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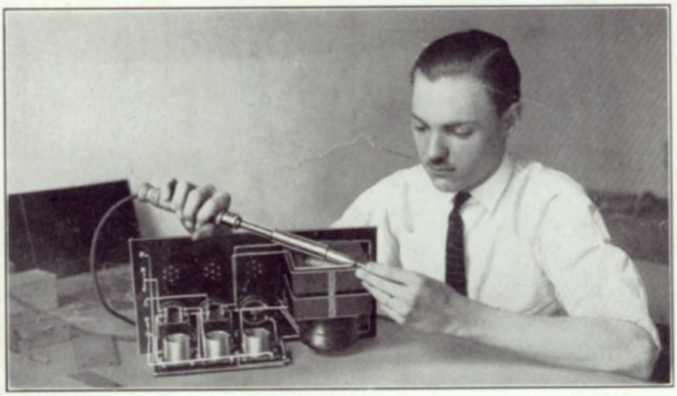

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A 150-1400 Meter Receiver

A regenerative outfit with a wavelength range that will include the Army broadcasting stations.

By M. B. Sleeper

A General Description

INQUIRIES regarding the loading of short wave receivers to permit reception on greater wavelengths are so frequently made that the description of a regenerative receiving set with a maximum wavelength of 1400 meters seems justified. The instrument here described and shown photographically in Figs. 1, 2, and 3, employs a single circuit tuning system so that its normal wavelength range can be increased by the addition of but a single loading coil if wavelengths above 1400 meters are ever desired. Tuning is accomplished by means of two inductance switches—one at the left for fine adjustment, and one at the right for inductance variations in large steps. A variometer connected in the plate circuit of the detector tube is coupled to the tuning inductance to obtain regeneration. It is found that by this arrangement the set will oscillate well at any frequency within its wavelength range.

The right hand half of the receiver is occupied by a detector and two stage audio frequency amplifier similiar to the one which has previously been described. A base panel secured to the front panel by angle brass brackets supports the tube socket and transformers. Telephones, B battery, and A battery binding posts are located at the extreme right, while antenna and ground terminals are provided at the left of the instrument.

The outfit is enclosed in a highly polished mahogany cabinet measuring $7\frac{1}{2}$ by 15 by $6\frac{1}{2}$ ins. It is made of $\frac{1}{2}$ in. stock with locked corners firmly glued. The top is hinged to permit the vacuum tubes to be placed in or removed from their sockets. Since the construction of such a cabinet can be successfully undertaken only where the builder has a well equipped carpenter shop and considerable experience in cabinet making, no detailed description will be given as the cases can be purchased already made.

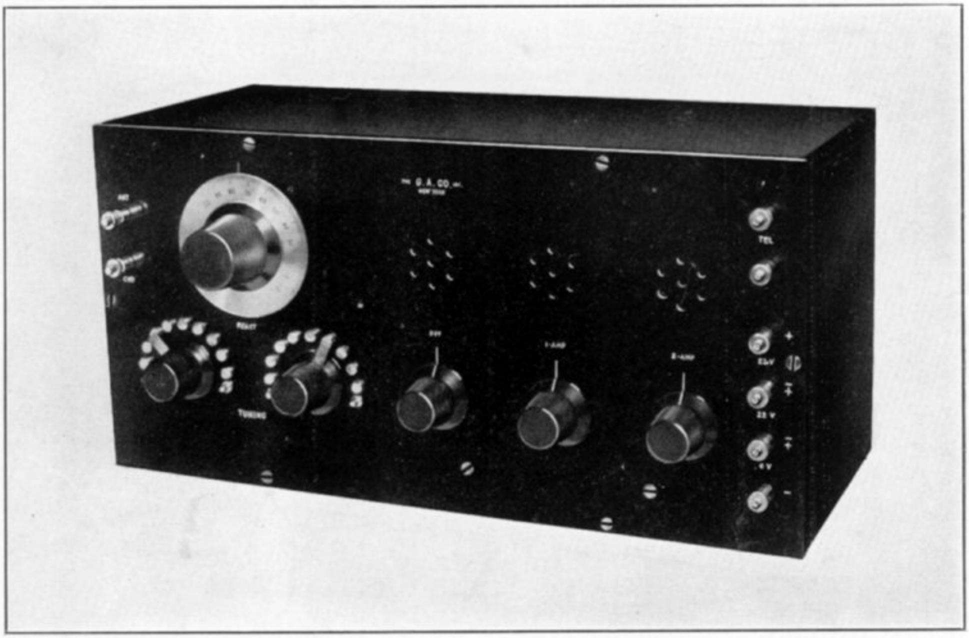


Fig. 1. A general view of the regenerative receiver which includes a detector and two-step amplifier

Work On the Panels

The construction of the receiver should be started with the laying out of the front and base panels. They are both of $\frac{3}{16}$ in. L. P. F., the former measuring $7\frac{1}{2}$ by 15 ins. and the latter 5 by $7\frac{1}{2}$ ins. These are stock sizes so no work is required in the way of cutting or squaring the panels. Following the scale drawings in Figs.

4 and 5, locate all holes on the reverse side of the L. P. F. from measurements taken from the drawings and multiplied by two for the small panel, and four for the large one. With the positions of the holes indicated by intersecting lines, centerpunch the panel before starting to drill. This insures the correct location of the holes. The numbers shown on the drawings represent the drill sizes for the various holes, and concentric circles mean that those holes are to be countersunk to take flat head screws.

Winding the Inductance

The tuning inductance is wound upon a 2½ in. length L. P. F. tuning 3½ in. in diameter. Two No. 27 holes are drilled diametrically opposite each other and $\frac{3}{16}$ in. in from one end to take brackets for fastening the inductance to the variometer. The winding of No. 24 S. S. C. wire is started at this end, leaving a margin of ⅜ ins. The coil is a two bank winding with taps taken at turns number 0, 3, 5, 7, 9, 11, 13, 15, 17, 34, 51, 68, 85, 102, 119, 136, and 153. Since the greatest source of trouble in bank winding is the tendency of the wire to slip on the tube, it is advisable to coat the L. P. F. with shellac or varnish before the winding is attempted. Allow it to dry only to the extent of becoming gummy, and then start the coil. Secure the end of the wire firmly and wind on two turns with considerable tension. Then bend the wire sharply and place the third turn between the two just wound. Care should be taken not to draw the wire tightly enough to force the turns apart. As the third turn is completed, the first tap is taken off and the wire is returned to the tube for the fourth turn. Another sharp bend is made and the fifth turn is wound adjacent to the third. All even turns will be wound beside each other on the tube while the odd turns will compose the second layer of the inductance. Where taps are to be taken off bend the wire from its normal course and wind a turn over some preceding portion of the coil. Return to the point where the tap was started and continue the winding in the usual manner. When the coil is completed these extra turns are cut and the ends thus made twisted together to form the tap.

Assembling the Receiver

With the tuning inductance wound, varnished, and baked, it is now fastened to a variometer by means of two brass angles secured to the tube with ¼ in. 6-32 machine screws and to the variometer stator with ⅜ in. wood screws. From Fig. 2 it can be seen just how the two units are mounted together.

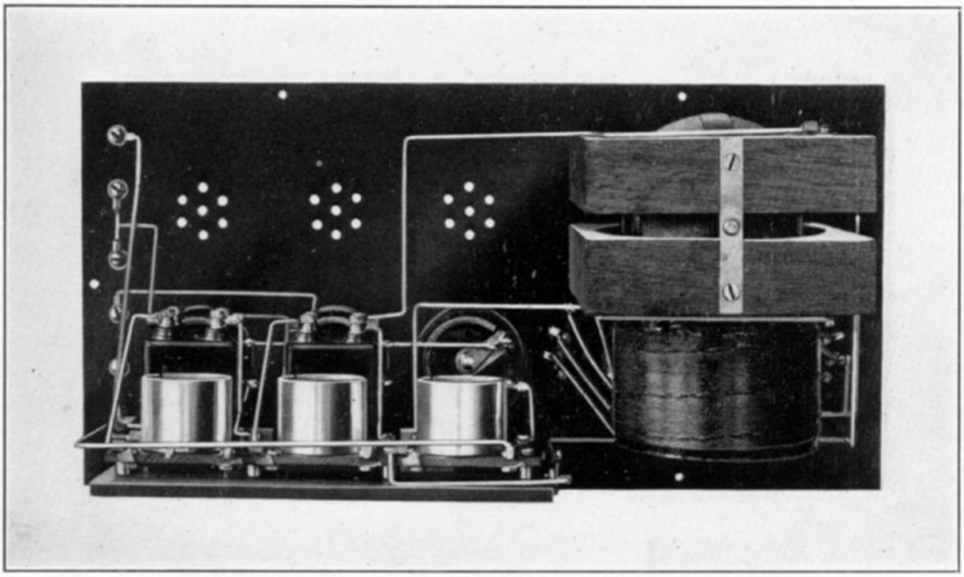


Fig. 2. Rear view of the receiver with case removed

Switch points, stopping points, and switches are now put in place with a small copper lug under each contact for soldering. The two-turn inductance taps are connected to the left hand switch and the seventeen-turn taps to the one at the right. The ninth tap is common to both switches. Empire tubing should be placed over each lead before soldering in order to make the job as neat as possible. It will probably be found easier to solder the taps before the inductance unit is fastened to the panel, as the space between the coil and the switches is very small. When the soldering job is finished the unit is held in place by two ½ in. wood screws which turn into the variometer stator from the front of the panel.

The base panel which supports the sockets and

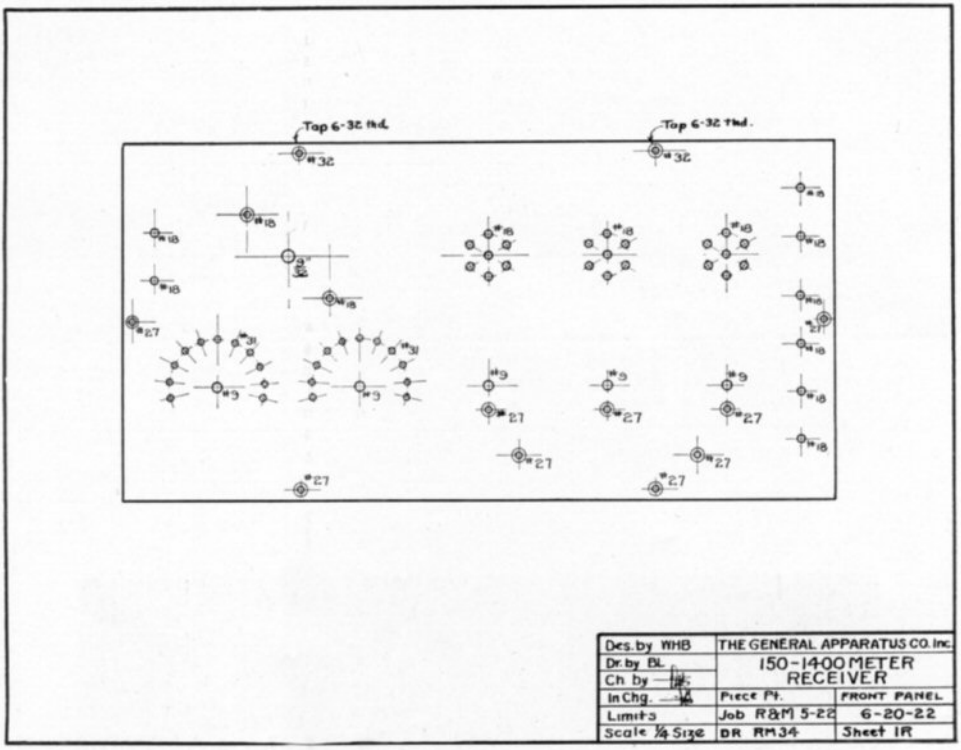


Fig. 4 A scale drawing of the front panel

amplifying transformers is held to the front panel by means of ½ in. 6-32 F. H. screws and nuts, and two brass angles. These brackets are 1 in. pieces cut from a 12 in. length of ⅜ in. angle brass. No. 27 holes are drilled in each side ⅜ in. apart to take the screws which hold them to the panels. Rheostats and binding posts fitted with copper soldering lugs are next put in place. The rheostats are held to the L. P. F. by ½ in. 6-32 F. H. screws and nuts. Mount the sockets and transformers on the base panel and the set is ready for wiring.

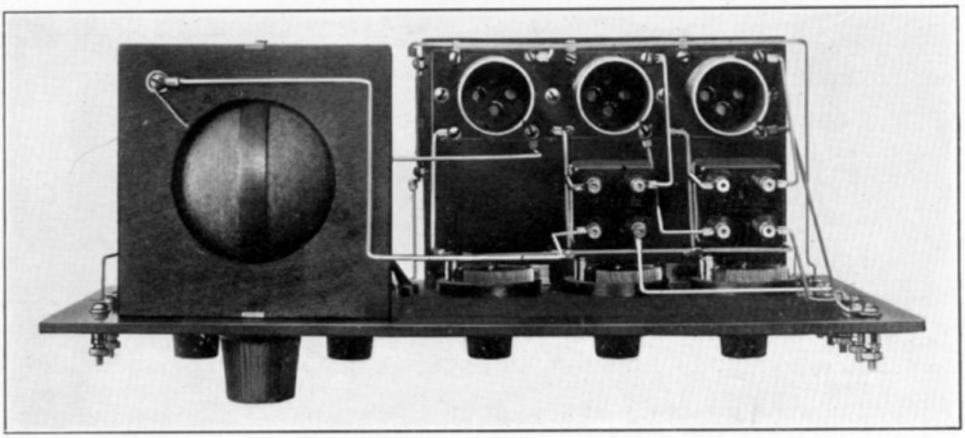


Fig. 3 This top view shows the location of the various parts as well as much of the wiring

The wiring is done with square tinned copper bus bar which should be carefully bent between terminals. Figs. 2 and 3 clearly show the effect of straight conductors with sharp right angle bends. Altho a good idea of the wiring system may be gained from these two views, they should not be followed too closely as errors may be caused by misinterpreting reflections, high-lights and shadows, as well as by the fact that portions of the wiring are often out of view. The wiring diagram, Fig. 6 gives the correct hook-up for the whole receiving system and should be followed carefully in every detail to prevent errors.

are placed in the top of the panel instead of the usual wood screws. They need to be filed off slightly at the back so as not to interfere with the cover.

Operation of the Receiver

This instrument is so complete within itself that batteries, telephones, antenna and ground are all that have to be added. Connect the antenna to the upper left hand binding post and the ground to the lower one. At the right, the telephones are attached to the two upper terminals, the positive side of a 45 volt B battery to the third, a 22½ volt tap to the fourth, and the

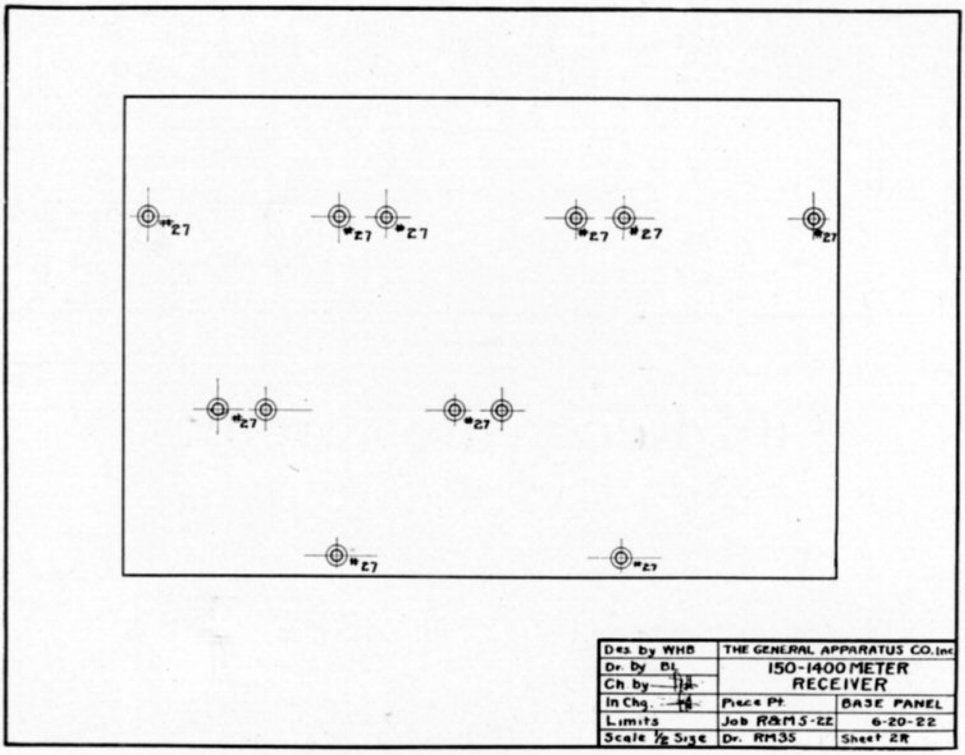


Fig. 5. A scale drawing of the base panel

Altho scarcely shown in the accompanying views, a .0005 mfd. grid leak condenser is wired in the grid circuit of the detector tube, and a .001 mfd. phone condenser is connected across the primary of the first amplifying transformer and B battery to provide a radio frequency path from the variometer to the filament.

When the outfit has been completely wired it is mounted in the mahogany cabinet by means of ½ in. F. H. nickel plated wood screws. A small hole should be started in the wood to guide each screw and to prevent splitting of the wood. To permit the use of the cover and still maintain the symmetrical appearance of the front of the instrument ¼ in. F. H. 6-32 nickel plated screws

negative side to the fifth. The positive lead of a six volt A battery is connected with the negative of the B battery and the other side to the last terminal down. If a loud talker is to be employed, the voltage between the third and fourth binding posts should be increased to 90 volts.

To pick up a signal, turn the amplifier rheostats about 200 degrees and increase the detector tube filament until a hissing noise is produced in the telephones. Set the right hand inductance switch on the first point and rotate the other. If nothing is heard bring the first switch to the second point and repeat the operation. As soon as a signal is picked up and brought to its maximum strength by the inductance switches, the variometer knob is adjusted to increase its volume thru regeneration. When the best setting is found, the rheostats are readjusted to the most efficient operating points of the tubes and the set is then at its best adjustment for reception on that wave length. For other wavelengths, only the inductance switches and variometer have to be changed, since a given filament setting works equally well on all waves. To increase the wavelength, put a 0.001 mfd. condenser across antenna and ground.

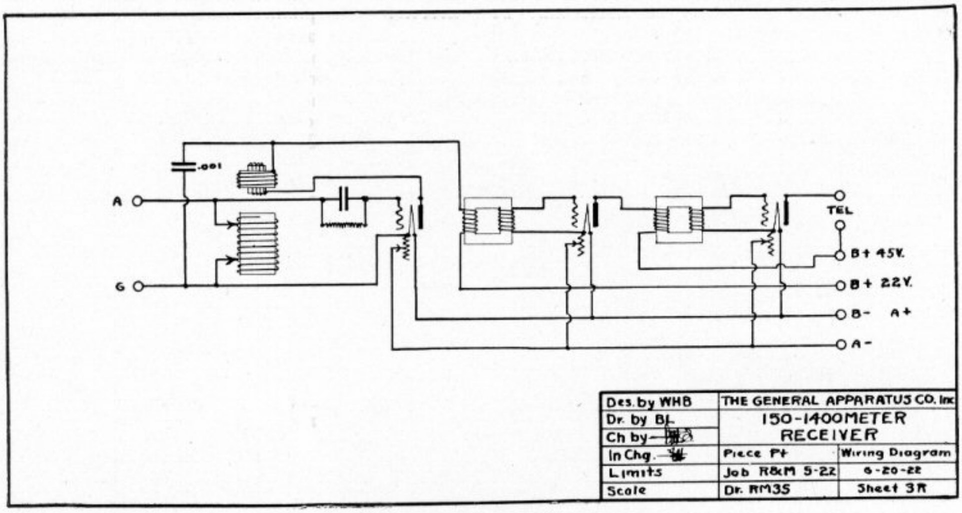
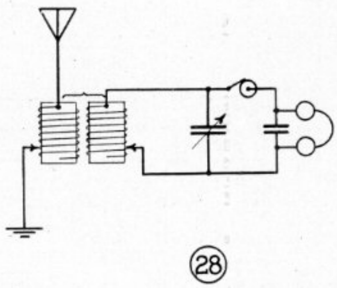


Fig. 6 Wiring diagram of the receiver

101 Receiving Circuits

Third Installment



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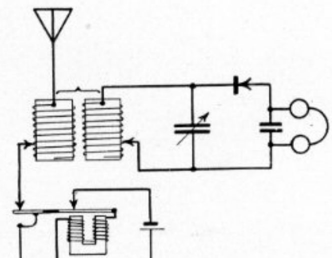
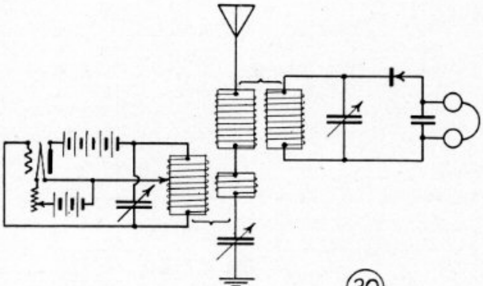


(29)

28. In this diagram we have the connection of a receiving outfit designed for the reception of sustained or undamped waves such as are emitted from arc transmitters, high frequency alternators, and oscillating vacuum tubes. Since undamped waves have no period of oscillation within the range of the human ear, it is necessary to employ in the receiver a device for breaking them up into audible groups. In this circuit an old, simple, and reliable method is given. The tuner does not differ from those previously described, but in place of the usual detector an instrument known as the Poulsen tikker is connected. This is merely a revolving disc upon which a spring wire or brush is brought to bear. As the disc rotates the light contact interrupts the circuit owing to the irregular surface over which it travels. The make and break does not occur regularly so the note produced in the telephones is not of a musical character. The received energy is accumulated in the secondary or closed circuit of the tuner while the tikker contact is open, and discharged thru the telephones when the circuit is closed. In this way the continuous wave is broken up at a rate which is within the limits of the ear and the received signal is thus made audible.

29. Another system for the reception of undamped waves is illustrated here. A loosely coupled receiving tuner with a crystal detector and telephones comprise the receiver proper, but in series with the ground lead is a make and break device. This serves to interrupt the incoming energy at an audible rate so that groups of oscillations rather than continuous oscillations take place in the circuits. It is these groups which are actually heard and their frequency determines the tone produced in the telephones by the incoming signal.

The interrupting mechanism is called a chopper and may either consist of a separate set of contacts on a buzzer or a revolving make and break of the commutator type. Its position in the circuit must not necessarily be in the ground lead, but may occupy almost any place in the open, or even the closed oscillatory circuit.



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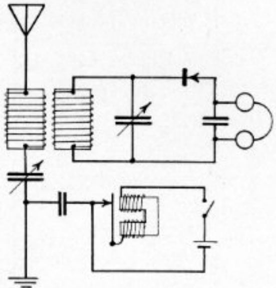

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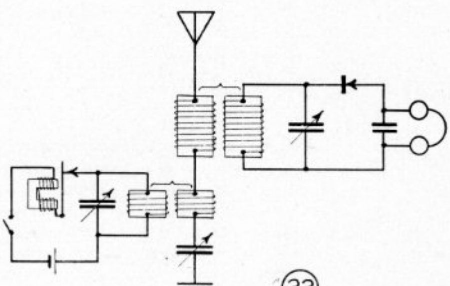
30. A more elaborate means of breaking up continuous waves so as to produce audible signals is given in this circuit. The usual type of crystal receiver is used, but a local generator of high frequency oscillations is inductively coupled to the primary circuit. This oscillator is tuned to a wavelength differing from that of a desired signal by some frequency within range of the ear. That is, if the incoming signal is being transmitted on a wavelength of 10,000 meters or 30,000 cycles, the local generator should be adjusted to radiate energy at a frequency of 29,000 or 31,000 cycles. Thi would produce a note in the telephones equal to the difference between the two or 1,000 cycles per second. This is called beat or heterodyne reception. With this system an even tone is produced and its frequency can be regulated to suit the operator. Due to the inherent characteristics of the detector, the efficiency of the receiver on weak signals is considerably increased by super-imposing local oscillations upon the incoming signals, for the value of the current flowing thru the circuit is built up to a point where slight variations in the signal energy result in greater variations in the telephone current, than would normally be the case.

In this circuit a vacuum tube oscillator is shown, but an arc or other form of high frequency generator will answer the same purpose.

31. A buzzer test circuit is here shown connected to a crystal detector receiving outfit. Its purpose is to assist the operator in determining the most sensitive adjustment of the detector. Various buzzer hook-ups are possible, but the one here given combines simplicity with effectiveness. A battery and a device for opening and closing the circuit are wired in series with the buzzer, while the contact of the instrument is led thru a fixed condenser to the ground. In operation the buzzer is started by closing the circuit and the point of the detector is moved about the surface of the crystal until a spot is found where the buzzer is heard with maximum strength in the telephones.



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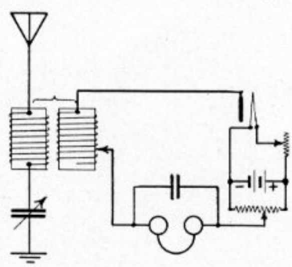

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(Continued in the July issue)

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EDITORIAL

LIKE many others whose radio career started a long time back in ship operating Mr. Bullock has a warm spot for a good loosely coupled tuning circuit without regeneration. He presents in this issue of R and M a unit which does credit to the loose coupler as well as to himself. Once in a while when travelling takes me on a boat I listen in on a ship set of this type and my enthusiasm for the loose coupler is revived. For plain, everyday work when full rotary controls are provided, as on this set, such an outfit has a place which it will keep for a long time to come. The wavelength range of this tuner may be extended to 1400 meters to include the Fort Wood and similar phone stations.

The regenerative receiving outfit described in this number will cover waves of this length without the addition of a loading inductance. This set was originally designed at the request of a New York exporting house who wished to demonstrate a radio set at an exhibition in London. The long wave broadcasting stations there operate at 1400 meters. Results obtained during the tests before shipment were so very good that the design was prepared for presentation to our readers. This receiver is quite inexpensive, requiring only a variometer and tapped tuning inductance. It is possible, too, to make up the tuning unit and connect it to a single detector or detector and amplifier, if you have that part already.

Mr. Condon, Comptroller of the G. A., has suggested that some readers of R and M may be interested in the availability of common stock in the Company. This circumstance has come about thru an increase in capitalization required by the enormously increased volume of business. If you wish to take advantage of this opportunity, Mr. Condon will be glad to give you full details concerning present earnings and other data of interest to investors.

You have probably heard rumors of a new circuit developed by Armstrong. His work has been completed at last, and the set publicly demonstrated. When you hear it work, you will agree that it is a greater advance over the plain regenerative circuit that the latter is over the ordinary types. As usual, R and M is right on the job. Circuits are available now, but the article will not appear until the July issue because we want to give you complete data on the actual construction of the set. After you have used it, you will agree with Major Armstrong you never knew before that such loud signals could come from a two-tube outfit.

As you know, all the equipment described in R and M is worked out in the G. A. laboratory, and for that reason you may have felt that contributions are not welcomed. That is not at all true, for ideas from the readers are essential to any publication. When you make up a set that gives exceptional results, or you make up something out of the ordinary, send in a description of it with such penciled sketches and circuits as are necessary. Then we will make it, test the instrument thoroughly, and put the dope in R and M, giving you full credit for the article. In some cases we have gone farther. Where ideas were original and of marketable value, we have completed the development work, secured patents in the name of the inventor, and found a company to buy the patent or produce the article on a royalty basis. Just because R and M is published by the G. A. you shouldn't feel that you can't call on us to help you out, for the editorial and engineering staff of R and M has done a great deal for a number of experimenters, and is at your disposal.

Slowly but very surely restrictions on radio work are being lifted in England. The licensing of eight broadcasting stations has just been authorized, and it is expected that short wave transmission will be permitted very soon. Then we can expect amateur transatlantic communication. To judge from the splendid mechanical and model work done in England we can expect big things from over there when their radio laws permit general experimenting such as we have here.

Practically all the articles in R and M have been on receiving equipment. That part of radio is occupying the field right now, but more and more transmitting is being done all the time. Are you constructing spark or vacuum tube sending sets? If you are or are not interested in transmitting won't you write me a letter telling me just how you feel about it? It will help greatly in planning the coming issues.

M. B. SLEEPER,
Editor

An Efficient Loose Coupler

A short wave tuner with provisions for loading to any wavelength desired.

By W. H. Bullock

Advantages of Two-Circuit Tuners

ALTHO single circuit receiving tuners seem to be the most popular, we must not lose track of the fact that while the loose coupler is more expensive to build and requires a little more skill to operate, it has many important points in its favor. Its chief advantage lies in the selectivity with which signals may be tuned in. This is of considerable value since it reduces the strength of undesired signals especially in cases where they are emitted from sharply tuned transmitters. Greater distances may be covered when interference can thus be reduced to an audibility so low that distant or faint signals on a slightly different wave can be heard thru it. It is for this reason that some outfits are capable of picking up distant signals that are seldom if ever heard on other outfits which give just as strong signal response at shorter ranges. Owing to the inductive coupling between the primary and secondary circuits, more energy is available at the detector for the reason that re-radiation of the received impulses is reduced to a minimum. Loose coupling between the antenna and detector circuits also reduces the interference caused at other near by receivers by the oscillations of the detector tube. Interference of this sort is often a source of much trouble where receiving stations are situated near together and the operators are attempting to cover the same wave lengths. When one becomes proficient in the handling of a loosely coupled two tuned circuit tuner, surprising results may be obtained in the comparatively uninterrupted reception of signals over long distances.

Description of a Modern Loose-Coupler

The design of the instrument here described was worked out after a careful review of the advantages and disadvantages of similar pieces of apparatus with the view of including the maximum of good points and a minimum of poor ones in its construction. Consequently we have an instrument of moderate size and pleasing appearance. The front panel measures 7½ by 10 ins. and the parts are so arranged that clearance is left for a cabinet of ½ in. stock, should the builder desire to enclose it. Owing to the expense of good cases, two legs are provided at the rear to hold the panel in a perfectly vertical position and permit the scientific part of the tuner to be readily displayed. The beauty of the instrument is brought about by the symmetrical arrangement of controls and terminals. This is better understood by referring to Fig. 1 where the positions of the polished nickel parts are shown on the glossy black L. P. F. Panel. The arrangement was not made for appearance alone but for convenience in operation as well. To this end the knobs most frequently used were placed so that the arm may be rested upon the table for adjusting them, while the other two tuning members were located higher on the panel, the least used at the top. The construction is simple and rugged, including nothing that is not absolutely essential for the efficient operation of the tuner. Unlike most loose couplers this instrument is so complete that nothing in the way of additional condensers can improve its working qualities in any degree. The circuit employed is shown in the wiring diagram Fig. 5.

The lower left hand dial and knob controls a variable condenser placed in series with the primary inductance. It has a maximum capacity of .001 mfds., and is placed on the ground side of the inductance to minimize the capacity effect of the hand and to secure a slightly greater efficiency which the lowest potential side of the circuit affords. Another variable condenser of the same capacity is located beside it for use in tuning the secondary or closed circuit. In this case the condenser is connected in parallel rather than in series with the inductance. At the center of the panel is a seven point inductance switch for use in varying the value of the primary coil. Above it the coupling knob is located. Mounted on a ¼ in. shaft, it carries the secondary winding which may be rotated within the stationary primary inductance. A feature which adds considerably to the value of the instrument is the provision of the two upper binding posts on each side of the panel to accommodate loading coils where wavelengths in excess of the normal 100-700 meter range is desired. In this way signals from the Army broadcasting stations as well as the Naval radio station at Arlington, Va., may be tuned in. For wavelengths under 700 meters the loading coil terminals must be short circuited. The two lower binding posts at the left are for antenna and ground while those at the right are wired to the detector.

With this general understanding of what the loose coupler is, we may now give our attention to the actual construction of the instrument.

The Inductance Unit

The primary inductance is wound upon an L. P. F. tube, 5 in. in length and 3½ ins. outside diameter. This is a standard size which has a wall thickness of ⅛ in., making a very rugged cylinder for supporting the unit. Before the wire is put on, drill the tube as shown in the drawing, Fig. 3. One shaft hole and two holes for support pillars are drilled in a line. The latter, made with a No. 27 drill, are located $\frac{3}{16}$ in. in from each end, while the ¼ in. shaft hole is $1\frac{7}{16}$ in. down from the top. A second shaft hole is drilled diametrically opposite

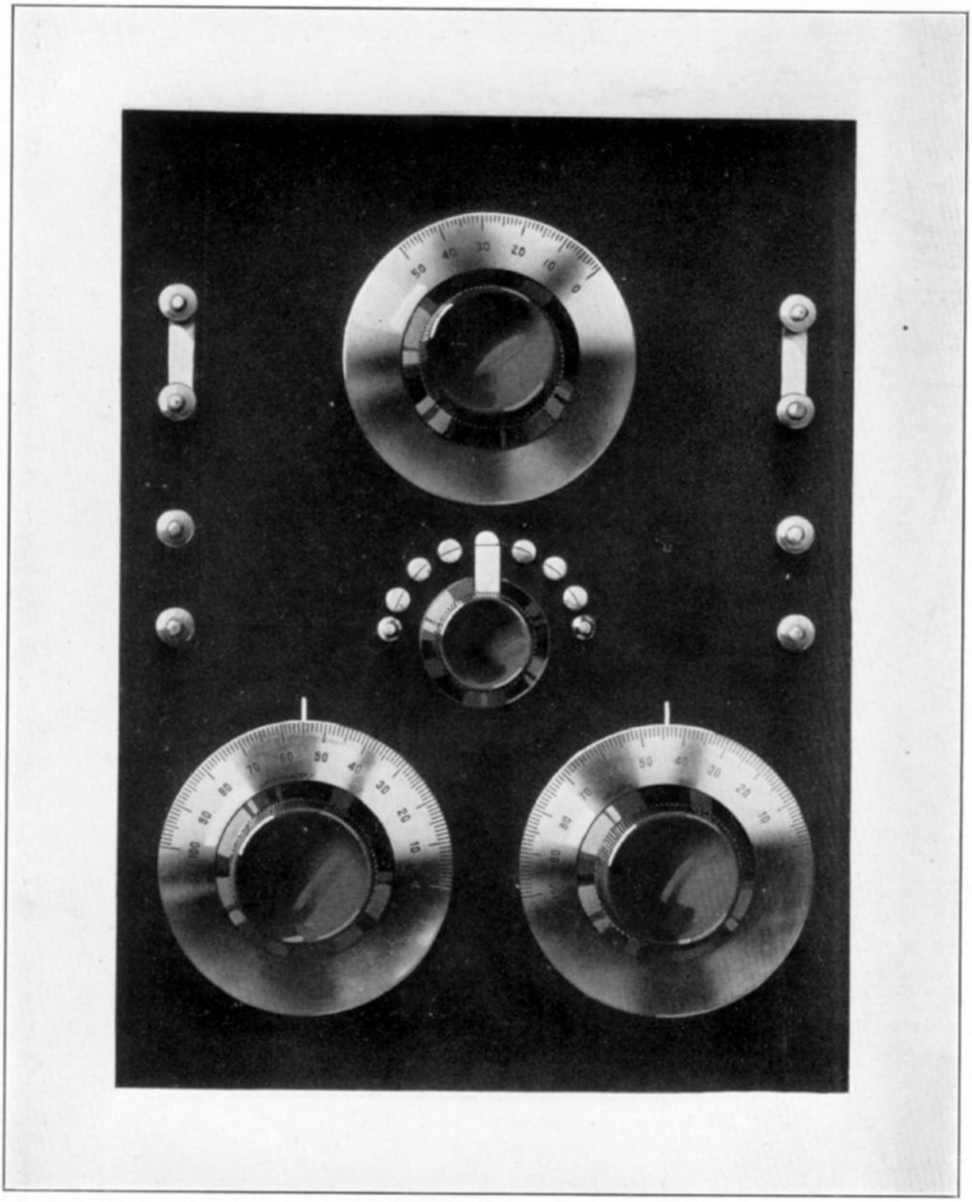

Fig. 1. Front view of the loose coupler

the first, and $\frac{13}{16}$ in. from each a No. 27 hole is placed to take 6-32 machine screws which hold the shaft contact springs. At points about ½ in. from the support pillar holes drill two small holes ⅜ in. from the end of the tube for securing the start and finish of the winding. For all of the drilling it is a good idea to have a block of wood inside of the tube to drill against. It not only serves to hold the work for this operation but keeps the holes from breaking out on the inside of the cylinder.

With the tube thus prepared, the winding is now put on. No. 24 S. S. C. wire is used for the purpose, a ½ lb. spool being ample for the job. Start by securing the end of the wire in the holes made ⅜ in. down from the top of the tube, and wind on 33 turns. Now take off the first tap by winding one turn of the wire back over the coil and bringing it down to the tube again. This should bring you to a point about ¾ in. from the start and a space ⅜ in. wide must now be left in the winding to clear the shaft holes. Continue with the winding until the 43rd turn is reached and take off the second tap in the same manner as the first. Five more taps are made at turns number 55, 72, 93, 126, and 170 which is the end of the inductance, not counting the turns used for taps. Fasten the end of the wire by inserting it into holes in the tube provided for the purpose. When the taps are required they are released by holding a finger over the point where they were led from the tube back over the coil, and cutting the raised turn diametrically opposite. The two ends thus made are twisted together to be placed in empire tubing and run to the switch points. To prevent the wire coming loose on the tube, it is advisable to give the winding a coat of shellac or varnish to hold it in place. The unit should then be baked in order to remove all moisture.

While the primary inductance is drying the secondary may be wound. A mahogany rotor 3 in. in diameter and drilled for a ¼ in. shaft is used to support the winding. Before the wire is put on, the coupling ball is drilled with four holes thru which the ends of the wire are inserted. One is placed just inside of the flange on each side of the ball and the other two are drilled each side of the center rib in such a way that they come out on the same side of the web on the inner part of the ball. The winding which is of No. 24 S. S. C. wire is started in one of the outside holes and wound on half of the form, terminating in one of the holes at the rib. The ball is now turned end for end and the second half wound in the same direction. Where the center ends of both sections come inside the rotor, they are twisted together and soldered to make the inductance continuous.

With both coils wound, the inductance unit may now be assembled. A shaft in two sections serves to lead the secondary connection thru the tube, so it is necessary to provide contacts for the shafts. These are made of ¼ in. by 1-64 in. phosphor bronze strip, cut $1\frac{13}{16}$ in. in length and drilled with a No. 27 hole, $\frac{5}{16}$ in. in from one end. Before the rotor is mounted they are fastened to the L. P. F. tube in the holes previously drilled for the purpose. Small copper soldering lugs are placed under ¼ in. 6-32 R. H. machine screws which pass thru the contact springs and tube where they are held by nuts on the inside. This must be done before the rotor is put in place as otherwise the ball would interfere with the holding of the nuts for the screws to be turned in them.

From a standard 12 in. length of ¼ in. round brass rod cut two sections, one 2 ins. long and the

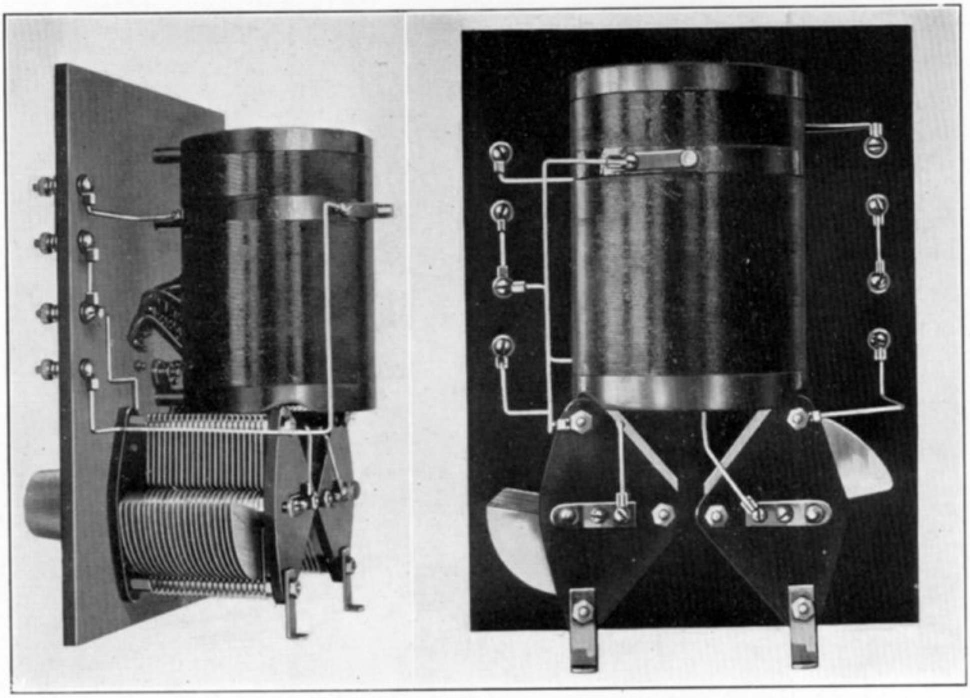

Fig. 2. Two views showing constructional details of the loose coupler

other 3¼ ins. Round off the edges slightly to remove all burrs, and insert the longer one into the shaft hole which is to go next to the panel. Place two fibre spacing washers over the inside end of the shaft and force it into the rotor ball until it shows for about ⅛ in. at the center. In a similar manner put the rear section of the shaft in place. Solder one of the two ends of the secondary winding to each shaft and the inside of the inductance is complete. Using ¼ in. 6-32 R. H. machine screws secure a coil support pillar at each end of the tube and set the unit aside until the panel is ready to mount it upon.

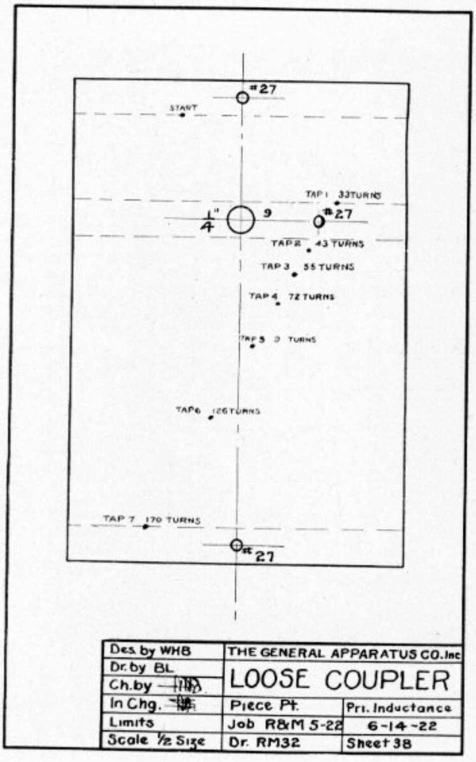

Fig. 3 A scale drawing of the primary induction tube

Work On the Panel

As stated previously, the panel measures 7½ by 10 by $\frac{3}{16}$ ins. and is of polished L. P. F. Since this is a standard size no work need be done in the way of sawing to dimensions or squaring corners. Simply follow the scale drawing, Fig. 5, and lay out the location of all holes on the reverse side. Work with the greatest accuracy for the different parts of the instrument are so close together when assembled that careless work may cause serious trouble. Start the holes with a center punch and follow with a twist of the size indicated in the drawing. To insure the holes coming thru the front of the panel without breaking out, use comparatively little pressure as the drill is about to come thru. As a further precaution have the panel placed on a flat smooth surface while the drilling is being done. Countersink all holes which are indicated in the plan by concentric circles as they are to take flat head screws.

Assembling the Parts

With the work on the panel and inductance unit complete, the assembly of the instrument is next in order. The first step is to put on the eight nickel plated binding posts with a copper soldering lug under each for the connections on the rear of the panel. Two switch stops and seven switch contact points are now added, with a small copper soldering lug under the nut of each contact to care for the coil taps. Turn the nuts down as tightly as possible and then put the locked lever switch in place. Using ½ in. F. H. 8-32 screws, secure two 43 plate, 0.001 mfd. condensers to the lower part of the panel. They are turned so that their stationary plates face each other so that their mutual capacity will remain constant at all adjustments. There are now three holes left in the panel to take care of the inductance unit. It will be found that the L. P. F. tube strikes the rear bakelite end-plate of the condensers, making it necessary to cut the tube or file down the interfering corner of the condenser. The latter is preferable. The inductance is held to the panel by means of ½ in. F. H. 6-32 screws turned into the support pillars. They are located in such a way that their heads are covered by the coupling dial and the switch knob.

With all of the parts assembled the wiring of the loose coupler is next taken up. The inductance taps are enclosed in empire tubing and run to the switch points where they are soldered into the copper lugs. Care should be exercised to prevent surplus solder or paste from getting between the contact points. The start, or upper end of the inductance, is connected to the top binding post on the left hand side of the panel, and the rest of the wiring is done with square tinned copper bus bar. Connect the second and third terminals together, the lower post to the primary condenser stator, and the variable plates to the inductance switch. This forms the primary circuit. The secondary tuning condenser is wired across the two lower right hand binding posts with the stationary plates to the lower one which is also a secondary inductance terminal. The remaining shaft contact spring goes to the upper right hand terminal, while the second post down is connected to the third. The several parts of the instrument are now wired according to the diagram Fig. 5. To the condenser shafts secure 180 degree dials and knobs and to the inductance rotor shaft fix one of 90 degree graduations in such a way that zero indication is shown when the axes of the inductances are at right angles.

If the loose coupler is not to be mounted in a cabinet two rear supports must be provided to hold the panel in an upright position. As seen from the rear view, Fig. 2, these consist of 1½ in. lengths of ⅜ by $\frac{1}{16}$ in. brass strip, turned over at one end. A No. 18 hole is drilled ⅞ in. from the bend in each and the lower condenser studs hold them in position.

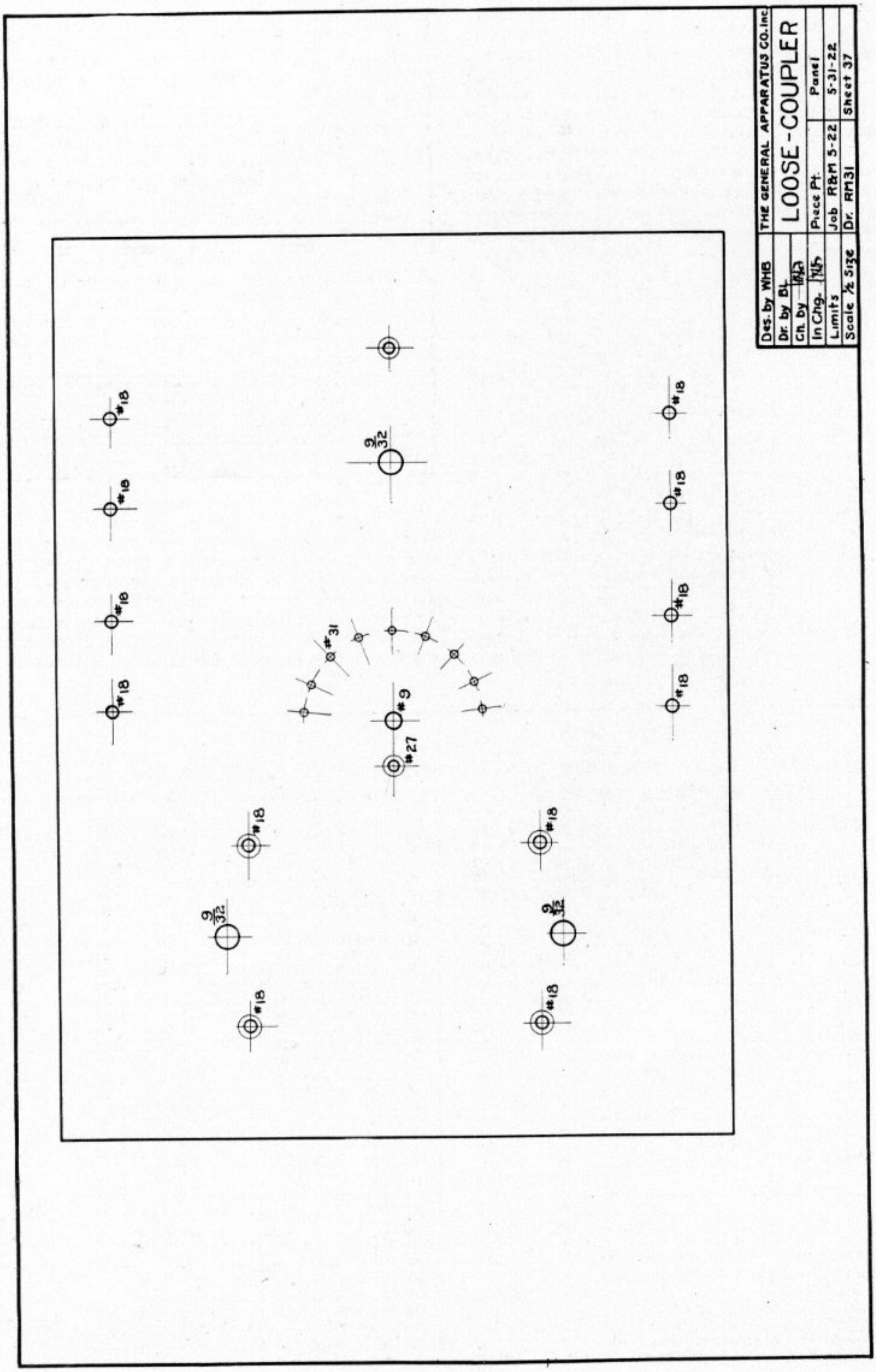

Fig. 4 A scale drawing of the panel

Use of the Loose-Coupler For use on wavelengths under 700 meters, the two upper binding posts on each side of the panel are shorted, but for signals on greater wavelengths the shorting links must be replaced by loading coils. This permits reception at practically any frequency—a condition which is so often desired but seldom possible with the average tuner. Either a crystal or vacuum tube detector may be efficiently employed with the loose coupler and results equal to the best non-regenerative outfit can be expected. For regeneration it is only necessary to include a variometer in the plate circuit of the detector tube. The instrument is well adapted for use with radio frequency amplifiers altho the tuning range will be limited to the wavelengths covered by the radio frequency transformers.

In operation the coupling should be set at maximum, the primary condenser at about the 50th division, and the secondary condenser rotated while the primary inductance switch is slowly moved from tap to tap. As soon as a signal is heard, the secondary condenser should be left where best response is obtained and the primary condenser varied until the sound is raised to its maximum strength. If this condition occurs with all of the primary capacity in, increase the inductance one point and readjust the primary dial. Likewise if the signal is loudest at zero condenser adjustment, decrease the inductance and rotate the condenser again until the desired station is received with maximum audibility.

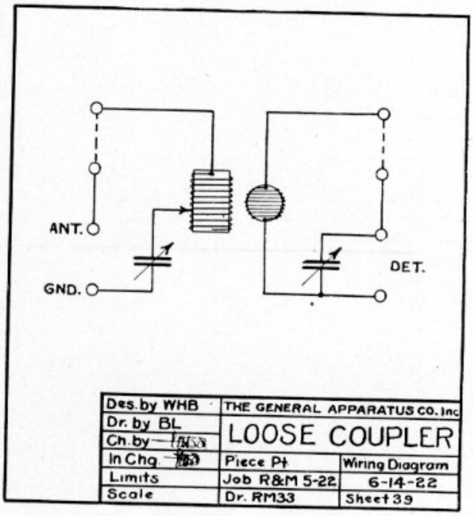

Fig. 5. Wiring diagram

When interference from undesired transmitter is experienced, the coupling between the inductances should be reduced, and the tuning condeners varied to compensate for the change. It will be found that the looser the coupling the greater the selectivity of the instrument will be, and a minimum of interference will result.

STANDARDIZED PARTS FOR THE 150-1400 METER RECEIVER. TYPE 2600

1—Mahogany cabinet	2 lb.	$5.87
1—L. P. F. panel 7½ by 15 by 3/16 in.	2 lb.	2.97
1—L. P. F. panel 7½ by 5 by 3/16 in.	8 oz.	.99
8—Nickeled binding posts	5 oz.	.80
2—Switches	4 oz.	1.30
18—Switch Points	2 oz.	.72
4—Stopping Points	1 oz.	.16
3—Rheostats	15 oz.	3.45
1—100°, ¼ in. knob and dial	2 oz.	1.25
1—Mahogany variometer	2 lb.	6.00
2—Audio amplifying transformers	15 oz.	10.00
3—Audion sockets	12 oz.	2.40
2—Pkgs. of 20 small lugs	2 oz.	.50
1—Grid leak condenser	1 oz.	.50
1—Phone condenser	1 oz.	.35
4—2 ft. lengths tinned copper bus bar	8 oz.	.24
1—1 ft. length 3/8 in. angle brass	2 oz.	.20
1—Pkg. of 10 No. 6 F. H. ¾ wood screws N. P	2 oz.	.15
1—Pkg. of 10 6-32 F. H. 3/8 in. screws N. P	1 oz.	.12
1—Pkg. of 10 6-32 nuts, N. P	1 oz.	.08
1—Pkg. of 10 8-32 ¼ in. F. H. screws, N. P	1 oz.	.12
1—5 in. length 3½ ins. diam. L. P. F. tube	3 oz.	1.48
1—¼ lb. spool No. 24 S. S. C. wire	4 oz.	1.25
1—12 in. length 3/8 in. brass strip	2 oz.	.13
1—Pkg. of 10 No. 4 3/8 in. wood screws	1 oz.	.10
Complete set of parts, as listed above (saving of $1.23)	10 lb.	39.90
Complete set of parts, as listed, but with front and rear panels drilled and engraved, coil wound with taps ready to cut, packed in neat display box	11 lbs.	47.12

STANDARDIZED PARTS FOR THE 150 TO 800 METER LOOSE COUPLER. TYPE 2700

1—L. P. F. Panel 7½ by 10 by 3/16 in	2 lb.	$1.97
8—Nickeled binding posts	5 oz.	.80
2—100° ¼ in. knobs and dials	4 oz.	2.50
1—50° ¼ in. knob a1d dial	2 oz.	1.25
7—Switch Points	1 oz.	.28
2—Stopping Points	1 oz.	.08
1—Switch	2 oz.	.65
4—Ft. empire tuning	2 oz.	.80
2—Coil mounting pillars	3 oz.	.16
1—5 in. length 3½ in. diam. L. P. F. tube	6 oz.	1.48
1—12 in. length ¼ in. brass rod	8 oz.	.15
1—Mahogany coupling ball	6 oz.	.90
2—0.001 mfd. variable condenser	2 lb.	8.80
2—Shaft contact springs	1 oz.	.08
5—Fibre spacing washers	1 oz.	.20
2—Pkg. of 20 small lugs	1 oz.	.50
1—½ lb. spool No. 24 S. S. C. wire	4 oz.	1.25
1—Pkg. of No. 6 washers, N. P	1 oz.	.04
1—Pkg. of 10 6-32 ½ in. F. H. screws, N. P	2 oz.	.12
1—Pk'. of 10 6-32 ¼ in. R. H. screws, N. P	2 oz.	.11
1—Pkg. of 10 8-32 ½ in. F. H. screws, N. P	3 oz.	.14
1—12 in. length 3/8 in. brass strip	2 oz.	.13
3—2 ft. lengths sq. tinned copper bus bar	3 oz.	.18
Complete set of unfinished parts, as listed above, for the 150 to 800 meter tuner (saving of $.68)	8 lbs.	21.89
Complete set of parts with front panels drilled and engraved, and loose coupler wound, tops ready to cut, and assembled, packed in a neat display box	8 lbs.	27.57
Mahogany cabinet for this tuner, 7½ by 10 ins	3 lbs.	5.98

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GA-STD-A25 R. F. transformer, 1st step $5.00

GA-STD-A30 R. F. transformer, intermediate $5.00

GA-STD-A31 R. F. transformer, last step $5.00

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