April 3, 1928. 1,664,494

H. F. SMITH

RADIO APPARATUS

Filed March 30, 1927

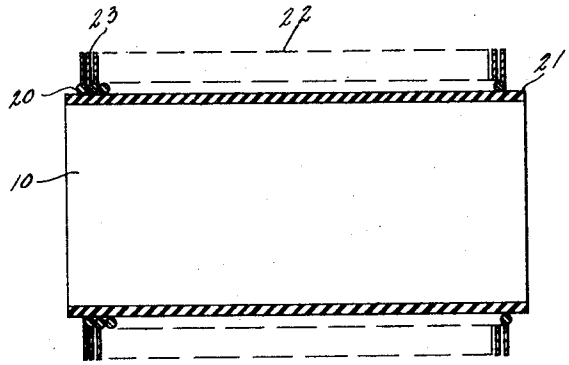

Fig. 1

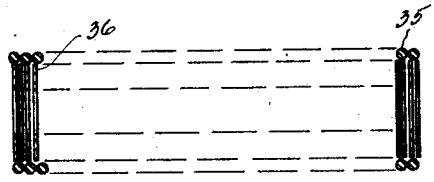

Fig. 2

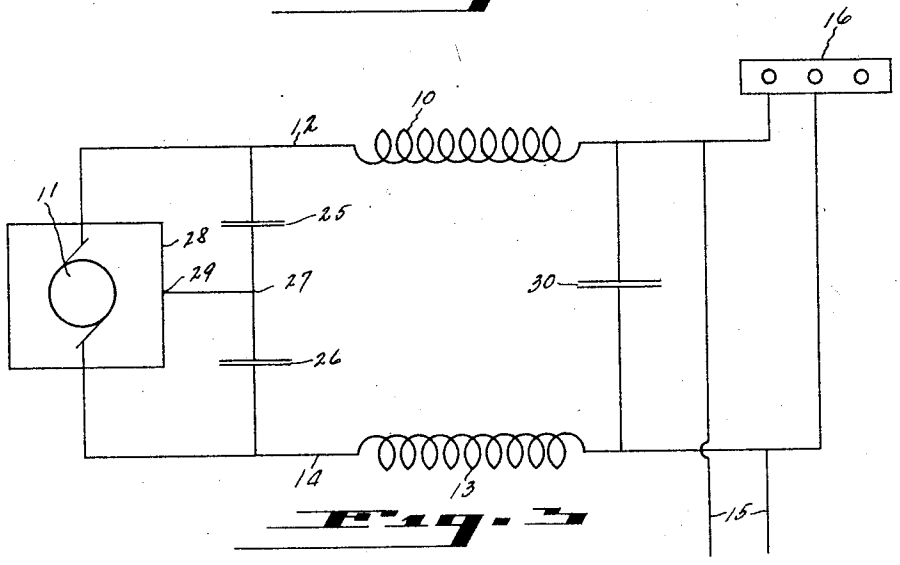

Fig. 3

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UNITED STATES PATENT OFFICE.

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RADIO APPARATUS.

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This invention relates to an electrical device adapted to absorb undesired high frequency oscillations so that they may be isolated from a radio receiving apparatus.

One object of the invention is the provision of an electrical device of the character mentioned having high inductance for currents of high radio and audio frequencies, but low inductance for currents of commercial power frequencies.

A further object of the invention is the provision of an electrical device of this character in which a coil of wire adapted to carry power currents is arranged in conjunction with a series of individual electrical conductors in which eddy currents are generated, so that a low impedance path is provided in which any objectionable high frequency oscillations may be absorbed and isolated from a radio receiving apparatus.

Further objects and advantages of the invention will be apparent from the following description and from the drawings in which:

Fig. 1 is a sectional view showing one form of the present invention;

Fig. 2 is a sectional view showing a modified form of the invention; and

Fig. 3 is a diagrammatic representation of the electrical connections of the present invention.

Electrical oscillations which are generated or which tend to be created in a commutator motor for example, or in any electrical apparatus in which an electric spark is produced, are of such nature that they seriously interfere with the proper operation of radio receiving sets which are in the neighborhood of the source of undesired oscillations, or which may be connected to the same part of the electrical network or power line to which the source of undesired high frequency oscillations is connected. The undesired electrical oscillations are propagated back into the line through which power is supplied to the apparatus wherein they are created, and the line becomes a miniature broadcasting station which distributes the disturbing oscillations and affects any radio receiving apparatus in the proximity.

In accordance with this invention therefore, an electrical device is provided in the line, through which the line power travels, the device being designed to absorb any high frequency oscillations which may be created in the load, or which tend to pass through the device into the line network. Referring to the accompanying drawings by reference numerals an electrical damping device or choke coil as indicated at 10 in Fig. 1 is provided in series with one or both sides of the line at the source of undesired high frequency oscillations such as would tend to be created from an electric commutator motor 11 or other power consuming or generating apparatus. The damping device 10 is connected as shown in Fig. 3 in series with the side 12 of the line and a similar damping device 13 is provided in series with the side 14 of the line adjacent the motor 11 so that the power currents supplied from the line 15 for the operation of the electrical apparatus 11 pass through the two damping devices 10 and 13.

The damping device 10, as shown in Fig. 1 comprises a coil of insulated wire 20 of suitable current carrying size, preferably arranged in a single layer from end to end of the cylindrical insulating cylinder 21. Arranged about the winding 20 is a non-magnetic core member 22 consisting of a number of separate spaced discs or rings 23. These discs or rings are formed of electrically conductive material such as copper and they are preferably coated with a thick layer of some suitable insulating material such as varnish so that they are electrically spaced one from another. Each ring or disc 23 provides an individual secondary circuit in which undesired high frequency oscillations such as those of audio or radio frequencies may be induced by the coil 20, so that eddy currents are created and absorbed in the individual discs, which are of high conductivity in a direction transverse to the coil axis. Each ring or disc 23 being electrically insulated from the adjacent discs prevents the undesired high frequency oscillations from traveling from end to end of the damping device or choke coil by the capacity effect between the primary and the secondary circuits, since the secondary circuits are individually isolated from one another and of very small length or extent in the direction of the coil axis. The various secondary circuits provided by the numerous discs 23 form a large number of short-circuited sec-

ondary paths in which the high frequency energy which tends to pass through the coil is consumed and dissipated.

The damping devices 10 and 13 shown in Fig. 3 will therefore effectively consume and dissipate the undesired high frequency oscillations which are created or which tend to be created in the electrical apparatus 11. Such oscillations will be isolated at their source and prevented from passing out to the line 15 or from finding their way to the radio receiving apparatus 16 which may be connected thereto or which may be in the neighborhood of the disturbing oscillation source 11 so as to be affected by induction or otherwise if the disturbing oscillations should find their way back into the line. The damping devices 10 and 13 are preferably used in conjunction with a pair of condensers 25 and 26 connected as shown to opposite sides of the line adjacent the apparatus 11 and interconnected at 27 to each other and to the motor housing 28 at the point 29. These two condensers form a comparatively low resistance path for high frequency oscillations so that they may be short-circuited immediately before they even find their way to the choke coils 10 and 13. These condensers although providing paths of comparatively low impedance for the passage of high frequency oscillations, do not offer paths of sufficiently low impedance for the passage of the comparatively low frequency power currents such as the common commercial 60 cycle currents. Those high frequency oscillations which find their way past the condensers 25 and 26 are dissipated and consumed within the damping choke devices 10 and 13 as previously stated. The effective impedance of the windings of the choke coils or damping devices 10 and 13 is comparatively low for high frequency oscillations such as those in the radio or audio frequency range, but the entire absence of iron from the damping device and the number and size of the turns of wire in the winding 20 are such that the passage of commercial power currents is not hindered to any substantial extent, the impedance of the choke coils for 60 cycle power currents being exceedingly low. The power currents supplied through the choke coils will be permitted to pass practically unhindered although the undesirable high frequency oscillations are effectively damped and consumed so that they are isolated from the remaining part of the line network to which the damping devices are attached.

A condenser 30 is preferably provided across the two line sides of the choke coils 10 and 13 so that any portions of the undesired high frequency oscillations which may pass through the choke coils 10 and 13 may be offered a comparatively low resistance path back to the other side of the line before these remaining oscillations may be effective upon the line network.

In Fig. 2 a modified form of construction of the damping device or choke coil is shown, wherein a coil of insulated wire 35 adapted to carry the power currents required is arranged so that it serves as the primary winding of a transformer the secondary of which is provided by the series of discs 36 of copper or other non-magnetic conducting material, these discs being arranged within the winding instead of being placed externally thereon as shown in Fig. 1. In either form of construction however, the secondary currents induced in the various discs at objectionable high frequencies efficiently damps these high frequency oscillations without providing a capacity connection from one end of the coil to the other through which the high frequency currents may pass. Each of the copper discs being electrically insulated and spaced from the adjacent discs necessitates the passage of all of the high frequency currents entering the coil, through its windings without being permitted to be by-passed by condenser action from one part of the coil to another.

While the forms of apparatus herein described constitute preferred embodiments of the invention, it is to be understood that the invention is not limited to these precise forms of apparatus, and that changes may be made in either without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. A radio apparatus of the class described comprising a coil of wire, a nonmagnetic secondary member extending longitudinally of said coil and formed of a number of separate spaced conductive discs having very short length in the direction of the coil axis and having high electrical conductivity in a direction transverse of the coil axis, said coil of wire being adapted to carry power currents and having very low inductance at commercial power frequencies and very high inductance at high frequencies.

2. A radio apparatus of the class described comprising a coil of wire arranged on an adjacent secondary member, said secondary member being formed of a number of adjacent electrically spaced copper discs, said coil of wire being adapted to carry power currents and having very low inductance at commercial power frequencies and very high inductance at audio and radio frequencies so that undesired high frequency currents are dissipated in the form of eddy currents induced in said discs.

In testimony whereof I hereto affix my signature.

HARRY F. SMITH.