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CLAMPING ASSEMBLY HAVING SELF-HELD PRESSURE PLATES

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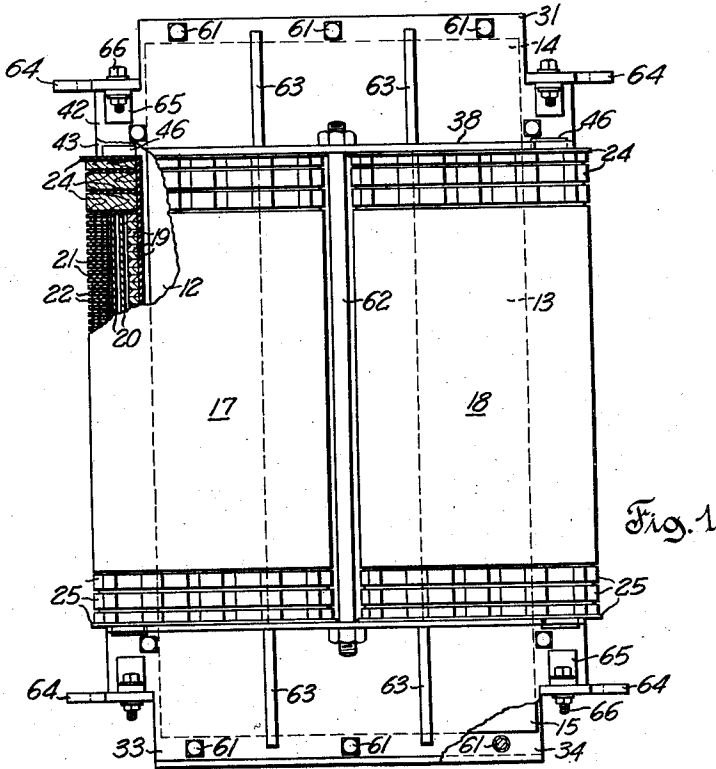


Fig. 1

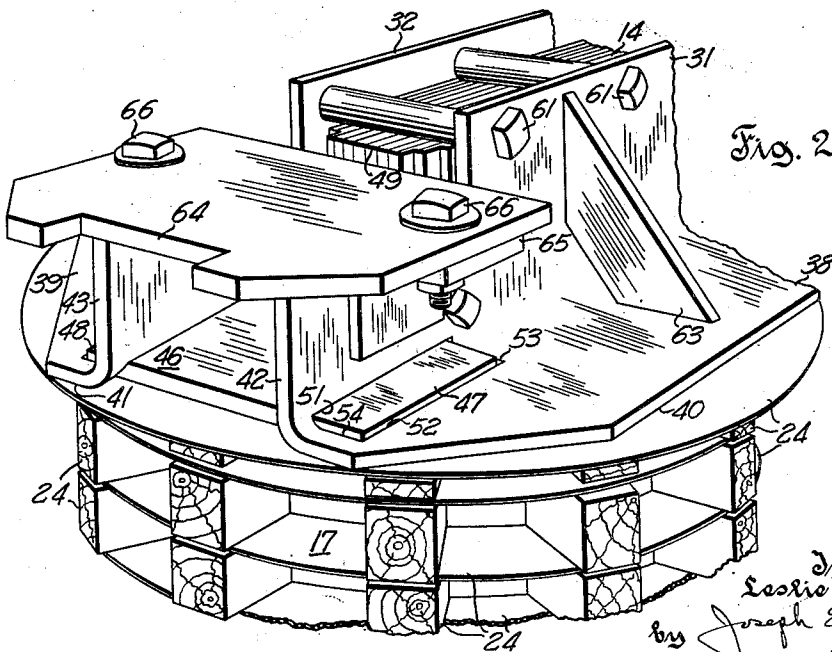


Fig. 2

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## CLAMPING ASSEMBLY HAVING SELF-HELD PRESSURE PLATES

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This invention relates to clamping structures, and in particular, to a clamping frame for electric induction apparatus.

Reactor and transformer type electric induction apparatus have clamping frames for holding the core and for holding the winding which is associated with the core. The clamping frame for the winding may be attached to the core clamping frame by being bolted or welded thereto.

When the winding of such apparatus encircles a winding leg of the core as in the so-called core type transformer construction, the angle or channel members of the core clamping frame which are abutted against the yokes of the core have end portions which extend beyond the outer edges of the core and which overhang the core leg. Such extended portions provide a frame against which the part of the winding which is outside the core may abut. Since those portions are merely extensions of angles or channels on opposite sides of the core, it is the practice to add members between the extended portions. These added members are arranged so that with flanges of the angles or channels on the sides of the core, they provide a substantially flat surface abutted against insulation at the end of the winding which serves as a pressure plate for axially clamping the winding.

It is necessary to provide a substantially continuous flat surface abutted against the ends of the winding in order to prevent deformation of the winding because of mechanical stresses which result from high currents.

It has been the practice to weld and bolt relatively small angles or channel supports to the back sides of those extending portions of the core frame and then to add flat pressure plates between those extending portions by bolting or welding the pressure plates to the supports. Since the pressure plates and the flanges of the angles or channels clamped to the side of the core form a substantially continuous flat surface abutted against insulation at the end of the winding, it is not practical to merely bolt or weld the pressure plates to the flanges of the extended portions. It therefore has been considered necessary to add the supporting members referred to above.

Having in mind the disadvantages of these core and coil frames from the point of view of their cost in labor and material, it is an object of this invention to reduce the amount of material utilized in the manufacture of a core and coil frame for electric induction apparatus.

Another object of the invention is to reduce the labor which is required to make and assem-

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ble the clamping frame for the core and coils of electrical induction apparatus.

Still another object of the invention is to provide a strong integral clamping frame with a minimum of material by utilizing the function of some of the parts of the frame to hold and confine other parts without fixedly attaching those other parts in making the frame.

These and other objects will become apparent to those skilled in the art to which this invention relates from the following description when read in connection with accompanying drawing, in which:

Fig. 1 is an elevation view partly in section of a transformer core and coil assembly embodying this invention;

Fig. 2 is an enlarged view in perspective of a portion of electrical apparatus shown in Fig. 1.

A core type transformer is shown upright in the drawing although the invention is applicable to apparatus standing in any position. The core of the transformer, of laminated magnetic material, is represented in this instance as having a rectangular shape with two winding legs 12, 13 and two yokes 14, 15 with the lengthwise directions of the yokes substantially normal to the lengthwise direction of the winding legs. There are two sets of tubular windings 17, 18 which respectively surround the winding legs 12, 13. These windings are conventional, comprising low voltage coils 19 surrounded by insulating barriers 20 and disk type high voltage coils 21 between which there are radial spacers 22. The ends of the windings include standard insulation represented by numerals 24 and 25. This includes yoke pads, washers, washer fillers, spacers and built-up blocks. These materials may be compressed to some extent when the winding is tightly clamped.

The transformer has a core and coil clamping frame. For this purpose there are four flanged members 31, 32, 33, 34 which are angle irons in this instance. These flanged members are disposed with their lengthwise direction extending along the lengthwise direction of the yokes. One side of the upper yoke 14 is abutted by an upstanding side of member 31, and the opposite side of the upper yoke is abutted by an upstanding side of member 32.

The flange of member 31 which in this instance is side 38 extends laterally from one side of the core. Likewise, the flange or side 39 of member 32 extends laterally from the other side of the core. Thus, the outer surfaces 40, 41 of the flanges 38, 39 abut the top end of the winding 17.

Each of the angle irons or flanged members associated with the upper yoke has an end portion which extends beyond the edge 49 of the corner of the core where the winding leg and yoke are joined.

The extending portions 42, 43 of the members 31, 32 respectively have flanges which provide flat surfaces against which the end of the winding can abut. However, they do not provide an abutting surface for the winding between the two extending portions 42, 43 and for that part of the winding an abutting surface must be added to the frame.

In order to provide a solid abutting surface in the same plane as the outer surface of the flanges, an intermediate element of any suitable form such as a series of rods or a single plate 46 is added to the clamping frame. This is best done by first forming a notch in the extended portion 42 and a similar notch in the extended portion 43. The notch in the extended portion 42 of member 31 is common to the outer surfaces of the two legs or sides of the member and is formed at the intersection of those two sides.

The notch may, as shown, extend completely through areas of the members 31, 32 so long as the notch is defined by wall surfaces of the member on four sides. These surfaces are a recessed surface 51 forming an edge in the upstanding side, a recessed edge surface 52 in the lateral side and sectional surfaces 53, 54 spaced longitudinally of the member and common to both of the sides of the member. The spaced sectional wall surfaces form ends of the notch. Preferably, the two recessed edge surfaces are perpendicular to each other, and the ends of the notch are parallel to each other and are perpendicular to each of the recessed edge surfaces. Opposite end portions 47, 48 respectively of the plate 46 are located in the notches of the extended portions 42, 43, and are confined by the recessed edge surfaces and by the spaced sectional surfaces of the notches.

The clamping frame associated with the lower yoke 15 is made a duplicate of the frame associated with the upper yoke. Angle irons are disposed on opposite sides of the lower yoke 15 and the angle irons each have a portion which extends beyond the outer edges of the core. A pressure plate or intermediate element is placed between the extended portions of the two angle irons with the opposite end portions of the plate located in notches which are formed in those extended portions. The core and coil clamping frame also includes similarly held pressure plates at the other end of both the upper and the lower yokes.

Suitable means are provided for clamping the angle irons against the yokes and for clamping the angle irons and pressure plates against the ends of the winding. In this instance insulated bolts 61 coact with the upstanding sides of the angle irons 31, 32 to clamp those angle irons against the upper yoke, and tie rods coact with the flanges of upper and lower angle irons so that a force can be exerted by the flanges and the pressure plate against the ends of the winding. This is shown as a tie rod 62 which cooperates with the flanges of angle irons 31 and 33.

The clamping frame is illustrated as including reinforcing braces 63 and conventional slotted guides 64. The guides are attached to the upstanding sides of the flanged members by angle irons 65 and bolts 66, and are utilized to position the transformer in a tank.

The principle of the invention is evident from 75

a consideration of the description of the illustrated embodiment. Briefly, the pairs of yoke clamping members, against which parts of the winding abuts, are formed so that they confine and position an unattached pressure plate. In forming those members to confine the pressure plate there is provided two spaced edges, one in the upstanding side of each member. These edges are caused to be pressed on opposite end portions of one surface of the pressure plate, thereby firmly holding the plate and evenly pressing the plate against an end of the winding.

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

I claim:

1. A support including a pair of members spaced apart, each of said members having a portion extending laterally away from the other member, each of said members having a notch therein; the notch in each member defining a recessed surface disposed in a plane substantially normal to said portion of the member, an edge spaced from said recessed surface and recessed from said portion of the member, and sectional surfaces spaced apart and in planes substantially normal to said recessed surface; and an element extending between said members, said element having opposite ends thereof confined between said recessed surfaces of said two members, said element having opposite sides thereof confined at one end portion of the element between said spaced sectional surfaces of one said member and at the other end portion of the element between said spaced sectional surfaces of the other said member, said element having one surface abutted at one end portion thereof by said edge of one said member and abutted at the other end portion thereof by said edge of the other said member, said element having an opposite surface disposed to abut an object, whereby said element coacts with said members and said object to prevent its being displaced from association with said members and said object and combines with said members to abut said object.

2. A support for an object including two members spaced apart and having clamping surfaces abutting said object, said clamping surfaces being spaced from each other and disposed in the same plane, a notch in each of said members; said notch in each member defined by a recessed surface extending substantially normal to said clamping surface of the member, an edge recessed from said clamping surface of the member and spaced from said recessed surface, and two sectional surfaces spaced apart and in planes substantially normal to said recessed surface; means for clamping said members to said object and an intermediate plate extending between said members, said plate having one surface in substantially the same plane as are said clamping surfaces, said one surface and said clamping surfaces abutting said object, said intermediate plate having opposite end portions disposed in the notches of said members, said intermediate plate having opposite ends thereof confined between said recessed surfaces of said two members, said intermediate plate having opposite sides thereof confined at one end portion of the intermediate plate between said spaced sectional surfaces of one said member and at the other end portion of the intermediate

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plate between said spaced sectional surfaces of the other said member, and said intermediate plate having a surface opposite said one surface abutted at one end portion of said intermediate plate by said recessed edge of one said member and abutted at the other end portion of said intermediate plate by said recessed edge of the other said member, whereby said intermediate plate coacts with said members and is restrained from being displaced and firmly abuts said object.

3. A clamping assembly for a first object and a second object comprising first and second members, each said member having a first surface and a second surface with said first surface disposed in a plane at an angle of approximately 90° to the plane of said second surface, said first and second surfaces of each member intersecting, said second surfaces of said two members being disposed in the same plane and spaced from each other, said first surfaces of said two members being in substantially parallel planes spaced from each other the approximate distance said second surfaces are spaced part, said second surfaces disposed to abut said second object, one of said first surfaces being disposed to abut one side of said first object and the other of said first surfaces being disposed to abut the opposite side of said first object, each of said members being notched at the intersection of said two surfaces of the member to define a first edge recessed from said first surface of the member, a second edge spaced from said second object and recessed from said plane of said second surface, and two spaced edge surfaces in planes substantially normal to said first and second surfaces of the member, a plate disposed in the space between said members with a surface thereof in the plane of said second surfaces of said two members, said plate having opposite end portions in the notches of said two members, said plate having opposite side edges disposed between said two spaced edge surfaces of each of said members, having opposite ends between said first edges of said two members, and having one surface abutted by said second edges of said two members and an opposite surface abutting said second object.

4. A clamping assembly for a first object and a second object comprising the combination of first and second members each having a first surface and a second surface disposed in planes at an angle of 90° to each other, said first surfaces of said two members being spaced from each other in substantially parallel planes and disposed to abut opposite sides of said first object, said second surfaces of said two members being in the same plane and spaced from each other the approximate distance said first surfaces are spaced apart, means for clamping said first surfaces against opposite sides of said first object, said second surfaces abutting said second object, each of said members having a portion longitudinally extending beyond said first object with a notch at the intersection of its said surfaces of said extending portion; each said notch defined by a first edge recessed from said first surface of the member, a second edge recessed from said second surface of the member, and two spaced edge surfaces each being in a plane substantially normal to said first and second surfaces of the member; and a plate having opposite end portions confined in the notches of said two members by having opposite ends between said first edges of said members opposite sides between said spaced edge surfaces of each of said members, one surface abutted by said second

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edges of said two members and an opposite surface in the plane of said second surfaces of said two members and abutting said second object.

5. A clamping assembly for a first object and a second object comprising the combination of a first member, a second member, each of said members having a web and a flange intersecting each other with an angle shaped cross section, said webs of said two members being substantially parallel to each other and abutting opposite sides of said first object, said flanges extending in opposite directions away from said first object, first means for clamping said webs of said members against the opposite sides of said first object to bring said webs of said members to a first predetermined distance apart, each of said members having a portion longitudinally extending beyond said first object with a notch at the intersection of its said web and its said flange; each said notch defined by a first edge recessed from said web of the member, a second edge recessed from said flange of the member and two spaced edge surfaces each being in a plane substantially normal said web and said flange of the member; said first edges of said members spaced at a second predetermined distance when said members are clamped by said first means, a plate extending between said flanges and having opposite end portions thereof confined in the notches of said members, said plate having a length intermediate said first and said second distances, each said end portion of said plate being surrounded on three sides by one of said flanges by said plate having opposite ends between said first edges of said members and opposite sides between said spaced edge surfaces of each of said members, said plate having one surface abutted by said second edges of said two members and an opposite surface of said plate in the plane of said flanges of the two members and abutting said second object, and second clamping means coacting with said two members to force said flanges against said second object and to cause said second edges of said two members to abut said plate to force said plate against said second object.

6. A clamping assembly for a first object and a second object comprising the combination of a first member, a second member, each of said members having a web and a flange intersecting each other with an angle shaped cross section, said webs of said two members being substantially parallel to each other and abutting opposite sides of said first object, said flanges extending in opposite directions away from said first object, means for clamping said webs of said members against the opposite sides of said first object to bring said webs of said members to a first predetermined distance apart, each of said members having a portion longitudinally extending beyond said first object with a notch at the intersection of its said web and its said flange; each said notch defined by a first edge recessed from said web of the member, a second edge recessed from said flange of the member and two spaced edge surfaces each being in a plane substantially normal the said web and said flange of the member; said first edges of said members spaced at a second predetermined distance when said members are clamped by said means, a plate extending between said flanges and having opposite end portions thereof confined in the notches of said members, said plate having a length intermediate said first and second distances, each said end portion of said plate being surrounded on three

sides by one of said flanges by said plate having opposite ends between said first edges of said members and opposite sides between said spaced edge surfaces of each of said members, said plate having one surface abutted by said second edges of said two members and an opposite surface in the plane of said flanges of the two members and abutting said second object.

7. A clamping assembly for an object comprising the combination of a first member, a second member, each of said members having a web and a flange intersecting each other with an angle shaped cross section, said webs of said two members being spaced apart and substantially parallel to each other, said flanges extending in opposite directions away from each other, each of said members having a notch at the intersection of its said web and its said flange; each said notch defined by a first edge recessed from said web of the member, a second edge recessed from said flange of the member and two spaced edge surfaces each being in a plane substantially normal said web and said flange of the member; a plate extending between said flanges and having opposite end portions thereof confined in the notches of said members, each said end portion of said plate being surrounded on three sides by one of said flanges by said plate having opposite ends between said first edges of said members and opposite sides between said spaced edge surfaces of each of said members, said plate having one surface abutted by said second edges of said two members and an opposite surface disposed in the plane of said flanges of the two members and abutting said object; and clamping means coacting with said two members to force said flanges against said object and to cause said second edges of said two members to abut said plate to force said plate against said object.

8. A clamping assembly for a first object and

a second object comprising the combination of a first member, a second member, each of said members having a web and a flange intersecting each other with an angle shaped cross section, said webs of said two members being substantially parallel to each other and abutting opposite sides of said first object, said flanges extending in opposite directions away from said first object, each of said members having a portion longitudinally extending beyond said first object with a notch at the intersection of its said web and its said flange; each said notch defined by a first edge recessed from said web of the member, a second edge recessed from said flange of the member and two spaced edge surfaces each being in a plane substantially normal the said web and said flange of the member; a plate extending between said flanges having opposite end portions thereof confined in the notches of said members, each end portion of said plate being surrounded on three sides by one of said flanges by said plate having opposite ends between said first edges of said members and opposite sides between said spaced edge surfaces of each of said members, said plate having one surface abutted by said second edges of said two members and an opposite surface in the plane of said flanges of the two members and abutting said second object.

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