

Dec. 31, 1935.

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2,026,060

SHIELD FOR RADIO AND LIKE APPARATUS

Original Filed Aug. 7, 1926 2 Sheets-Sheet 1

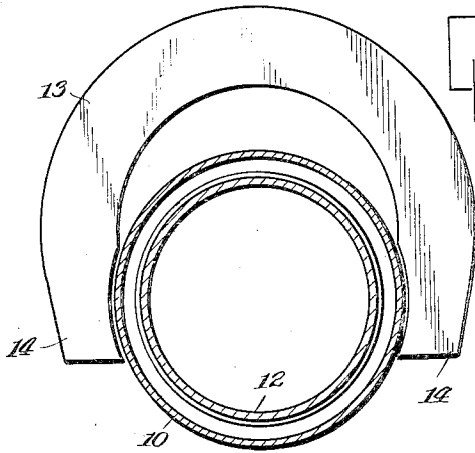


Fig. 1.

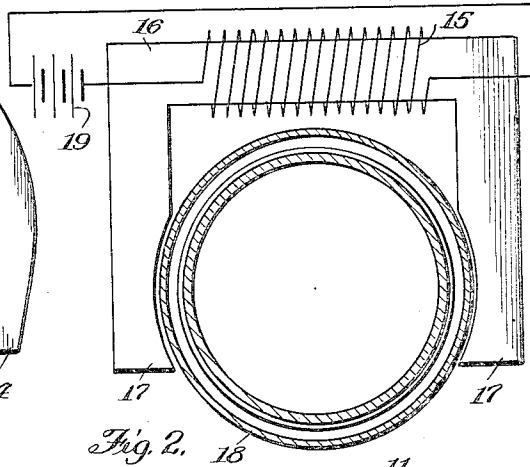


Fig. 2.

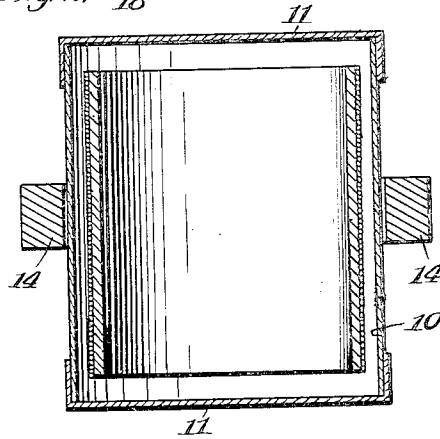


Fig. 3.

Fig. 5.

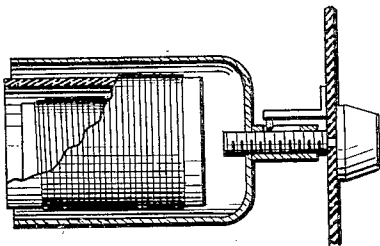


Fig. 6.

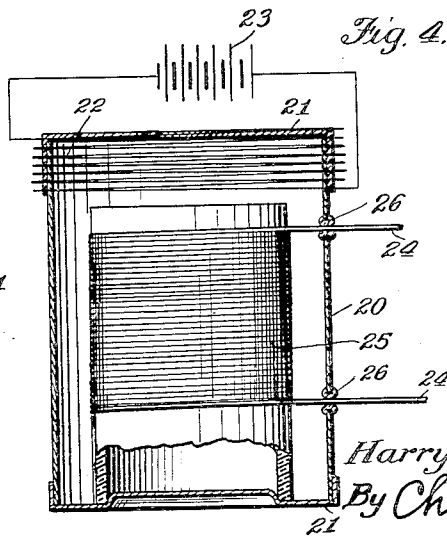
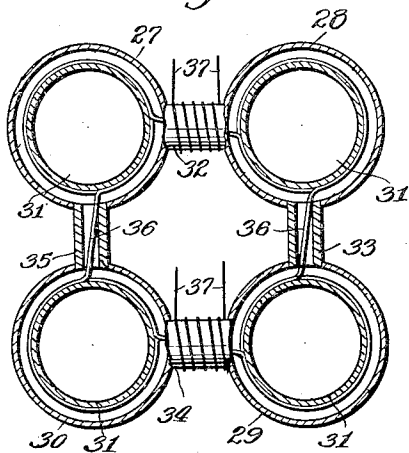


Fig. 4.

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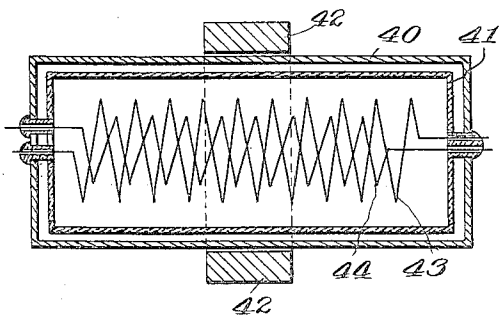


Fig. 7.

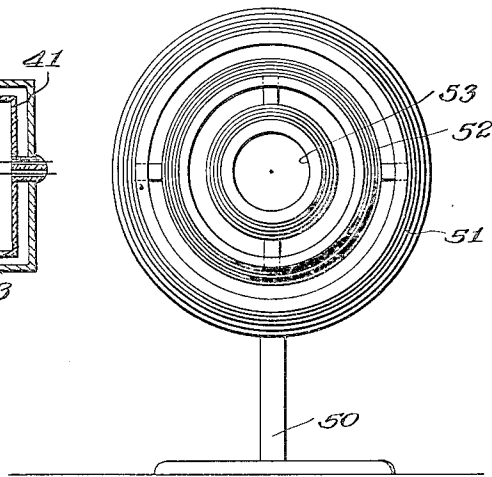


Fig. 8.

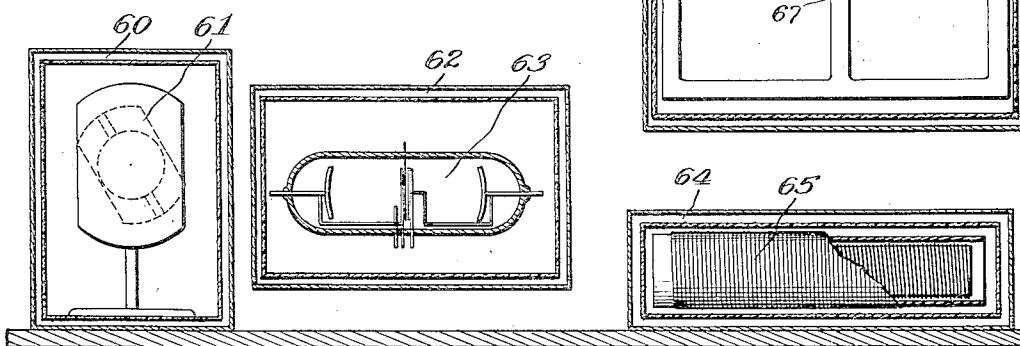


Fig. 9.

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2,026,060

SHIELD FOR RADIO AND LIKE APPARATUS

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Application August 7, 1926, Serial No. 127,769
Renewed January 4, 1934

10 Claims. (Cl. 250—16)

My invention relates to an improvement in means for protecting the coils and other parts of a radio set from inductive action between the different pieces of apparatus and also from outside electro-magnetic and electro-static disturbances.

It is well known that there is an inductive action between the different pieces of radio apparatus, especially the coils of the set. Also the set is affected by electrical oscillations, as shown by the fact that many sets will respond to the radio oscillations even when the antenna is disconnected therefrom.

There are two types of electrical forces which operate to affect the instrumentalities of a radio set. These disturbances may be either electro-magnetic or electro-static. A shield which will operate to shield the radio apparatus from the disturbances of one character, will oftentimes be ineffective to shield the set from disturbances of the other type.

Attempts have been made to shield the coils of a radio apparatus by providing a thin metallic shell of copper, aluminum, or other suitable material, about the part to be protected. It has been found, however, that this expedient is only partially successful, as some of the magnetic lines penetrate the shell and affect the enclosed apparatus notwithstanding. Also this expedient does not operate efficiently to shield the apparatus from the electro-static disturbances.

One of the objects of the present invention is, therefore, the provision of means to more thoroughly protect the coils and other radio apparatus from electro-magnetic disturbances.

Another object of the invention is the provision of means to also protect the apparatus from electro-static disturbances.

One of the features of the invention is the provision of a metallic shell or shield arranged in a magnetic field, as for instance the keeper of a permanent magnet, so that the magnetic lines of forces traverse the shell and create a magnetic shield through which the external electro-magnetic oscillations cannot penetrate.

Another of the features of the invention is the provision of a shield of non-magnetic material which may be employed, if desired, in conjunction with the electro-magnetic shield, just above referred to, so as satisfactorily to protect the apparatus from both electro-magnetic and electro-static disturbances.

The electro-static shield, just referred to, may, if desired, be positioned immediately within the electro-magnetic shield, either in intimate con-

tact therewith, or slightly separated therefrom, or it may be otherwise arranged.

The electro-magnetic lines of force to which radio and other apparatus are subjected operate very materially to affect the apparatus. Certain magnetic emanations are of such force and direction that in striking the electro-magnetic shield of thin metallic material they penetrate the shield and affect the apparatus positioned therein. It has been shown, however, that if the metallic shell is placed in a magnetic field, as above described, the electro-magnetic lines encountering the shield will be caught by the lines of force traversing the shield and carried around with them; thus acting more efficiently to protect the apparatus within the shell.

It is believed the further disclosure of the invention will be understood most readily from a detailed description thereof, taken in connection with the accompanying drawings, in which:

Fig. 1 is a section through one form of applicant's device where the shield is magnetized by means of a permanent magnet;

Fig. 2 is a similar view of a modification, in which the shield is magnetized by means of a coil mounted about the connecting leg of the U-shaped member;

Fig. 3 is a view through the coil and shield of Fig. 1 and shows the relation of the magnet poles to the shield;

Fig. 4 shows another modification, in which a coil is provided about one end of the shield, the said coil being in series with a source of electrical energy;

Fig. 5 shows a cup-shaped adjustable shield which may be moved back and forth over the coil;

Fig. 6 shows a plurality of coils, each surrounded by an individual shield, the shields being joined into an endless series by the connecting tubular conduit members, preferably of magnetic material;

Fig. 7 shows a shield structure similar to that of Fig. 1, but with an electro-static shield provided in addition to the electro-magnetic shield;

Fig. 8 schematically indicates a selective receiving coil structure, such as shown in applicant's application, Serial No. 46,692, filed July 29, 1925, and Fig. 9 shows a number of pieces of apparatus of a radio receiving set each surrounded by a double shield, one a magnetic shield and the other an electrostatic shield.

Referring now to the drawings, in which like reference characters indicate the same parts in

the several views, 10 is a cylinder of sheet metal preferably of magnetic material, having the end caps or covers 11. Within the closure or shield 10, 11 is positioned a coil or coils 12. This coil structure 12 may, if desired, comprise the usual primary and secondary and means for adjusting one of the coils in relation to the other. As this coil structure is old and well known, it is not shown in detail in the present drawings. There is provided in connection with the shield 10 a permanent magnet 13, between the poles 14 of which the cylinder 10 is positioned, as clearly disclosed in Figs. 1 and 3. The magnet 13 operates to set up lines of force in the shield 10, 11, which lines of force operate in connection with the metal cylinder and end caps to form a medium through which the stray electro-magnetic lines in the atmosphere can pass with great difficulty.

Where the coil is protected merely by a shield of thin magnetic material, it is found certain of the magnetic lines will pass through this shield and enter the coil or coils producing a disturbing effect. When, however, the shield is slightly magnetized, at least to the extent of equalizing that of the disturbing force, these entering magnetic lines are caught by the magnetic current existing in the shield and carried around with it so that they may be absorbed thereby and seldom, if ever, enter the apparatus within the shield. However, it is essential that the strength of the magnetic field within which the shield is positioned shall be properly proportioned, for if too strong the magnetic lines set up thereby may saturate and enter the shield and disturb the apparatus therein and if too weak the shielding effect above referred to will not be sufficient to protect it.

Fig. 2 discloses an apparatus similar to that shown in Fig. 1, except the magnetic lines are set up by means of the coil 15 positioned about the intermediate member 16 of the U-shaped bar, between the ends or poles 17 of which the shield 18 is positioned. The coil 15 will be arranged in series with a suitable source of electrical energy diagrammatically indicated at 19.

Fig. 4 shows another modification of applicant's invention, which consists of the cylinder 20 having the end caps 21, one end of the cylinder being surrounded by a coil 22 which is in series with a source of current indicated at 23. The conductors 24 leading to the coil or coils 25 within the shield 20 are provided with insulating collars 26, at the points where they pass through the shield 20.

Fig. 6 shows a series of shields which may be similar to that shown in Figs. 1 and 3, except that the permanent magnet is omitted. Within the shields 27, 28, 29, and 30 are pieces of radio apparatus, which in the present illustration, are diagrammatically indicated as coils 31. From a reference to Fig. 6 it will be noted that the shields 27 and 28 are joined by conduit 32, shields 28 and 29 are joined by conduit 33, shields 29 and 30 by conduit 34 and shields 30 and 31 by conduit 35. The conductors 36 which connect the pieces of apparatus each to the other will preferably pass through these conduits. About the conduits 32 and 34 are arranged the coils 37 which will be wound in the same direction and arranged in series with a source of electrical energy (not shown). It is to be understood that the several shields shown in this figure, as well as the conduits joining them, are preferably all of magnetic material.

Therefore, the coils 37 operate to set up a magnetic field, the lines of which will pass in general throughout the whole shield structure, operating effectively to protect the apparatus within the shield and also the conductors passing 5 through the conduits 32 to 35, inclusive.

While in Fig. 6 a series of coils are shown within the shields 27 to 30, inclusive, it is to be understood that other apparatus may be positioned within these shields with beneficial effects. 10

In Fig. 7 is shown a double shield comprising a magnetic shield 40 within which is an electrostatic shield 41. The shield 40 is formed of sheet metal, preferably of magnetic material, such as described in connection with Fig. 1 and has 15 associated therewith a magnet, the poles of which are shown at 42. This magnet may be either a permanent magnet, as disclosed in Fig. 1, or an electro-magnet, such as disclosed in Fig. 2. The inner shield 41 will be formed from 20 dielectric, such as glass, bakelite, or the like.

It has been found that the electro-static lines of force will often penetrate the magnetic shield even though the shield is impervious to the electro-magnetic lines, and in like manner the 25 electro-magnetic lines will pass through the electro-static shield. Therefore, in order to protect the apparatus from both the electro-static and the electro-magnetic lines, a double shield, similar to that shown in Fig. 7, should be provided. 30 Within the shields 41 and 42 of this figure are shown a pair of coils 43 and 44. However, it is to be understood that any piece of apparatus which is injuriously effected by the stray electro-magnetic or electro-static waves may be pro- 35 tected by a shield, such as here shown.

In Fig. 8 is shown a selective receiving coil structure composed of 3 coils, each of which may be rotated. Referring to this figure, 50 indicates a supporting stand on which the coil 51 is pivotally supported to rotate about a vertical axis. The middle coil 52 is pivotally supported from the frame of coil 51 to rotate about a horizontal axis and the innermost coil 53 is pivotally supported on the frame of coil 52 to rotate about 45 an axis at right angles to the axis of rotation of coil 52. This axis, however, will change its position as the coil 52 is rotated in respect to coil 51.

Fig. 9 represents a series of different radio 50 instrumentalities, each of which is enclosed by a double shield, one shield being of an electrostatic character which may be made from non-magnetic material, and the other shield being of magnetic material. No magnet or other 55 means for externally energizing the magnetic shield is shown in this view. This is for the reason that the coils, transformers and tubes of a radio receiving set are capable of setting up a magnetic field in the magnetic shield of their own 60 accord which is sufficient to overcome stray electromagnetic influences. Within the shield 60 is diagrammatically illustrated a coil structure 61, such as shown in Fig. 8. Within the shield 62 is shown a vacuum tube 63, such as disclosed in 65 applicant's application No. 628,962, filed March 31, 1923. Within the shield 64 is shown a coil structure 65, which, if desired, may comprise a plurality of coils either fixed in relation to each other, or relatively movable and within the 70 shield 66 is shown a condenser 67 which may be of any well known construction.

Experiments have clearly demonstrated that the several different instrumentalities of a radio circuit are injuriously affected by the stray 75

electro-magnetic and electro-static waves and the system is also affected by articles brought adjacent to the different instrumentalities. For instance, it is a common occurrence to find that the mere moving of the hand toward or from the equipment which is commonly accredited to "body capacity" and may be likened to the discharge of static accumulations, will change the tuning of a receiving set, and as above explained, the electrical oscillations thrown out by the pieces of apparatus themselves affected the adjacent apparatuses.

By enclosing each of the several major parts or instrumentalities of the radio apparatus in a separate shield, the equipment is almost absolutely protected, not only from the stray electrical oscillations arriving from outside sources, but also from the waves set up by the instrumentalities of the set. For the most delicate radio equipment it is very desirable to provide a double shield, such as shown in Figs. 7 and 9. However, with less powerful apparatus, a single shield of magnetic material may be found sufficient.

A shield consisting of any magnetic material may be employed with beneficial results. However, a shield, consisting of nickel chromium and iron in parts of about sixty-five (65) per cent nickel, ten (10) per cent chromium and twenty-five (25) per cent of iron, has been found to give very good results.

While in the drawings each of the radio instrumentalities is shown as provided with a separate shield, in certain cases, a plurality of instrumentalities may be positioned within the same shield if insulated from other instrumentalities which would injuriously affect them.

The shield partitions dividing each instrumentality from the next may be common to adjacent instrumentalities, as for instance, where the elements are positioned within a trough like shield and the separate devices within the member are separated from each other by partitions which may be either slideably inserted or fixed in position. Various modifications of this character will readily suggest themselves to one skilled in the art. It is, therefore, to be understood that the applicant contemplates many modifications and the invention, therefore, should be limited only by the scope of the appended claims.

Having thus described my invention, what I claim is new and desire to secure by Letters Patent of the United States is.

I claim:—

1. In a radio set, an instrumentality, a magnetic shield about said instrumentality, said shield comprising an envelope of magnetic material and means associated with said envelope

for creating a magnetic field about said envelope for magnetizing said envelope.

2. In a radio set, an instrumentality, a magnetic shield about said instrumentality, said shield comprising an envelope of magnetic material and magnet poles of opposite polarity associated with and arranged on the opposite sides of said shield to magnetize the shield.

3. In a radio set, an instrumentality, a magnetic shield about said instrumentality, said shield comprising an envelope of magnetic material and a magnet for magnetizing said shield, the said envelope being positioned between the poles of said magnet.

4. In a radio set, an instrumentality, a shield of magnetic material about said instrumentality, means for creating a magnetic field to magnetize said shield, and means for adjusting said shield relative to said instrumentality whereby a greater or lesser portion of said instrumentality is protected by said magnetized shield.

5. In a radio set, a plurality of instrumentalities and shields, said shields being positioned about certain of said instrumentalities, each of said shields comprising an envelope of magnetic material and means for creating a magnetic field about said envelope to magnetize the shield.

6. In a radio set, a plurality of instrumentalities, shields of magnetic material surrounding certain of said instrumentalities, respectively, conduits of magnetic material joining said shields into a series and means for creating a magnetic field to magnetize said shields.

7. In a radio set, a plurality of instrumentalities, shields of magnetic material surrounding certain of said instrumentalities and means associated with the shields for creating a magnetic field within which said shields are positioned for magnetizing the shields.

8. The method of protecting a radio set from foreign electrical disturbances which consists in surrounding several of the instrumentalities with separate shields of magnetic material and creating a magnetic field about said shields for magnetizing the shields.

9. The method of protecting a radio instrumentality from foreign electrical disturbances which consists in surrounding the instrumentality with a shield of magnetic material and creating a magnetic field about said shield for magnetizing it.

10. The method of protecting a radio instrumentality from foreign electrical disturbances which consists in substantially enclosing the instrumentality with an envelope of magnetic material and creating a magnetic field in said envelope to magnetize it.

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