Jan. 16, 1951 D. M. KALTENBACHER 2,538,525

METAL-CASE PORTABLE RECEIVER

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Fig. 1.

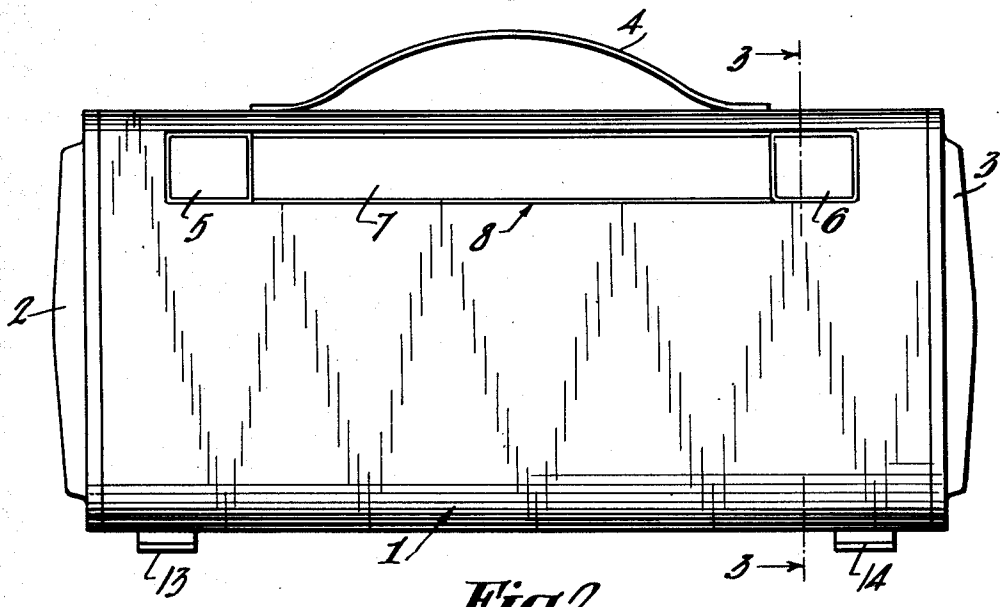
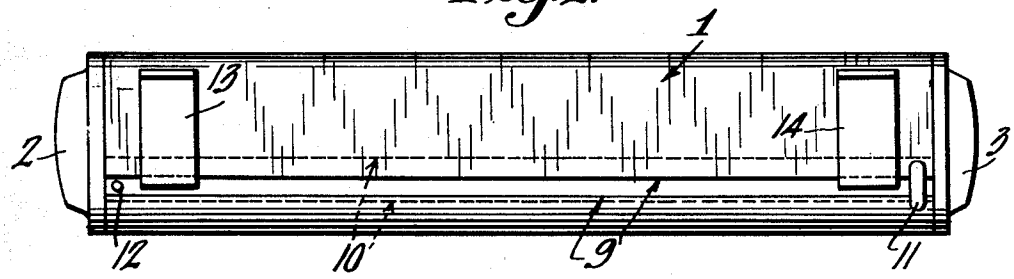


Fig. 2.



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Fig. 3.

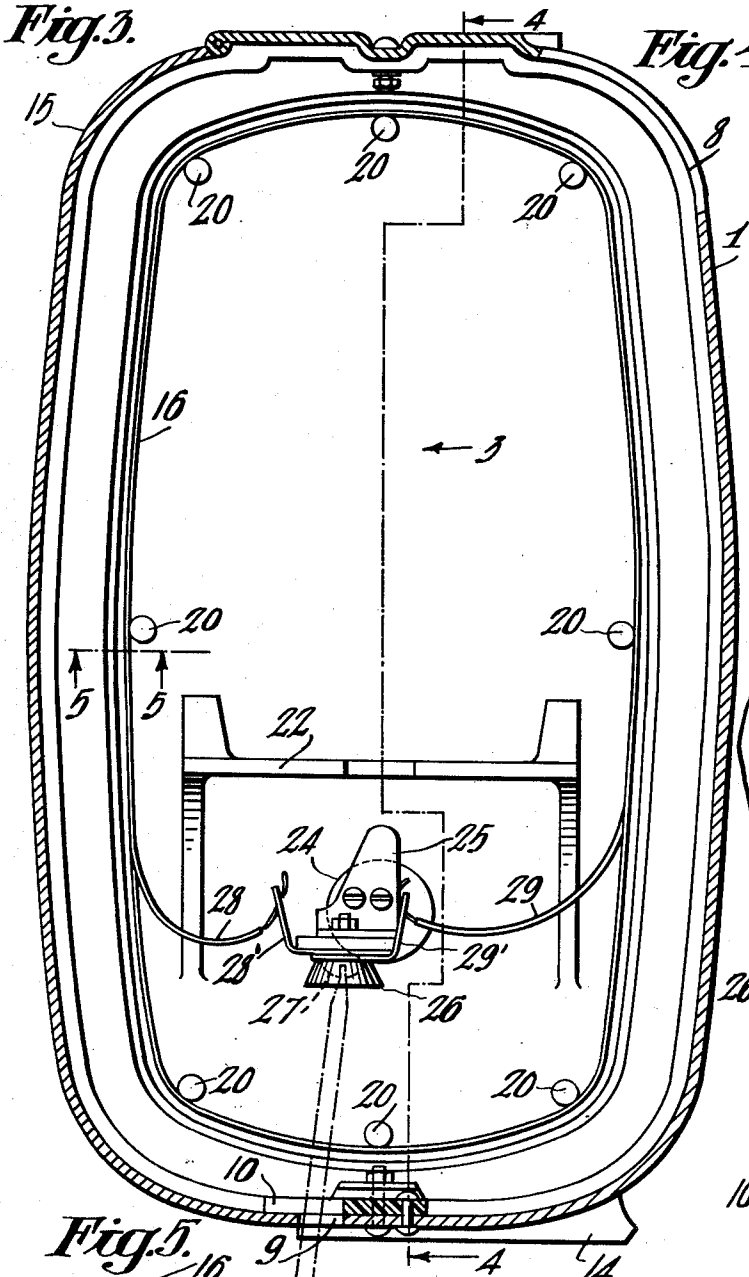


Fig. 4.

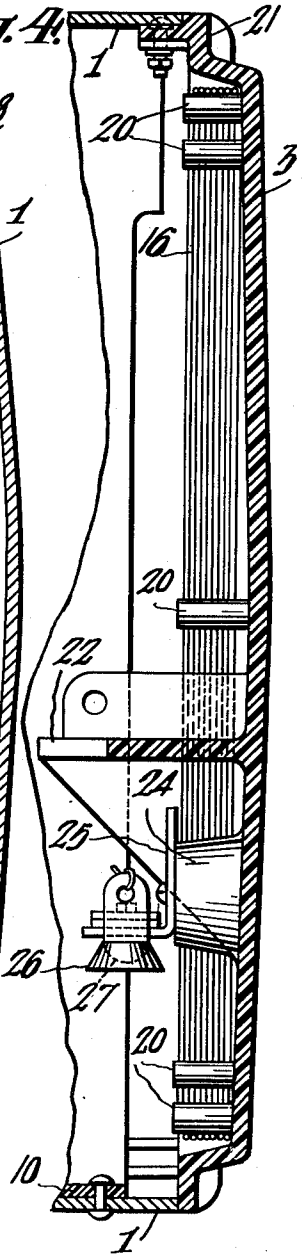
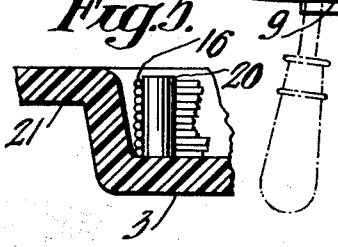


Fig. 5.



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METAL-CASE PORTABLE RECEIVER

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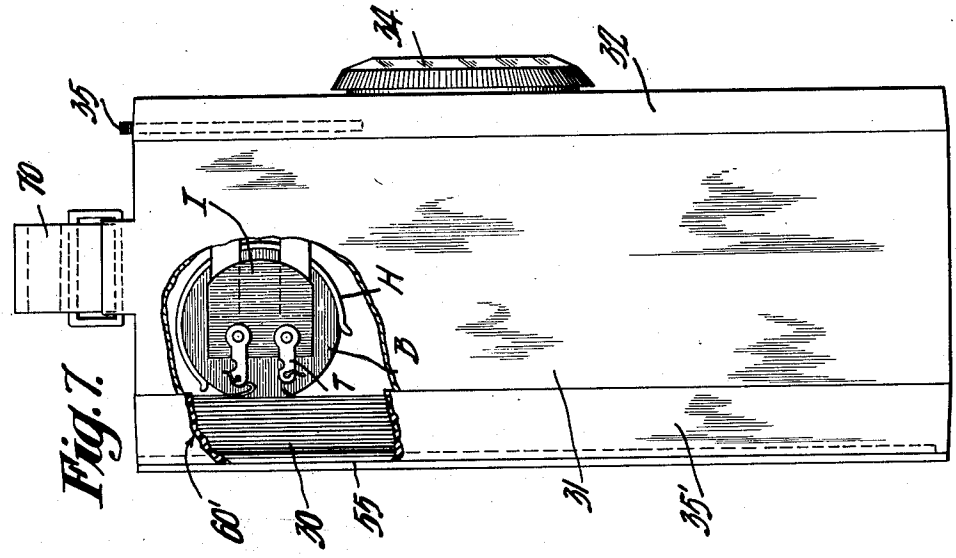


Fig. 7.

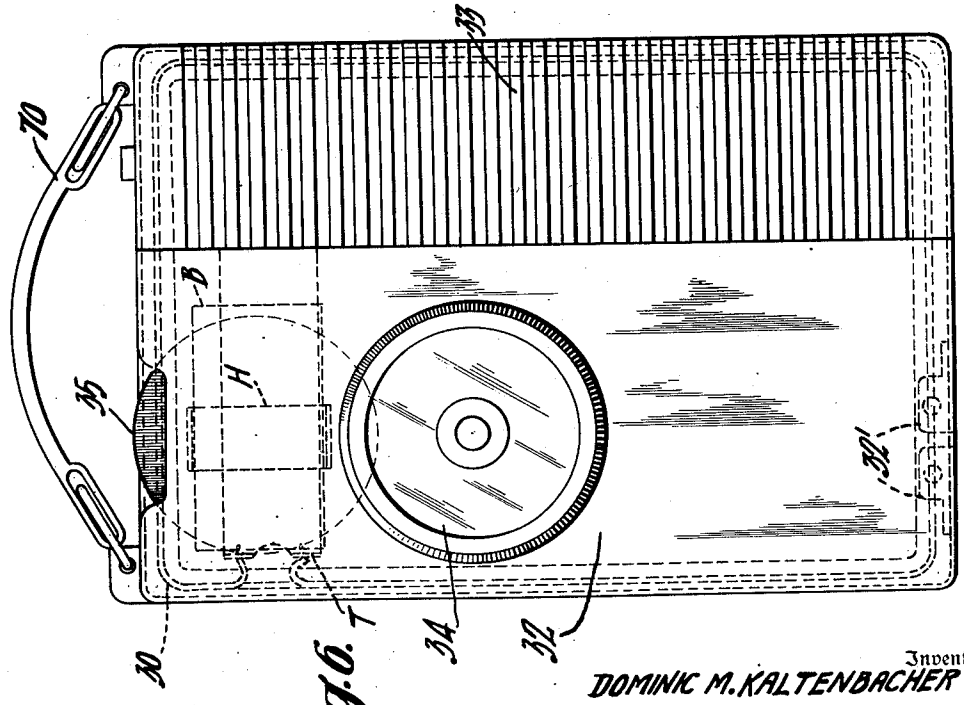


Fig. 6.

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METAL-CASE PORTABLE RECEIVER

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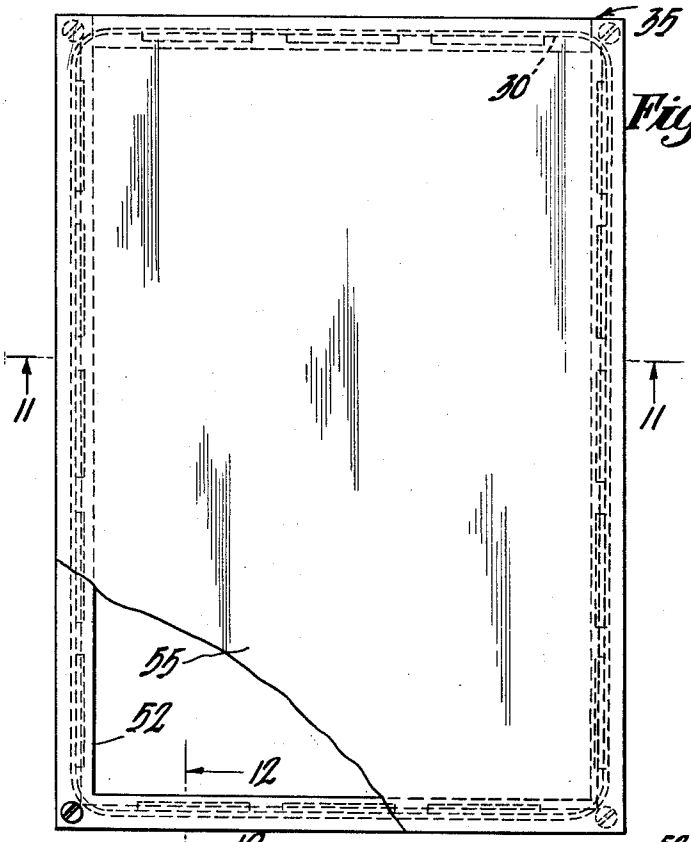


Fig. 8

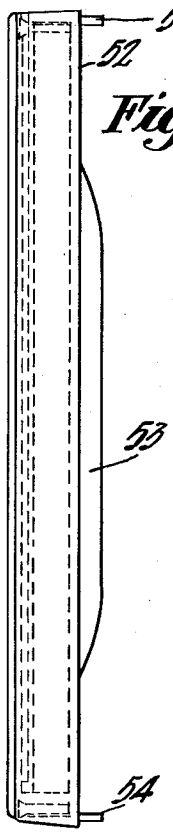
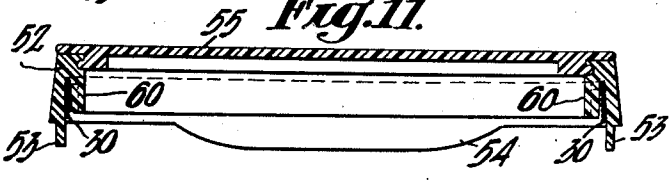


Fig. 9.

Fig. 10.

Fig. 11.



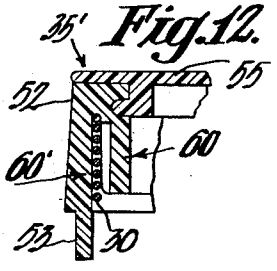


Fig. 12.

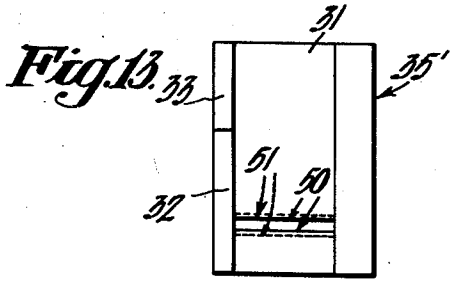


Fig. 13.

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Patented Jan. 16, 1951

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METAL-CASE PORTABLE RECEIVER

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Application June 10, 1947, Serial No. 753,710

2 Claims. (Cl. 250—16)

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My present invention relates generally to portable radio receivers of the metal case type, and more particularly to a metal-cased portable receiver provided with a satisfactory radio signal collector.

An important object of this invention is to provide a satisfactory radio signal pickup device, such as a loop, for a metal-cased portable receiver. In accordance with this object of my invention, the short-circuiting effect of the metal case on the receiver loop is removed by providing a gap or discontinuity in the metal casing. Since the metal case must be in place when the loop circuit is aligned, means is provided for aligning the loop circuit through an insulated gap in the metal case.

A more specific object of my invention is to provide a broadcast receiver in which a loop antenna is protectively mounted in a recess of an insulation end wall of a metal cabinet, the latter being slitted from one end wall to the opposite end wall to prevent it from having a single-turn short-circuiting effect on the loop. In accordance with this object the split in the metal cabinet may be provided at the bottom thereof so as to be least noticeable thereby to permit attractive styling. The split is, furthermore, provided with a non-metallic closure to provide the effect of a continuous cabinet surface.

Still further objects of the invention are to improve generally the utility and appearance of metal-cased portable receivers employing loop type antennas, and more especially to provide a construction which is not only economically manufactured but is readily assembled.

Still other features and objects of my invention will best be understood by reference to the following description, taken in connection with the drawings, in which I have indicated diagrammatically several constructions whereby my invention may be carried into effect.

In the drawings:

Fig. 1 is a front view of a portable receiver viewed from the operating face;

Fig. 2 shows the bottom of the case;

Fig. 3 is a vertical sectional view taken on line 3—3 of Fig. 1 looking in the direction of the arrows, certain of the interior elements being omitted to show the construction of the metal case and its insulation end walls;

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Fig. 4 is a sectional view taken on line 4—4 of Fig. 3 looking in the direction of the arrows;

Fig. 5 is a section taken on line 5—5 of Fig. 3 looking in the direction of the arrows;

Fig. 6 is a front view showing the operating panel of a different type of metal-cased portable receiver of the personal type;

Fig. 7 shows an end view of the receiver of Fig. 6, a portion of the wall being broken away to show the interior thereof;

Fig. 8 shows the outer face of the removable rear wall of the receiver;

Fig. 9 shows an end view of the rear wall;

Fig. 10 shows a plan view of the rear wall;

Fig. 11 is a section taken on line 11—11 of Fig. 8 looking in the direction of the arrows;

Fig. 12 is a section taken on line 12—12 of Fig. 8 looking in the direction of the arrows; and

Fig. 13 is a view of the bottom of the portable receiver to show the split in the metal case.

Referring now to the accompanying drawings, wherein like reference numerals in the several figures denote similar elements, Figs. 1 and 2 show the appearance of a metal-cased portable receiver constructed in accordance with my invention. In general, and viewed externally, the embodiment shown comprises a metal casing 1 and a pair of end walls 2 and 3. The upper and lower edges of the end walls are contiguous with the top and bottom surfaces of casing 1 to provide smooth overall surfaces. The end walls 2 and 3 are hollow or recessed, and they are made of any suitable insulation material. For example, the phenol condensation composition known under the trade-mark "Bakelite" may be used, or polystyrene may be employed. The casing 1 is composed preferably of thin sheet aluminum, although magnesium metal could be used if desired. The essential thing is to employ a light metal of attractive appearance. A handle 4 of any suitable construction may be secured to the top surface at a median point thereof.

Further, in this particular embodiment rotatable cylinders 5 and 6 provide tuning and volume adjusting devices, whereas numeral 7 denotes the usual tuning dial. The elements 5, 6 and 7 are located behind an opening 8 provided adjacent the top of the front wall of casing 1. Within the casing 1 there will be located a radio receiver chassis, a battery pack and a loop antenna. In

general, the chassis is located in the upper half of the casing while the battery pack is located in the lower half, while the loop antenna is protectively located within the hollow or recess of the insulation end wall 3.

Looking at the bottom of the casing shown in Fig. 2, it will be seen that there is provided a split or gap 9 which extends from end wall 2 to end wall 3. A non-metallic closure strip 10 is secured to the casing in overlapping relation to the split 9 so as to close the gap, and thereby to provide the effect of a continuous space. The opening 11 is provided in the metallic and non-metallic material so as to permit access to the interior of the casing. If desired, an external loop strap may be passed through the opening 11. The same opening is used for adjustment of an aligning condenser thereby to provide loop adjustment.

The opening 12 is provided in the insulation strip 10 to permit the passage of a power line cord therethrough. In addition, the bottom of the casing is provided with a pair of flat supports 13 and 14, which may, also, function as slideable latches to permit the hinged rear section 15 of the casing to be opened for access to the interior of the casing. Attention is directed to Figs. 3 and 4 for a showing of certain of the mechanical details of construction of the interior of the casing, it being understood that these details are shown for the sake of completeness. My present invention relates to the loop antenna circuit and its electrical and mechanical association with the metallic casing.

In any receiver using a loop antenna for radio signal pickup, the signal voltage delivered to the first control grid of the first receiver tube is proportional to the area, the "Q" and the number of turns of the loop. In receivers of the portable type the area is limited by the size of the case, while the number of turns is limited by the inductance requirements. The "Q," however, is determined by the type of wire employed, the proximity of metals, and the quality of the material on which the loop is fastened. When the receiver is housed in a metal cabinet, the ordinary problems of designing a satisfactory loop are multiplied. Since for satisfactory operation in medium and low priced radio receivers a loop cannot be completely covered by metal, some insulating material must be used in the cabinet construction. A solution is provided herein by having a metallic sheet wrap-around with plastic end pieces. Since the metal case is a shorted turn in the loop field, this effect must first be removed. This is accomplished by providing a gap, such as split 9, in the casing, preferably at the bottom where it is unnoticeable. The gap may be closed by any desired insulation material.

The next problem is to obtain a satisfactory figure of merit for the loop. Since the figure of merit varies directly as the effective area of the loop, a box type loop is preferable to a flat wound loop. The box type loop has a larger effective area, and by mounting it at several points less "Q" is lost than with a flat loop mounted to a flat surface. In general, with limitation in space and the extra losses involved, it is desirable to have the product of loop area, "Q" and the number of turns a maximum.

In Figs. 3, 4 and 5 I have shown the hollow or recessed insulation end wall 3, and the manner of protectively mounting the box type loop antenna 16 within the recessed end wall 3 so as to provide maximum signal pickup and yet have the loop antenna as far from the metal case and chassis as is possible. It is emphasized that the short-circuiting effect of the metal case 1 on the loop antenna 16 is removed by virtue of the split or gap 9 in the case.

The end wall 3 is shown provided with spaced insulation support pins 20. These pins project from the wall, and may be an integral part of the insulation wall. As shown in Figs. 3 and 4, a set of three spaced pins is provided adjacent the upper and lower edges respectively of the end wall, while a pair of spaced pins is provided in horizontal alignment at the middle of the end wall. The pins 20 are arranged in a substantially oval pattern so that the box loop antenna 16, which is of generally oval shape, may readily be slipped on to the support pins. As shown in Fig. 5, each pin 20 has a length substantially equal to the depth of the hollow wall 3 and the depth of the wound loop antenna 16. In this way the loop 16 is protectively located entirely within the end wall, and its axis is in the axial line of the metal case. Further, the effective area of the loop is of the order of the area of the end wall 3, the pins 20 being located close to the ledge 21 of the end wall.

The edge of the end wall 3 may be secured to the open end of case 1 in any desired and suitable manner. The structural details of the interior of the case are no part of my present invention, and such details are only generally referred to. As shown in Fig. 4, the open end of case 1 fits snugly in alignment with the peripheral flanges of end wall 3. The opposite insulation end wall 2 is constructed in the identical manner as wall 3. With such an arrangement only one part is stocked, and only one mold is necessary for limited production. Both end walls may have a shelf 22 projecting therefrom to support the receiver chassis. The space below the shelves receives the energizing dry batteries. Any suitable locking or clamping devices may be provided to keep the chassis firmly positioned on the shelves.

The insulation boss 24 projects from wall 3 below shelf 22, and carries the L-shaped bracket 25. A trimmer condenser 26 of any suitable construction is secured to the bracket 25. The adjusting head 27 of the trimmer condenser is located above the opening 11 (Fig. 2) so that the blade of an aligning tool may be inserted (see Fig. 3) to adjust the capacitance of the trimmer without disturbing the case. The loop 16 has its terminal leads 28 and 29 connected to the respective electrode terminals 28' and 29' of trimmer condenser 26. The usual tuning condenser (not shown) is shunted across the loop 16, the trimmer 26 being connected in parallel to both the tuning condenser and loop. The loop and tuning condenser provide the usual parallel resonant input circuit connected between the control grid and cathode of the first receiver tube.

The metal case affects the inductance and distributed capacity of the loop, and it is necessary that the complete receiver be in its operating condition when the loop circuit is aligned.

The loop is designed for a definite value of inductance with the receiver in operating condition and the metal case closed. The trimmer condenser adjusts the capacity of the antenna circuit at the high frequency end. When the case is opened the inductance and capacity of the loop are a different value than when closed. If the trimmer is adjusted when the case is open and then the case is closed, alignment no longer exists and the loop is tuned to a different fre-

quency than the other selective circuits. Access to the adjusting screw 27 of trimmer condenser 26 is provided by the hole 11 in the insulating strip 10 at the bottom of the case thereby rendering it unnecessary to provide a visible hole in the casing.

The loop winding need not represent the total inductance in the tunable circuit. The present invention is applicable to a receiver construction where a low impedance loop is used. In cases where a satisfactory "Q" is not obtainable for the loop a low impedance loop may be used, and a high "Q" loading coil is then connected in series with the loop to bring the total inductance of the tuned loop circuit to the correct value. In the modification shown in Figs. 6 to 13 there is employed a low impedance loop 30 (Fig. 7). In this particular set the inductance of the loop, for example, comprises about 20% of the total inductance of the tuned circuit. There is an optimum relation between loop and loading coil which depends on the "Q's" of the two.

As shown in Figs. 6 and 7, the portable receiver is of the so-called personal type. It comprises a metal case 31, made of zinc for example, which is rectangular in shape and houses the receiver chassis and batteries. The operating panel, or front wall, consists of an insulation panel 32 made of any suitable insulation material, and a grille section 33 made of metal. The grille section 33 is a part of the case casting. The tuning dial 34 and volume control dial 35 are fastened to respective shafts on the chassis. The rear wall or closure 35 is made of an insulation material, for example polysterene. The loop 30, of the box type, is mounted within the back wall 35. In Fig. 7 the back wall 35 and casing 31 are broken away to show two anchor points of the loop 30. In Fig. 7 the circular object B is the end view of the dry cell "A" battery mounted in battery holder H. The two terminals T are fastened to the insulator I which is held by, and is part of, the battery holder. The two terminals T are anchor points for the loop, and are not connected to anything shown in the drawing. It will be sufficient to show only these components of the receiver. One side of the loop is connected to the high potential side of the tuning condenser through a high "Q" loading coil, and the opposite side of the loop is connected to the low potential side of the tuning condenser.

In Figs. 8 to 12 there is shown the construction of the rear wall 35 and the manner of protectively mountinng loop 30 therein. In Fig. 13 I have shown the gap 50 provided in the metal case 31 to remove the short-circuiting effect of the case on the receiver loop 30. The non-metallic, or insulation, strip 51 is located on the inner face of the case, and overlaps the gap 50. The brackets 32', shown dashed, in Fig. 6 are part of the case casting. The case is cast with all sides continuous, and the gap or split 50 is milled in between the two brackets 32'. A molded strip 51 is then fastened to the brackets to fill up the gap. The specific manner of providing the gap and its insulation closure is not material to my invention. There is provided a continuous casing surface. It will be recognized that gap 50 in metal casing 31 functions in a manner analogous to gap 9 in the aluminum case 1 of Fig. 2, while insulation strip 10 of the latter functions in the manner of strip 51 of Fig. 14. In both instances the axis of the metal case is common with the horizontal axis of the loop, and the plane of the loop is across one end of the case. The latter is split to prevent it from acting as a short-circuiting turn on the loop. In addition, both metal cases have the opposite open ends thereof closed by insulation end walls.

The rear wall 35 consists of a rectangular frame 52 provided with opposed vertical flanges 53 and upper and lower horizontal flanges 54. These flanges fit inside (not shown) the casing 31 to provide the smooth continuous surface shown in Fig. 7. The rear rectangular opening of insulation frame 52 (see Figs. 11 and 12) is closed by slidable insulation plate 55. Plate 55, which is the back cover, slides off to provide access to the batteries, tubes etc., without disturbing the loop. The loop frame 52 is fastened to the case 31 by screws at the four corners (see Fig. 8). The plate 55 may have any suitable construction, and an illustrative joint between the plate 55 and the inner edge of frame 52 is shown in Figs. 11 and 12.

The frame 52 is constructed as a double wall so as protectively to receive the loop 30. The frame is a plastic molding with a slot molded in to receive the loop. As shown in detail in Fig. 12, the frame 52 is molded to have an inner wall 60 all around the four sides thereof. The space between inner wall 60 and outer wall 60' (Fig. 12) is sufficiently wide to receive the loop 30, and to house the latter snugly. In this personal type of set the loop is hidden in the slot in the molded back. The main goal is to get the loop as far from the metal case and chassis as practicable with the required styling. In Fig. 7 the outer wall 60' of frame 52 is broken away to show the wires of loop 30. It will be recognized that the mounting of loop 16 in end wall 3 of Figs. 3 and 4 is analogous to the mounting of loop 30 in insulation rear wall 35 of metal case 31.

The small gang capacitor (not shown) used on this particular receiver requires a large tuning inductance. It was impossible to get this large inductance in a reasonably small space, and the "Q" would have been unsatisfactory. That is why the low impedance loop and load coil were provided to secure a reasonable "Q." As previously stated, it is desirable to have the product of loop area, "Q," and number of turns a maximum.

While I have indicated and described two constructions for carrying my invention into effect, it will be apparent to one skilled in the art that my invention is by no means limited to the particular arrangements shown and described, but that many modifications may be made without departing from the scope of my invention.

What I claim is:

1. A receiver comprising a hollow metal case adapted to house a receiver chassis, said case having open ends on a lateral axis therethrough, insulation end walls for said open ends, and a loop antenna located at one of said walls, said case being split on a line normal to said loop plane to prevent the case acting as a short circuiting turn in the loop, said one wall having a recess in which protectively to house the loop, the plane of the loop being perpendicular to the transverse axis of said case.

2. A portable receiver comprising a hollow metal case adapted to house a receiver chassis and batteries therefor, said case being split on a line parallel to the transverse axis of said case to prevent the case from acting as a shortcircuiting turn in the loop field, said case having an insulation rear wall, and a loop antenna protectively located in said rear wall, said rear wall

having a peripheral slot in which to house the loop, the plane of the loop being perpendicular to the transverse axis of said case.

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