United States Patent [19]

Okano

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[54] **COIL BOBBIN**

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July 29, 1971 Japan 46/67391

[52] **U.S. Cl.** **336/198,** 242/118.41, 336/208

[51] **Int. Cl.** **H01r 27/30**

[58] **Field of Search** 336/198, 208; 242/118.41

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[57] **ABSTRACT**

This invention relates to a coil bobbin. Said coil bobbin comprises a pair of coil bobbin members identical in shape and each comprising a box-shaped body formed with flanges at opposite ends of the body to define a coil chamber therebetween on the outer periphery of the body, and an insulating frame adapted to mount said pair of coil bobbin members on opposite sides thereof.

6 Claims, 5 Drawing Figures

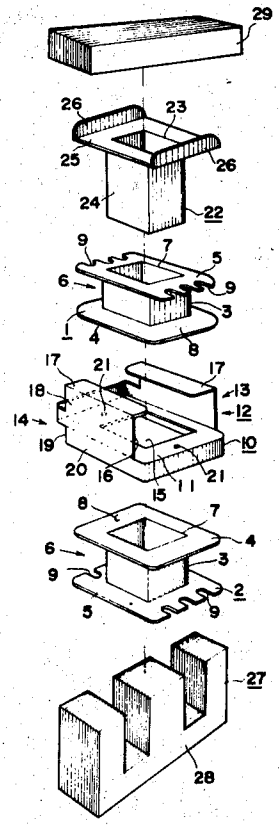


FIG. 1

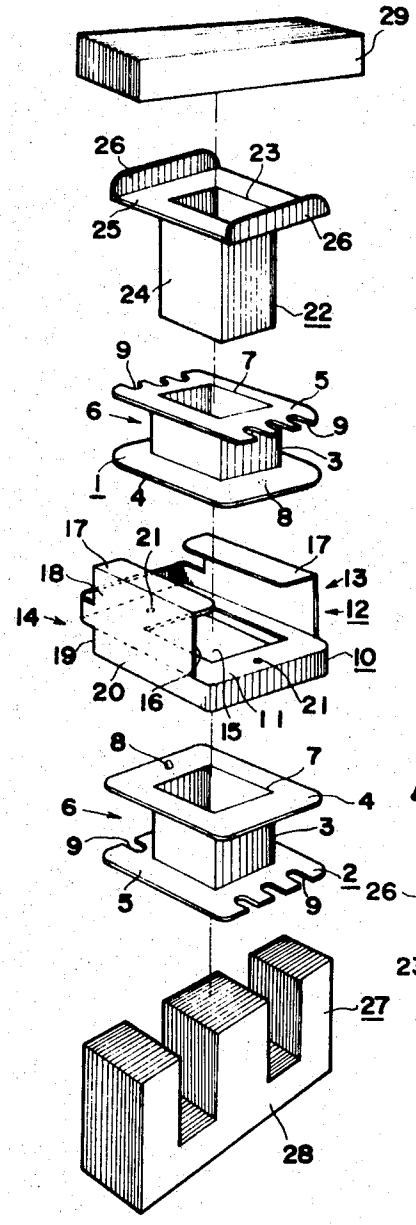


FIG. 2

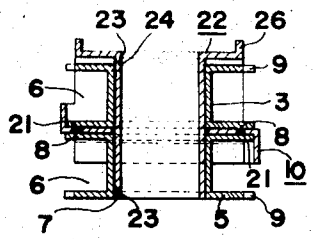


FIG. 3

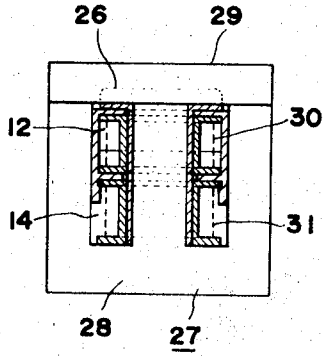


FIG. 4

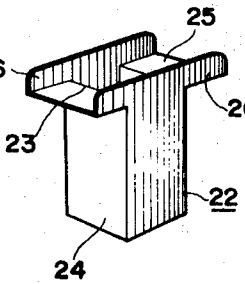
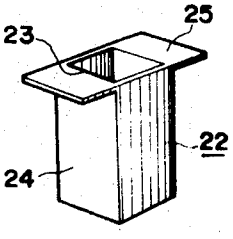


FIG. 5



COIL BOBBIN

This invention relates to coil bobbins, and more particularly it is concerned with a coil bobbin for a transformer which provides the transformer with sufficiently great creeping distances to withstand a high voltage and which has high mechanical strength.

Generally, coil bobbins for transformers of the prior art have insulating frames for the iron core disposed between the primary coil chamber and the secondary coil chamber and between the primary coil chamber and the iron core respectively so as to provide the transformers with sufficiently great creeping distances to withstand a high voltage.

In conventional transformers, the insulating frames for the iron core should be formed separately from coil bobbins, since the coil bobbins are in fixed form and the shape of the iron core is determined magnetically. Stated differently, the shape and configuration of the insulating frames arranged between the coil chambers and between the coil chamber and the iron core respectively may vary depending on the form of the coil bobbin and the shape of the iron core. Thus, the provision of transformers with sufficiently great creeping distances to withstand a high voltage inevitably renders the shape and configuration of coil bobbins complex. This makes it necessary to fabricate a coil bobbin in several pieces and assemble them to produce a coil bobbin unit instead of producing it in one piece by molding. As a result, conventional coil bobbins are low in mechanical strength.

The use of conventional coil bobbins produced in this way necessarily makes it impossible to provide transformers which are low in cost, reliable in performance and high in mechanical strength, because assembling of the parts requires a lot of labor.

This invention obviates the aforementioned disadvantages of the prior art. Accordingly an object of this invention is to provide a coil bobbin, low in cost and reliable in performance, which is constructed such that sufficiently great creeping distances are provided between the coil chambers and between the coil chambers and the iron core respectively so that the transformer can withstand a high voltage when the coil bobbin according to this invention is used, and which permits to save labor in assembling the parts to produce a transformer and increase the productivity thereof.

Another object of the invention is to provide a coil bobbin composed of a plurality of coil bobbin members having an insulating frame adapted to be inserted between the coil bobbin members so as to increase the creeping distance between the coil chambers.

Another object of the invention is to provide a coil bobbin of high mechanical strength in which the insulating frame is formed on opposite surfaces of the base thereof with coil bobbin chambers for receiving therein the respective coil bobbin members, so that the coil chambers are spaced apart from each other a sufficiently great creeping distance to enable the transformer using the coil bobbin according to this invention to withstand a high voltage.

Still another object of the invention is to provide a coil bobbin in which the insulating frame is formed on one surface of the base thereof with side walls disposed at three sides of the base, portions of the side walls disposed at opposite sides of the base each being provided with an auxiliary wall member projecting horizontally

inwardly from the top of each side wall portion so as to define one coil bobbin chamber by the side walls, so that the creeping distance between the coil in one coil chamber and the iron core can be increased and assembling of the parts can be facilitated.

Still another object of the invention is to provide a coil bobbin in which an insulating frame for the iron core is disposed on the auxiliary wall members provided on the side walls defining one coil bobbin chamber and the iron core is inserted into the coil bobbin through the insulating frame for the iron core, so that the creeping distance between the coil in one coil chamber and the iron core can be increased and the transformer incorporating the coil bobbin according to this invention can withstand a high voltage.

A further object of the invention is to provide a coil bobbin of high mechanical strength in which the plurality of coil bobbin members are each formed with a projection disposed substantially in the middle of one portion of the flange formed at one end of the body of the coil bobbin member, and the base of the insulating frame constituting the base for the two coil bobbin chambers is formed with openings in positions corresponding to the projections formed in the two coil bobbin members, so that the coil bobbin members can be accurately positioned in the respective coil bobbin chambers.

A further object of the invention is to provide a coil bobbin in which the provision of the flanges in the coil bobbin members imparts high mechanical strength to the coil bobbin and increases the creeping distance between the coils and the iron core sufficiently to enable the transformer incorporating the coil bobbin according to this invention to withstand a high voltage.

Additional and other objects of the invention as well as features and advantages thereof will become evident from the description set forth hereinafter when considered in conjunction with the accompanying drawings, in which:

FIG. 1 is an exploded perspective view of a transformer comprising an iron core composed of a laminated iron core member of the E type and a laminated iron core member of the I type and incorporating the coil bobbin according to this invention;

FIG. 2 is a vertical sectional view of the coil bobbin according to this invention;

FIG. 3 is a vertical sectional view of the transformer of FIG. 1;

FIG. 4 is a perspective view of another form of the insulating frame for the iron core; and

FIG. 5 is a perspective view of still another form of the insulating frame for the iron core.

The embodiment of the invention shown in FIG. 1 to FIG. 3 will now be described. The coil bobbin shown is composed of a pair of coil bobbin members 1, 2 identical in shape which are made of a synthetic resinous material or other insulating material. Coil bobbin members 1, 2 each has a box-shaped body 3 formed with flanges 4, 5 on opposite ends thereof respectively to define a coil chamber 6 therebetween on the outer periphery of body 3 which has a central axial space 7 therein for the iron core to extend therethrough. One flange 4 of coil bobbin members 1, 2 is formed with a projection 8 disposed substantially in the middle of one portion of the flange while the other flange 5 is formed with lead wire engaging portions 9 in a pair of opposite portions thereof.

10 designates an insulating frame formed integrally from a synthetic resinous material or other insulating material and comprising a base 11 on which is formed a coil bobbin chamber 12 divided into a primary coil bobbin chamber 13 and a secondary coil bobbin chamber 14 disposed on the upper surface and the lower surface of base 11 respectively.

The primary coil bobbin chamber 13, which is required to withstand a higher voltage than the secondary coil bobbin chamber 14, is defined by side walls 18 formed integrally with the base 11 of insulating frame 10 and disposed at three sides of the upper surface of the base, the portions of the side walls disposed at opposite sides of the base each being provided with an auxiliary wall member 17 extending horizontally inwardly from the top of each side wall 18. The primary coil bobbin chamber 13 is shaped identically in a plan view with the flanges 4 of coil bobbin members 1, 2. The base 11 of insulating frame 10 is formed with an axial space 15 in the central portion for the iron core to extend therethrough. An opening 16 is formed at one of the four sides of base 11 which has no side wall so as to permit coil bobbin member 1 to be inserted therethrough into chamber 13.

The lower voltage coil bobbin chamber 14 is defined by side walls 20 formed integrally with the base 11 of insulating frame 10 and disposed at three sides on the lower surface of the base. An opening 19 is formed at one of the four sides of base 11 which has no side wall to permit coil bobbin member 2 to be inserted therethrough into chamber 14. The opening 16 for chamber 13 formed on the upper surface of base 11 is disposed at a side opposite to the side at which the opening 19 for chamber 14 is formed on the lower surface thereof. The secondary coil bobbin chamber 14 is shaped identically in a plan view with the flanges 4 of coil bobbin members 1, 2. The base plate 11 of insulating frame 10 is formed with an opening 21 in each of opposite marginal portions thereof for receiving therein one of the projections 8 formed on the opposite portions of the flanges 4 of coil bobbin members 1, 2.

22 is an insulating frame for the iron core formed integrally and made of the same material as insulating frame 10. Insulating frame 22 for the iron core comprises a box-shaped body 24 formed therein with an axial space 23 for inserting the iron core therethrough and including a flange 25 provided at one end of body 24. Flange 25, which is slightly smaller than but substantially of identical shape as the flanges 4 of coil bobbin members 1, 2, is formed integrally with side walls 26 disposed at opposite portions of the flange 25.

27 is an iron core composed of silicon steel plates arranged in laminated form and comprising a laminated iron core member 28 of the E type and a laminated iron core member 29 of the I type.

The coil bobbin according to this invention is constructed as aforementioned. To produce a coil bobbin unit, a primary coil 30 is wound on the outer periphery of the body 3 in the coil chamber 6 of coil bobbin member 1, which is inserted in the primary coil bobbin chamber 13 in insulating frame 10. A secondary coil 31 is wound on the outer periphery of the body 3 in the coil chamber 6 of coil bobbin member 2, which is inserted in the secondary coil bobbin chamber 14 in insulating frame 10. The projections 8 formed in the flanges 4 of coil bobbin members 1, 2 are received in the openings 21 formed in the base 11 of insulating frame 10 so that the two coil bobbin members 1, 2 may be firmly held in position in the respective coil bobbin chambers.

The body 24 of insulating frame 22 for the iron core is inserted from above in the central axial space 7 in the coil bobbin member 1 disposed in primary coil bobbin chamber 13, so that the underside of the flange 25 of frame 22 is maintained in contact with the upper surfaces of auxiliary wall members 17 of insulating frame 10.

The center leg of laminated iron core 28 of the E type is inserted from below in the rectangular space 7 in the coil bobbin member 2 disposed in secondary coil bobbin chamber 14 and laminated iron core 29 of the I type is placed on the flange 25 of insulating frame 22 for the iron core so that end surfaces of the three legs of iron core 28 may be brought into contact with the underside of iron core 20. Thus, a transformer is produced.

In the transformer produced in this way, the creeping distance between a primary coil 30 and a secondary coil 31 is sufficiently large, due to the presence of insulating frame 10 and the flanges 4 of coil bobbin members 1, 2, to enable the transformer to withstand a high voltage, and the creeping distance between primary coil 30 and iron cores 27 is sufficiently large, due to the presence of the auxiliary wall members 17 of insulating frame 10 and the insulating frame 22 for the iron core, to enable the transformer to withstand a high voltage.

FIG. 4 and FIG. 5 show modified forms of insulating frame 22 for the iron core. The insulating frame shown in FIG. 4 is formed with two ledges 25 each extending horizontally outwardly from one of two opposite sides of the axial space 23 in box-shaped body 24 and having the same width as body 24, and two side walls 26 integral with body 24 and each extending vertically from one of two opposite sides of axial space 23 at which there are no ledges 25 for guiding iron core 27 in its movement through rectangular space 23.

The insulating frame 22 shown in FIG. 5 is similar to the insulating frame 22 shown in FIG. 4 except that the former lacks the side walls 26 of the latter. The use of the two forms of insulating frame 22 shown in FIG. 4 and FIG. 5 also increases the creeping distance between the primary coil and the iron core, although the absence of the side walls 26 reduces the creeping distance that much.

From the foregoing description, it will be appreciated that the coil bobbin according to this invention is constructed such that it is possible to increase the creeping distance between the coils and the creeping distance between the coil and the iron core to enable the transformer to withstand a high voltage. Besides, the coil bobbin has high mechanical strength and can be produced readily because it can be produced by molding on a mass production basis.

What is claimed is:

1. A coil bobbin comprising a pair of coil bobbin members identical in shape and an insulating frame receiving said coil bobbin members, each of said coil bobbin member having a body formed with a central axial space for receiving therein an iron core and formed with flanges at opposite ends of the body to define a coil chamber therebetween on the outer periphery of the body, said insulating frame having a base formed with a central axial space for receiving therein said iron core and formed on opposite surfaces thereof with side walls extending vertically to define two coil

bobbin chambers each disposed on one of the two surfaces of the base, each of said two coil bobbin chambers being formed at one side thereof with an opening for inserting one of the coil bobbin members therethrough into the respective coil bobbin chamber.

2. A coil bobbin as claimed in claim 1 wherein one of said two coil bobbin chambers is for secondary coil bobbin and the other is for primary coil bobbin which is required to withstand a higher voltage than the secondary coil bobbin, and one of said openings for said two coil bobbin chambers for inserting the coil bobbin members therethrough is disposed at a side opposite the side at which the other opening is disposed.

3. A coil bobbin as claimed in claim 2 wherein said side walls extending vertically and defining at least one coil bobbin chamber is formed with a pair of auxiliary wall members extending horizontally inwardly from the top of said side walls and said auxiliary wall members cover a portion of one surface of the flange of said coil bobbin member .

4. A coil bobbin as claimed in claim 3 further comprising an insulating frame for the iron core having a box-shaped body formed with a central axial space for receiving therein the iron core and received in said central axial spaces of the pair of coil bobbin members and said insulating frame for the coil bobbin members, said body being formed at an upper end thereof with a flange so as to contact with the upper surface of the flange of said one of the coil bobbin members.

5. A coil bobbin as claimed in claim 4 wherein said flange of the insulating frame for the iron core is formed with side walls disposed at opposite portions thereof.

6. A coil bobbin as claimed in claim 1 wherein one portion of the flange provided at one end of each of said pair of coil bobbin members is formed therein with a projection, and two openings are formed in the base of the insulating frame having the coil bobbin chambers formed thereon in positions corresponding to the projections formed on the flanges of the coil bobbin members, the said projections formed in the coil bobbin members interfitting with the openings formed in the base plate of the insulating frame.

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