Radio and Model Engineering

10 cents a Copy - 570 West 184th Street, New York City - $1.00 Per Year

Vol. I JULY, 1921 No. 3

Editorial

IN the June issue of R and M you may have noticed the statement that your combination square, dividers, scriber, and center punch are your best friends in laying out your panels. That this is true I have seen demonstrated many times by Experimenters who say they can't lay out a panel neatly and accurately, but when they locate their holes by cross lines made with the square and scriber or the dividers, and carefully start the holes by center punch marks, they do as good work as the best. The use of these small tools is a habit, and one that every Experimenter should acquire.

Of great assistance is the use of L. P. F. panels because they are ground on the edges to be perfectly square and accurate as to dimensions. Therefore a line at right angles to one side is at right angles to the opposite side. This material is also agreeable to drill and tap, for the holes are clean, with no broken under-sides. It can be filed nicely, too.

The added time required to make things right and accurate is both time and money saved, for it guards against spoiled materials and the necessity of "making it over." Most important of all, however, is the feeling of pride and confidence in a well made instrument, against the untidy work of a man who has to hurry to try it out, for he has little pleasure for his pains.

Look over your own apparatus and see which kind of a man you are. On the next instrument make a real job of it.

M. B. Sleeper, *Editor.*

A Real Receiving Equipment

This set probably introduces a new era in experimental instruments; it is a regeneration tuner of astonishing sensitivity for 150 to 2,600 meters.

By W. H. Bullock

The Tuning Cicuit.

REGENERATIVE receivers, as many an experimenter knows, are not only difficult to handle but are quite expensive. Some of the variometer type sets have as many as nine control knobs, the minimum being five, exclusive of the audion circuits.

The time required to tune such sets multiplies rapidly with the number of controls, because of the extremely sharp tuning and the frequency variations due to the hands, with the result that short calls are often lost before they can be tuned in. Moreover, the wavelength range at best is 150 to 300 meters unless an air or mica condenser is added in the secondary.

When properly constructed, this set brings in signals louder than the very best variometer set, regenerates splendidly on the first half of the feed-back coil scale, and oscillates freely on the second half. In addition, it is excellent for receiving long waves to which a variometer outfit will not respond.

Both in operating qualities and cost it is a logical successor to the older receivers, which have so long held the interest of experimenters.

New Type of Construction.

ANOTHER new feataure is introduced in this aricle, namely, the panel supporting methods. At the G. A. Company we have actually built dozens of boxes and tried out many and varied schemes for supporting instrument panels, for the purpose of finding an inexpensive and at the same time good-looking method. The angle brass supports, shown in Fig. 1, is the outcome. These are easily made, furnish excellent bracing for the panel, permit instruments to be attached on top or at the sides, and carry the rear connection panel conveniently. All around, it is the best system for the man who does not want to put four or five dollars into a cabinet for each instrument.

Panels and Supports.

FIG. 2 gives the layout of the front and rear panels and of the angle brass supports. These can be cut and drilled from regular stock. They are also sold completely made up, in which case the brass is nickeled. Since all dimensions are one-half size, they can be readily scaled off from the drawings. If a sharply pointed scriber is used, light lines can be made on the front of the panel and later sanded off, when the holes have been drilled, with No. 0 sandpaper and oil. Do not rub dry sandpaper on L.P.F., for it quickly fills up. Plenty of oil, however, keeps the particles floating, and they do not coat over the sandpaper.

First Ass mbly Job.

AS soon as the front panel has been drilled, the three coil mounting pillars, the switch, and switch points should be put on. An extra switch point is allowed at each end of the row. The condenser may be mounted also, but none of the other parts, for they will be in the way.

Winding the Coil.

BANKED windings, hold a terror for many experimenters who have had experience with them, in almost every case because they did not go about it in the right way. A simple winding rig is needed, consisting of two round pieces to fit in the tubing, fastened to a ¼-in. shaft fitted with a handle and supported on two sturdy uprights. It is difficult to tell an Experimenter how to wind the coil; he must learn by practice. For a three-bank coil, the process, briefly, is this:

Wind three complete turns around the tube, keeping the wire just as tight as possible. At the end of the third turn, bring the wire up between the second and third turns and wind once around. Then another turn between the first and second. At the end of the fifth turn, jump up between the fourth and fifth and wind one turn. The result should be a pyramid of three layers of three turns, then two, then one.

When the sixth turn has been completed, bring the wire down onto the take off the taps. This method keeps the winding tight and the taps out of the way.

A G-A-Lite tube, 3½ ins. in diameter and 4½ ins. long, carries the winding of No. 24 S.S.C. wire in three banks. Taps

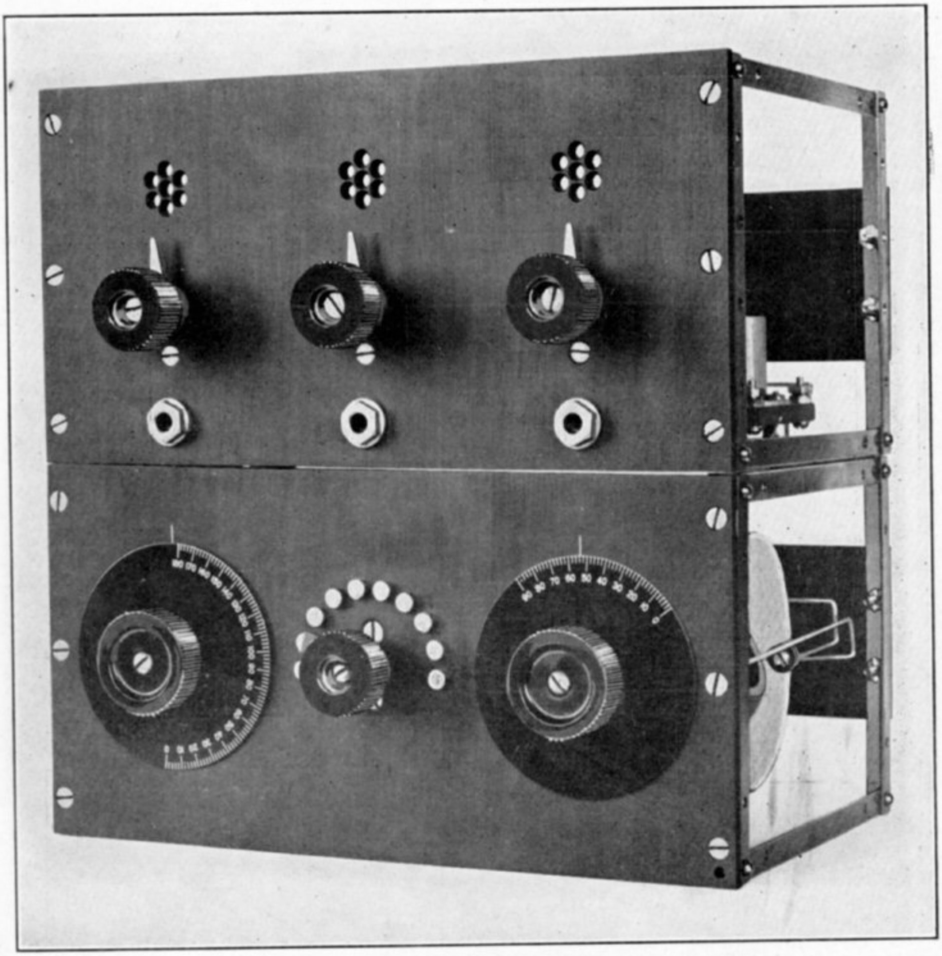

Fig. 1. The 150 to 2,600 meter regenerative set with a detetor and two-step amplifier. The latter will be described in the August issue.

tube and put on the seventh turn, the eighth turn on the seventh, and the ninth turn on the eighth. Jump to the tube again, and repeat the process. To take off taps, when the tapping point is reached, bend the wire sharply to one side and wind a single turn around the part of the coil already wound. Bring the end of that turn back to where it was started and continue with the winding. After the coil has been completed and varnished, cut the tapping turns and for this 150-to 2600-meter coil are taken off, as shown in Fig. 2. Remember that a ⅜-in. space is allowed after the fifth tap. The inductances and wavelength ranges with a 0.0008 mfd. series condenser and a 0.0003 mfd. antenna are:

Tap 1—0.09 millihenry
150 to 253 meters.

Tap 2—0.16 millihenry
200 to 337 meters.

Tap 3—0.30 millihenry
270 to 462 meters.

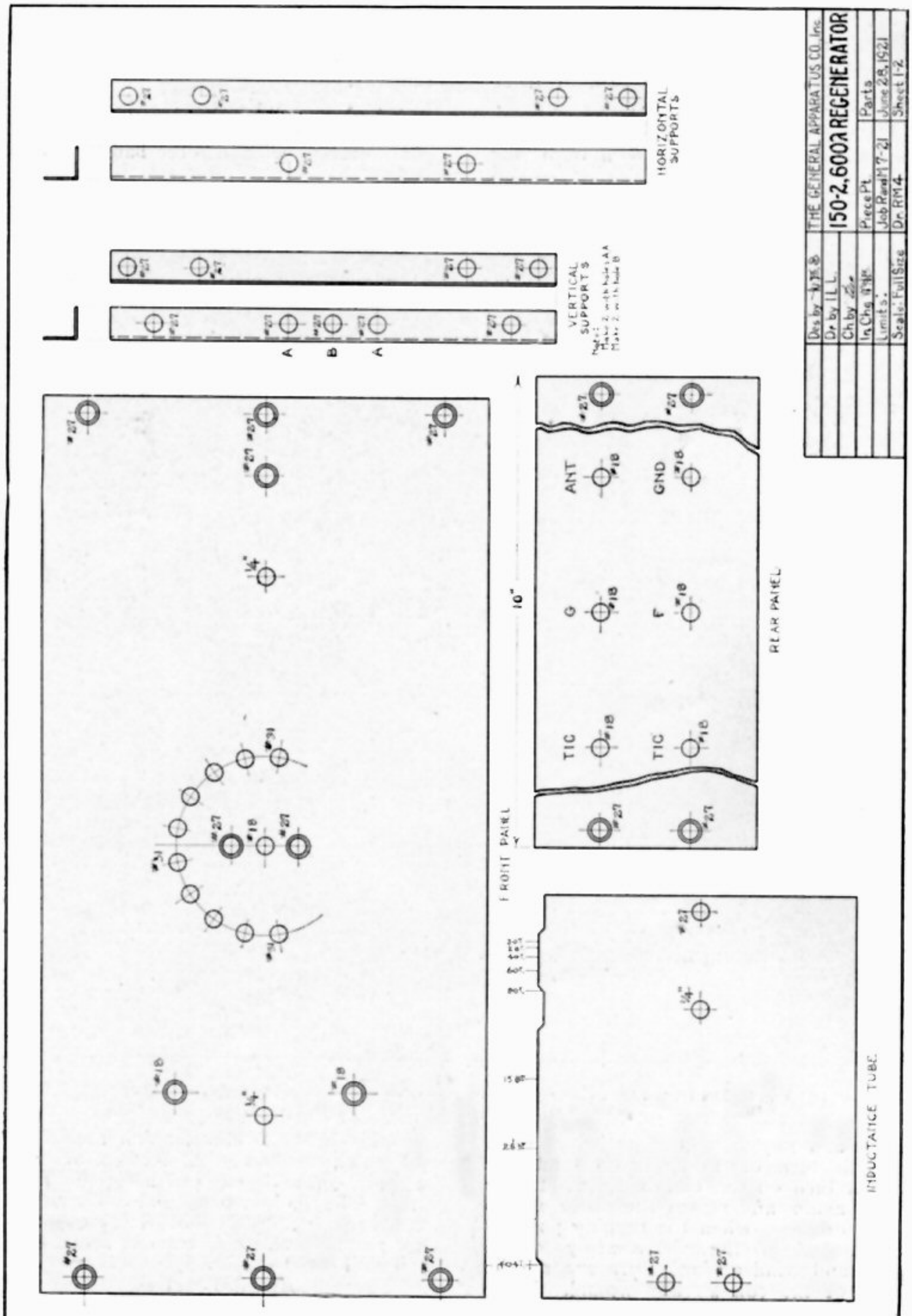

Fig. 2 Mechanical details of the receiver.

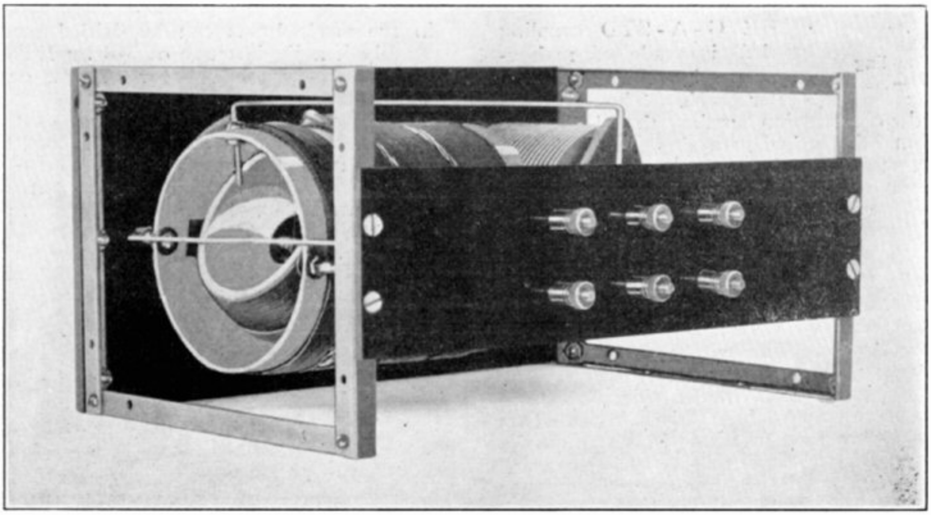

Fig. 3. End view, showing the tickler details and the connection panel.

Tap 4—0.60 millihenry
383 to 653 meters.
Tap 5—1.20 millihenries
546 to 923 meters.
Tap 6—2.50 millihenries
789 to 1,333 meters.
Tap 7—5.00 millihenries
1,066 to 1,885 meters.
Tap 8—10.00 millihenries
1,577 to 2665 meters.

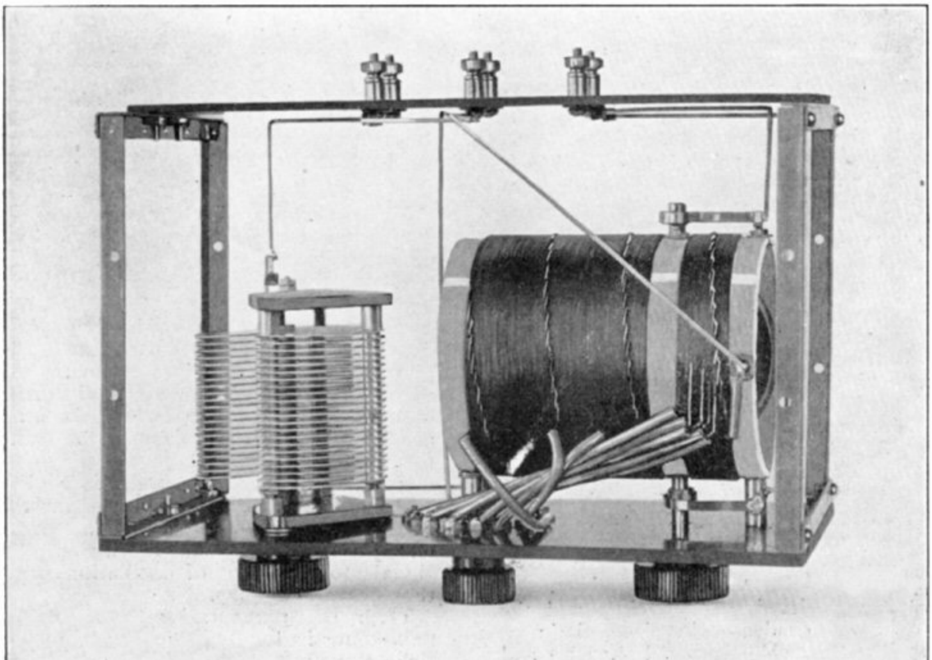

Fig. 4. Looking down on the condenser and inductance.

The Coupling Ball. THE G-A-STD coupling ball is made of mahogany, turned out with a heavy center web. The material and construction make the ball free from the usual warping and shrinking experienced with thin-walled balls of other wood. Moreover, greater friction and support is given to the shaft, so it will not run out of true or become loose.

To obtain sufficient inductance to make the set oscillate over such a wide wavelength range, the ball is wound on each side with two layers of No. 24 S.S.C. wire. The winding is started at the outside, running up to the top, then, jumping down to the outside, the winding is run up again. This is repeated on the other side, winding in the opposite direction so that the two halves will actually be in the same direction. The adjacent ends of the two halves are soldered together and the outside ends run to the two parts of the split shaft.

Mounting the Coils. THREE GA-STD coil mounting pillars are required, one at the right and two at the left, as shown in Fig. 2. Holes in the tube for the tickler shaft must be located carefully or the tickler dial will not turn true. The shafting is of ¼-in. brass rod. Since the tickler ball is already drilled with a small guiding hole, it is only necessary to enlarge it with a ¼-in. drill.

Before the tickler is put in place, two small pieces, ¾ by 1½ ins., should be cut from No. 24 spring brass sheet, and drilled with a ¼-in. hole in their centers. They are for spacers between the ball and the inside of the inductance tube. When the coil has been mounted, the shaft, carrying the dial, is put in from the panel, a spacer fitted over it, and the shaft pushed into the ball. This is repeated from the rear. The wires from the tickler are then soldered to the ends of the shaft, Fig. 3, and pigtails soldered on outside as in Fig. 4. Finally a 1-in. screw is put through the tube, Fig. 3, 3/16 in. from the end, to act as a stop for the tickler. This also serves as a terminal for the start of the winding, as may be seen in Fig. 4.

Connecting and Finishing. WITH the taps, covered with Empire tubing, soldered to the points and the condenser in place, the next step is to assemble the panel supports and the connection panel.

Round head 4-36 machine screws hold the angle brass strips together. Holes in the angle brass can be drilled more readily if a jig is made of 3/8 by 1/16th in. brass strip, bent over at one end. The holes are first laid out on this strip. Then, by hooking it on one end of the angle brass, the holes can be located quickly and exactly.

The binding posts should be put in place, with No. 6 soldering lugs, and tightened before the panel is fitted to the panel supports. Fig. 5 gives the connections, and they can be traced out in Fig. 4.

Operating the Set. ONLY an audion detector and its accessories are required in addition to the receiver. A variable grid leak or grid condenser is not necessary; they should be fixed, of approximately 1 megohm and 0.0005 mfd. respectively.

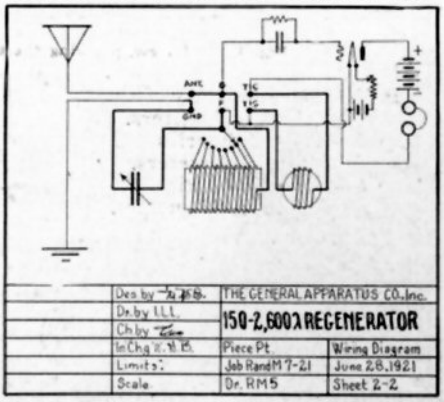

Fig. 5. Wiring diagram of the complete outfit.

If, at maximum tickler coupling, the set does not oscillate, as indicated by a plucking sound when the grid post is touched, the connections to the tickler should be reversed. Sometimes it is necessary to put a 0.001 mfd. phone condenser around the B battery and telephones. This is required when an amplifier is used. A little experimenting will show whether one, two or three are needed around the primary of the transformer.

To tune the set, the tickler is slightly advanced, and the switch and variable condenser adjusted until signals come in. Increasing the tickler brings up the signals to the point of oscillation, when they become mushy.

With the regeneration obtained signals come in loudly which, without the tickler, cannot be heard at all. It will be found that the more closely the set is tuned, the greater is the regenerative action.

Inductance, Capacity and Wavelength

By M. B. Sleeper

Showing that wavelength is not a cause but an effect—a result and not a factor.

THE beginner usually comes to realize in a short time that wavelength has nothing to do with transmitting or receiving range, but of those who have been in radio work for years not one in a hundred really understands the meaning and application of the term.

Did you ever hear of the area of length, or the area of a width? You know that there can be area only as a result of width *and* length. In radio work, inductance can be compared with the length of a piece of paper, capacity with the width, and wavelength, the area. A circuit made up of inductance alone has no wavelength, nor has a circuit of capacity only. When, however, an inductance *and* a capacity are connected together, they give a resulting wavelength.

For this reason, Experimenters who wish to speak intelligently should no more talk about the wavelength of a coil than about the area of a width. There is, of course, a natural period for every coil, just as there is area in a ten-inch pencil mark, but this value is of no use except in very special cases.

Here is another important point. A given coil which, added to one circuit, increases the wavelength from 1,000 to 1,500 meters will not increase the wavelength of a 3,000-meter circuit to 3,500 meters. Carrying out the comparison given above: Suppose a panel measuring 5 by 10 inches, giving an area of 50 square ins., is increased in length to 15 ins. The area then becomes 75 sq. ins., increasing the area by 25 sq. ins. Another panel 10 by 10 ins., 100 sq. ins., is increased by 5 ins. in length, giving an area of 150 sq. ins. or an increase of 50 sq. ins. However, 5 ins. was added to the length in both cases.

In a radio circuit a coil of 1,000,000 cms. and a 0.0005 mfd. condenser are connected. The wavelength resulting is 1,333 meters. Adding a coil of 500,000 cms. brings the wavelength up to 1621 meters, an increase of 288 meters. On the other hand, a circuit of 2,500,000 cms. and 0.0002 mfd. also gives a wavelength of 1,333 meters, but when the inductance is increased to 3,000,000 ins. the wavelength only goes up to 1,460 meters, or an increase of 127 meters.

Consequently the man who thinks and designs his apparatus intelligently must learn to figure the actual inductance of his coils and, knowing the capacity ranges of his condensers and the capacity of his antenna, determine the wavelengths to which these values will respond. The former can be worked out by simple arithmetic with the aid of Inductance Tables[1], and the latter read directly from tables given in Design Data for Radio Transmitters and Receivers.[2]

You owe it to yourself and to those who are learning from you to clear up this very fundamental subject, for wavelength is to radio work what vibration is to the study of sound.

(1) Inductance Tables, Published by The General Apparatus Co., Inc. Price $.25.

(2) Design Data, Sold by The General Apparatus Co., Inc. Price $.75.

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The G. A. mark on a condenser means that the capacity is accurate within 5% and the resistance within 10%.

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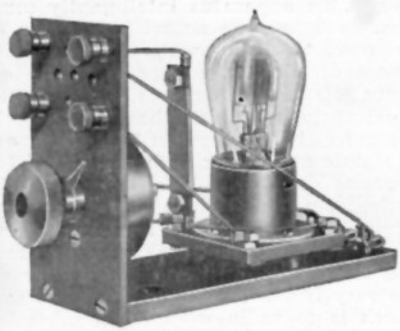

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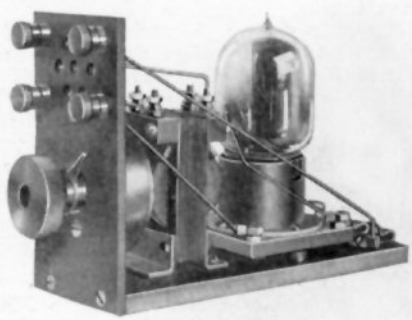

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