TRANSFORMER CORE AND COIL MOUNTING FRAME

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References Cited

UNITED STATES PATENTS
1,974,588 9/1934 Snell 336/210 X
2,360,511 10/1944 Nelson 336/210 X

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ABSTRACT

A transformer core and coil mounting in which two generally rectangular core loops disposed side-by-side and having a coil surrounding their two adjacent legs are held in a rectangular frame for mounting the unit in a transformer tank, with means extending laterally of the frame and projecting up from the bottom and down from the top of the frame between the adjacent legs of the loops and having a close fit in the coil for holding it against shifting laterally relative to the frame, and with said flanges extending up from the bottom of the frame, the core loops being supported on the upper edges of the flanges whereby the core loops are electrically grounded to the frame.

19 Claims, 5 Drawing Figures
TRANSFORMER CORE AND COIL MOUNTING FRAME

BACKGROUND OF THE INVENTION

This invention relates to a transformer core and coil unit and a frame of such a unit, and more particularly to a frame for and the assembly with the frame of two magnetic core loops and a pre-formed coil associated with the loops.

The invention is especially concerned with the framing of a core and coil assembly for a transformer to provide a means for mounting the assembly in a transformer tank, and more particularly the framing of a core and coil assembly of the type comprising two generally rectangular magnetic wound core loops positioned side-by-side and a pre-formed coil surrounding the two adjacent legs of the two loops. Such core and coil assemblies are typically confined in an open rectangular frame for mounting in a transformer tank, and this invention involves a frame for this purpose and the overall assembly of the frame and the core and coil assembly.

Frames broadly similar to those of the present invention are known and have been used in the past, but these have various disadvantages, such as being structurally rather complex, expensive to fabricate, and not providing a simple and direct manner for firmly and reliably supporting the pre-formed coil unit and relative to the cores so as to avoid undesirable movement along each of the three possible axes of movement. Also, because it is difficult to fabricate wound core loops with close tolerances in the height of each, frequently there will be a substantial difference in the heights of a pair of core loops that have to be mounted side-by-side in a frame, and this presents problems in properly and conveniently securing both core loops in the frame without having either overly stressed mechanically (which undesirably increases the noise level and losses) or inadequately retained (which undesirably allows movement relative to the frame). Examples of typical prior framed core and coil assemblies are illustrated in U.S. Pat. Nos. 2,408,211 and 3,374,453 (FIGS. 18-20).

SUMMARY OF THE INVENTION

Among the several objects of this invention may be noted the provision of an improved core and coil unit of the class above described and an improved frame for such a unit adapted to securely confine the core and coil assembly in the frame to prevent shifting and rotating of the core and coil assembly; the provision of such a frame in which core loops of somewhat different heights are properly supported without overstressing and without understressing in a manner insuring that the core loops are electrically grounded to the frame; and the provision of such a frame which is of simple and economically constructed and is adapted to facilitate assembly of the core and coil unit within the frame.

In general, a transformer core and coil unit of this invention comprises an open rectangular frame and a core and coil assembly confined in the frame. The core and coil assembly comprises at least two generally rectangular core loops disposed side-by-side with adjacent vertical legs of the core loops constituting a pair of inner legs and a coil surrounding each pair of inner legs. The frame comprises a U-shaped main body having a bottom member and end members extending up from the ends of the bottom member, and a top member extending between the end members adjacent the upper ends thereof and secured thereto. The bottom member has upwardly extending side flanges and the top member has downwardly extending side flanges. The core and coil assembly is positioned in the frame with the core loops extending beyond and bearing on the side flanges of the bottom member. A first means, extending laterally of the bottom member, projects up above the side flanges of the bottom member and has portions which project laterally outward beyond the side flanges of the bottom member. This first means is disposed between the lower inner corners of the adjacent loops and has first tongue means extending upwardly therefrom in the space between the inner legs of the loops. A second means extends laterally of the top member and projects down below the side flanges of the top member, and has portions which project laterally outward beyond the side flanges of the top member. The second means is disposed between the upper inner corners of the adjacent core loops and has second tongue means extending downwardly therefrom in the space between the inner legs of the loops. The first and second tongue means are of such width as to have a close fit in the coil for holding the coil against shifting laterally relative to the frame.

Other objects and features will be in part apparent and in part pointed out hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective of a core and coil assembly confined within a mounting frame of this invention;

FIG. 2 is a front elevation view of the frame with the core and coil assembly shown in phantom;

FIG. 3 is a side elevation of the frame;

FIG. 4 is a vertical section on line 4—4 of FIG. 2 with the core and coil assembly shown in phantom; and

FIG. 5 is a vertical section on line 5—5 of FIG. 3.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, FIG. 1 shows a transformer core and coil unit of this invention, generally indicated at 1, comprising a frame 3 and a core and coil assembly, generally indicated at 5, confined within the frame. The core and coil assembly comprises two generally rectangular wound magnetic core loops, each designated 7, disposed side-by-side with adjacent vertical legs of the two adjacent core loops constituting a pair of inner legs and a pre-formed coil 11 surrounding these inner legs. The frame 3 comprises a U-shaped main body, generally indicated at 13, of steel or the like, having a bottom member 15 and end members 17 extending up from the ends of the bottom member, and a top member 19 extending between the end members adjacent the upper ends thereof and secured thereto. The bottom member has upwardly extending side flanges 21 and the top member has downwardly extending side flanges 23.

The core and coil assembly 5 is positioned in the frame with the core loops 7 extending beyond and bearing on the bottom member side flanges 21. A first means, indicated at 25, extends laterally of the bottom member and projects up above the bottom member side flanges 21, and has portions indicated at 27 in FIGS. 3 and 4 which project laterally outward beyond these side flanges. This first means is disposed between the lower inner corners of adjacent core loops 7 and has a first tongue means generally indicated at 29 which extends upwardly therefrom in the space between the inner legs of the adjacent core loops. A second means, generally indicated at 31, extends laterally of the top member 19 and projects down below the top member side flanges 23. The second means has portions, indicated at 32 in FIGS. 3 and 4, which project laterally outward beyond the top member side flanges 23. The second means is disposed between the upper inner corners of the adjacent core loops and has a second tongue means generally indicated at 33 extending downwardly therefrom in the space between the inner legs of the adjacent core loops. The tongue means are of such width as to have a close fit in coil 11 for holding the coil against shifting laterally in the frame. The first and second means 25 and 31, respectively, each constitute means for reinforcing their respective tongue means, and although these reinforcing means are shown as being wedge-shaped, it will be understood that they could be of any suitable shape as they are intended to reinforce and support their respective tongue means. The uppermost ends of the end members 17 include means constituted by ears 35 for mounting the core and coil unit 1 within a conventional transformer tank (not shown).
More particularly, each core loop 7 is wound of thin strips of grain-oriented steel or the like and has a generally rectangular central window or opening 37 formed by upper and lower horizontal yokes or legs 39 and 41, respectively, and by inner and outer vertical legs 43 and 45, respectively. The core loops 7 are placed in the frame 3 so that the inner legs 43 of each loop are closely adjacent to one another and so that the openings 37 face latterly of the frame. The preformed coil 11 has concentric high and low voltage windings (not shown) with the windings separated from one another and from the core loops by suitable electrical insulation. The pre-formed coil has a rectangular central opening 53 at its center adapted to receive the two inner legs 43 of the adjacent core loops so that the coil surrounds the inner legs of the core loop. The core loops may be of any of the conventional types well known in the art which are adapted to facilitate assembly of the core and coil assembly.

The bottom and top frame members 15 and 19, respectively, are generally channel-shaped in cross-section with the bottom frame member having a horizontal web 57 and bottom side flanges 21 extending upwardly therefrom, and with the top frame member having a horizontal web 59 and top side flanges 23 extending downwardly therefrom. The core and coil assembly 5 is positioned within the frame 3 with one core loop 7 in one half of the frame (its left half as shown in FIG. 1) and the other core loop in the other half. Referring to FIG. 4, the core loops 7 (shown in phantom) are wider than the top and bottom frame members and the topper extends beyond the top and bottom side flanges 21 and 23. The core loops are supported on the relatively narrow upper edges of the bottom side flanges 21 so that the core loops are electrically grounded to the frame; thus separate grounding wires are not required to connect the core loops to the frame. The weight of the core and coil assembly bearing on the edges of the bottom flanges 23 will cause the latter to cut through any coating or scale that may form on the core loops thereby insuring that the core loops will remain grounded to the frame.

As shown in FIGS. 3 and 4, the top frame member 19 is adapted to be secured to the upper end portions of the end members 17 after the core and coil assembly 5 has been positioned within the frame with the lower edges of the top member side flanges 23 engaging the top of the core loops 7. The end frame members 15 have a plurality of horizontal slots 61 in their upper ends arranged in horizontal rows, one above the other to accommodate core loops of different heights. The top frame member has a plurality of tabs 62 at each end adapted to be inserted in the slots of a corresponding row so that the lower edges of the top side flanges engaging the tops of the core loops, the tabs may be bent over on the outside of the end members (as shown in FIG. 3) for securing the top member to the end members. It will be understood that other means for securing the top frame member to the upper ends of members 17 may be utilized in accordance with this invention, e.g., the top frame member after being placed in position spanning members 17 may be welded or machine or self-threading screws may be employed with a slot or series of spaced apertures in members 17.

In assembling the core and coil assembly 5, core loops are paired so that their magnetic and electrical characteristics complement each other. The tolerances of the outer dimensions of paired core loops may vary somewhat from core loop to core loop so that when one core loop is paired with another, one of the core loops may be shorter than the other (as shown in FIG. 2), or both may be the same height but taller than or shorter than the nominal core loop height. For the last-mentioned case, top frame member 19 is placed over the core loop with flanges 23 firmly engaging the tops of both core loops, and the top frame member is secured to side frame members 7 by inserting the tabs 62 into a row of slots 61 which correspond to the height of both core loops and bending the tabs as heretofore described. In the case of unequal height core loops, means, generally indicated at 65, is provided to hold the shorter core loop within the frame without overstressing the taller core loop. As shown in FIG. 1, a hole 64 is provided in the center of web 59 of the top frame member above the center of each core loop. If upon securing the top frame member to the side members it is determined that one of the core loops is shorter than the other, a thread-forming screw constituting holding means 63 is threaded into the hole 64 above the shorter core loop and threaded downwardly until its lower end contacts the top of the shorter core loop. Thus, both core loops are held within the frame without overstressing or understressing either loop. It will be understood that other means for holding the shorter core loop may be utilized in accordance with this invention.

The first and second means 25 and 31, respectively, are essentially identical except for their orientation within the frame, and each in conjunction with its respective tongue means 29 or 33 comprises a unitary structure generally indicated at 65 in FIG. 5. This unitary structure is formed of a sheet metal strip bent 180° on itself at 67 to have two halves having face-to-face tongue portions 69 which together constitute the tongue means. Each half is again bent at 45° as indicated at 71 to provide an inclined panel 73 with the two inclined panels of the two halves constituting the first or second means 25 or 31. The halves are further bent at 45° as indicated at 75 to provide two oppositely directed feet 77 (at 90° to the tongue) for securement to the web of the respective top or bottom frame member 19 or 15 at equal distances from the center thereof so that the tongue means 29 and 33 are substantially centrally located within the central plane of the frame. The width of the tongue portions 69 and the width of the portions of inclined panels 73 which project beyond the bottom and top member side flanges 21 and 23, respectively, are substantially the same as the lateral dimension of the core opening 53 so that portions of the inclined panels extend laterally outward beyond the bottom and top member side flanges and so that the tongue portions have a close fit within the coil frame.

With the core and coil assembly 5 confined within the frame 3, the tongue portions 69 of the first and second tongue means 29 and 33, respectively, extend in a vertical plane within the space between the adjacent inner legs 43 of the core loops to fit closely within central coil opening 53 to hold core and coil assembly 5 from shifting laterally and longitudinally of the frame and to prevent rotation of the core and coil assembly about a central vertical axis or about a central horizontal axis extending therethrough. Additionally, since the coil surrounds the inner legs of the core loops, the core loops are held from shifting laterally of the frame by the coil. As shown in FIG. 2, the first and second tongue means terminate short of one another so that there is a gap between the upper end of the first tongue means and the lower end of the second tongue means for lessening of magnetic losses between the core loops.

It is contemplated that the principles of the invention are applicable to a frame holding more than two core loops (e.g., three core loops with two coils).

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A transformer core and coil unit comprising an open rectangular frame and a core and coil assembly confined in the frame comprising at least two generally rectangular core loops disposed side-by-side with adjacent vertical legs of the core loops constituting a pair of inner legs and a coil surrounding said pair of inner legs, said frame comprising a U-shaped main body having a bottom member and end members extending up from the ends of said bottom member, and a top member extending between the end members adjacent the upper ends thereof and secured thereto, said bottom member having upwardly extending side flanges and said top member
having downwardly extending side flanges, said assembly being positioned in the frame with said loops extending beyond and bearing on the side flanges of the bottom member, first means extending laterally of the bottom member projecting up above the side flanges of the bottom member and having portions projecting laterally outward beyond the side flanges of the bottom member, said first means being disposed between the lower inner corners of the adjacent loops and having first tongue means extending upwardly therefrom in the space between the inner legs of the loops, second means extending laterally of the top member and projecting down below the side flanges of the top member and having portions projecting laterally outward beyond the side flanges of the top member, said second means being disposed between the upper inner corners of the adjacent loops and having second tongue means extending downwardly therefrom in the space between the inner legs of the loops, said tongue means being of such width as to have a close fit in the coil for holding the coil against shifting laterally relative to the frame.

2. A transformer core and coil unit as set forth in claim 1 wherein the core loops are supported on the upper edges of the side flanges of said bottom member, said core loops thereby being electrically grounded relative to said frame.

3. A transformer core and coil unit as set forth in claim 1 wherein said coil has a central opening with said pair of core loop inner legs extending vertically therethrough and with said tongue means having a close fit within said central opening for holding said core and coil assembly against shifting laterally relative to the frame and against rotation about a vertical axis.

4. A transformer core and coil unit as set forth in claim 1 wherein said first and second tongue means terminate short of one another so that there is a gap between the lower end of the second tongue means and the upper end of the first tongue means.

5. A transformer core and coil unit as set forth in claim 1 wherein said top member has means for securing it to the upper ends of said end members after said core and coil assembly has been placed within said main body.

6. A transformer core and coil unit as set forth in claim 1 wherein said end members have a plurality of slots in the upper portions thereof, and wherein said means for securing the top member to said end members comprises a plurality of tabs at each end of the top member adapted to be inserted in said slots and to then be bent over on the outside of said end members.

7. A transformer core and coil unit as set forth in claim 1 wherein one of said core loops is shorter than one of the others and means is included to hold the shorter core loop within the frame substantially without movement relative thereto and to prevent overstressing of the taller core loops.

8. A transformer core and coil unit as set forth in claim 1 wherein said means for holding the shorter core loop comprises a screw member threaded through said top frame member above said short core loop, said screw member being adapted to be threaded downwardly to engage the top of said short core loop to hold the latter within the frame.

9. A transformer core and coil unit as set forth in claim 1 wherein the end members have means at their upper ends for mounting said unit within a transformer tank.

10. A transformer core and coil unit as set forth in claim 4 wherein said core and coil assembly has two of said core loops disposed side-by-side with the adjacent vertical legs of the two loops constituting a pair of said inner legs and a coil surrounding said pair of inner legs, said assembly being positioned in the frame with one loop in one half of the frame and the other loop in the other half of the frame.

11. A transformer core and coil unit as set forth in claim 10 wherein said first means extends laterally of the bottom member at the center of its length and said second means extends laterally of the top member at the center of its length.

12. A frame for a transformer core and coil assembly comprising a U-shaped main body having a bottom member and end members extending upwardly from the opposite ends of said bottom member, and a top member extending between the end members adjacent the upper ends thereof, the bottom member having upwardly extending side flanges and the top member having downwardly extending side flanges, said bottom member having first means extending laterally of the bottom member and having portions projecting laterally outward beyond the side flanges of the top member and second tongue means extending downwardly from the center portion of said second means.

13. A frame as set forth in claim 12 wherein said first means in conjunction with its respective tongue means comprises a unitary structure having two halves with two face-to-face portions constituting the first tongue means, two inclined panels constituting said first means and two oppositely directed feet for securing the unitary structure to the bottom member.

14. A frame as set forth in claim 13 wherein said second means in conjunction with its respective tongue means comprises a unitary structure having two halves with two face-to-face portions constituting the second tongue means, two inclined panels constituting said second means and two oppositely directed feet for securing of the unitary structure to the top member.

15. A frame as set forth in claim 14 wherein said first and second means are positioned in the frame with the second means directly above said first means, said first and second tongue means terminating short of one another so that there is a gap therebetween.

16. A frame as set forth in claim 15 wherein said top member has means for securing it to said end members comprising a plurality of tabs at each end thereof, and wherein said end members have a plurality of slots in the upper portions thereof adapted to receive said tabs, said tabs being adapted to be bent over on the outside of the respective end members for securing the top member to the end members.

17. A frame as set forth in claim 15 wherein said end members have means at their upper ends for mounting the frame within a transformer tank.

18. A frame as set forth in claim 15 having said first means extending laterally of the bottom member at the center of its length and said second means extending laterally of the upper member at the center of its length.

19. A frame as set forth in claim 15 wherein each of said first and second means including its respective tongue means is bent from a single strip of metal.