Nov. 17, 1931. R. L. BROWN 1,832,616

TRANSFORMER

Filed July 30, 1930

Fig. 1.

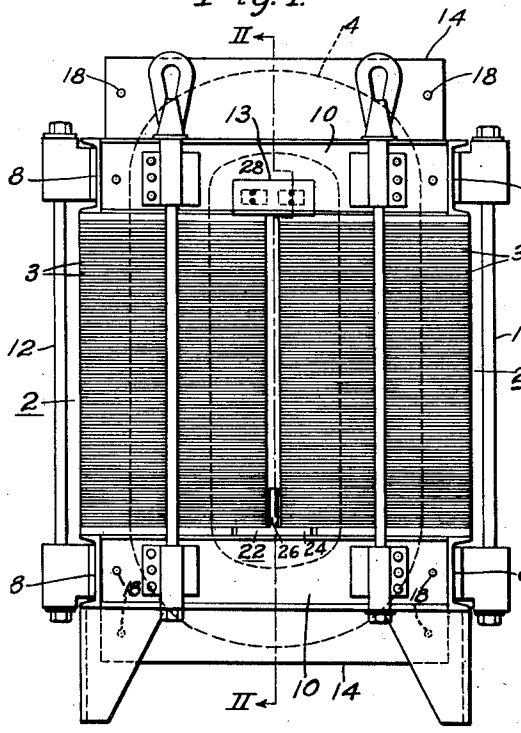


Fig. 2.

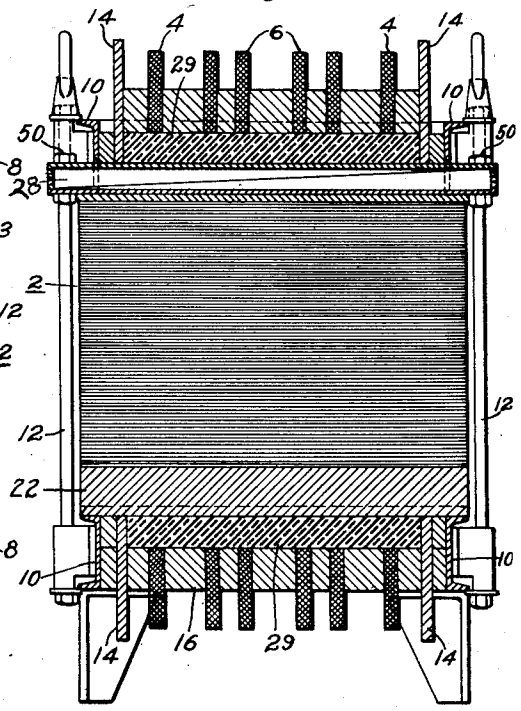


Fig. 3.

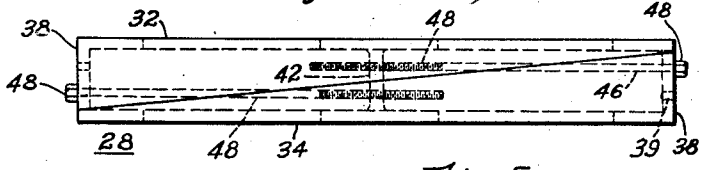


Fig. 4.

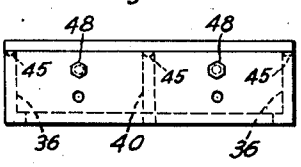


Fig. 5.

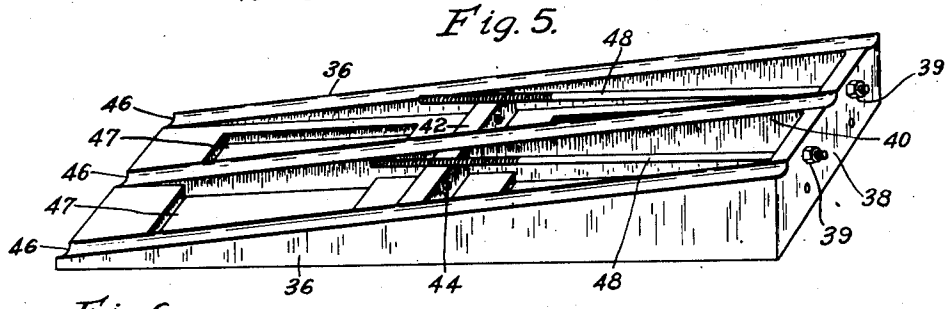
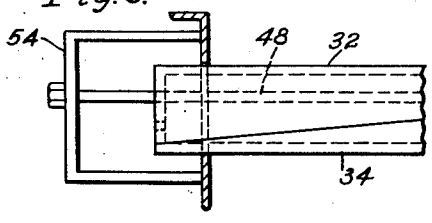


Fig. 6.



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Patented Nov. 17, 1931 1,832,616

UNITED STATES PATENT OFFICE

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TRANSFORMER

Application filed July 30, 1930. Serial No. 471,685.

My invention relates to transformers and it has particular relation to the provision of means for preventing noise and for supporting and bracing transformer coils.

In transformers of the shell type, the coils or windings are oblong in shape and extend beyond the iron core at each end, thus leaving a space between the end portions of the coils and the iron.

When the windings of a transformer are short-circuited or heavy overloads occur, severe mechanical stresses are set up within the transformer which tend to separate the coils in a direction normal to their faces and in a direction parallel to their faces. To prevent the movement of the coils in a direction normal to the faces, heavy plates are placed against the flat faces of the end coils which are bolted together, thereby tightly clamping all the coils together.

It is also necessary to brace the coils against the stresses acting in a plane parallel to their faces and therefore tending to separate the primary and secondary coils in that direction.

To brace the coils against movement in a direction parallel to their faces and to clamp the transformer laminations tightly together, it has heretofore been customary to insert T-beam tongue wedges, through the openings of the coils at the top and bottom, between the iron and the end portions of the coils, and, in order to force these beams apart and to brace the coils, spreader bolts were applied between the beams.

While the tongue wedges have performed their function to a satisfactory degree, it is the main object of this invention to provide a wedge that will more effectively brace the transformer coils against short-circuit stresses and to more tightly clamp together the transformer laminations, thereby reducing the noise when the transformer is energized. When a short circuit occurs within the transformer, the stresses set up in the wedges are beam stresses which produce a shearing action that is very undesirable.

One object of my invention is to provide means for effectively bracing the coils of a transformer against movement caused by short-circuit stresses.

Another object of my invention is to provide means for clamping transformer laminations together and for so bracing the coils of a transformer that noise will be prevented when the transformer is energized.

Another object of my invention is to provide means for bracing the transformer coils in which the stresses set up in the bracing means, during short-circuit conditions, are compression stresses.

My invention will be better understood by referring to the following description, when read in conjunction with the accompanying drawings in which,

Figure 1 is a view, in front elevation, of a transformer provided with the means for clamping the laminations together and bracing the coils utilized in the practice of my invention.

Fig. 2 is a sectional view, taken on the line II—II of Fig. 1.

Fig. 3 is a side elevational view of a cooperating pair of triangular wedges employed in the practice of my invention.

Fig. 4 is an end elevational view of wedges shown in Fig. 3.

Fig. 5 is a perspective view of a wedge employed in the practice of my invention.

Fig. 6 is a detail view illustrating the manner in which the triangular wedges may be removed from the transformer.

Referring to the drawings, a shell-type transformer is illustrated comprising core members 2, consisting of a plurality of laminations 3 and cooperating primary and secondary windings 4 and 6, inductively related thereto. The laminations 3 are supported and bound together by upper and lower longitudinally and laterally extending channel members, or end frames, 8 and 10, respectively, connected together by a plurality of vertically extending tie bolts 12. The channel members 10 have apertures 13 therein for a purpose to be hereafter described.

The coils are prevented from moving in a direction normal to their faces by pressure plates 14 and spacing blocks 16 that are con-

nected together by longitudinally extending bolts 18.

To aid in filling the space between the lower edges of the laminations and the end portions of the coils, and to assist in supporting the iron of the core members, a wedge 22 is inserted therein. The wedge 22 is preferably of T-shape in cross section, having a horizontal portion 24 and a vertical web portion 26, but it may be constructed of a horizontal plate and a separate and abutting vertical web member. The wedge 22 is disposed with the horizontal portion 24 in engagement with the bottoms of the laminations and with the vertical web member 26 extending between the core members.

The coils are supported and vertical movement thereof is prevented and the transformer laminations are tightly clamped together by an upper longitudinally extending tongue wedge 28. Longitudinally extending spacing members 29 are disposed between the lower wedge 22 and the lower end portions of the coils and also between the upper wedge 28 and the upper end portions of the coils to further assist in supporting and insulating the coils.

The wedge 28 comprises two cooperating members 32 and 34 of triangular shape, each having outside walls 36, an end wall 38, having upper and lower openings 39 therein, and a center wall 40 extending along the longitudinal axis of each member and parallel to the side walls 36. Web members 42 extend between the side walls 36 and the center wall 40 and have threaded openings 44 therein, one opening being disposed between each side wall and the center wall. The longitudinally extending walls of the wedge members 32 and 34 are respectively provided with cooperating tongues 45 and grooves 46 in order that the members may easily slide on each other and form a tight joint. Apertures or openings 47 are provided in the bases of the wedge members 32 and 34 to permit circulation of the transformer cooling oil.

To place the wedge 28 in position, the ends of the wedge member 34 are supported by the upper channel member 10, and extend through the openings 13, and the wedge member 36 is disposed in cooperating relation thereto. Bolts 48 extend through the upper openings in the end walls 38 of each of the members 32 and 34 and through the web members 42 of the other wedge member. When the bolts are tightened, the two wedge members 32 and 34 are drawn together and are tightly clamped, after which the bolts may be removed. During shipment of the transformer, the wedge members may become loose, due to vibration or other causes, and, to prevent this, they may be bolted together by bolts 50.

In order not to provide a path of low magnetic reluctance for the stray magnetic flux, thereby producing excessive heat that would injure or destroy the coil insulation, the upper and lower tongue wedges are constructed of non-magnetic material.

Should a short circuit or a fault occur within the transformer, the stresses set up that are normal to the face of the coils are taken up by the end plates 14, and the stresses that are parallel to the faces of the coil are taken up by the wedge member 28. The stresses on the wedge member 28 are compression stresses and there is no shearing action between the coils.

When it is necessary to remove the wedge members 32 and 34, a channel member 54 is placed against the upper channel member 10, and the bolts 48 extend through the lower openings in the end wall 38 and the web member 42 of the member 32. When the bolt is tightened, the member 32 is pulled away from the member 34, thereby loosening the joint and permitting the wedge members 32 and 34 to be easily removed.

Some of the advantages to be derived from this construction of the upper wedge are, the members 32 and 34 are light, well ventilated and are clamped tightly together by the wedging action of the members, thereby tightly clamping the transformer iron and coils and thus reducing the noise when the transformer is energized; the cost of the transformer may be reduced, as it is only necessary to machine the surfaces of the wedge members that are in the contact, and the size of the openings 47 may be reduced to that required for ventilation only.

Since many modifications may be made in the features of my invention without departing from the spirit thereof, I do not wish to be limited otherwise than by the scope of the appended claims.

I claim as my invention:

1. In a transformer, a core member comprising a stack of laminations of magnetic material, and a plurality of substantially flat windings inductively related thereto, means for preventing movement of said windings in a direction normal to their faces, and means for preventing movement of the windings in a direction parallel to their faces and for compressing the laminations comprising two cooperating members disposed between the laminations and the end of the windings, said members having engaging sloping faces for wedging them apart.

2. A transformer comprising a plurality of core members, each comprising a stack of laminations of magnetic material, and substantially flat windings inductively related thereto, said windings extending beyond said laminations and normal thereto, means for bracing said windings to prevent movement thereof in a direction parallel to their faces and for preventing movement of the lami-

nations comprising two cooperating triangular shaped members disposed between one end of the laminations and the windings and adapted to move over each other, and means for moving the triangular members over each other to wedge them tightly in said position.

3. A transformer comprising a plurality of core members, each consisting of a plurality of laminations of magnetic material, and substantially flat cooperating primary and secondary windings linking said core members, means for preventing movement of the laminations and preventing movement of said windings in a direction parallel to their faces comprising two triangular shaped members having their hypotenuse in engagement and disposed between the laminations and the windings, and means for effecting relative movement of said triangular members to tightly wedge them in said position.

4. A shell-type transformer comprising a plurality of core members, each comprising a stack of laminations of magnetic material, cooperating primary and secondary oblong windings linking said core members, means for tightly compressing each stack of laminations and for preventing movement of said windings in a direction normal to the laminations comprising two wedge-shape members engaging each other and disposed between the laminations and the end portions of the windings, and means for tightening the wedge-shape members in said position.

5. A shell-type transformer comprising a plurality of core members, each comprising a stack of laminations of magnetic material, and cooperating primary and secondary oblong windings linking said core members, means for clamping the laminations tightly together and for preventing movement of said windings comprising a pair of apertured wedge-shape members in engagement with each other and disposed between the core members and the end portions of the windings, and means for tightening the wedge members in said position comprising bolts extending from one wedge member to the other wedge member and adapted to pull said wedge members together.

6. In electrical apparatus, a core structure comprising a plurality of laminations of magnetic material, a plurality of coils positioned about a portion of said core structure, means for clamping said laminations together comprising a pair of oppositely directed wedges positioned within the coils adjacent to said laminations.

7. In electrical apparatus, a core structure comprising a plurality of laminations of magnetic material, a plurality of coils positioned about a portion of said core structure, means for clamping said laminations together comprising a pair of oppositely directed wedges positioned within the coils adjacent to said laminations, and means for effecting a relative movement of said wedges for varying the pressure between said coils and said core structure.

In testimony whereof, I have hereunto subscribed my name this 17th day of July, 1930.

ROY L. BROWN.