April 1, 1941. E. F. McDONALD, JR 2,237,260

PORTABLE RADIO RECEIVER

Filed June 27, 1940 2 Sheets-Sheet 1

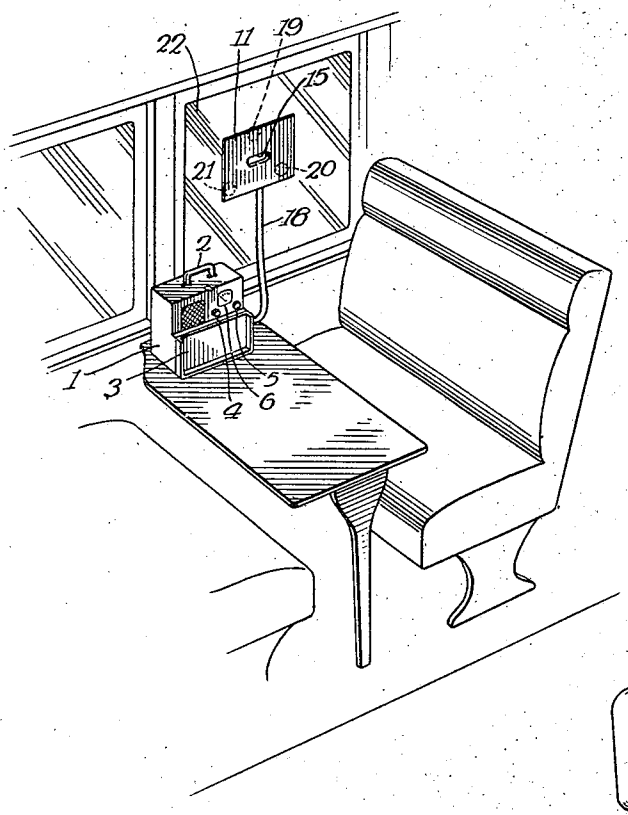

Fig. 1

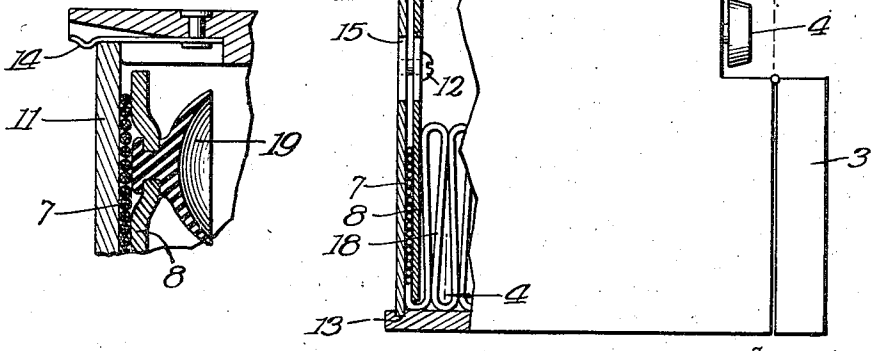

Fig. 3

Fig. 2

Inventor

Eugene F. McDonald, Jr.,

By Bacon & Thomas

Attorneys

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Fig. 4

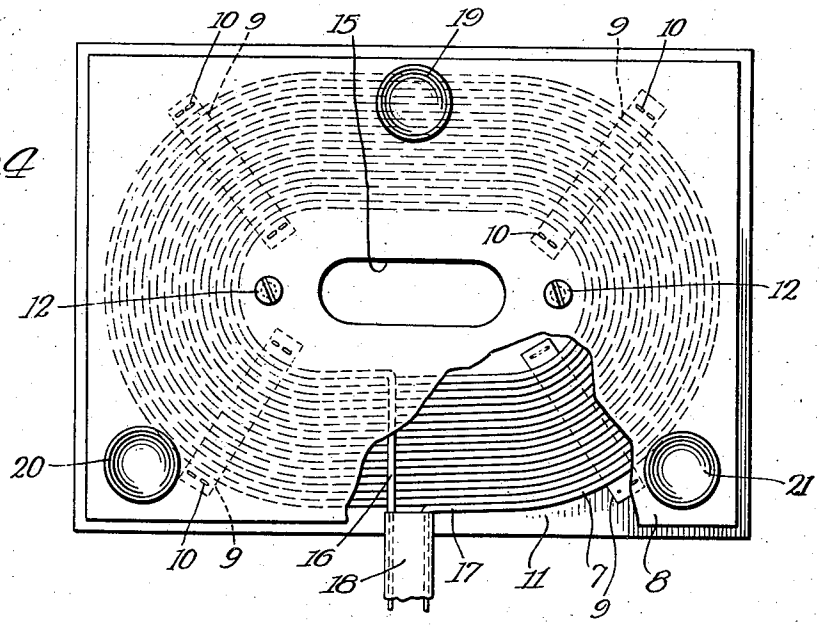
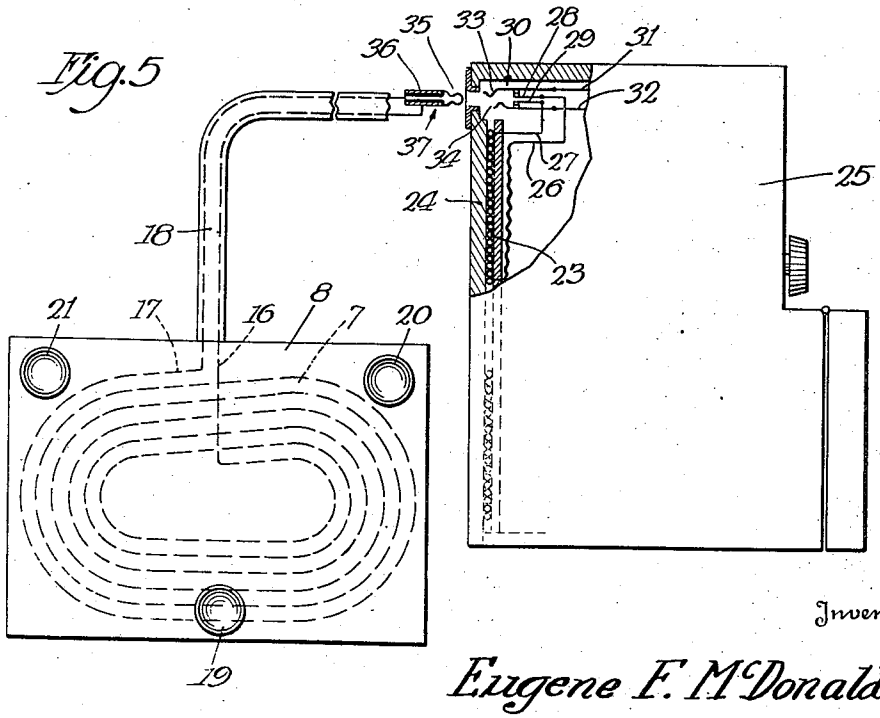


Fig. 5



Inventor

Eugene F. McDonald, Jr.

By Bacon & Thomas

Attorneys

Patented Apr. 1, 1941 2,237,260

UNITED STATES PATENT OFFICE

2,237,260

PORTABLE RADIO RECEIVER

Eugene F. McDonald, Jr., Chicago, Ill.

Application June 27, 1940, Serial No. 342,818

5 Claims. (Cl. 250—14)

This invention relates to radio receiving apparatus, and more particularly concerns a novel construction and arrangement of a loop antenna forming a part of such apparatus.

The object of the invention is to provide a simple and efficient construction through which the signal-receiving properties of a radio receiving set may be greatly increased and improved, and through which radio receiving sets of the loop antenna type may be satisfactorily used in locations and under circumstances heretofore considered to be impracticable.

It is well known to those familiar with the radio art that, in radio receiving sets employing a loop antenna, the direct signal input from the loop is comparatively weak and that, while sets of this type have been constructed to operate satisfactorily under some conditions, their sensitivity or signal pick-up qualifications are greatly diminished if they are placed too near metal structures. This is quite apparent if such a set is moved into and from close proximity to the beams or posts in the walls of a steel framed building, and I have found that highly efficient radio receiving sets of this type are practically useless within metal enclosures or partial metal enclosures, such as the cabin walls of a steel ship, a steel railroad-car, an automobile, or an aeroplane. Assuming that these enclosures constituted efficient shields for the loop antenna, I found that, by placing the set so that the loop antenna thereof was in an opening in the enclosure, the normal sensitivity or signal pickup of the set was reestablished.

Since it was impracticable to provide universally applicable means for supporting radio receiving sets in openings to obtain the results I have just mentioned, I have devised the present novel loop antenna construction and provided it with means by which it may be so supported individually in a convenient and thoroughly practicable manner, as, for example, upon a glass port-closure or window. When so positioned, the loop is located in an opening through the surrounding metal wall of the room, ship, railroad-car, automobile, or aeroplane, as the case may be, and the shielding or blanketing effect of said wall upon the loop is substantially eliminated.

For convenience in illustrating and describing the application of my device, I have shown the loop antenna construction in connection with a portable radio receiving set and applied upon the window of a railroad-car, but it will be understood from the foregoing explanation and the following description that neither its connection nor application is so limited, nor is the invention limited in any sense to the several uses I have mentioned.

In the drawings:

Figure 1 is a view of a portion of the interior of a railroad-car, showing a portable radio receiving set upon the usual folding table and the loop antenna of my invention in position upon the adjacent car-window;

Fig. 2 is an end elevational view of a portable radio receiving set, with the end wall thereof partly broken away to illustrate the loop antenna of the set constructed and arranged according to one form of my invention;

Fig. 3 is a fragmentary sectional detail view, upon an enlarged scale, illustrating the use of a conventional spring latch for removably holding the loop antenna unit in the position shown in Figure 2;

Fig. 4 is a front elevational view of the loop antenna construction embodying my invention, viewed in the direction of the arrows 4—4 of Figure 2; and

Fig. 5 is an end elevational view of a radio receiving set, with the end wall thereof partly broken away to illustrate the built-in loop antenna of the set and the plug-in connection of a separate loop antenna constructed and arranged according to another form of my invention.

The particular form and construction of the radio receiving apparatus does not form a part of this invention, and I have therefore illustrated only the general outward appearance of a radio receiving set, having a casing 1, a carrying handle 2, a hinged drop-cover 3, control knobs 4 and 5, and a tuning dial 6.

The loop antenna 7 herein shown is coiled upon the panel 8 and secured thereto in any suitable manner, as by the flat strips 9—9 spanning the coils at spaced distances and stapled as at 10—10 to the panel. The panel 8 is secured to a second panel 11 by means of screws 12—12, the loop being positioned between the two panels and protected thereby upon its opposite sides. In the arrangement shown in Figures 2 and 3, the panel 11 constitutes the removable back of the casing 1, the lower edge-part of the panel being received in a channel or groove 13 along the upper rear edge of the bottom of the casing and the upper edge thereof being held by a releasable spring latch 14. A "hand-hole" is cut through both panels 8 and 11, as at 15, to facilitate removal, replacement, and handling of the loop antenna unit. The inner and outer ends of the loop are connected with leads 16 and 17, respectively, and these leads

are stitched in spaced parallel arrangement along the opposite edges of a flexible tape or webbing 18 of a length sufficient to permit the loop antenna unit to be removed from the casing and individually supported in a manner to be described without requiring disconnection of the leads from the loop or from the input leads of the receiver circuit arrangement.

I provide the outer surface of the panel 8 with one or more rubber suction-cups, such as 19, 20 and 21, secured thereto in any suitable manner, by means of which the entire loop antenna unit may be supported upon the glass window 22, as illustrated in Figure 1, or upon any other suitable flat surface. As hereinbefore mentioned and as will be apparent from the illustration, when the loop is thus supported upon the window of the car or other enclosing structure, it will be positioned at an opening in the wall of said structure and completely insulated therefrom. In the actual use of the apparatus herein set forth, it has been found that under given conditions there is a definite location for best reception adjacent the opening in the wall. For example, best reception for stations in a given direction from the opening may require the antenna to be positioned in the upper left-hand or lower right-hand corner, while for stations in another direction the other corners of the opening may provide best reception. As shown in Figure 2, when the loop antenna unit is returned to its position at the back of the casing 1, the tape or webbing 18 is stowed within the casing, and the loop continues to serve as the antenna for the radio receiver. It is to be understood that the removability of the loop antenna unit and the described provision for its individual support do not interfere with or reduce its efficiency or the efficiency of the radio receiving set when it is returned to its position in the casing, as shown in Figure 2, but constitute additional features which permit it to be used satisfactorily in locations and under circumstances which would otherwise be impracticable.

Referring, now, to the construction shown in Figure 5, I have illustrated a radio receiving set similar in general appearance to the set shown in the other figures of the drawings, but which contains a built-in spiral loop antenna, which is indicated at 23 and which may be substantially the same in form and arrangement as the one already described. While the back panel 24 may be made removable for permitting convenient access to the interior of the casing 25, it will be assumed for the purpose of the following description that the loop and the back panel are not intended to be removed excepting for inspection and repair purposes. Under such circumstances, an additional loop antenna unit may be provided and plugged into connection with the receiving set. I have therefore shown the radio receiving set of Figure 5 provided with a jack-switch, and have provided an additional loop antenna unit, constructed according to my invention as already described, but having the leads therefrom terminating in a plug connector. The leads 26 and 27 from the built-in loop 23 are shown connected with contacts 28 and 29, respectively, of the jack-switch 30, and the input leads 31 and 32 of the radio receiver circuit are shown connected with the spring contact-fingers 33 and 34, respectively. The leads 16 and 17 from the additional loop antenna unit are shown connected, respectively, with the head and sleeve contacts 35 and 36 of the plug 37. With this arrangement, prior to the insertion of the plug 37, the built-in loop 23 will be connected with the input leads 31 and 32 through loop-leads 26 and 27, contacts 28 and 29, and spring contact-fingers 33 and 34. Insertion of the plug 37 will spread spring contact-fingers 33 and 34, breaking their connections with contacts 28 and 29 and thereby disconnecting loop 23, and leads 16 and 17 of the additional loop antenna unit will be connected with the input leads 31 and 32 through engagement of the spring contact-fingers 33 and 34 with the head and sleeve contacts 35 and 36 of the plug 37.

I claim:

1. In a radio receiving set provided with an antenna carried by said set and having a jack-switch in its connection therewith, which antenna is operative to receive radio signals, the improvement which comprises a second antenna, said second antenna having means for quickly attachably and detachably securing the same to a surface in any one of a plurality of positions apart from said set, and circuit connections including a plug for cooperation with said jack-switch, said plug upon insertion in said jack-switch acting to disconnect the first mentioned antenna and to connect said second antenna in circuit with said set.

2. Radio apparatus for enhancing radio reception within a shielding structure having an opening therein, which comprises a receiving set and an antenna carried by said set and connected thereto for supplying signal energy to said set, a second antenna structure having means for quickly attachably and detachably securing the same to a surface in any one of a plurality of positions apart from said set, said second antenna being provided with means to connect the same to said set, said last named means acting to disconnect said first mentioned antenna from said set.

3. A loop antenna for enhancing radio reception of a portable radio set of the type having an antenna carried thereby, said loop antenna comprising a flat relatively thin supporting structure of substantial area having conductors forming a loop supported by said supporting structure substantially in a plane during use of said antenna, a vacuum cup secured to said structure and being adapted for quickly attachably and detachably securing the same to a surface in any one of a plurality of positions within a shielding structure having an opening therein and apart from said set and parallel to said surface and a flat flexible and foldable connecting element including a web having spaced conductors secured near the edges thereof, said connector element having one end connected to said loop antenna and the other end provided with means to connect the loop antenna to said set, said last named means being constructed to disconnect the antenna carried by said portable set.

4. Radio apparatus for enhancing radio reception within a shielding structure having an opening therein, which comprises, a portable receiving set and a loop antenna carried by said set and connected thereto for supplying signal energy to said set, a second loop antenna including a relatively thin flat supporting structure of substantial area having conductors forming a loop supported by said structure substantially in a plane during use of said second antenna, a vacuum cup secured to said structure and adapted to quickly attachably and detachably secure the same to a surface in any one of a plurality of positions apart from said set and parallel to said surface and a flat flexible and foldable connecting member formed of a web with spaced conductors secured near opposite edges thereof, said set being

provided with switch means for alternatively connecting said antennas to said set, said flexible connector having one end connected to said second loop antenna and the other end provided with means insertable into said switch means for operating said switch to disconnect the antenna carried by said set from said set and connect said second antenna to said set.

5. Radio apparatus for enhancing radio reception within a shielding structure having an opening therein, which comprises, a portable receiving set and a loop antenna carried by said set and connected thereto for supplying signal energy to said set, a second loop antenna including a relatively thin flat supporting structure of substantial area having conductors forming a loop supported by said structure substantially in a plane during use of said second antenna, a vacuum cup secured to said structure and adapted to quickly attachably and detachably secure the same to a surface in any one of a plurality of positions apart from said set and parallel to said surface and a flat flexible and foldable connecting member formed of a web with spaced conductors secured near opposite edges thereof, said connector having one end connected to said second loop antenna and means for connecting the same to said set at the other end.

EUGENE F. McDONALD, JR.