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CORE CLAMP AND COIL BINDING DEVICE

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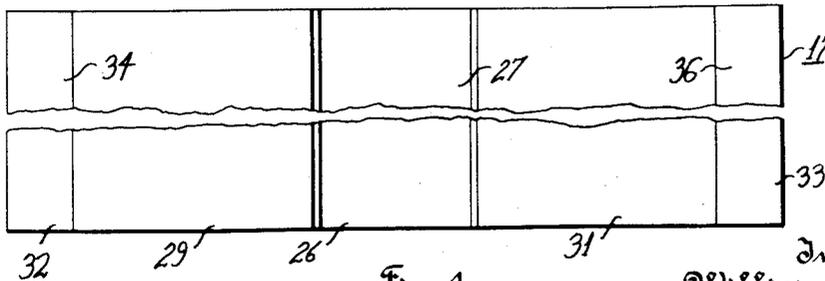
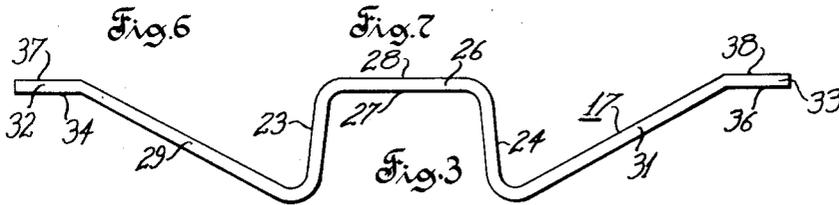
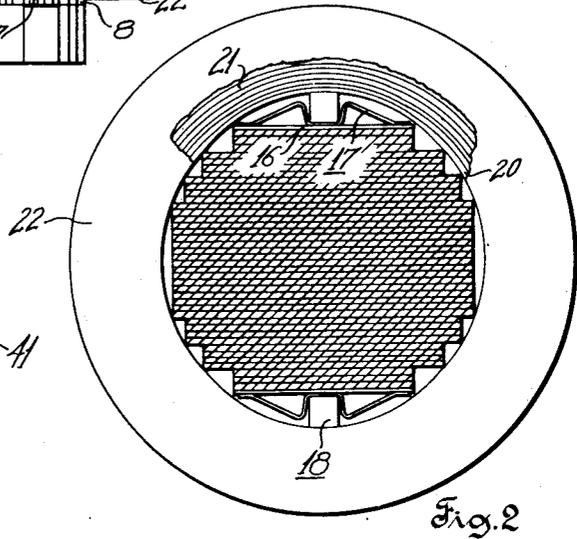
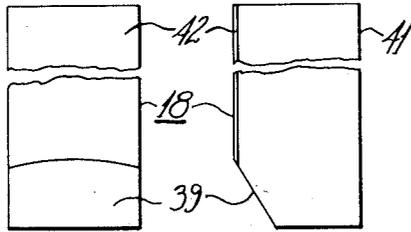
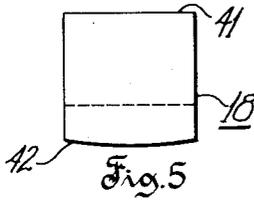
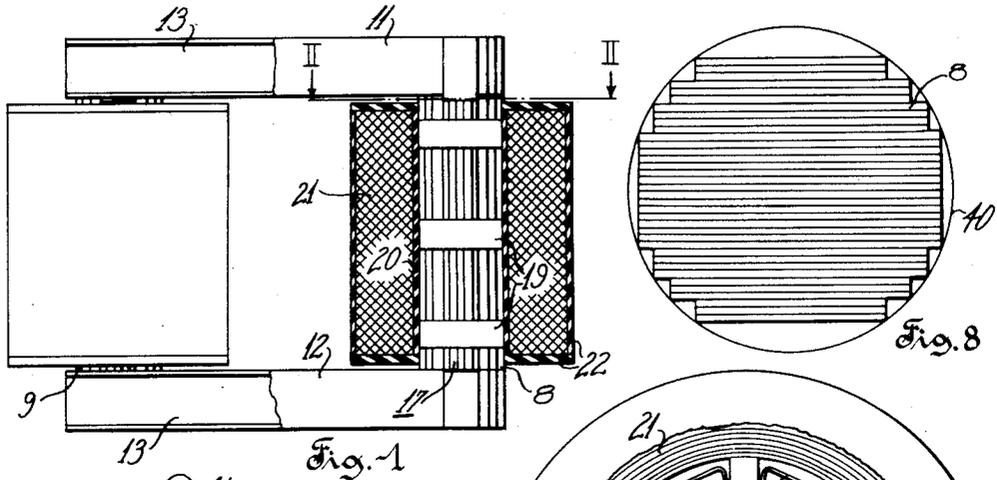


Fig. 4

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CORE CLAMP AND COIL BINDING DEVICE

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5 Claims. (Cl. 336—197)

This invention relates to electrical induction apparatus having laminated iron cores and particularly to improved means for clamping cores and locking a winding about a core leg. An application of this invention is, for example, in a transformer where the flexible laminations of a core leg are clamped together and an electrical winding is prevented from moving with respect to that core leg.

In prior art construction one of the problems in manufacturing transformers, particularly in the larger sizes, is that the long steel laminations of a winding leg tend to become wavy as it is stacked. This is partly due to the fact that the laminations are not uniformly supported throughout their entire length. After stacking, steel bands are wrapped about the laminations and the winding leg raised until it is vertical. Cotton tape is then wrapped around the leg and as winding coils are dropped in position around the leg the steel bands are removed. The winding leg retains the waviness in the laminations when in a vertical position. The winding leg made in the way described has many localized strains due to the fact that a uniform clamping pressure is not obtained throughout the winding leg. Such localized strains resulting from irregular clamping pressures are in turn apparently responsible for increased noise level, exciting current and core losses. In addition, the waviness causes an increase in the cross section of the core leg. This means that larger winding tolerances are required resulting in larger diameter coils which raise the copper cost, increase the size of the tank, etc.

It is therefore desirable to eliminate or minimize to a large degree all those undesirable effects mentioned above.

It is an object of this invention to provide in an electrical induction apparatus an improved means for bracing and straightening the core laminations thereof.

A further object of this invention is to confine a given laminated core material in an electrical induction apparatus into a reduced cross sectional area.

Another object of this invention is to provide electrical induction apparatus in which an electrical winding is locked about a core winding leg.

Still a further object of this invention is to provide an electrical induction apparatus having improved core support throughout the length of the core winding leg.

And another object of this invention is to reduce the noise level of an electrical induction apparatus.

Still another object of this invention is to reduce the core losses by improved construction of an electrical induction device.

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Objects and advantages other than those set forth above will be apparent from the following description when read in connection with the accompanying drawing in which:

5 Fig. 1 is a view in elevation of a transformer showing an embodiment of this invention;

Fig. 2 is an enlarged sectional view taken on line II—II of Fig. 1;

10 Fig. 3 is an enlarged plan view of a core brace embodied in the invention;

Fig. 4 is a view in elevation of the core brace shown in Fig. 3;

Fig. 5 is an enlarged plan view of a wedge embodied in the invention;

15 Fig. 6 is a view in elevation of the wedge shown in Fig. 5;

Fig. 7 is a side view of the wedge shown in Fig. 6; and

Fig. 8 is a view of the core stack shown in Fig. 2 inscribed within a core circle.

20 The invention is used and is explained in connection with the assembly of the transformer core shown in Fig. 1, but can also be used in other types of electrical induction apparatus. The core is shown as having two winding legs 8 and 9 connected at their ends by two yokes 11 and 12. The laminations of the yokes are held together by channel beam clamps 13. Those clamps also maintain the winding legs and yokes in a fixed position with respect to each other. Upon each winding leg, as shown in Figs. 1 and 2, are insulating means or insulation pads of pressboard 16, core braces 17, wedges 18, core bands 19, insulation barrier 20, electrical winding or coils 21 and insulation 22.

25 Since winding legs 8 and 9 are assembled in an identical manner, only the assembly of winding leg 8 will be described.

30 Winding leg 8 is stacked in a specific manner. A first elongated rigid core brace 17 is laid out on a stacking jig. The core brace is of thin gauge metal having longitudinal corrugations and resembles in cross section a modified W. Those corrugations form a channel shaped middle section with sides 23 and 24 interconnected by base 26 having inner and outer faces 27 and 28, respectively. A sloping section 29 extends from side 23 and a sloping section 31 extends from side 24, each of those sloping sections sloping in a direction away from the channel shaped section to a plane containing outer face 28. End sections 32 and 33 having inner faces 34 and 36, respectively, and outer faces 37 and 38, respectively, extend from the sloping sections at the points the sloping sections touch the above mentioned plane in a direction away from the channel shaped section and parallel to the above mentioned plane. A first insulating means, for example, a pad of pressboard 16 is then laid on the outer faces 28, 37 and 38. An outermost core lamination is placed on the pad which thus may be said to be interposed between that lamination and the brace to isolate that lamination from the core brace. Winding leg 8 is built up with laminations placed in the conventional manner shown in Fig. 2.

35 After the last or opposite outermost lamination has been stacked, a second insulation pad 16 is interposed between that last lamination and outer faces 28, 37 and 38 of a second core brace 17 disposed opposite the first core brace. It should be noted that in smaller size 40 transformers the insulation pads 16 may be omitted

since the difference in permeability between the metal brace and the core steel laminations does not effect the overall performance of transformers in those sizes.

The core braces are disposed with the longitudinal corrugations parallel to the longitudinal axis of winding leg 8 and extend in longitudinal length for a distance less than the length of that winding leg to provide room for the interleaving of yoke laminations with end portions of that winding leg lamination.

The cross section of winding leg 8 is inscribable within core circle 40 as shown by Fig. 8. Core braces 17 lie within that core circle and thus do not gouge cylindrical barrier 20 interposed between the core circle and electrical coils 21 or any electrical winding lying outside that core circle.

After winding leg 8 is assembled in the manner described above, steel bands are temporarily wrapped about the winding leg, insulation pads 16 and core braces 17. The winding leg is then raised to a vertical position. Next, several core bands of cotton tape 19 are tightly wound about that winding leg, insulating means 16 and core braces 17 at a plurality of points along the length of the winding leg. The core bands retain insulating means 16 and core braces 17 in a fixed position with respect to the winding leg and also clamp together the laminations and the core braces.

With the laminations of the winding leg held together by core bands 19, insulation barrier 20 is dropped about the core circle of the winding leg. The steel bands are removed as the cylindrical barrier 20 is pulled down over the winding leg.

Electrical winding 21, schematically representing the coils of the transformer on leg 8, is then lowered about barrier 20 which insulates those coils from the winding leg. After the electrical winding is in position wedges 18 are interposed between core braces 17 and core bands 19. Each of the wedges has a chamfered end portion 39, an inner face 41 and an outer face 42 rounded to conform with the surface of insulation barrier 20. Each of the wedges is disposed chamfered end first within the channel shaped middle section of a respective core brace 17. Inner face 41 of the wedge abuts inner face 27 of base 26 within a channel shaped section of the core brace and outer face 42 of the wedge abuts core bands 19.

Wedges 18 tighten core bands 19 and apply pressure through outer faces 28, 37 and 38 of core braces 17 against the outermost laminations of winding leg 8 giving greater rigidity to and reducing the cross sectional area of that core winding leg.

Another function is accomplished by the structure disclosed by this invention. Outer faces 42 of the wedges extend outside the core circle of the winding leg and thus stretch core bands 19 beyond that core circle. Outer faces 42 exert pressure on barrier 20 through the core bands causing the barrier to wedge against electrical coils 21, thus locking those coils in place over the core winding leg.

The structure which has been described provides a core winding leg with its laminations held tightly and compactly together. There is uniform pressure applied, throughout the length of the winding leg which reduces the waviness of the laminations and also the cross sectional area of the winding leg. The structure described also serves a double function in locking the winding over the core leg.

Although but one embodiment of the present invention has been illustrated and described it will be apparent to those skilled in the art that changes and modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

It is claimed and desired to secure by Letters Patent:

1. A stationary induction apparatus comprising in combination a magnetic core having at least one winding leg comprising a plurality of stacked laminations, an electrical winding surrounding said winding leg in coaxial

relation thereto to define an axially extending opening between a side of said leg and a circumferential portion of said winding adjacent said side, and means for applying a uniform pressure to said stacked laminations and said winding comprising a core brace and wedge member disposed in said opening, said brace extending substantially the length of said opening and having a W-shaped cross section, said cross section being modified at its radially inward portion to provide three spaced coplanar surfaces adapted to abut said side in force distributing relationship thereto and modified at its center section to provide a U-shaped channel opening radially outward from the axis of said cylinder, means for maintaining said brace in a fixed position longitudinally with respect to said leg comprising a core band of an electrical insulating material wrapped transversely around said leg and brace, said wedge member disposed between the bottom of said channel and said band to simultaneously clamp said winding with respect to said leg and apply a uniform pressure normal to the plane of said laminations.

2. A stationary induction apparatus comprising in combination a magnetic core having at least one winding leg comprising a plurality of stacked laminations, an insulating cylinder surrounding said winding leg in coaxial relation thereto to define a pair of diametrically opposed axially extending openings between said leg and radially adjacent portions of said cylinder, a winding disposed coaxially on said cylinder, and means for applying a uniform pressure normal to the plane of said stacked laminations and radially with respect to said winding to simultaneously clamp said winding to said cylinder and brace said laminated winding leg, said means comprising a core brace and wedge member disposed in each of said openings, and a plurality of longitudinally spaced core bands of an electrical insulating material tightly surrounding said brace and leg, each said brace extending substantially the length of its respective said opening and having a W-shaped cross section modified to provide three spaced coplanar surfaces adjacent the side of said winding leg to abut said side in force distributing relationship thereto, said brace including a longitudinally extending U-shaped channel opening radially outward from the axis of said cylinder for receiving and positioning said wedge member to cause said force distributing relationship.

3. The combination recited in claim 2 in which insulating pads are disposed intermediate said core braces and said leg.

4. A stationary induction apparatus comprising in combination a magnetic core having a winding leg comprising a plurality of stacked laminations, a brace for said stacked laminations extending for less than the full length of said winding leg, the longitudinal axis of said brace being superimposed on the longitudinal axis of said winding leg, said brace having a W-shaped cross section modified to provide three longitudinally extending spaced coplanar surfaces adjacent one side of said leg so as to abut said side in force distributing relationship thereto and including a center section defining a longitudinally extending U-shaped channel opening radially outward from the axis of said winding leg, and at least one banding strap of an electrical insulating material tightly surrounding said brace in said winding leg to apply a substantially uniform pressure normal to the plane of said stacked laminations.

5. A stationary induction apparatus comprising in combination a magnetic core having a winding leg comprising a plurality of stacked laminations, a brace for said stacked laminations extending for less than the full length of said winding leg, the longitudinal axis of said brace being superimposed on the longitudinal axis of said winding leg, said brace having a W-shaped cross section modified to provide three longitudinally extending spaced coplanar surfaces adjacent one side of said leg so as to abut said side in force distributing relationship thereto

and including a center section defining a longitudinally extending U-shaped channel opening radially outward from the axis of said winding leg, at least one banding strap of an electrical insulating material surrounding said brace and said winding leg, and means for applying a substantially uniform pressure normal to the plane of said stacked laminations comprising a wedge member disposed in said channel and acting between said brace and said strap.

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