

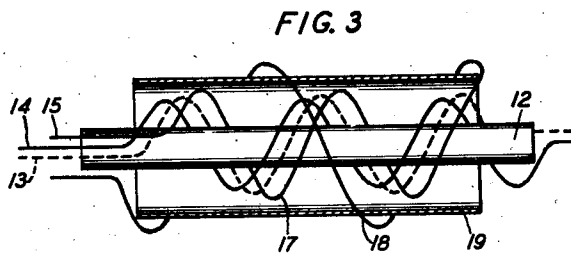
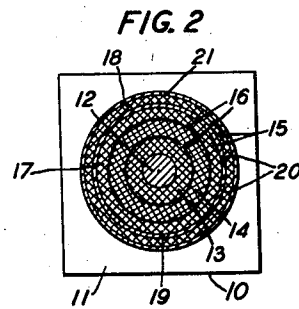
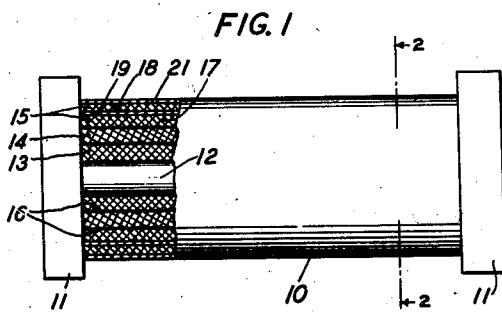
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ELECTRICAL COIL

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ELECTRICAL COIL

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This invention relates to electrical coils, and, more particularly, to that class of coils used in telephone substation circuits.

An object of this invention is to provide an electrical coil in which is combined effectively the usual transformer and a balancing network in an anti-sidetone telephone circuit.

It is well known that, to properly balance any anti-sidetone substation circuit so that there will be no sidetone in the receiver of the transmitting station when transmitting, it is necessary that the combined impedance of the components or elements forming that portion of the circuit which provides the balancing network have the same phase angle as that of the line to which the set is connected as well as a certain definite ratio between the absolute magnitudes of the impedances of the line and the network. In some types of anti-sidetone circuits ordinarily employed for common battery lines, the condenser which is used to confine the direct current to a path through the transmitter, although not commonly considered as such, forms a part of the balancing network and, hence, introduces a negative reactance. Since many common battery telephone lines have practically a zero or a positive phase angle, it is apparent that the proper phase angle cannot be given to the balancing network for these lines unless the effect of the condenser is counteracted or minimized. This may be done in either of two ways: (1) by adjusting the capacity of the condenser, or (2) by inserting an inductance element in the network. When a positive phase angle is desired, only the latter method would be effective. In cases where the phase angle is small, relatively large values of capacity would be required, since the magnitude of the network is small as compared to the impedance of the line. The usual method of inserting an inductance would be to use a separate retardation coil. This, taken in conjunction with the usual induction coil, would be relatively expensive.

Another object of this invention therefore is to provide a single electrical coil that performs cheaply and effectively the electrical functions of an induction coil and a retardation coil.

A feature of this invention comprises an electrical coil having a plurality of windings one of

which is divided into two sections by a magnetic shield member.

Another feature comprises an electrical coil having three superposed windings, one of which is divided into two sections, one section being closely coupled to the other windings and the other section being loosely coupled thereto.

A further feature comprises an electrical coil comprising a plurality of windings, one of which is divided into superposed sections by a magnetic shield member.

Other and further features will be evident from the detailed description which follows hereinafter.

A more complete understanding of this invention will be obtained from the following description taken in conjunction with the appended drawing wherein:

Fig. 1 is a side view, partly broken away and in section, of an electrical coil embodying the invention;

Fig. 2 is a sectional view of the device of Fig. 1, along the line 2—2 thereof; and

Fig. 3 is a schematic of the device of Fig. 1 to show the relation of the various windings thereof.

The device of Figs. 1 to 3 is an electrical coil embodying an induction coil and a retardation coil for use in an anti-sidetone telephone substation circuit. It comprises insulating end pieces 11 at the ends of and supporting a core 12 of magnetic material, such as silicon steel. A first winding 13 is wound about the core, a second winding 14 is wound about the first, and a third winding 15 is wound about the second, the windings being separated by layers 16 of insulating paper. The third winding is divided into two portions or sections 17, 18 by a sheet metal shield or spacer 19 of magnetic material, such as silicon steel or permalloy, which may be divided into substantially semi-cylindrical sections 20. The portion 17 of winding 15, it is evident, is closely coupled to the first and second windings and functions with them as a transformer or induction coil in the usual manner. The portion 18 functions in part as a retard inductance and, in other part, is coupled to the other windings of the coil, the closeness of coupling being determined by the proportions of the shield. In addition, the amount of inductance may be varied and the ratio of transformation with windings 13, 14

may be controlled by variation in the number of turns in each section of the third winding. If desired, an additional shield 21 of magnetic material may be placed around the outer section of winding 17 to more completely isolate it from the other windings.

The formulae for designing the winding 15 to obtain an uncoupled inductance are as follows:

$$C_1 + C_2 + 2k\sqrt{C_1 C_2} = C$$

$$C_2 = \frac{L_0}{1-k}$$

$$n_1 = k'\sqrt{C_1}$$

$$n_2 = k''\sqrt{C_2}$$

where:

C is the self-inductance of winding 15.

C₁ is the self-inductance of section 17 of winding 15.

C₂ is the self-inductance of section 18 of winding 15.

L₀ is the inductance desired to be uncoupled from the other windings.

k is the coupling factor between the section 18 and other windings of the coil.

k' k'' are constants expressing the relation between the number of turns n₁, n₂ and the inductance C₁, C₂ of the sections of winding 15.

While this invention has been described with reference to a specific embodiment, it is to be understood that it is capable of other embodiments and that the invention, therefore, is limited in scope by the appended claims, only.

What is claimed is:

1. An electrical coil comprising a magnetic core, a first winding wound on said core, a second winding wound directly around the first, and a third winding comprising two sections separated by a shielding element of magnetic material, one section being wound directly on said second winding and the other on said shielding element.

2. A combined induction coil and inductor comprising a cylindrical core of magnetic material supported at its ends by blocks of insulating material, at least three windings wound in concentric layers over said core and between said blocks, and a cylindrical shield of magnetic material for

magnetically segregating two portions of one of said windings, said core, windings and shield being arranged as follows: a first winding directly on said core, a second winding directly over said first winding, a first portion of a third winding directly over said second winding, said shield over said first portion, and a second portion of said third winding over said shield.

3. An electrical coil device including transformer and inductive impedance portions, substantially mutually independent magnetically but embodied in the same unit structure, said device comprising a core, a shield, each of magnetic material, and a first, second and third winding said first winding being wound directly on said core, said second winding being wound directly over said first winding, a first portion of said third winding being wound directly over said second winding, said shield lying over said first portion, and a second portion of said third winding being wound over said shield.

4. A combined induction coil and inductor comprising a core of magnetic material, a first winding wound on said core, a second winding wound over said first winding and in close coupled relation thereto, a shield of magnetic material, and a third winding having two portions, one of said portions being wound over said second winding and closely coupled thereto and the other of said portions being separated from said one portion and the other windings by said shield.

5. A combined induction coil and inductor comprising a core, a shield, each of magnetic material, and a first, second and third winding, the first winding being wound on said core, the second winding being wound directly over said first winding, a portion of said third winding being wound directly over said second winding, the shield being over said first portion, and a second portion of said third winding being wound over said shield, whereby the first and second windings and the first portion of the third winding constitute an induction coil and the second portion of the third winding constitutes an inductor.

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