

June 5, 1945.

M. L. HILL

2,377,420

ELECTRICAL COIL

Filed Oct. 1, 1942

FIG. 1

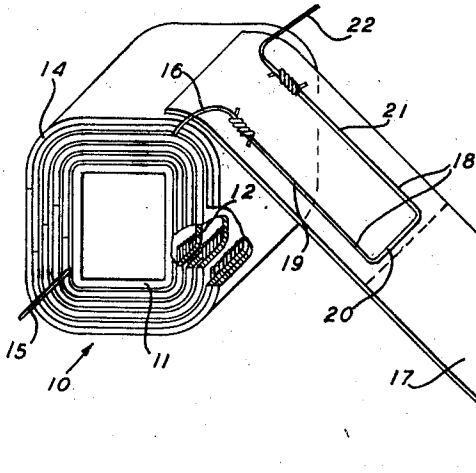


FIG. 2

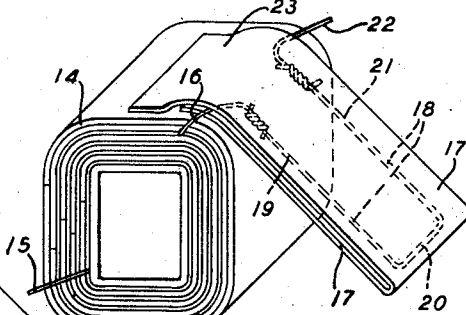


FIG. 3

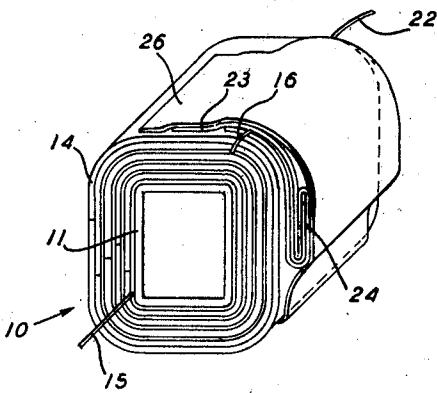


FIG. 4

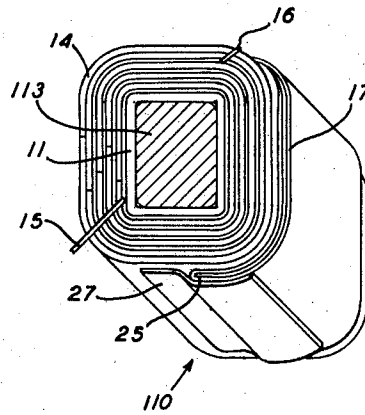
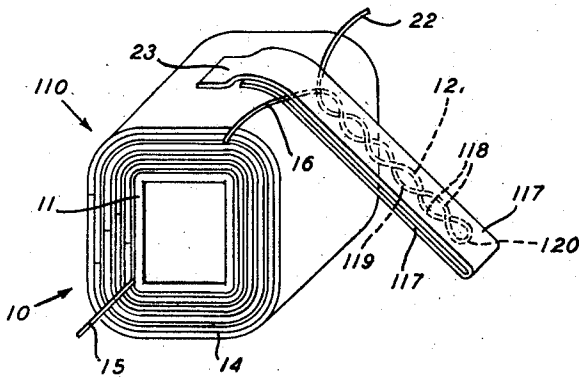


FIG. 5



INVENTOR
M.L. HILL
BY
E.R. Nowlan
ATTORNEY

UNITED STATES PATENT OFFICE

2,377,420

ELECTRICAL COIL

Marvin L. Hill, Summit, N. J., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York

Application October 1, 1942, Serial No. 460,404

6 Claims. (Cl. 175-21)

This invention relates to electrical coils, and more particularly to electrical inductance coils of predetermined resistance.

Electrical coils having a specified inductance for a specified alternating current and a specified resistance are becoming increasingly important in the electrical arts, especially in radio and in telephony generally. It is frequently found that a coil wound to have a predetermined value of inductance, will have a resistance value less than the desired minimum by a small amount.

An object of the present invention is to provide an electrical coil wound to have a predetermined inductance value and having a slightly deficient resistance value corrected without affecting the inductance to a minimum predetermined value.

With the above and other objects in view, the invention may be embodied in an inductance coil having connected in series with a winding thereof a loop of resistance conductor with the loop folded snugly against the body of the coil and the sides of the loop running generally and for substantially equal distances and in opposite directions along the turns of the winding.

Other objects and features of the invention will appear from the following detailed description of embodiments thereof taken in connection with the accompanying drawing in which the same reference numerals are applied to identical parts in the several figures and in which

Fig. 1 is a view in perspective of a first stage in adding non-inductive resistance to an induction coil;

Fig. 2 is a similar view of a second stage;

Fig. 3 is a similar view of the completed article;

Fig. 4 is a similar view of a modified form; and

Fig. 5 is a similar view of another modified form.

As disclosed in Figs. 1, 2 and 3, an induction coil is generally indicated by the numeral 10. For simplicity the simplest type of self-inductance or impedance coil is used to illustrate the invention in these figures, namely, an air core coil with a single winding, although the invention is by no means so limited. The particular coil chosen comprises a liner or form 11, which may be merely a length of tubing of solid insulating material, cardboard, hard fiber, hard rubber, ceramic material, molded plastic or the like. Upon this may be wound one layer 12 of the winding of the coil, i. e. consecutive helical turns of insulated electrical conductor wire side by side circumferentially around the form 11.

Over this layer of winding is wound a layer of insulating material, e. g. one turn of a tape of paper, textile fabric or other suitable material wide enough to cover the winding layer. Upon the insulating layer is wound a second layer of winding, then another insulating layer, and so on until the number of turns of winding desired has been wound on. The outside is covered with a last layer 14 of tape to hold the last winding in place. The inner end 15 and the outer end 16 of the winding are brought out as shown for connections as desired.

As thus far described, the structure is a familiar one in the prior art. For present purposes it is supposed that the coil is to have a predetermined inductance or impedance and also to have a resistance between predetermined minimum and maximum values. Inductance or impedance will depend primarily upon the number of turns of winding. Resistance will depend both upon the size and material of the conductor in the winding and upon the length of the conductor, i. e. the number of turns. Hence by proper predetermination of the number of turns, the required inductance or impedance may be built into the coil. Doing so will also determine the length of the conductor and thus partially determine the resistance. However, by suitable selection of conductor material and of conductor size, a coil of a given number of turns and hence of given inductance may be given any desired resistance within a wide range of values.

Nevertheless, while a desired resistance value can, in practise, be closely approximated, small variations in conductor size and conductivity along the length of the conductor cannot be wholly avoided except perhaps under laboratory conditions. Hence inductance can be fairly accurately predetermined, while resistance can be ordinarily only approximated. Where a coil is to have accurately predetermined values of both inductance and resistance, means must be provided to correct minor discrepancies in an approximated resistance value.

For purposes of the present invention, the coil 10 is so made as to have the required number of turns to produce the predetermined inductance or impedance value, while the conductor selected for the winding is so chosen as to material and cross-sectional area as to have a resistance a little smaller than the predetermined value. The coil having been completely assembled, a length 17 of a flexible flat sheet, strip, ribbon or tape of insulating material, e. g.

paper, textile tape, cellulose plastic tape, or the like, and having its upper surface coated with adhesive material, e. g. varnish, glue, rubber cement, or the like, is laid at one end against the outer surface of the coil body and near the point of exit of one of the winding ends, preferably the outer end 16. To this end of the winding is connected, e. g. by intertwisting and soldering, one end of a length 18 of resistance wire, the resistance of the coil 10 having been measured and found deficient by a known amount. The length of the wire 18, its size and its material are so selected that the resistance of the wire 18 added to the deficient resistance of the coil 10 brings the resistance of the whole to the desired predetermined value.

Preferably, the tape 17 is first positioned, as shown in Fig. 1, so that the main portion of it extends out roughly tangentially away from the body of the coil and transversely to the axis of the coil. The resistance wire 18 having been attached to the winding end 16 as described, a little less than half the length of the wire 18 is laid out along and on the tape 17 as at 19, away from the coil body and transversely to the coil axis. The wire is then bent around on the tape, as at 20, and the remainder of the wire laid on the tape, as at 21, parallel to the portion 19 but running in the opposite direction. If desired, a terminal lead 22 may be attached to the outer end of the wire 18 before this is laid on the tape. The depth of the loop thus made in the wire 18 is such that its two ends are even with each other and the straight portions 19 and 21 are of equal length. The whole is so arranged that the straight portions extend out parallel to each other and generally transversely to the coil axis. It will be noted that every portion of the loop 19, 20, 21 has a symmetrically corresponding, oppositely directed portion. Hence any inductive effect exerted upon any part of the loop is exactly balanced by the corresponding equal and opposite effect upon the corresponding symmetrical but oppositely running part of the loop. Therefore, the loop, in effect, neither adds to nor subtracts from the inductance or impedance of the coil, while the resistance of the loop is added to the resistance of the coil.

Preferably, the tape 17 is somewhat more than twice as long as the loop 18, as best shown in Fig. 1. The loop 18 lies on the upper half of the tape and the lower half is folded up and laid on the loop and the lower half of the tape as shown in Fig. 2. This brings the adhesive faces of the two parts of the tape against each other to adhere firmly together with the loop 18 protected and insulated between them and with the parts of the loop held in their positions relative to each other. The outer, upfolded half of the tape being longer than the loop, will extend up past the top of the loop and is adhered against the body of the coil as at 23 in Figs. 2 and 3. For compact convenience the protected and insulated loop may be folded one or more times against the body of the coil as at 24 in Fig. 3, or it may be wrapped without folding around the coil body as at 25 in Fig. 4. In either instance the loop may then be held in place by an outer strip of adhesive tape covering the whole as at 26 in Fig. 3 or only a part as at 27 in Fig. 4.

The coil 110 of Fig. 4 is like that of Fig. 3 in all respects except that there is a core 112 of magnetic material.

As shown in Fig. 5, if desired, the loop 19, 20, 21, after being formed and before being laid on

the tape 17, may be twisted as shown at 118. The portion 120, which in any case has no inductive effect since it runs generally transverse to the turns of the coil winding, becomes vanishingly small, while every part of the portion 119 has a corresponding symmetrically reversed part, inductively, in the portion 121, so that the whole loop 118 is still non-inductive. The loop in this case may be laid on and protected by narrower adhesive tape than in the other instances previously illustrated, but, being thicker, may pile up more.

Other modified forms and applications of the invention may be made within the spirit and scope of the invention as described and pointed out in the appended claims.

What is claimed is:

1. An electrical coil having a winding of predetermined inductance and of less than desired predetermined resistance, in combination with a loop of electrical conductor of resistance equal to the deficiency of resistance of the winding, one end of the loop being connected to one end of the winding, the loop being formed to have all its parts in oppositely symmetrical pairs so that inductive effect in any part is equal and opposite to the inductive effect in the symmetrical part, and the loop being folded snugly against the body of the winding with opposite sides of the loop parallel to the turns of the winding in such position that the inductance of the coil will not be affected by the loop.

2. An electrical coil having a winding of predetermined inductance and of less than desired predetermined resistance, in combination with a loop of electrical conductor of resistance equal to the deficiency of resistance of the winding, and two sheet-like layers of insulating material having the loop therebetween, one end of the loop being connected to one end of the winding, the loop being formed to have all its parts in oppositely symmetrical pairs so that inductive effect in any part is equal and opposite to the inductive effect in the symmetrical part, and the double layer of insulating material with the loop between being folded snugly against the body of the winding with opposite sides of the loop parallel to the turns of the winding in such position that the inductance of the coil will not be affected by the loop.

3. An electrical coil having a winding of predetermined inductance and of less than desired predetermined resistance, in combination with a loop of electrical conductor of resistance equal to the deficiency of resistance of the winding, and two sheet-like layers of insulating material held together by an adhesive and having the loop therebetween, one end of the loop being connected to one end of the winding, the loop being formed to have all its parts in oppositely symmetrical pairs so that inductive effect in any part is equal and opposite to the inductive effect in the symmetrical part, and the double layer of insulating material with the loop between being folded snugly against the body of the winding with opposite sides of the loop parallel to the turns of the winding in such position that the inductance of the coil will not be affected by the loop.

4. An electrical coil having a winding of predetermined inductance and of less than desired predetermined resistance, in combination with a loop of electrical conductor of resistance equal to the deficiency of resistance of the winding, one end of the loop being connected to one end of

the winding, the loop being formed to have all its parts in oppositely symmetrical pairs so that inductive effect in any part is equal and opposite to the inductive effect in the symmetrical part, the loop being folded snugly against the body of the winding with opposite sides of the loop parallel to the turns of the winding in such position that the inductance of the coil will not be affected by the loop, and means to retain the loop in its folded position.

5. An electrical coil having a winding of predetermined inductance and of less than desired predetermined resistance, in combination with a loop of electrical conductor of resistance equal to the deficiency of resistance of the winding, and two sheet-like layers of insulating material having the loop therebetween, one end of the loop being connected to one end of the winding, the loop being formed to have all its parts in oppositely symmetrical pairs so that inductive effect in any part is equal and opposite to the inductive effect in the symmetrical part, the double layer of insulating material with the loop between being folded snugly against the body of the winding

with opposite sides of the loop parallel to the turns of the winding in such position that the inductance of the coil will not be affected by the loop, and means to retain the insulating layers and loop in their folded positions.

6. An electrical coil having a winding of predetermined inductance and of less than desired predetermined resistance, in combination with a loop of electrical conductor of resistance equal to the deficiency of resistance of the winding, and two sheet-like layers of insulating material held together by an adhesive and having the loop therebetween, one end of the loop being connected to one end of the winding, the loop being formed to have all its parts in oppositely symmetrical pairs so that inductive effect in any part is equal and opposite to the inductive effect in the symmetrical part, the double layer of insulating material with the loop between being folded snugly against the body of the winding with opposite sides of the loop parallel to the turns of the winding in such position that the inductance of the coil will not be affected by the loop.

MARVIN L. HILL.