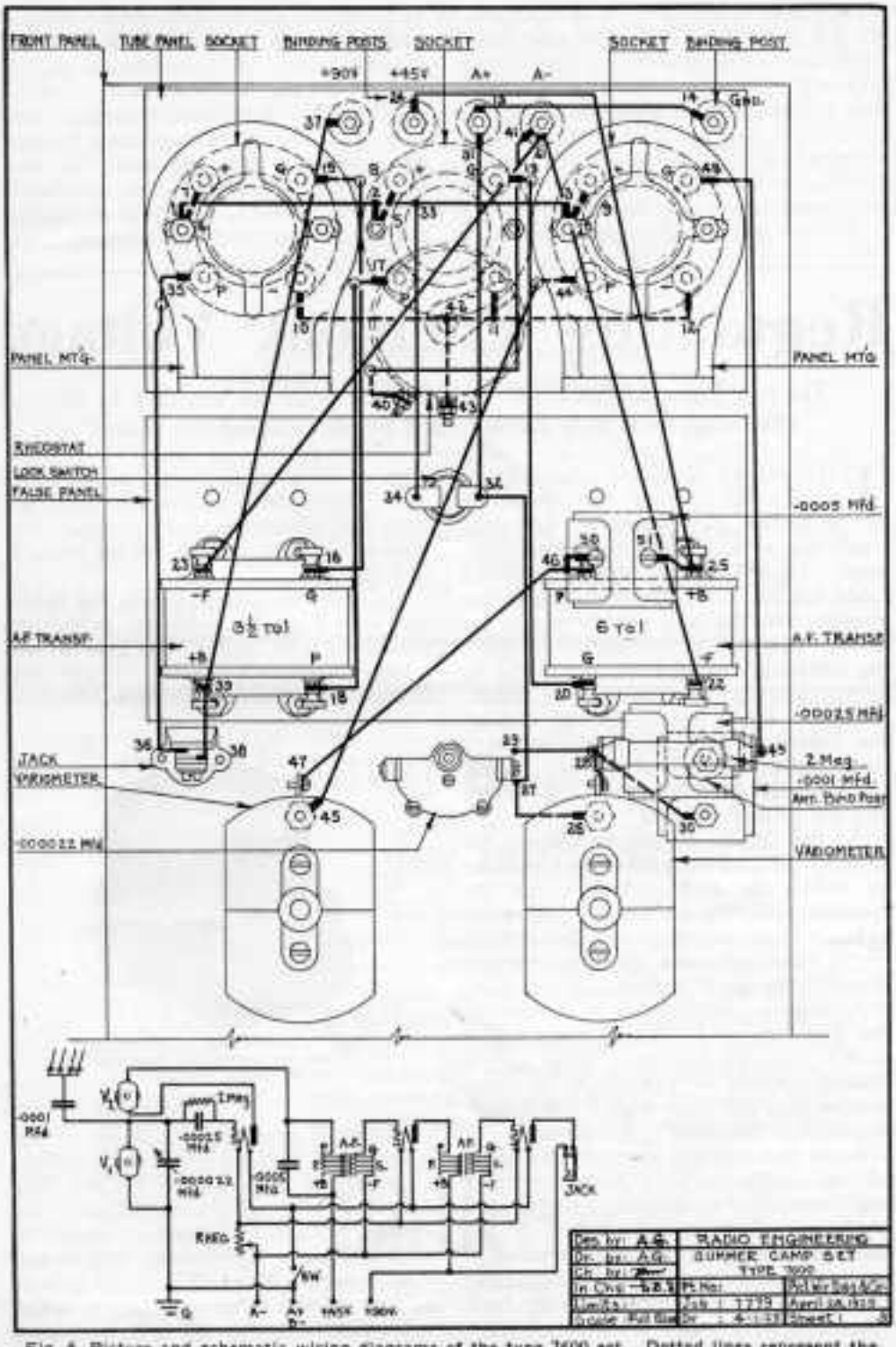


Fig. 4. Picture and schematic wiring diagrams of the type 7600 set. Dotted lines represent the wires on top of the tube panel.

where they belong and, connecting two 45-volt B batteries in series, run a lead from the — terminal of the first battery to the A+ binding post, connect the 45-volt terminal of the first battery to the +45V. binding post, and the 45-volt terminal of the second battery to the +90V. binding post. Put on the antenna and ground and plug in the telephones.

To tune the set, set the right hand dial at about 50 and turn the left hand dial back and forth until a station comes in. Having located a transmitter at say 30 degrees on the left hand dial, turn the dial back and forth about 5 degress each side of 30 and at the same time increase the reading on the right hand dial until you bring the signals to maximum strength. Finally, get a close adjustment with the vernier condenser.

Regulating Filament Voltage

Do you know whether the results from your set are due to its efficiency, or if they are obtained by overloading the tubes?

THE results of comparative tests of radio receiving sets vary as widely as audibility measurements, and for much the same reason—the human element. On tests it is natural to push the tubes far beyond their normal operating voltage. In this way the volume is increased in the R. F. circuits by introducing a tendency to oscillate, and in the A. F. circuits by overloading the tubes. Obviously this is unfair, not only because the increase in volume is achieved at a sacrifice of quality but because, under these conditions, the tube and B battery life are greatly reduced.

At the Darien laboratory when a set is being tried out we have made a practice of letting the demonstrator adjust the controls for what he considers best results. Then we measure the voltage across each tube and the total current drawn from the B battery.

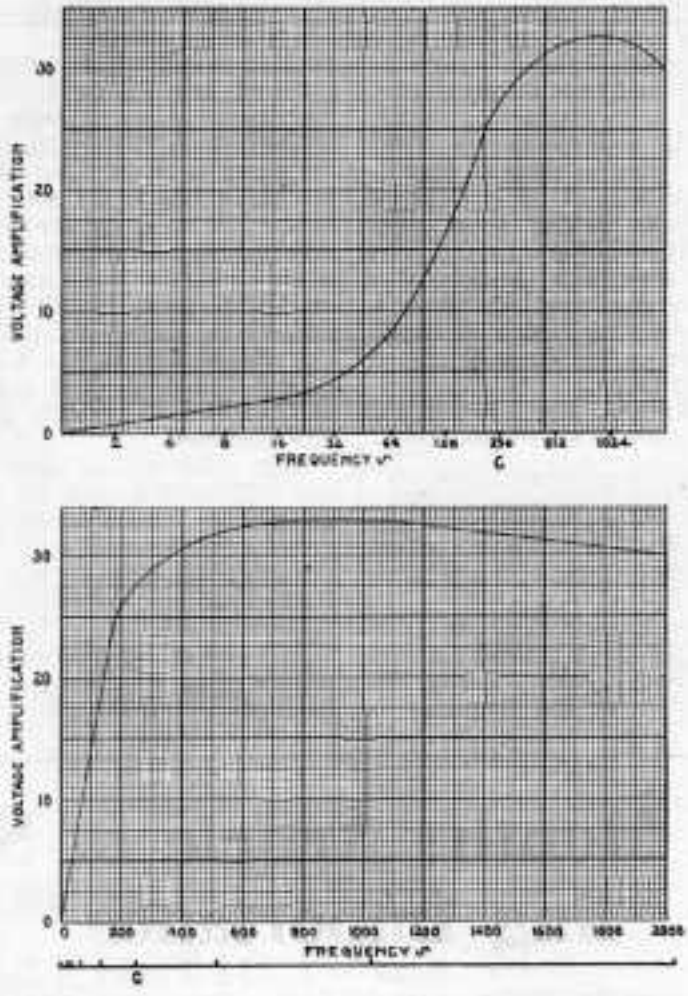
Invariably, we find 5.5 to 6 volts on the filaments of UV201-A tubes and 4 to 4.5 volts on UV199's, while the B battery current is usually 20 to 50% greater than the value with 5 and 3 volts respectively on these types of tubes.

From this you can see that tests to be of real usefulness must be made under real operating conditions, for no one would knowingly buy a set that, to get satisfactory results, required the tubes to be operated at a filament voltage and plate current that fairly eats up both tubes and B batteries. Another thing—some sets tend to oscillate more readily than others when the tubes are overloaded. Therefore, a set which does not come up to another under normal conditions may give greater volume when it is forced.

To test the voltage across the tubes, run leads from the voltmeter to the terminals on each socket. Be sure to use a high resistance voltmeter. If the brilliancy of the filament changes when the voltmeter is connected, the meter is not suitable and does not give a true reading.

Fig. 1. A Weston double-range meter for measuring filament and plate voltages.

Remember that the B battery consumption is greatly increased when the filament voltage is allowed to exceed its named value. By putting the correct voltage on the filaments you can save 20 to 50% of the B battery current, which will quickly pay for the cost of a good meter.



Transformer Curves and the Piano Scale

As amplification curves are ordinarily drawn, they do not give a true picture of the results

GRADUALLY we are learning to translate radio from the specialized science which it appeared to be at first into terms of everyday science with which we are all familiar. Transformer, resistance, and impedance amplification are being straightened out gradually, with the prospect that we shall have this very important part of radio reception boiled down to a real starting point, even tho much remains to be done before we can accept any one method as the ultimate development.

The following curves may come as a shock to those who feel that transformer design has brought amplification close to perfection, but the purpose of the data presented is to show how much remains to be achieved rather than to show how poor good transformers really are.

Perhaps the best picture of amplification can be obtained from the piano scale. Transformer manufacturers generally consider the high audio frequencies, from 400 to 4,000 cycles, as those of importance in the reception of music. On the piano, 400 cycles is four notes above middle C, while 4,000 is a little beyond the upper end of the scale. Imagine what kind of music you would get from a piano if it had no keys below middle C. The lowest key on the piano vibrates at a frequency of 27.

The lower curve in Fig. 1 is a typical amplification curve of a very good transformer. It looks, at first glance, as if it is doing excellent work. But it seems that way because the frequency is evenly divided. Middle C is shown on the bottom line, and the octaves above and below indicated by short marks.

Above is the same curve, also covering a range of 2,000 cycles, but laid out with the octaves evenly spaced. Taking 256 cycles as middle C, the frequency is doubled at each octave. This is slightly different from the frequencies to which the piano notes are adjusted, but only by a few cycles. The amplification at each frequency is exactly the same as is on the curve below, yet how different it looks! Now you can see clearly that, at middle C, the amplification is only 77% of the maximum; at an octave lower, the amplification drops to 46%, and another octave down, 23%. To put it differently, the amplification at 512 cycles is 24% greater than at middle C, and 36% lower at 128 cycles. That looks like considerable distortion.

With some musical instruments it is, and with some it isn't, for the peculiar qualities of different instruments is determined by the harmonics. The distortion, then, depends upon the amplification of the harmonics as well as the fundamental frequency.

If, however, we are to get a practical picture of amplification the curves must be drawn with the octaves evenly spaced.

Next Month: Article of Startling Importance

PASSING over the developments of the last six years which have been hailed as "revolutionary," we have the rise and fall of super-regeneration, the neutrodyne degenerated into a tuned R. F. losser, the super-heterodyne has not produced results that simpler sets cannot equal, battery eliminators have not eliminated batteries, the A. C. filament tube, the latest of the amazing inventions, is after all only a vacuum tube with a different kind of heater.

For all the straining of thousands of radio workers, there has not been produced an idea that is fundamentally new or different, representing an advance that could startle us, puzzle us, make us wonder how it can be done, or amaze us by the temerity of the inventor who had the idea that he could do it successfully.

It is to be expected, perhaps, because RADIO ENGINEERING has always pioneered in introducing things of practical importance, that we shall have the privilege of bringing out in the July issue the full details of an invention which is fundamentally new, which represents an improvement of vital importance, and which introduces a principle never before employed in radio reception. In fact, the entire physics and chemistry involved are almost unknown to science.

In addition to this construction article, RADIO ENGINEERING will have a series of exclusive articles, written by the inventor, covering the complete theory, design, and application of his achievement.

Although other publications will have articles on this subject, only RADIO ENGINEERING will have the original data from the inventor.

RADIO ENGINEERING

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EDITORIAL

IF YOU think the age of superstition is over, listen in on some of the conversations in the radio stores and you will change your mind. Superstitions are mistaken ideas based upon a misconception or ignorance of the truth, whether they concern spilled salt or oscillations.

Today, the pet radio superstition has to do with neutralizing. Professor Hazeltine developed the neutrodyne receiving circuits on sound, logical principles. However, for all the articles explaining the truth of his neutralizing method, comparatively few people took the trouble to understand this system. Instead, most everyone simply assumed that "neutralizing" a set meant stopping the oscillations.

Hence the neutralizing superstition which came about through ignorance of the neutrodyne principle.

It is extremely difficult to build a tuned R. F. receiver with low-loss tuning circuits and to make it non-oscillating, by means of neutralizing condensers, over the entire wavelength range. With the possible exception of the Howard Radio Company, not one of the neutrodyne licensees obtains the full efficiency which a neutrodyne circuit is capable of giving because they depend as much on losses in the tuning circuits as on the neutralizing condensers to prevent oscillations.

The manufacturers of plain R. F. sets are entirely dependent upon losses. Sets advertised as being "self-neutralized," or coil and condenser combinations "self-neutralized," are not neutralized in any way at all. They are so constructed as to have high resistance in the coils. Low resistance—high efficiency—circuits oscillate readily. If the resistance is high—the efficiency correspondingly low—oscillations will not take place. One of the easiest ways to increase the losses, or resistance, is to mount the coils so that their fields cut the metal plates of the condensers. This was explained in the November 1924 issue.

The tuned R. F. set owes its existence largely to the fact that the majority of radio manufacturers do most everything for no better reason than that everyone else does it. They thought they were making "self-neutralized" sets. They didn't know they were making sets so full of losses that oscillations couldn't take place! They thought they were doing a real job when they connected low-loss condensers to coils of such high resistance that the oscillations were choked out.

Occasionally we get a letter from a set builder who complains that, with low resistance pickle-bottle coils, it is impossible to neutralize the set. He really means that the losses are too low to choke the oscillations.

That is why four-tube radio sets using low-loss coils and condensers in circuits that do not depend upon the introduction of losses to stop oscillations can out-perform any of the five-tube sets in which an extra stage of R. F. is necessary to make up, in part, for the low efficiency of the high resistance tuning circuits.

Why not turn the light of knowledge on this neutralizing superstition and do a little constructive thinking?

In the next issue of Radio Engineering you will find some preliminary data on a set which, without the use of a regenerative circuit, potentiometer, or even the readjustment of a rheostat, gives an efficiency equal to that of a regenerative set, yet it does not oscillate over the entire range from 250 to 600 meters.

M. B. SLEEPER,
Editor.

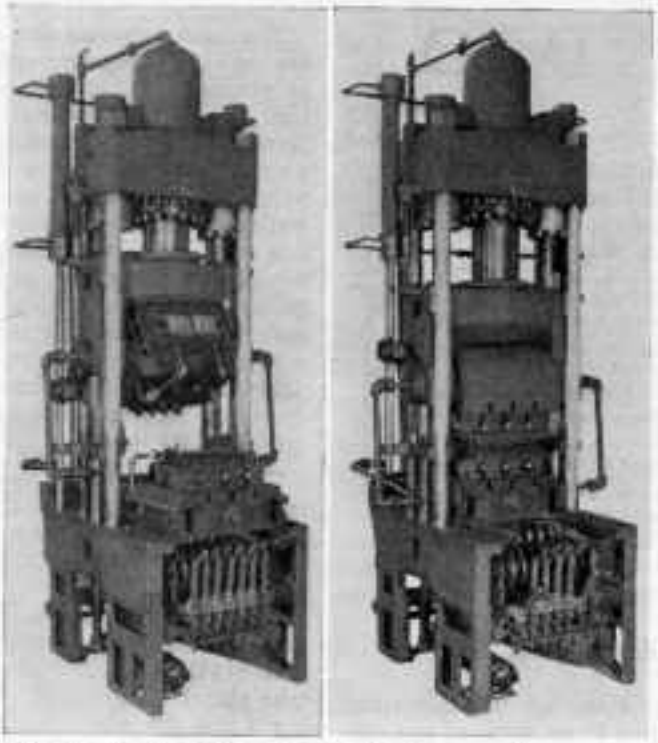


Fig. 1. At the left, the press ready to start the operating cycle. Right, closed, with pressure applied.

Production Type of Hydraulic Molding Press

Features of the Hydraulic Press Manufacturing Company's plastic molding press, designed for high speed production of Bakelite parts

THE hydraulic molding press, as it has been built, is a rather cumbersome affair, and not well adapted for working at a high rate of speed. The action of the press itself is slow and a great deal of hand work is required on the part of the operator.

With this in mind, the new H-P-M universal automatic press has been developed to reduce the amount of attention required by the operator, the idle time between molding operations, and the number of defective parts.

Essentially the improvement in this type of press is in the design of the revolving head and the sliding arrangement for the table which carries the lower half of the molding die. Fig. 1 shows the press in the open position. Comparing it with the illustration on the right, you will see that the table moves forward and the head is thrown up at the end of the operating cycle. These movements are controlled automatically.

To go through the sequence of operations, with the lower half of the die forward and in a position easily accessible, the operator cleans the dies, puts in new inserts, and reloads with raw compound. Then he throws a small lever which starts

a motor mounted just inside the left hand forward leg. Thereupon the table slides back, the head turns down, and takes up the closed position while steam is applied to the chambers of the upper and lower dies. Low hydraulic pressure is applied to the main press cylinder for closing the dies fully. After the Bakelite has become plastic and has had an opportunity to flow in every corner of the die, high hydraulic pressure is applied to the main press cylinders. Then the steam supply to the die chambers is cut off. Next, cold water is circulated through the die chambers for chilling and setting the molded pieces. High pressure is cut off from the main cylinder which is then connected with a return line. The main ram is withdrawn through the action of auxilliary rams, thus separating the two halves of the die. In the final movement the head, carrying the upper part of the die, is revolved through an angle of about 120 degrees while the table moves forward again. At the same time an ejecting mechanism is automatically operated simultaneously in the head and on the table. This permits the use of ejecting pins in both halves of the die or in either one, as may be required. This concludes the cycle of operations. A simple electric cutout mechanism is actuated by a cam and the motor stopped until the operator is ready to start it again to put the press through the next series of operations. It should be noted that the ejecting mechanism does not operate during the return movement.

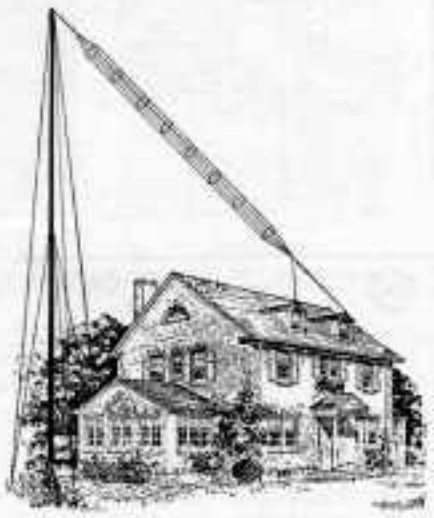
Different kinds of pieces require different timing, of course. This factor is taken care of by the design of the controlling mechanism. The total time for an operating cycle can be increased from the minimum by 500%. The nine steps are regulated by individual speed change mechanisms and any one stage can be altered in its sequence by adjusting the position of the corresponding cam, or it can be eliminated altogether.

The valve cams are designed as units so that, when the die equipment is changed, the entire set of cams can be changed also, if the new piece of molding requires an altogether different timing. The making of the cams is so simple that they can be turned out easily and cheaply by the maintenance department of any molding plant.

From the description you will see that no attention to the press is required except for removing the pieces, cleaning the dies, and reloading. Moreover, the timing is not dependent upon the attention of the operator. Therefore, one man can handle two or more machines. In addition, defective pieces resulting from the lack of attention on the part of the operator to the timing are entirely eliminated.

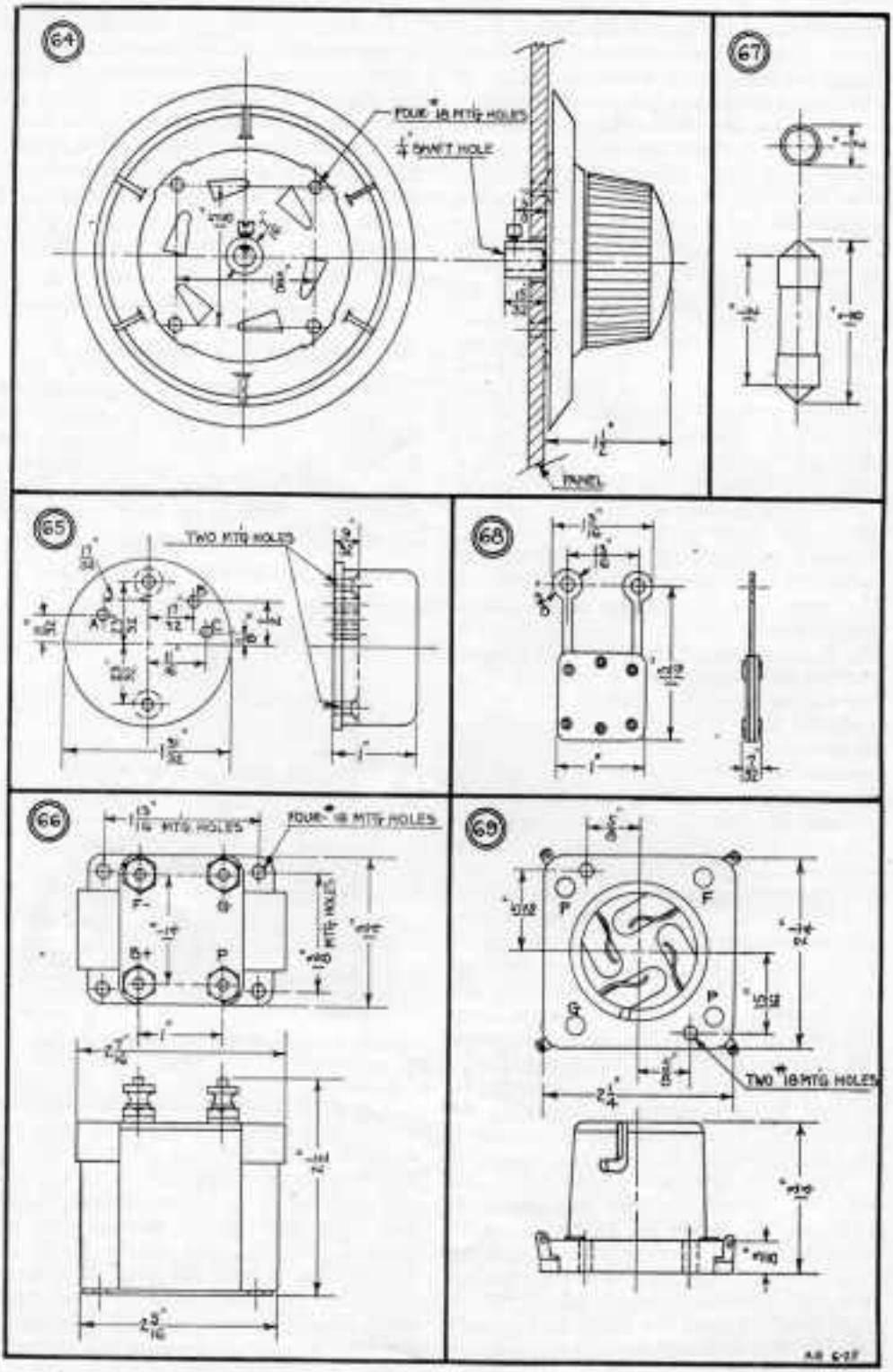
Cages for Receiving

An increasing number of cage antennas are to be seen now-a-days at stations of the better sort. Unlike the cages for transmitting, these are of small diameter, about 6 ins., with hoops made of ⅛-in. brass rod which have been hammered around wooden mandrels.



A Hull mast for supporting a cage type receiving antenna.

The accompanying illustration shows a typical installation using a Hull mast for support at the far end. For receiving, six or eight wires should be used, each one soldered to each ring or hoop. Not only does this type of antenna give increased efficiency, due to its lower resistance, but it provides great mechanical strength. In combination with the Hull mast, which is tested for 500 lbs. pull at the top, it gives a storm-proof strength which ordinary antennas do not have.


64
FOUR 18 MTG HOLES
¼ PANEL HOLE
1½
PANEL
67
65
TWO MTG HOLES
68
66
1 13/16 MTG HOLES
FOUR 18 MTG HOLES
F-
G
B+
P
18 MTG HOLES
69
F
P
G
P
TWO 18 MTG HOLES
AR 6-37

Data Sheet No. 9

64. NATIONAL VERNIER DIAL: This vernier dial, which has a 5 to 1 ratio, represents a distinct departure from the ordinary type employing reduction gearing. The vernier depends for its action upon friction discs held in place by springs. The entire friction disc mechanism is enclosed in a box made of stamped brass. This box is fastened to the front panel with four round head machine screws. The movable face of the box fastens to the 4-in. or 3-3/8-in. diameter dial which has graduations on it. A knurled knob fastens in front of the dial by means of a set screw. The collar which receives the condenser shaft goes through the front panel and is fastened to the shaft with a set screw. When using this dial with other than National variable condensers, the shafts must be cut off so they just barely reach to the front face of the front panel when mounted.

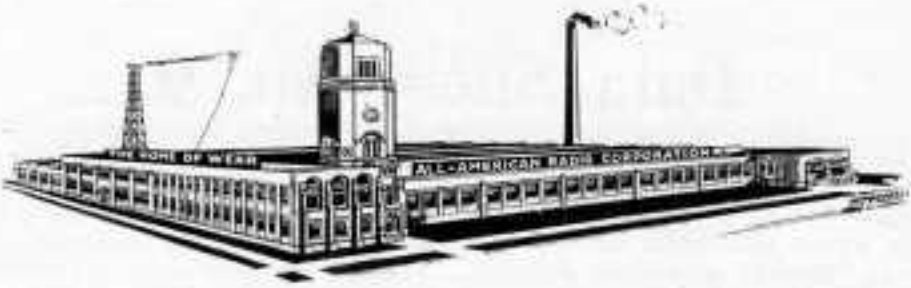
65. FEDERAL BUZZER: This instrument was especially designed for radio work and is very rugged and compact. The buzzer mechanism is mounted on a hard rubber base which has two countersunk holes for mounting, with the two ½-in. F. H. wood screws provided. A black enameled brass cover encloses the buzzer mechanism protecting it from dust and mechanical injury. Three holes are provided in the base for bringing connections to the instrument. Hole A goes to one side of the winding. Hole B goes to the frame. Hole C goes to the contact arm.

66. THORDARSON A. F. TRANSFORMER: This transformer is made in both 3½ to 1 and 6 to 1 ratios. The coils are square in cross section, and fit over a liberal sized silicon steel core made up of very thin laminations. This is responsible for the excellent tone quality for which these transformers are noted, and makes them exceptionally suitable in sets having a large output. The windings are shielded by an aluminum case. The binding posts are at the top and are marked as shown. Four mounting holes are provided at the base.

67. BRACH-STAT: This device is an automatic filament current regulator for use on radio sets in place of the ordinary rheostat. The resistor element is enclosed in a fibre cartridge having metal end caps for snapping into a holder. The Code B type is designed for use with a UV201-A or C301-A tube, on 6 volts. Other types are made for various tubes and A battery voltages.

68. GRAY LIGHTNING ARRESTER: This item represents a new design of lightning arrester which can be connected directly across the antenna and ground binding posts of the set. The two small plates are assembled with Micarta on the outside, the entire unit being held together tightly by six eyelets. Two lugs are provided for connection and they have center holes large enough to permit their being slipped directly on ordinary binding posts. The arrester is very compact and is out of sight when placed at the rear, or inside of any set.

69. WALBERT SOCKET: The Walbert socket is an all-bakelite socket with a reinforced rim of nickled brass to prevent chipping and breaking out at the tube slot. The contact springs are unique in that they make contact with the tube prongs both at the bottom and side. Each spring is made of a single piece of metal, terminating in a soldering lug at the corner of the socket. This construction eliminates any possible resistance arising from poor contacts through binding posts. Two mounting holes are provided in the base, as shown. The springs are permanently fastened to the socket base with eyelets.



EVERYONE who is interested in tube tests should have a copy of the new Jewell circular which describes the use of the Jewell radio test set No. 95. In addition to some very interesting information on vacuum tube testing in general, there is some important special data on the quick determination of mutual inductance, amplification constant, and plate resistance. Another circular describes the super-heterodyne voltmeter panel, a panel identical to that used at the front of the right hand battery box, on which is mounted a 0 to 5 voltmeter. Leads with special terminals are supplied for connecting to the batteries.

A special type of tube, designed with a high amplification factor for use in resistance coupled amplifiers, has been brought out by the Cleartron Company. Tests which we have made show that, with these tubes, greater amplification can be obtained from a 3-stage resistance coupled amplifier than from a 2-stage transformer amplifier. The introduction of these special tubes indicates the increasing popularity of the resistance coupled amplifier.

The Aerodyne Company of New York has been appointed the exclusive sales agent for the Tridot Electric Company, manufacturers of gridleaks. Mr. E. P. Chalfant, head of the Aerodyne Company, is also the president of the Motor Accessory Manufacturers Association, and of the Rotary Club of New York.

A new receiving set has been announced by the Sonora Phonograph Company, Inc., of New York City. The outward appearance is unusually attractive, and the price of $90.00, without accessories, puts it in a class to compete with the moderate priced outfits built by other concerns.

Apparently the Jewett Radio and Phonograph Company, of Pontiac, Michigan, decided to make the very finest of cabinets when they designed the Jewett Highboy. As a piece of furniture, it is suitable for any home. From the radio point of view it is all-complete, for it contains a built-in loud speaker and ample space for batteries or an eliminator.

The Brach Manufacturing Company of Newark have brought out a coupling unit for resistance coupled amplifiers. It is fitted with the usual clips for the resistance elements but incorporates an improvement in the mounting for the condenser. Instead of fastening it between clips, the Micadon is held by machine screws and nuts which are connected under the base to the resistors.

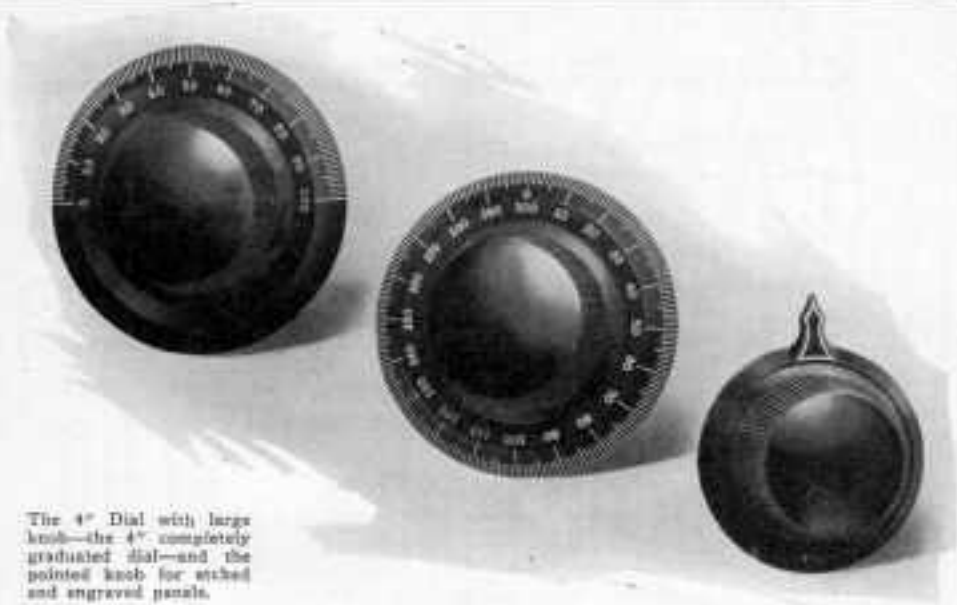
A complete line of radio equipment is in process of development by the American Bosch Magneto Corporation whose works are at Springfield, Mass. No information has been given out as to the details of the line but it should contain some excellent features for the most thorough planning has been in progress for some time.

Manufacturers' and Designers'

Reference Data on

Sockets, dials and switches

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



The 4" Dial with large knob—the 4" completely graduated dial—and the pointed knob for etched and engraved panels.

Here are three models from the *new* Kurz-Kasch Aristocrat Line of Dials and Knobs. No matter what set you own or manufacture, or what kind of panel it has, or what kind of condensers you use—

The Kurz-Kasch Aristocrat Line will make *that* set more beautiful and more efficient.

Genuine Kurz-Kasch products bear this trademark on the back of each part—Accept no substitutes.

The KURZ-KASCH CO Dayton Ohio

Specifications for Dials, Sockets, and Switches.

INSTRUMENT DIALS

Manufacturer	Outside diameter (inches)	Diameter and depth of hole (inches)	Color	Material	Divisions & Direction	Vernier	Fastening
Accuratune Products	4	1/4 x 1	Black, Mahog.	Bakelite	100 — C. W. — C. C. W.	80-1	S. S.
Alden Mfg. Co	5	1/4 x 1 1/4	Black, Mahog.	Bakelite	100 — C. C. W.	None	S. S.
Alden Mfg. Co	4	1/4 x 11/64	Black, Mahog.	Bakelite	100 — C. C. W.	None	S. S.
Alden Mfg. Co	3 7/8	1/4 x 7/64	Black, Mahog.	Bakelite	100 — C. W. or C. C. W.	None	S. S.
Alden Mfg. Co	3	1/4 x 11/64	Black, Mahog.	Bakelite	100 — C. C. W.	None	S. S.
Alden Mfg. Co	2	1/4 x 11/64	Black, Mahog.	Bakelite	100 — C. C. W.	None	S. S.
Amsco Products, Inc	4	1/4 x 1	Black, Mahog.	Bakelite	100 — C. C. W.	None	S. S.
Amsco Products, Inc	3	1/4 x 1	Black, Mahog.	Bakelite	100 — C. C. W.	None	S. S.
Amsco Products, Inc	2	1/4 x 1	Black, Mahog.	Bakelite	50,100 — A. C. W.	None	S. S.
Ajax Electric Specialty Co	4	1/8, 1/4 x 1	Black	Composition	180 — C. C. W.	None	S. S.
Ajax Electric Specialty Co	3	1/8, 1/4 x 1	Black	Composition	180 — C. C. W.	None	S. S.
Ajax Electric Specialty Co	2	1/8, 1/4 x 1	Black	Composition	100 — C. C. W.	None	S. S.
Apex Electric Mfg. Co	4	1/4 x 1	Brass, Silver, Gold	Brass & Bakelite	100 — C. C. W.	12-1	S. S.
Apex Electric Mfg. Co	3 3/4	1/4 x 1	Brass, Silver, Gold	Brass	100 — C. C. W.	12-1	S. S.
Balleton Insulating & Comp. Co	4	1/4 x 1	Black, Mahog., Walnut	Ballite	100 — C. C. W.	None	S. S.
Balleton Insulating & Comp. Co	3	1/4 x 1	Black, Mahog. Walnut	Ballgite	100 — C. C. W.	None	S. S.
Balleton Insulating & Comp. Co	2 1/4	1/4 x 3/4	Black, Mahog., Walnut	Ballsite	100 — C. W.	None	S. S.
Balleton Insulating & Comp. Co	2	1/4 x 3/4	Black, Mahog., Walnut	Ballsite	100 — C. W.	None	S. S.
Chas. A. Branston, Inc	4	1/4 x 1	Black	Bakelite	100 — C. W.	10-1	Clutch
Bremer Tully Mfg. Co	4	1/4 x 1	Black and Gold	Bakelite & Metal	100 — C. C. W. — C. W.	12-1	S. S.
Electrical Research Laboratories	4	1/4 x 5/8	Gold, Silver	Brass & Bakelite	100 — C. W.	None	S. S.
Electrical Research Laboratories	3	1/4 x 5/8	Gold, Silver	Brass & Bakelite	100 — C. W.	None	S. S.
E-Z Toon Radio Co	4	1/4 x 1	Black, Mahog.	Bakelite	100 — C. C. W. — C. W.	80-1	S. S.
E-Z Toon Radio Co	3	1/4 x 1	Black, Mahog.	Bakelite	100 — C. C. W. — C. W.	80-1	S. S.
E-Z Toon Radio Co	2	1/4 x 3/4	Black, Mahog.	Bakelite	150 — C. W.	None	S. S.
Federal Tel. & Tel. Co	4	1/4 x 1	Black	Bakelite	100	None	S. S.
Federal Tel. & Tel. Co	3	1/4 x 1	Black	Bakelite	100	None	S. S.
Federal Tel. & Tel. Co	2	1/4 x 1	Black	Bakelite	100	None	S. S.
General Instrument Corp	4	1/4 x 1	Black	Bakelite	100 — C. W.	None	S. S.
General Radio Corp	4	1/4 x 3/4	Silver and Black	Brass & Bakelite	100 — C. C. W.	8-1	S. S.
General Radio Corp	3 3/4	1/4 x 1/8	Silver and Black	Brass & Bakelite	100 — C. C. W.	5-1	S. S.
Howard Mfg. Co	2 3/4	1/8 shaft molded in	Black, Mahog.	Compo. or Bakelite	100 — C. W.	None	Moulded
Holzeman Electric Co	4	1/4 x 13/64	Black	Bakelite	180 — C. W.	70-1	S. S.
International Insulating Corp	3 1/2	1/8 or 1/4 x 3/4	Black	Compo. or Bakelite	100 — C. C. W. — C. W.	None	S. S.
International Insulating Corp	3 1/4	1/8 or 1/4 x 3/4	Black	Compo. or Bakelite	100 — C. W.	None	S. S.
International Insulating Corp	3	1/8 or 1/4 x 3/4	Black	Compo. or Bakelite	100 — C. C. W.	None	S. S.
International Insulating Corp	2 1/2	1/8 or 1/4 x 3/4	Black	Compo. or Bakelite	150 — C. C. W.	None	S. S.
Kellogg Sw'bd. & Supply Co	4	1/8 or 1/4 or 1/8 x 3/4	Black	Bakelite	90 — C. C. W.	None	S. S.
Kellogg Sw'bd. & Supply Co	3	1/8 or 1/4 or 1/8 x 11/64	Black	Bakelite	90 — C. C. W.	None	S. S.

Kurz-Kasch Co.	4	⅞ or ¾ x 1	Black, Brown, Mahog.	Bakelite	100 — C. W.— C. C. W.	None	Clutch	
Kurz-Kasch Co.	3½	⅞ or ¾ x 1	Black, Brown, Mahog.	Bakelite	100 — C. W.— C. C. W.	None	Clutch	
Kurz-Kasch Co.	3	⅞ or ¾ x 1	Black, Brown, Mahog.	Bakelite	100 — C. W.— C. C. W.	None	Clutch	
Kurz-Kasch Co.	2	⅞ or ¾ x ⅝	Black, Brown, Mahog.	Bakelite	150 — C. W.	None	.....	
Kurz-Kasch Co.	2	⅞ or ¾ x ⅝	Black, Brown, Mahog.	Bakelite	100 — C. W.	None	.....	
Magnus Elect. & Radio Mfg. Co.	4	¾ x ⅜	Black	Bakelite	100 — C. W.	None	S. S.	
Martin Copeland Co.	4	¾ x ⅝	———	Bakelite	100 — C. C. W.	Special	S. S.	
National Co., Inc.	4	¾ x ⅝	Black, Mahog.	Bakelite	100 — C. C. W. or 200 C. W.	5-1	S. S.	
National Co., Inc.	3½	¾ x ⅝	Black, Mahog.	Bakelite	100 — C. C. W. or 200 C.W.	5-1	S. S.	
Parkin Mfg. Co.	3	⅞ or ¾ x ⅝	Black	Bakelite	100 — C. W.	None	S. S.	
Phenix Radio Corp.	4	¾ x ⅝	Silver & Black	Brass & Bakelite	100 C. W.	20-1	S. S.	
Scranton Button Co.	4	⅞ or ¾ x ⅜	Black, Mahog.	Lacnite	100	None	S. S.	
Scranton Button Co.	3½	⅞ or ¾ x ⅜	Black, Mahog.	Lacnite	100	None	S. S.	
Scranton Button Co.	3	⅞ or ¾ x ⅜	Black, Mahog.	Lacnite	100	None	S. S.	
Scranton Button Co.	2	⅞ or ¾ x ⅝	Black, Mahog.	Lacnite	100	None	S. S.	
Sheffield Trimming & Stamping Corp.	4	¾ x ⅝	Silver & Black	Brass & Bakelite	100 C. W.	100-1	S. S.	
Sheffield Trimming & Stamping Corp.	4	¾ x ⅝	Silver & Black	Brass & Bakelite	100 C. W.	None	S. S.	
Splitdorf Electrical Co.	4	¾ x ⅝	Black	Bakelite	100	None	S. S.	
Splitdorf Electrical Co.	2½	¾ x ⅝	Black	Bakelite	100	None	S. S.	
Splitdorf Electrical Co.	2¼	¾ x ⅝	Black	Bakelite	100	None	S. S.	
Walbert Mfg. Co.	3½	⅞ or ¾ or ⅞ x ⅝	Gold & Mahog.—Silver & Black	Brass & Compo.	180 — C. W.	12-1	Anchor Lug	
Walbert Mfg. Co.	4	⅞ or ¾ or ⅞ x ⅝	Black	Bakelite	180 — C. W.	12-1	Anchor Screw	
"X" Laboratories	3½	¾ x ⅝	Black	Bakelite	100 — C. C. W.	None	S. S.	

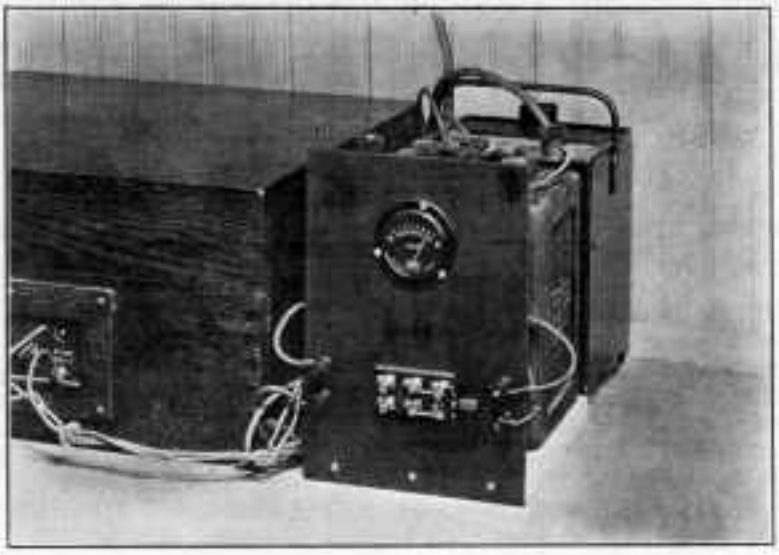
SOCKETS

Manufacturer	Type of tube	Height, width, length (inches)	Material	Type of Contact	Contact Material	Mounting
Alden Mfg. Co. (Panel mtg. brackets supplied)	Standard	1¾ x 2½ x 2½	Bakelite	Side & Bottom	Phosphor Bronze	Base
Alden Mfg. Co.	Standard	1½ x 2¾ x 2½	Bakelite	Bottom	Phosphor Bronze	Base
Alden Mfg. Co.	Standard	1 ⅞ x 2 ⅞ x 2 ⅞	Bakelite	Side & Bottom	Phosphor Bronze	Base
Alden Mfg. Co.	Standard	1½ x 1 ⅞ x 1 ⅞	Bakelite	Bottom	Phosphor Bronze	Base
Alden Mfg. Co.	199	1 x 2 ⅞ x 2 ⅞	Bakelite	Bottom	Phosphor Bronze	Base
Alden Mfg. Co.	199	1 ⅞ x 2 ⅞ x 2 ⅞	Bakelite	Bottom	Phosphor Bronze	Base
Alden Mfg. Co.	199	1¾ x 1½ x 1½	Bakelite	Spring Plunger	Brass	Base
Alden Mfg. Co.	W D-11	1½ x 2½ x 2½	Bakelite	Side	Phosphor Bronze	Base
Amsco Products Co.	Standard	1 ⅞ x 2 ⅞ x 2 ⅞	N. P. Brass, Bakelite	Bottom	Phosphor Bronze	Base or Panel
Ballston Insulating & Compo. Co.	Standard (single)	1½ x 2½ x 2½	N. P. Brass, Ballsite	Bottom	.....	Base or Panel
Ballston Insulating & Compo. Co.	Standard (triple)	1½ x 2½ x 7½	N. P. Brass, Ballsite	Bottom	.....	Base or Panel
Benjamin Electric Mfg. Co.	Standard	1¾ x 2 ⅞ x 2 ⅞	Bakelite	Bottom	Phosphor Bronze	Base
Benjamin Electric Mfg. Co.	199	1 ⅞ x 2 ⅞ x 2 ⅞	Bakelite	Bottom	Phosphor Bronze	Base
Bennington Radio & Elect. Mfg. Co.	Standard	1 ⅞ x 2 ⅞ x 2 ⅞	Bakelite	Bottom	Phosphor Bronze	Base
Bremer-Tully Mfg. Co.	Universal	1½ x 1⅞ x 1⅞	Bakelite	Side	Phosphor Bronze	Base
Buell Mfg. Co.	Standard	1½ x 2¼ x 2¼	Bakelite	Side	German Silver	Base
Buell Mfg. Co.	199	1 ⅜ x 1½ x 1½	Bakelite	Bottom	Phosphor Bronze	Base

Circle F. Mfg. Co.	Standard	———	N. P. Brass, Porcelain	Bottom	Phosphor Bronze	Base
Duray Radio Corp.	Standard	1¾ x 2¼ x 2¼	Glass	Bottom	Phosphor Bronze	Base
Electrical Research Laboratories	Standard	1 11/16 x 2¼ x 2½	N. P. Brass, Bakelite	Side	Spring Brass	Base
Electrical Research Laboratories	199	1 x 1 11/16 x 1 11/16	N. P. Brass, Bakelite	Bottom	Spring Brass	Base
General Instrument Corp.	Standard	1 3/16 x 2½ x 2½	Isolantite	Bottom	Ph. Br., Silver Contacts	Base
General Radio Co.	Standard	1¾ x 2½ x 2½	N. P. Brass, Bakelite	Side & Bottom	Phosphor Bronze	Base
General Radio Co.	199	1 x 1¾ x 2¾	Bakelite	Bottom	Phosphor Bronze	Base
General Radio Co.	W D-11	1 x 1¾ x 2½	Bakelite	Bottom	Phosphor Bronze	Base
Goodrich Rubber Co.	Standard	1⅝ x 2¼ x 2¼	Hard Rubber	Sides	Phosphor Bronze	Base or Panel
Howard Mfg. Co., Inc.	Standard	1⅝ x 2½ x 2½	N. P. Brass, Bakelite	Sides	Phosphor Bronze	Base
Heinemann Electric Co.	Standard	1 11/16 x 2⅝ x 2⅝	Bakelite or Hard Rubber	Sides & Bottom	German Silver	Base
Heinemann Electric Co.	199	1¾ x 2½ x 2¾	Porcelain	Bottom	German Silver	Base
Kellogg Sw'h'd & Supply Co.	Standard	1⅝ x 2¼ x 2¼	Bakelite	Bottom	Phosphor Bronze	Base
Magnus Electric & Radio Mfg. Co.	Standard	1⅝ x 2¼ x 2¼	———	.....	Phosphor Bronze	Base or Panel
Martin Copeland Co.	UV 199	1½ x 1½ x 1½	N. P. Brass, Bakelite	Spring Plunger	Brass	Base
Martin Copeland Co.	W D 11	¾ x 1½ x 1½	Hard Rubber	Side	Brass	Base
Parkin Mfg. Co.	Standard	1½ x 2 x 2⅝	Bakelite	Bottom	Phosphor Bronze	Base or Panel
Premier Electric Co.	Standard	1½ x 2⅝ x 2⅝	N. P. Brass & Bakelite	Bottom	Phosphor Bronze	Base or Panel
Premier Electric Co.	199	1½ x 2⅝ x 2¾	N. P. Brass & Bakelite	Bottom	Phosphor Bronze	Base or Panel
Radio Products Mfg. Co.	Standard	1 11/16 x 2⅝ x 2⅝	Bakelite	Bottom	Phosphor Bronze	.....
Radio Products Mfg. Co.	199	11/16 x 2 x 2	Bakelite	Bottom	Phosphor Bronze	.....
Signal Electric Mfg. Co.	Special single and gang sockets					
Splitdorf Electrical Co.	Standard	1 3/16 x 2¼ x 2¼	Bakelite	Bottom	Phosphor Bronze	Base
Splitdorf Electrical Co.	Standard	1½ x 2 3/16 x 1 11/16	Bakelite	Bottom	Phosphor Bronze	Base
Union Radio Corp.	Standard	1¾ x 1 11/16 x 1 11/16	Condensite	Bottom	Phosphor Bronze	Base
United Radio Mfg. Co.	Standard	1½ x 2½ x 2 11/16	N. P. Brass, Formica	Bottom	Phosphor Bronze	Panel
United Radio Mfg. Co.	Standard	1 11/16 x 2⅝ x 2⅝	N. P. Brass, Formica	Bottom	Phosphor Bronze	Base
United Radio Mfg. Co.	Standard (triple)	1½ x 7½ x 2 11/16	N. P. Brass, Formica	Bottom	Phosphor Bronze	Panel
Walbert Mfg. Co.	Standard	1¾ x 2¼ x 2¼	Bakelite, N. P. Brass Rim	Side & Bottom	Phosphor Bronze	Base

FILAMENT SWITCHES

Manufacturer	Movement	Max. diam. behind panel	Over-all depth behind panel	Diameter, hole in panel	Front finish	Knob	Lock
Allen-Bradley Co.	Push-pull	1 in.	11/16 in.	.....	Nickel Plated	Black Fibre	None
Benjamin Electric Mfg. Co.	Push-pull	7/8	5/8	¾ in.	Nickel Plated	Black Compo.	None
Carter Radio Co.	Turn	5/8	7/8	1/4	N. P. or Gold	Black or Mahog.	None
Carter Radio Co.	Turn	5/8	3/8	1/4	N. P. or Gold	Black or Mahog.	Key
Carter Radio Co. (jack switch)	Turn	1x5/8	3 1/16	3/8	N. P. or Gold	Black or Mahog	None
Central Radio Laboratories	Push-pull	5/8	1¾	5/8	Nickel Plated	.....	None
Consolidated Instrument Co.	Push-pull	1¼	1¾	5/8	Nickel Plated	Nickel Plated	None
Electrical Research Laboratories	Push-pull	1	¾	3/8	Nickel Plated	Nickel Plated	Plunger
Federal Tel. & Tel. Co.	Push-pull	1/4	1	11/16	Nickel Plated	Hard Rubber	None
General Radio Co.	Turn	2	———	1/4	Nickel Plated	Bakelite	None
Martin-Copeland Co.	Turn	1¼	1¾	1/4	.....	Bakelite	None
Martin Copeland Co.	Push-pull	1 3/16	1	1/4	.....	Bakelite	None
Premier Electric Co.	Push-pull	5/8	7/8	1/4	Nickel Plated	Thermoplex	None
Walbert Mfg. Co.	Push-pull	3/8	1	3/8	Nickel Plated	Nickel Plated	Plunger



Better Battery Service

A convenient arrangement for setting up the storage battery and the charger

FROM all outward aspects, a storage battery, fully charged or empty, is still a storage battery. In our laboratory we originally used a 120 ampere-hour battery, choosing a large one with the idea that, once charged, it would last a long time. Actually, it didn't work out that way because, since it lasted so long on each charge, we never expected it to run down until it suddenly failed at some inopportune time.

Therefore, we went to the other extreme, and made up the panel shown above. This is a little 50 ampere-hour Exide rubber-case battery, mounted on a wooden base board which carries the front panel. At the top of the panel is a little 0-7 voltmeter, with a D.P. D.T. Marco switch below.

Two binding posts are provided on each side, at the left for the charger leads, and at the right for connections to the top of the laboratory bench. The charger posts, positive at the top, are wired to the left hand clips of the switch, another pair of leads go from the battery to the center of the switch, while the output posts are connected to the right hand clips. A fourth set of leads go from the voltmeter to the right hand clips.

When the battery is in use, the switch is thrown to the output side. This connects the battery to the wires running up to the bench, and puts the meter on. It is an easy matter to keep an eye on the needle. As soon as it falls below 6 volts, we put the switch to the left, and turn on the charger. At night, when we close up, we open the switch. Then we are sure that none of the tubes will be left lighted. You will note that the meter is across the battery only while it is in use.

As a precautionary measure, if the battery is working hard all day long, we usually throw it over to charge during the night. Battery manufacturers tell us that the life is greatly reduced if it is run regularly from full to empty, and that batteries last much longer if they are not allowed to go below 50% discharge. We haven't had the little Exide long enough to make any comparisons, but it is certain that, with the small size, we manage to get better storage battery service and to give the battery better attention than we had the big one.

Another thing, frequently it is necessary to put one of these units on the portable bench, or to put it up on a board during special tests. Then the ease with which it can be moved around is an important factor.

Does it Help to Tune the Antenna?

Showing by actual results the effect of capacity and inductance tuning in the antenna circuit

UNTIL the advent of the neutrodyne type receiver, practically all sets were arranged for antenna tuning, either by means of a variable condenser, tapped inductance, or both. RADIO ENGINEERING was the first publication to show the fixed coupler applied to various types of circuits, April 1923, particularly the three-circuit regenerative tuner, which was shown in May 1923.

To quote from that issue, "That it is unnecessary to tune the primary circuit can be demonstrated by setting the inductance switches at any points and tuning in signals. Then change the switches, readjust the secondary condenser, and the signals will come in as before. Change the switches again and you will find that the signals can be brought back by the secondary condenser. This is conclusive evidence that switches, too, are unnecessary."

But someone raised the question recently about possible advantages that we may be overlooking in accepting the untuned primary as final. Accordingly we made a series of tests to bring out the practical value, if any, of the tuned antenna circuit. There are various ways to get at this information, but we tried to choose the most direct means of finding out what tuning in the antenna circuit mean in terms directly applicable to receiver design. Here is the method:

A radio frequency oscillator using a UV201-A, with 90 volts on the plate, was set up on one bench. Four turns of small wire were wound around the oscillator inductance to provide coupling. One lead from this four-turn coupling coil was run to a calibrated variable condenser,* and the other side of the condenser to a 30-ohm Carter rheostat. Leads were then run from the other side of the rheostat and of the coupling coil to the 6-turn primary of an Eastern pickle-bottle coupler.

This circuit served as a dummy antenna, the variable condenser and rheostat providing the antenna capacity and resistance, and the leads and the rheostat winding sufficient inductance.

The secondary of the pickle-bottle coil was connected to a variable condenser,

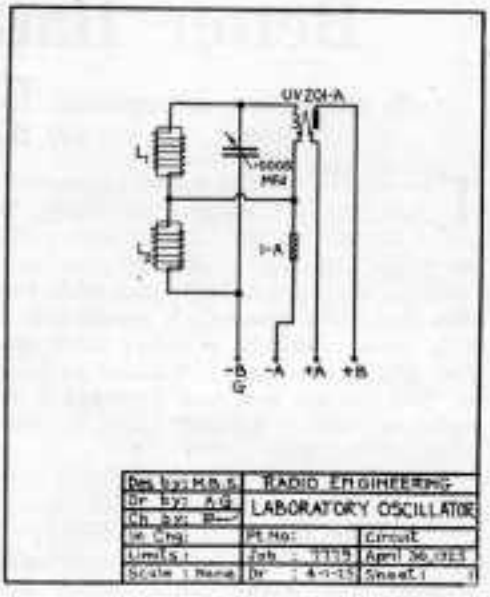


Fig. 1. Diagram of the laboratory oscillator used in these tests.

with a Weston thermo-galvanometer in series to indicate the current in the secondary circuit. The complete layout represents the equivalent of a transmitting station, antenna, and tuner, with the meter to show the current in the tuning circuit.

You will see in Fig. 1 a diagram of the oscillator. The coil L_1L_2 is a General Radio inductance with a center tap. All the other parts were selected from odds and ends around the laboratory. The

* See Radio Engineering, January 1925, page 12.

six sets of curves represent six different wavelengths transmitted by the oscillator —300, 350, 400, 450, 500, and 550 meters —covering the broadcasting range. Since the output of any oscillator varies with the frequency, or wavelength, the curves are grouped as they were made at each wavelength, so that the transmitting conditions would be the same for each group.

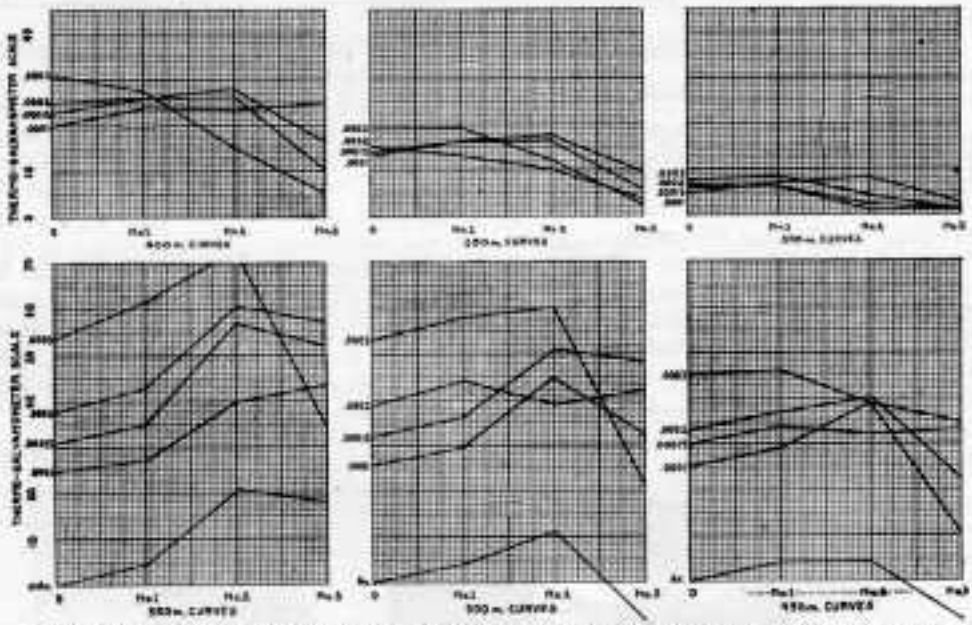


Fig. 2. These curves show, at different wavelengths, the effect of tuning in the antenna circuit with different antenna capacities.

With the oscillator set at 550 meters, the antenna condenser was set at 0.0001 mfd. This represents a small in-door antenna. When the secondary condenser was adjusted, the meter read 25. With 0.00015 mfd., the meter stepped up to 31; at 0.0002 mfd., 38; at 0.0003 mfd., representing a large antenna, 54. The secondary condenser was readjusted each time. This shows an increasing current in the receiving curcuit as the size of the antenna is increased.

Next, without changing the oscillator, we inserted a coil of 10 turns of No. 24 S.S.C. wire, wound on a 3½-in. Formica tube, in one of the leads to the primary of the pickle-bottle coupler. It was set with its axis at right angles to that of the pickle-bottle coil to prevent coupling. This 10-turn coil acted as a loading coil in the antenna circuit of a receiving set.

Readings of the meter at the four different capacities were 27, 35, 43, and 61, as you will set in the curve for 550 meters at coil 1. Coil 2, similar to the first, but with 20 turns, gave further increases. Coil 3, of 40 turns, increased the reading only at 0.0001 mfd. The bottom curve shows the average increase over the readings obtained without any loading coil.

Following are curves made in a similar manner at wavelengths down to 300 meters. At 500 meters the average increase is very small, indicating only a slight gain by the use of the loading coil. At 450 meters the gain is negligible, while at 400 meters and below there is a definite loss.

Thinking that there might be resonance peaks which we skipped by using a step inductance, we connected another variable condenser in series in the dummy antenna circuit. This made the equivalent of a tapped coil and series tuning condenser in a receiving set. However, when

we repeated the measurements we found that, at most settings, the readings were cut down, and increased only slightly at a few settings.

This series of measurements appears to indicate, then, that for all practical purposes, a 6-turn primary coupling coil gives as good results, or better, than can be obtained with a tuned antenna circuit. We had an idea that a double condenser might be used advantageously, one section to tune the secondary, and the other to tune the antenna roughly, but these results show that there is no use for such an arrangement as it is no improvement over the simpler method.

A New Method for Making Connections

AN analysis of defects which develop in receiving sets after they have left the factory shows that one of the weakest points in radio receivers is the methods of making the connections between various instruments. There are several things that contribute to this difficulty. It is hard to explain it, but somehow or other, unless the nuts which hold the soldering lugs on the terminals are actually soldered to the screws, they do come loose. Again, soldered joints which appear to be secure are frequently just about strong enough to hold the wires until they are subjected to strain when the set is being shipped out. Soldering lugs frequently break off right at the nuts which hold them in place. Altogether, for production work, lugs are not satisfactory. Some concerns have tried to solder wires directly to the screws but here again there is trouble because a film of oil is generally found on screws which have not been nickel plated, and soldering does not stick well to screws which have been nickeled.

The first practical method for making permanent and solid connections has been brought out by the William Stevens Company. These connectors are shown in Fig. 1, applied to some of the conventional instruments. The Lastite is a sort of hexagonal cap nut, threaded for 6-32 or 8-32 screws. The head of the nut, instead of being rounded off, is turned down to a small tube. The hole is large enough to take two No. 18 wires, and the wall thin enough so that it can be soldered to very quickly. In trying out these Lastites at the Darien laboratory, we have found it most satisfactory to put the ends of the wire in soldering paste, then insert them in the hole, and finally solder them. This is the best way to make sure that the paste gets into the hole. The solder then flows in readily.

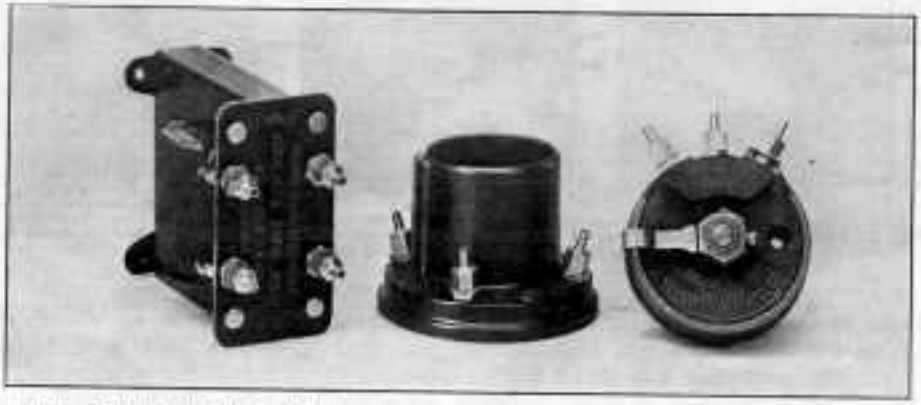


Fig. 1. Lastites fitted to binding posts on a Kellogg transformer, hnald socket, and Pacent rheostat, illustrating their use on radio instruments.

Another important factor is that the Lastites can be put in place more quickly than lugs, for they do not need to be pointed in any particular direction and clamped in place.

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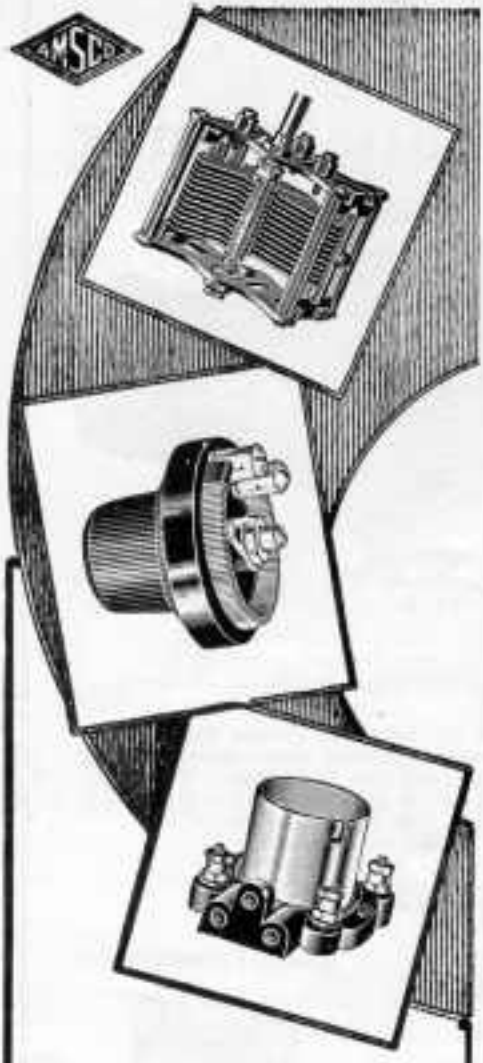

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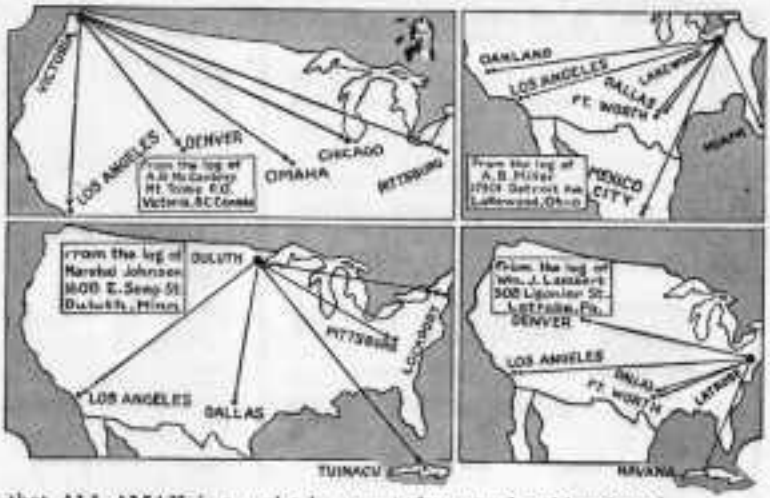

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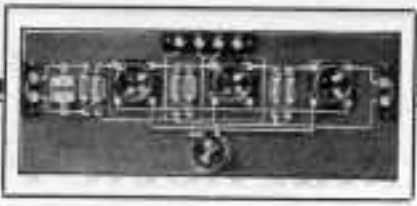

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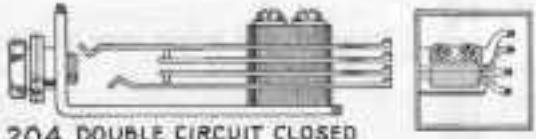

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Data on Batteries, Eliminators, and Chargers

MANUFACTURERS of batteries, eliminators, and chargers are requested to send immediately, for publication in the July issue of Radio Engineering, the following data on each type which will be on sale this fall: Dry Cell A Batteries: 1. Width, thickness, height over binding posts. 2. Open Circuit voltage. 3. Load voltage when battery should be destroyed. 4. Maximum steady current drain recommended.

Storage A Batteries: 1. Open Circuit voltage. 2. Width, thickness, height over binding posts. 3. Ampere-hour rating. 4. Load voltage at which battery should be recharged. 5. Charging rate. 6. Does battery have 2-volt binding post? 7. Can battery be supplied with built-in charger?

Dry Cell B Batteries: 1. Width, thickness, and height over binding posts. 2. Open Circuit voltage. 3. Load voltage when battery should be destroyed. 4. Maximum steady current drain recommended.

Storage B. Batteries: 1. Open-circuit voltage. Width, thickness, and overall height. 3. Approximate ampere-hour rating. 4. Load voltage at which battery should be recharged. 5. Charging rate. 6. Is voltage variable? 7. Can battery be supplied with built-in charger? 8. What type of cells are used?

Eliminators for 110V. A.C. 60 cycles. 1. Overall width, thickness and height. 2. Chemicals or tubes. 3. Number of tubes. 4. Voltage for detector. 5. Amplifier load voltage at 10 milliamperes drain. 6. Amplifier load voltage at 20 milliamperes drain. 7. Amplifier voltage at 30 milliamperes drain. 8. Current drawn from line.

Battery Chargers for 110V. A.C. 60 cycles: 1. Overall width, thickness and height. 2. What voltage batteries will it charge? 3. Charging rate. 4. Chemical or tube. 5. Approximate normal life of tube.

This data should be addressed to Manufacturers' and Designers' Data Department, Radio Engineering Magazine, 52 Vanderbilt Avenue, New York City. It must be received before June 5.

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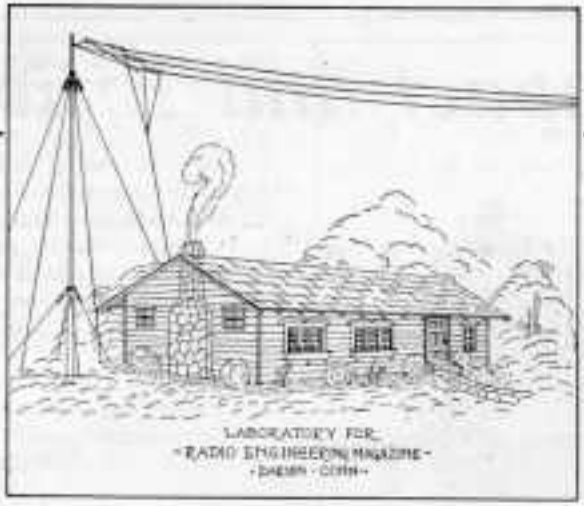
RADIO ESSENTIALS



Preliminary Sketch for the New Laboratory at Darien, Conn.

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

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

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

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

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

SPECIAL ADVANCE INFORMATION

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

LABORATORY SERVICE WITHOUT COST

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

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

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

M. B. SLEEPER, INC.

A-52 Vanderbilt Ave., New York City.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, of RADIO ENGINEERING.

Published monthly at New York, N. Y., for April 1, 1923.

State of New York } ss.:
County of New York }

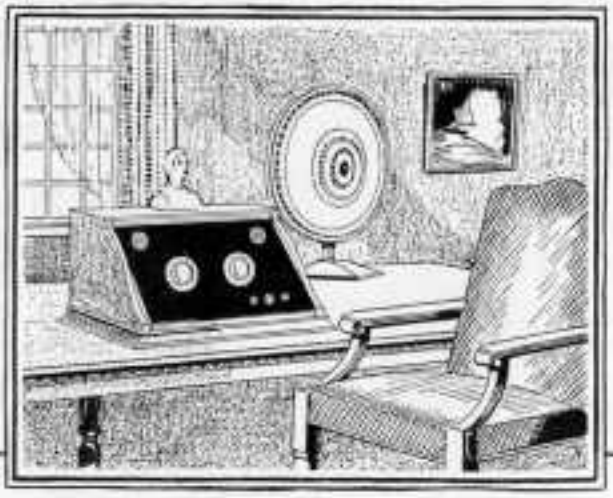
Before me, a Notary in and for the State and county aforesaid, personally appeared Francis A. Shelton, who, having been duly sworn according to law, deposes and says that he is the Business Manager of RADIO ENGINEERING, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24th, 1912, embodied in section 443, Postal Laws and Regulations, to wit: 1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, M. B. Sleeper, Inc., 52 Vanderbilt Avenue, New York; Editor, M. B. Sleeper, Darien, Conn.; Managing Editor, Francis A. Shelton, 52 Vanderbilt Avenue, New York; Business Manager, Francis A. Shelton, 52 Vanderbilt Avenue, New York. 2. That the owner is M. B. Sleeper, Inc., whose stockholders are: Anne F. Sleeper, Darien, Connecticut; Milton B. Sleeper, Darien, Connecticut; Francis A. Shelton, 17 East 59th St., New York, N. Y.; and Mae G. Murray, Halstead Ave., Harrison, N. Y. 3. That the known bondholders, mortgagees, and other security holders owning or holding 1% or more of the total amount of bonds, mortgages, or other securities are: None. 4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where a stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

(Signed) Francis A. Shelton, Business Manager

Sworn to and subscribed before me this 27th day of March, 1923.

(Seal) F. N. BUNGER, Notary Public

Westchester County.
New York Co. Clerk's No. 952-A.
New York Co. Register's No. 6031.
Commission expires March 30th, 1925.



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FORMICA panels, tubing and Base panels are the marks of quality in a radio set. You can be sure that the set which has them has been built for lifetime service—and that enduring good performance has not been sacrificed to the saving of a few cents here and there.

It is more necessary than ever this year to judge a radio set by the material it contains. Price competition last year brought in the type of apparatus that would perform beautifully for a week or two and then quit. And price competition is still with us.

Formica is used by nearly all the great makers of high quality apparatus. They swear by it as they always have. Be sure you have it in the set you buy.

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The Ultimate in Four-Tube Performance

Super-het results on four tubes are common occurrences reported by builders of the famous Four-Tube "Knockout," designed by McMurdo Silver, Assoc., I. R. E. This remarkable receiver, which was described and recommended by M. B. Sleeper in last month's "Radio Engineering," will positively do on a seventy-foot aerial what any super will do on a loop. A novice can build and operate it. Mr. Silver's booklet on the "Knockout" describes the receiver in detail. It may be had for 25 cents.

Complete Parts—$44.40

	Each
2 Silver .0005 Low Loss Condensers No. 501	$4.50
3 4" Moulded Dials—Tapered Knobs	1.00
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6 Insulated Top Binding Posts	.60
1 Carter 1024 Jack	.50
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1 Silver Low Loss Coupler No. 105	2.00
1 Silver Low Loss Antenna Coil No. 205	2.50
4 Hoosick Falls Panel Mounting Sockets	.60
1 Thordarson 3½:1 Audio Transformer	4.50
1 On-off Switch	.90
1 .00025 Mica Condenser with Leak Clips	.45
1 .002 Mica Condenser	.40
1 .0075 Mica Condenser	.75
1 XL Variodenser	1.00
2 2 Meg. Grid Leak	.50
1 7 x 24 x 3/16 Bakelite Panel, Drilled, Grained and Engraved	7.00
Bus-Bar, Brackets, Screws, Nuts, Solder, Lugs, Etc.	1.50

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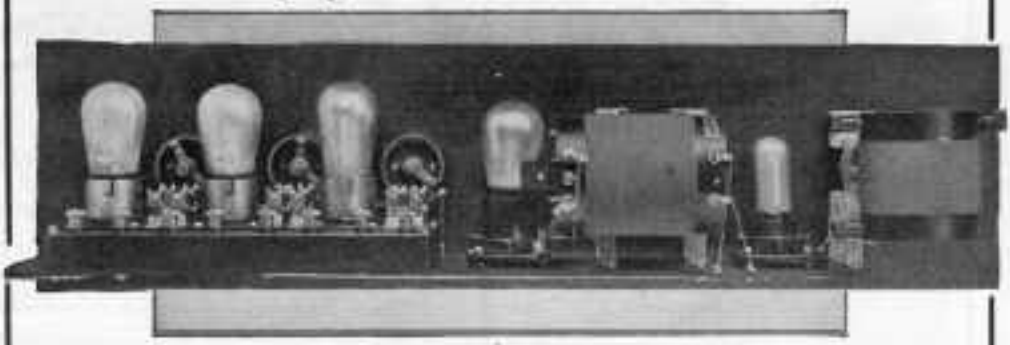
BROWNING-DRAKE FIVE

Simplified Construction Kits



Why it Pays to Buy DURRANT Kits at DURRANT Prices

The surest guarantee of success in your radio work is the use of good parts—not things that may be good enough, but the best parts, made by manufacturers of national reputation. Gyp parts give gyp results.

Realizing this, DURRANT, in building a reputation as the foremost supply house for set builders, supplies to its customers only such products that, by their high performance, will maintain the reputation of DURRANT for selling construction kits that are always successful.

DURRANT does not offer cut-price inducements. Obviously there is something wrong when goods are advertised at prices less than cost. If you stop to consider it, you will see that you pay DURRANT the lowest price at which you can get dependable supplies promptly with the postage prepaid.

The companies listed below furnish the parts for the Browning-Drake Five construction kit:

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Brooklyn Metal Stamping Co.	James Goldmark Company
Daven Radio Company	Mitchell-Rand Mfg. Company
Dubilier Condenser & Radio Co.	Metro Electric Mfg. Company
Formica Insulation Company	National Company Incorporated
General Instrument Company	New York Coil Company

DURRANT SELLS ONLY NATIONALLY ADVERTISED PRODUCTS

The Browning-Drake Five is a year ahead of all other receiving sets in four important features:

1. In a single stage of tuned radio frequency amplification it produces the amplification of two ordinary neutralized tuned R. F. stages.

2. The efficiency of regeneration—which tuned R. F. sets do not have—is obtained by a simple control which prevents oscillations and interference with other receiving sets.

3. Resistance coupled amplification is provided to give the perfect, high-ratio volume which only resistance coupling can produce—and with one-third the B battery consumption.

4. In miles per tube and volume per milliampere, the Browning-Drake Five outperforms any other circuit at far lower operating cost. Build this set for real satisfaction. No worry that it will be out of date next year.

BROWNING-DRAKE FIVE, the set that's a year ahead—complete construction kit, all parts, even to the screws and nuts, Formica panels drilled and engraved, packed in heavy shipping case, post paid..... $59.90

DURRANT RADIO, Ltd.

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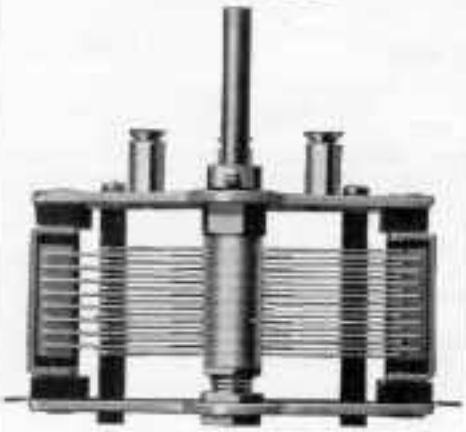
DXL Condensers are Unequalled Your Engineers Know It Your Sales Will Prove It



Fans demand Better Sets.

A good Set demands Better Condensers.

D X L offers a complete line of Straight Line Low Loss Condensers representing the high point in condenser design.

Each condenser is a precision instrument.

Prices are Attractive.

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The "Self-Adjusting" Rheostat

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GLASS GRID LEAKS

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No PENCIL MARKS

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YOUR OWN NAME OR TRADE-MARK IF DESIRED

WRITE FOR PRICE LIST

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ELECTRIC CO., INC.

16 HUDSON ST., NEW YORK CITY

WHOLESALE ONLY

I and M REGISTRY

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

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

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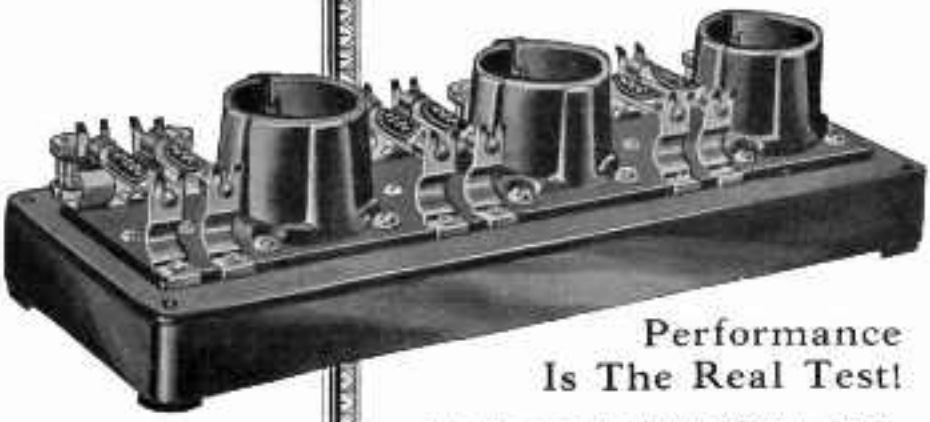

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LOW "B" BATTERY CONSUMPTION

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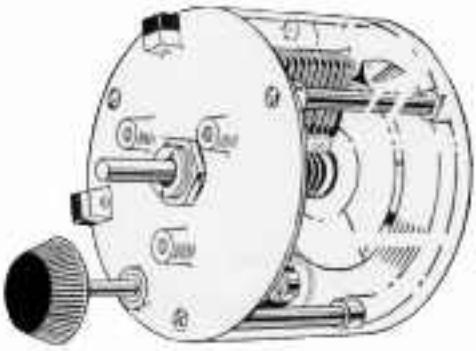
ACME APPARATUS CO. makes a condenser especially adapted for short wave transmission. Dielectric losses are so small that the condenser will stand up under high voltage and not get warm.

The dielectric is of the finest grade hard rubber so that there is no chance of a breakdown. The capacity is .0001, a low capacity very useful on short waves as more inductance can be used. It is of the same low loss construction as the standard .0005 Acme low loss condenser.

The Acme Transmitting Condenser has been tested in transmitting apparatus and users are enthusiastic about the satisfactory results.

If you have any difficulty in getting Acme transmitting Apparatus write either to the Acme Apparatus Company, New York Office, 1270 Broadway, or to the factory, Cambridge, Mass., and you will be taken care of promptly. Send for Booklet T, on Transmitting Apparatus.

ACME APPARATUS COMPANY
Dept. H-5 Cambridge, Mass.



ACME

~for amplification