Feb. 27, 1951 W. J. KRUG 2,543,551

VARIABLE INDUCTANCE CORE STRUCTURE

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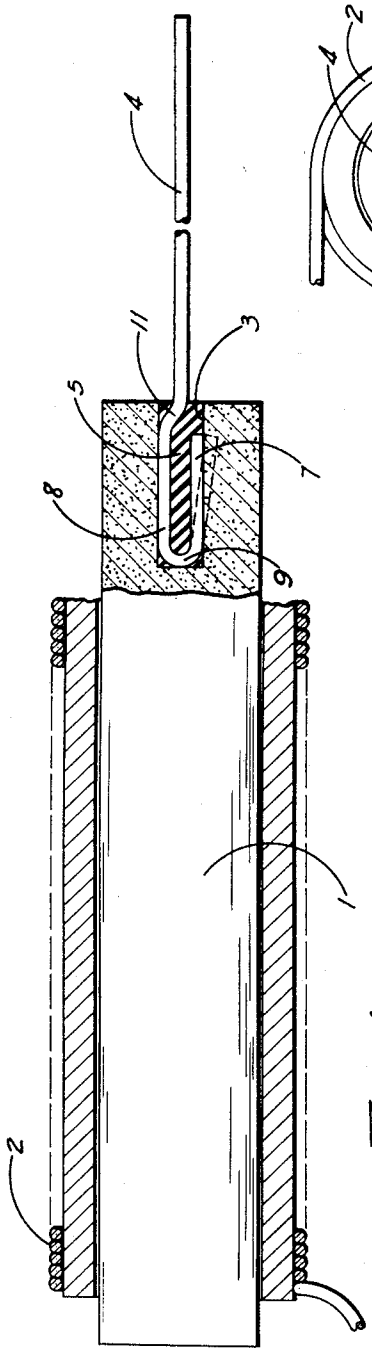

Fig. 1

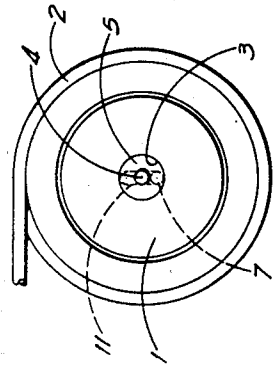

Fig. 2

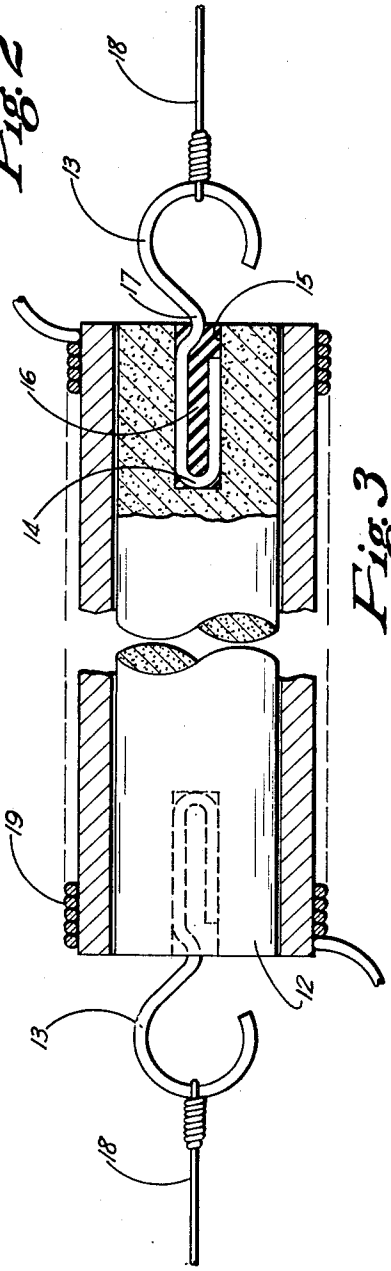

Fig. 3

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VARIABLE INDUCTANCE CORE STRUCTURE

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8 Claims. (Cl. 175—21)

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This invention relates to electrical inductance coils, and more particularly to the cores disposed in variable inductance coils.

Wires are attached to the ends of such cores, which are made of iron or other suitable inductance-varying material, to connect them to means by which the cores can be moved lengthwise in inductance coils. For that purpose an opening is drilled axially into at least one end of the core for receiving one end of the wire. Heretofore the wire has been held in the core by a bonding material that was tamped tightly into the opening around the wire. One reason that a tamped material was used is that the wire had to be coaxial with the core and therefore a tamping tool was employed which held the projecting portion of the wire coaxially of the core until the wire had been anchored in place. To help hold the wire in the tamped material, the embedded portion of the wire was crimped. Nevertheless, such wires do pull out of the bonding material, but more frequently they can be twisted slightly in that material so that there is a little play. Although the wire does not carry electric current, the purchasers of these cores object strenuously to any looseness between the wires and the bonding material.

It is among the objects of this invention to provide an inductance-varying core structure in which a wire is securely anchored by a bonding material, in which there is no play between the wire and the bonding material, in which the bonding material is not tamped, and in which the wire is fastened in the core in a cheaper manner than heretofore. Another object is to provide a method of making such a core structure.

In accordance with this invention a wire is bent at one end to form a loop which is inserted in an axial opening in one end of an electrical inductance-varying core. Opposite sides of the loop engage the side wall of the opening and press outwardly against it. The remainder of the wire projects from the opening and has a portion offset inwardly from the sides of the loop so as to locate that portion coaxially of the core. With this arrangement the wire is self-centering in the opening before any bonding material is placed in the opening. Consequently, as it is unnecessary to hold the wire in position while a bonding material is being placed in the opening, a thermo-setting material in powdered form can be poured into the opening and vibrated into a compact body filling that opening. During this operation the wire loop will hold the wire

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centered relative to the core. The projecting portion of the wire can be either straight or provided with a hook. Then the core is baked to cure the bonding material which, preferably, is of such a character that it expands while curing and therefore securely anchors the wire in the core. Because of the relatively large size of the loop in the core opening, there is no danger of the wire twisting in the bonding material and becoming loose, or pulling out of it.

The invention is illustrated in the accompanying drawings, in which Fig. 1 is a greatly enlarged side view, partly broken away, of an iron core disposed in an inductance coil; Fig. 2 is an end view; and Fig. 3 is a view similar to Fig. 1, showing a modification.

Referring to Figs. 1 and 2 of the drawings, an inductance-varying core 1 is disposed inside of an inductance coil 2 which is supported in any suitable manner (not shown) and which is connected in an electric circuit the inductance of which is to be varied. The core may be formed in the usual manner from powdered iron or other suitable material compacted under great pressure and held together by a thermo-setting binder, such as Bakelite or some other resinous material. The core has a cylindrical opening or socket 3 drilled a short distance into one end. The socket is concentric with the core. The inner end of a small, but relatively stiff, wire 4 is anchored in the socket by means of a bonding material 5. The portion of the wire that projects from the opening is relatively straight and in line with the axis of the core.

It is a feature of this invention that the wire is self-centering in the socket before the bonding material is put in. Accordingly, the inner end of the wire is bent into the form of a loop which engages the side wall of the core socket. Preferably, the loop is U-shape with substantially parallel straight sides 7 and 8 integrally connected at their inner ends by a return bend 9. Before the loop is inserted in the core the free side 7 of the loop diverges slightly from the other side so that it will have to be sprung inward when the loop is inserted in the socket. This insures that the sides of the loop will tightly engage the side wall of the core socket.

Another feature of this invention is that the projecting portion of the wire is offset inwardly relative to the side 8 of the loop integrally connected to it. This is accomplished by bending the wire at the outer end of that side of the loop to form a short portion 11 that extends diagonally therefrom to the axis of the socket, at

which point the diagonal portion is connected by another bend to the inner end of the straight portion of the wire projecting from the core. The diagonal connecting portion of the wire preferably is disposed inside of the socket. Due to the loop firmly engaging the side wall of the opening, the inner or core end of the projecting portion of the wire is held at the axis of the core even before any bonding material is placed in the socket. Consequently, the wire holds itself in centered position without the help of some other instrumentality while the loop is being anchored in the core by the bonding material.

The method of anchoring the wire preferred by me involves supporting the core vertically with its socket up and the wire loop inserted in it. Then the socket is filled with a powdered thermo-setting material as the core is vibrated at high frequency to cause the powdered material to settle down quickly in the socket and form a compact body around the loop. Of course, material is fed into the opening as the settling occurs, so that when the vibration is stopped the socket is filled. The unit then is baked to set or cure the bonding material so that the wire will be securely anchored by it in the core. The outer end of side 7 of the loop is located far enough back in the socket to allow the bonding material to cover that end. A better bond is obtained if the material used is one that expands while curing, so that it will press tightly against the loop embedded in it and against the side wall of the socket. Such a material can be made from a phenolic resin and aluminum oxide. This should be baked at about 340° F. for about an hour. The temperature should be below that at which the binder in the core is cured so that the binder will not be destroyed.

This method of mounting a wire in a core is considerably cheaper than the old tamping method. Also, it is much more satisfactory because the wire will not pull out and will not twist or otherwise become loosened in the bonding material. As there are no sharp bends in the wire, there is no danger of the wire breaking at such bends. After the wire has been anchored in place, its outer end can be bent if desired. Also, wires can be mounted in both ends of the core.

In the embodiment of the invention shown in Fig. 3, wires 13 are mounted in both ends of the core 12. The inner end of each wire is bent into the same shape loop 14 that appears in Fig. 1, and is anchored in the surrounding socket 15 by means of bonding material 16 the same as bonding material 5. However, the projecting portions of the wires, instead of being straight, are hook shape and are connected to the loops 14 by short portions 17 that are coaxial of the core. The hooks are shaped so that a line 18 connected to them will be coaxial with the core, too. By pulling on the line in a well known manner, the core can be moved back and forth in the inductance coil 19. The wires can be provided with hooks at their outer ends before the loops are inserted in the sockets, because my method of centering the wires in the core and anchoring them there does not require the use of a tamping tool which could not receive a hook shape wire.

According to the provisions of the patent statutes, I have explained the principle of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. In combination, a rod-like inductance coil core provided at one end with an axial opening, a relatively stiff wire having a U-shape loop at one end disposed in said opening and having sides in engagement with the side wall of the opening, the remainder of the wire projecting from the opening and having a portion offset inwardly from the sides of the loop and the side wall of the opening to locate said portion coaxially of the core, and a bonding material filling said opening to anchor the loop therein.

2. In combination, a rod-like inductance coil core provided at one end with an axial opening, a relatively stiff wire having a U-shape loop at one end disposed in said opening and provided with substantially parallel sides pressing outwardly against the side wall of the opening, the remainder of the wire projecting from the opening and having a portion offset inwardly from the adjoining side of the loop to locate said portion coaxially of the core, and a bonding material filling said opening to anchor the loop therein.

3. In combination, a rod-like inductance coil core provided at one end with an axial opening, a relatively stiff wire having a U-shape loop at one end disposed in said opening and having sides in engagement with the side wall of the opening, the remainder of the wire being substantially straight and projecting from the opening, said straight portion being offset inwardly from the sides of the loop and the side wall of the opening to locate the core end of the straight portion at the axis of the core, and a bonding material filling said opening to anchor the loop therein.

4. In combination, a rod-like inductance coil core provided at one end with an axial opening, a relatively stiff wire having a loop at one end disposed in said opening, said loop being provided with substantially straight sides engaging the side wall of the opening, the major portion of the wire being substantially straight and projecting from the opening, the wire having a diagonal portion integrally connecting the end of one side of the loop at the outer end of said opening with the adjacent end of said straight portion to locate said adjacent end at the axis of the core, and a bonding material filling said opening to anchor the loop therein.

5. In combination, a rod-like inductance coil core provided at one end with an axial opening, a relatively stiff wire having a loop at one end disposed in said opening, the loop having substantially parallel sides pressing outwardly against the side wall of the opening and integrally connected at their inner ends by a return bend, the wire having a diagonal portion integral with the end of one side of the loop at the outer end of said opening and extending across said opening to its axis, the rest of the wire being substantially straight and projecting away from the core coaxially therewith from the opposite end of said diagonal portion, and a bonding material filling said opening to anchor the loop therein.

6. In combination, a rod-like inductance coil core provided at one end with an axial opening, a relatively stiff wire having a U-shape loop at one end disposed in said opening and having sides in engagement with the side wall of the opening, the remainder of the wire projecting from the opening and having a portion offset inwardly from the sides of the loop and the side

wall of the opening to locate said portion coaxially of the core, and a cured thermo-setting bonding material filling said opening to anchor the loop therein.

7. In combination, a rod-like inductance coil core provided at one end with a cylindrical socket concentric therewith, a relatively stiff wire having a U-shape loop at one end disposed in the socket and provided with substantially straight parallel sides pressing outwardly against the side wall of the socket and integrally connected at their inner ends by a return bend, the wire having a short portion integral with the end of one side of the loop at the outer end of said socket and extending diagonally across the socket to its axis, the end of the other side of the loop near the outer end of the socket being spaced inwardly from the outer end of the socket, the rest of the wire being substantially straight and extending away from the core coaxially therewith from the outer end of said diagonal portion, and a cured thermo-setting bonding material filling the socket to anchor the loop therein, said bonding material being a thermo-expanding material.

8. In combination, a rod-like inductance coil core provided at one end with an axial opening, a relatively stiff wire having a U-shape loop

at one end disposed in said opening and having sides in engagement with the side wall of the opening, the remainder of the wire projecting from the opening and having a portion offset inwardly from the sides of the loop and the side wall of the opening to locate said portion coaxially of the core, the outer end portion of the wire being hook shape, and a bonding material filling said opening to anchor the loop therein.

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Certificate of Correction

Patent No. 2,543,551 February 27, 1951

WILLIAM J. KRUG

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 6, line 24, for the patent number "2,205,278" read *2,250,278*;

and that the said Letters Patent should be read as corrected above, so that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 29th day of May, A. D. 1951.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.

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