

April 2, 1940.

W. L. DUNN

2,196,147

COIL SYSTEM

Filed Jan. 11, 1937

2 Sheets-Sheet 1

Fig. 1

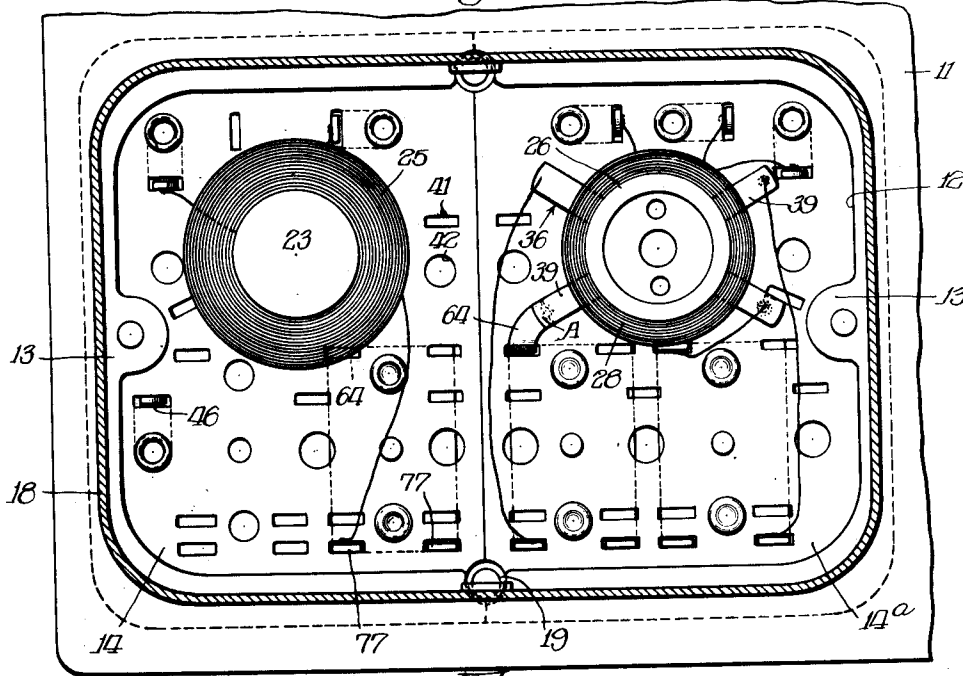
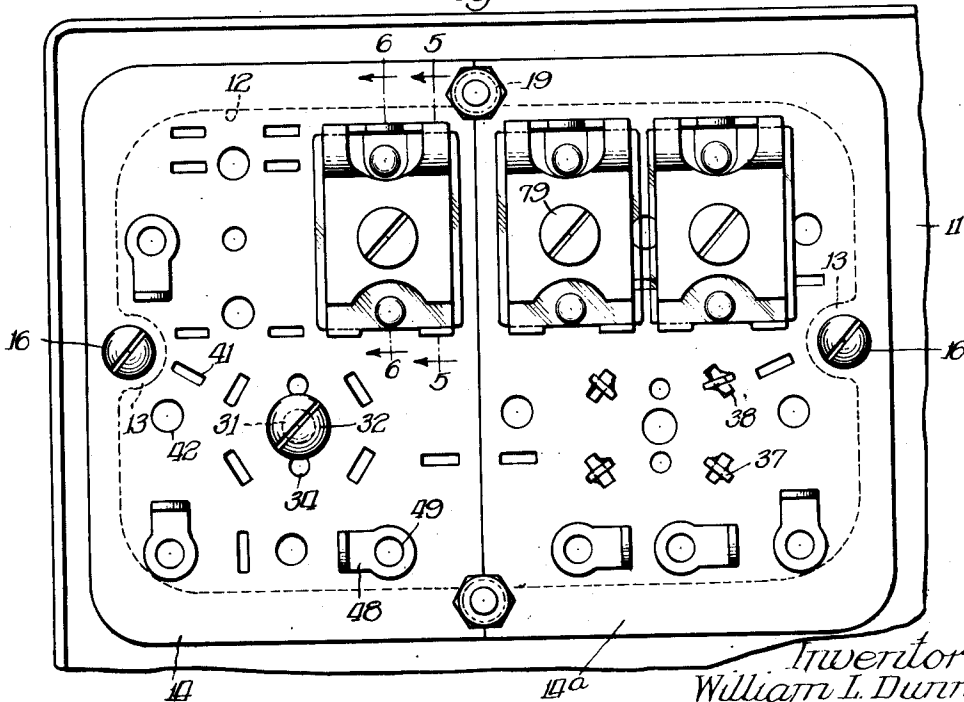


Fig. 2



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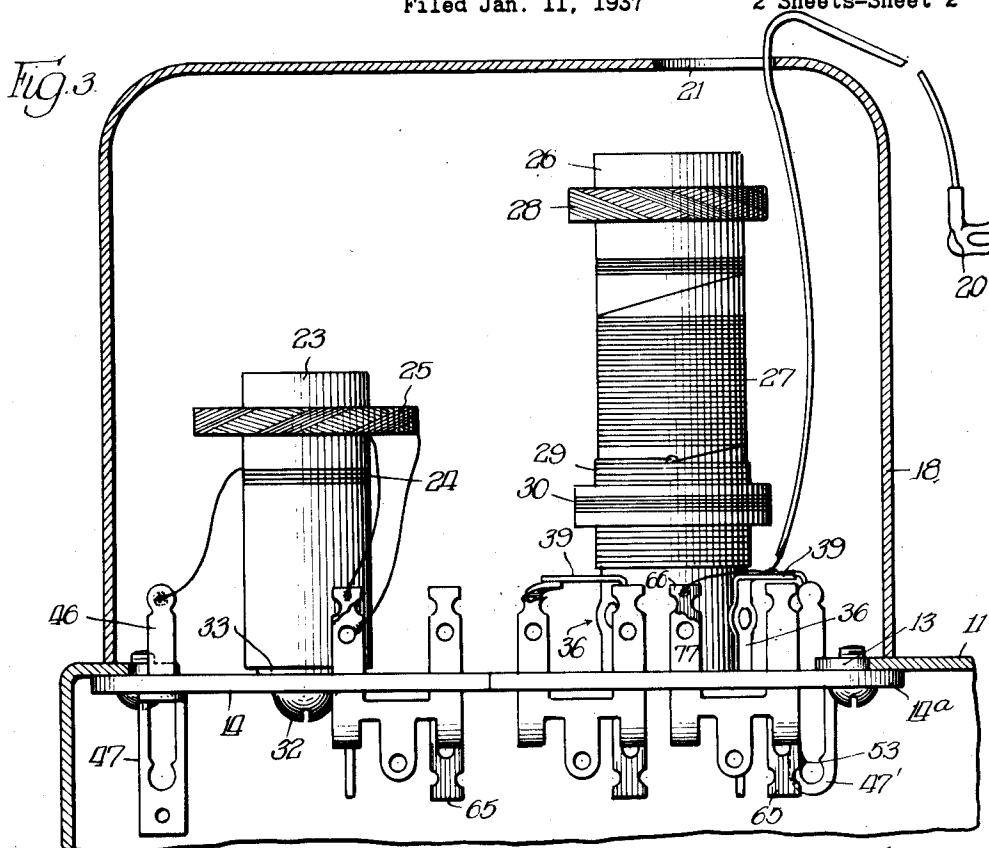


Fig. 5.

Fig. 6.

Fig. 4.

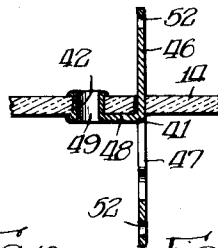
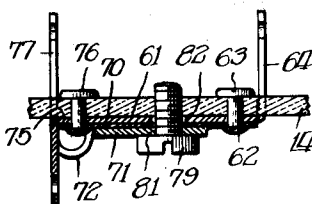
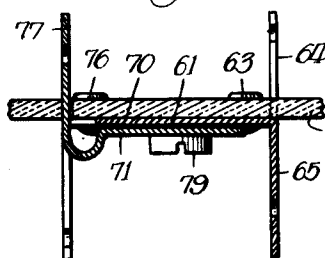


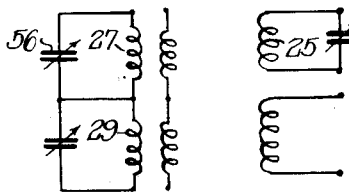
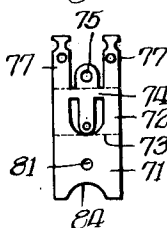
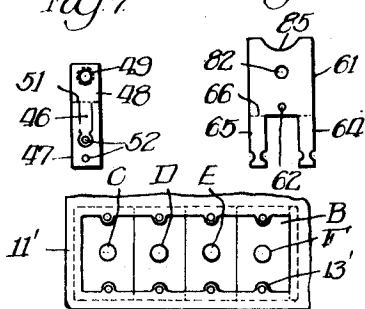
Fig. 7

Fig. 8.

Fig. 9.

Fig 10

Fig. 11



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UNITED STATES PATENT OFFICE

2,196,147

COIL SYSTEM

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Application January 11, 1937, Serial No. 120,047

4 Claims. (Cl. 250-16)

This invention relates to coil systems for radio receiving sets or the like, and particularly to such coil systems as are adapted to be constructed separately for inclusion in a radio set as a unit. These units have been illustrated as including inductively coupled coils together with trimmer condensers therefor, connecting lugs for connecting said coils to other parts of the circuit, and a base adapted to have mounted thereon any one of a variety of different coil structures and the condensers and connecting lugs for each.

All of the features of this invention are of general utility, but some of them are of especial value in connection with the so-called multiband radio receivers. In such receivers it is common practice to provide one or more primary coils and a different secondary coil for each band of wave lengths or frequencies which the receiver is designed to receive. If all of these coils are mounted into a single unit, the entire unit must be rejected when one coil thereon is defective, and hence the number of rejects is relatively large. There would be the fewest number of rejects if each secondary with its primary formed a separate unit so that one unit could be rejected without the others. This results in excessive material costs, however, and the most economical arrangement therefore is to place the coils for at least two bands in a single unit with the result that in a three-band receiver, two units will be necessary.

In order to keep the material and production costs as low as possible, and yet maintain a highly efficient operating level for the coil system, it is necessary in such coil systems for the multiband receiver to consider not only the question of rejects of coil units, but the assembly of the units themselves, the assembly of the entire coil system, and particularly the actual testing and inspection operation.

In most efficiently taking care of all these factors, there was the problem of providing all elements of the system capable of rapid assembly into units and into the coil system, providing them to perform as many functions in the complete apparatus as possible, and at the same time eliminating or minimizing undesirable capacities, and inductances in the circuit of the coil system, as well as having those elements act to speed up inspection and reduce breakage and rejects. Inasmuch as variations in the particular coil assembly might be necessary for each band of each particular type of multi-band receiver, it was desirable to have a universal base of insulating material which would take any one of

such various assemblies. The connecting leads in high frequency circuits may introduce an appreciable and undesirable inductance in the circuit, and it was therefore desirable to have connecting leads in the complete coil system as short as possible. While it was desirable to provide variable capacitors across each secondary of the coil system to adjust the circuit capacity at the high frequency end of the bands to a uniform value, it was likewise necessary to maintain stray capacity of all components to ground in the entire coil system at a minimum. In providing terminal members both for general wire connection, and for the variable capacitors of metal in a stamped out construction extending through the assembly base, undesirable inductance and circuit capacity is minimized, while the single shield of large perimeter of the present invention, has the most beneficial effect so far as the coil dissipation constant is concerned. Where previously in making inductance tests particularly, on coils, one or more wire ends were placed into spring contacts in the testing jig, the present construction now makes it possible to eliminate this added handling and danger of breaking wires, inasmuch as the lugs alone effect all the necessary circuit connections in the jig.

According to the present invention, therefore, the receiver is provided with two detachable bases, each adapted to have a coil unit mounted thereon, but in the interests of economy these bases are identical, and in the interests of ease of mounting, each of them is secured to the chassis by a single screw. It is understood, of course, that more than two bases may be employed as the system is adapted to receivers of increasing numbers of wavebands. The coil system of the present invention, as illustrated and described, provides a complete coil assembly sufficient for at least a four-wave band receiver circuit, all covered by a single shield. This single shield has the double advantage of reducing material costs and increasing the coil dissipation constant which in general is increased as the perimeter of the shield is increased. Furthermore, the coils themselves are small physically with relation to the shield, thereby increasing the spacing between the coil components and the shield, and reducing the stray capacity at this point to a minimum.

Since the base is to be identical for different coil units, it is formed with suitable apertures for mounting thereon, any one of several specifically different coil assemblies and associated terminal elements as such unit. This of course

is desirable whether two different units are to be used in one set or not, so that the same base may be used with different coil structures even in different receivers. In using two identical

5 bases in juxtaposition in one set, there is a special problem in providing compactness of arrangement together with ease of mounting the bases to the frame. For compactness it is of course desirable to have a single cut-out opening through the chassis, at which opening both the bases are to be secured; and it is likewise desirable that the bases fit snugly against one another, and that no space within the opening be wasted. Accordingly, the identical bases are made with the securing aperture at one side thereof, and one of the bases is inverted for assembly of the elements on it so that the securing holes are positioned at the far sides of the two bases as used, thus making it possible to mount the two coil units against the receiver chassis frame at the edges of the bases while lugs on the bases extend through a hole in the chassis under which the coil units are positioned.

A very important feature of the present invention, both from the standpoint of convenience in connecting the coils with the external portions of the receiving circuits and from the standpoint of minimizing stray capacity and other losses, is the provision of connecting lugs which are secured to the base and extend therethrough so that the external wires may be connected on either side of the base, rather than extend through the base. This feature is utilized throughout the coil units including the lugs on the individual coil forms, the trimmer condensers and the separate connecting lugs. One reason it is important to minimize stray capacities is to obtain reception over any desired range of frequency with the smallest possible number of coils. The use of a large shield encircling the coil system contributes to this result.

Inasmuch as the trimmer condensers and connecting lugs pertaining to each coil form are mounted on the base to which that form is secured, the coils may be connected thereto before assembly of the units in the receiving sets. Furthermore, because of the fact that the standard perforations of the base insure uniformity of positioning of the connectors with each type of coil unit, testing of the coils is greatly facilitated by virtue of the fact that a testing jig may be provided with spring contacts for each corresponding aperture in the base so that it is merely necessary to place the entire coil unit thereon and the proper test connections will be automatically connected, depending on the particular terminal arrangement in the apertures on that base.

The objects of the invention are mostly apparent from the foregoing description of the special features and advantages. Further objects and advantages will be apparent from the following description and from the drawings, in which:

Fig. 1 is a horizontal sectional view of the form of this invention chosen for illustration, showing a plan view of the coil assemblies in substantially twice actual size.

Fig. 2 is a bottom view of the structure shown in Fig. 1.

Fig. 3 is a vertical sectional view showing the coil assemblies in elevation.

Fig. 4 is a fragmentary sectional view of one of the connecting lugs.

Figs. 5 and 6 are fragmentary sectional views

taken respectively on the lines 5-5 and 6-6 of Fig. 2, and showing the trimmer condensers.

Figs. 7, 8 and 9 are views indicating the manner of forming respectively the connecting lugs, the fixed condenser plate, and the movable condenser plate from single pieces of metal.

Figs. 10 and 11 are fragmentary circuit drawings showing the connections provided in the coil assemblies; and

Fig. 12 is a view of a modified embodiment illustrating fragmentarily a coil system with more than two coil units.

Although this invention may take numerous forms, only one has been chosen for illustration. In this form, the invention has been illustrated as associated with a frame or chassis 11 of a radio receiving set. This chassis is provided with an opening 12 therethrough of generally rectangular shape. Securing lugs 13 on the chassis may project into the general outlines of the opening 12. A pair of insulating bases 14 and 14A are secured below the chassis 11 by means of screws 16 passing through suitable perforations in the bases 14 and 14A and threaded into the securing lugs 13.

Above the frame 11 a shield 18 is secured, this shield surrounding the entire opening 12 and consequently substantially the entire areas of the insulating bases. The shield may conveniently be secured by means of a pair of securing studs riveted thereto and passing downwardly through the frame 11 and through holes formed between the two bases 14 and 14A as shown at 19. These last mentioned holes may be formed by the provision of semicircular notches in the edge of each base. The shield 18 may be provided with an aperture 21 at the top thereof through which a grid clip 20 (Fig. 3) may be passed for connection to a tube requiring an external top connection.

From Figs. 1 and 2 it would appear at first glance that base 14 and base 14A are different, one being adapted to fit at the left-hand side of the opening 12, and the other at the right-hand side thereof, as seen in Fig. 1. As a matter of fact, however, these bases are identical, the necessary result being obtained by positioning them with their opposite faces up, thus making it possible to stamp out only a single form for all bases, yet use them either for the coil unit for the right side, or that for the left side in the two-unit assembly of Fig. 1.

A modified embodiment is illustrated in Fig. 12, in which more than two coil units are provided in the complete coil system. Identical bases B are mounted at an opening in a chassis 11' by means of screws through holes at the top and bottom of each base B extending into mounting lugs 13' on the chassis at the opening. Coils C, D, E, F, with one mounted on each base, are illustrated somewhat diagrammatically. It is understood of course that the number of individual coil units may be varied in accordance with the number of wave bands for which the receiver is designed.

From Fig. 3 it will be seen that two different coil forms are provided. As a matter of fact, there may be several other forms than those shown. In general, however, they will comprise a solid dowel 23 which may be either of ceramic material or wood, on which coils 24 and 25 are wound, or a tube 26 on which coils 27, 28, 29 and 30 may be wound. The solid dowel such as 23 may be secured to the base 14 (or 14A) very easily by means of a screw 32 passing through hole 31 in the base and screwing into the bottom

of the dowel. To prevent the dowel from turning, a lock washer 33 may be desirably positioned between it and the base 14, and for that purpose the base 14 is provided with small apertures 34 into which special projections on the lock washer may fit, while projections in the opposite direction project into the dowel.

The tubular coil form 26 may be secured in a somewhat similar manner (not shown) by having its lower end flanged over and a washer inserted down through the tube 26 to be secured to the base by a screw or by an eyelet. However, it is preferred in accordance with this invention, to provide the tube 26, which may be formed of any desirable insulating material, with a plurality of combined connection and attachment members 36 secured to the lower end of the tube. These members 36 include flat connecting and securing lugs 37 projecting downwardly from the tube 26 and passing through correspondingly shaped apertures 38 in the base 14A. The lower ends of the lugs 37 are twisted to stand in a plane crosswise of the apertures 38 as seen in Fig. 2 so as to bind the lugs in the slots and lock the tube 26 in place on the base. These lugs also facilitate testing of the coil before it is assembled on a base 14 or 14A, inasmuch as they will slip directly into spring contacts in a testing jig. The members 36 also include outstanding lugs 39 so that connections can be made to them above the base 14A as well as below.

From Figs. 1 and 2 it will be noted that grouped around the securing hole 31 of each base (i. e. around the coil forms) are a plurality of pairs of apertures in the base, each pair including a small slot 41 and a circular opening 42. These are provided for connecting lugs, some of which have been shown in place. These connecting lugs each include an upstanding soldering lug 46, a downwardly extending soldering lug 47, and a securing base 48, of which a portion is extruded to form an integral eyelet 49. In the preferred form of the invention, the soldering lug 46 extends through a slot 41, while the eyelet 49 is clinched in a paired opening 42.

The construction of these double connecting lugs may be seen more clearly in Fig. 4 and in Fig. 7, which shows how they are formed from a single piece of sheet stock on which the eyelet 49 is shown as already formed. From Fig. 7 it will be apparent that by bending the soldering lug 46 in one direction and the soldering lug 47 in the other direction about the dotted line 51, the finished connecting member will be formed as shown in Fig. 4, which also shows how it is secured to the base 14 by upsetting the eyelet 49. Both of these soldering lugs may be provided with perforations 52 to facilitate securing a wire thereto, if desired. However, the soldering lug 47 may be shortened as at 47' in Fig. 3 to omit the perforation 52. In this case the projections 53 formed by cutting out the lug 46 will tend to help hold the wire in place during soldering.

As seen in Figs. 10 and 11, a trimmer condenser 56 is desirably connected to each of the secondary coils 25, 27 and 29. Thus, on the base 14A, on which two of the secondary coils are mounted, there will be two trimmer condensers while on the base 14 there will be one trimmer condenser. Since two trimmer condensers will be desired on some bases, the bases are still provided with suitable perforations for these condensers, these perforations being those shown in the lower portion of Fig. 1.

The structure and arrangement of the con-

densers is shown best in Figs. 5 and 6 with reference also to Figs. 8 and 9. Each of the condenser plates is stamped out of a single sheet of metal, as seen in Figs. 8 and 9. The fixed condenser plate 61 is provided with a securing aperture 62 through which a rivet is passed to secure it to the base 14 or 14A by a rivet 63. It is also provided with lugs 64 and 65 which are respectively bent upwardly and downwardly about the dotted lines 66. The upwardly bent lug 64 passes through a slot in the base 14, thus determining with the rivet 63 the position of the plate 61 and preventing rotational movement of the plate, and also furnishing a soldering lug above the base 14.

The movable plate 71 is of a more complicated structure, being provided with the integral resilient loops 72 bent from the plate 71 at the dotted line 73. At the far ends of the loops 72 a transverse web 74 is provided from which is bent a securing lug 75 which is firmly secured to the base 14 by a rivet 76. The loops 72 are continued to form lugs 77 which both pass upwardly through slots in the base 14 and together with rivet 76 properly position and hold the condenser plate 71 on the base.

The loops 72 are resilient and biased in a direction to move the plate 71 away from the plate 61. A mica plate 78 or any other good dielectric insulatingly separates the two metal plates and is retained against the fixed plate 61 by the rivet 63 therethrough and the rivet 76 securing the movable plate 71 on the base (Figs. 5 and 6). Plate 71 is moved towards the plate 61 for adjustment of the capacity of the condenser by a screw 79 passing through a hole 81 in condenser plate 71. An enlarged hole 82 is provided in fixed condenser plate 61 so that it will not make contact with the screw 79, which screws into the base 14. The plates 61 and 71 are of course recessed wherever necessary to prevent contact with the rivets for and connected with the other plate, such recesses being seen at 84 and 85.

From the foregoing it will be seen that each condenser plate has at least one contact above the base 14 and one below, and that all of the other connection members are likewise provided with a connecting portion above and a connecting portion below the plates. This makes it entirely unnecessary to have any wires extending through the base 14 or 14A and hence the constants of the coils can be predetermined very accurately since the coils may always be connected to connecting lugs with minimum lengths of wire positioned entirely above the bases, thus preventing excessive inductances in the current due to long leads. In fact, in some instances, as at A (Fig. 1), the lugs are of such length, and so positioned, that two lugs may be soldered together rather than run a wire from one to the other. At connection A a lug 64 from the stationary plate of a trimmer condenser is connected to a lug 39 carrying a lead from the coil 27. The wires connecting the coil assembly with external portions of the circuit will usually be connected below the bases, and of course a band selector switch will be provided for connecting the coils to be used.

Although the invention has been described in its preferred embodiments, it is understood that various specific coil assemblies and systems may be provided, all utilizing the present invention, and it is not limited thereby but is limited only by the scope of the appended claims.

I claim:

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1. In a radio receiving set, a chassis having a relatively large opening therethrough, a pair of identical bases differently disposed with reference to one another secured to said chassis at said opening by securing means at an outer edge of each base and having formations therein for mounting parts of a coil system on the portions of the bases which are exposed through said opening, with said bases being mounted at said opening with an inner edge of each in abutting relation but with the securing means therefor being such that each base is mounted independent of the other and a separate coil form together with connecting means for all terminals of the coils thereof mounted on each of said bases whereby each of said units including coil form, connectors, and base, may be accepted or rejected and replaced independently after test.

2. In a radio receiving set, a chassis having a relatively large opening therethrough, a pair of identical bases differently disposed secured to said chassis at said opening at an outer edge of each base and having formations therein for mounting parts of a coil system on the portions of the bases which are exposed through said opening, with said bases being mounted on said chassis in edge to edge relation but independently of one another, a separate coil form together with connectors for all terminals of the coils thereof mounted on each of said bases whereby each of said units including coil form, connectors, and base, may be accepted or rejected and replaced independently after test, and a shield surrounding both of said coil forms and secured to said frame.

3. Apparatus of the character described including in combination a metal radio receiving chassis having an aperture therein and a coil system secured to said chassis at said aperture comprising a pair of insulating bases positioned in abutting relationship at one edge of each base, and such bases together having a perimeter greater than the aperture in said chassis so as to overlie the aperture and extend together beyond the edge of said aperture whereby to be supported on said chassis at said aperture edge, each of said bases adapted to be secured directly to said chassis adjacent the aperture with the se-

curing of each being at a point spaced from the abutting edge, a coil mounting supported on each insulating base and a coil on said mounting, a condenser secured to each base, contact means for said condenser extending to each side of said base for electrical connection with said coil on one side and for receiving on the other side electrical connections from the radio receiver, with said two bases with the elements thereon being independently mountable and removable so that each base with its associated elements may be assembled, tested, and serviced independent of the other, and a single shield surrounding the elements on said two bases having means thereon for securing said shield to said chassis at said aperture with said securing means acting to also secure said insulating bases to said chassis.

4. Apparatus of the character described including in combination a metal radio receiving chassis having an aperture therein and a coil system including a pair of coil units secured to said chassis at said aperture, each of said coil units including an identical insulating base having a coil mounted on one side thereof, contact lugs for said coil having portions extending entirely through said insulating base for receiving wire connections on each side thereof, with the wire connections on one side extending to said coil and on the other side extending to radio receiver apparatus on said chassis, with the base of said coil units being positioned in edge to edge relationship and together having a perimeter greater than the aperture in said chassis and overlying said aperture whereby to be supported on said chassis beyond the aperture edge, a single shield member for mounting over said pair of coil units and adapted to be secured to the chassis, securing means for said shield extending through said insulating bases at their abutting edges and acting to secure said bases to said chassis as well as secure said shield to said chassis, and the assembly of the structure and connections on each base being such as to permit the assembly on and the removal from said chassis of each coil unit independent of the other coil unit.

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