June 29, 1937. R. L. BROWN 2,085,080

TRANSFORMER CASE STRUCTURE

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Fig. 1.

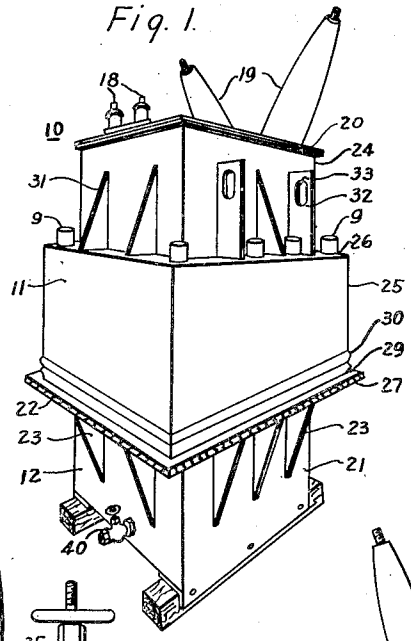


Fig. 2.

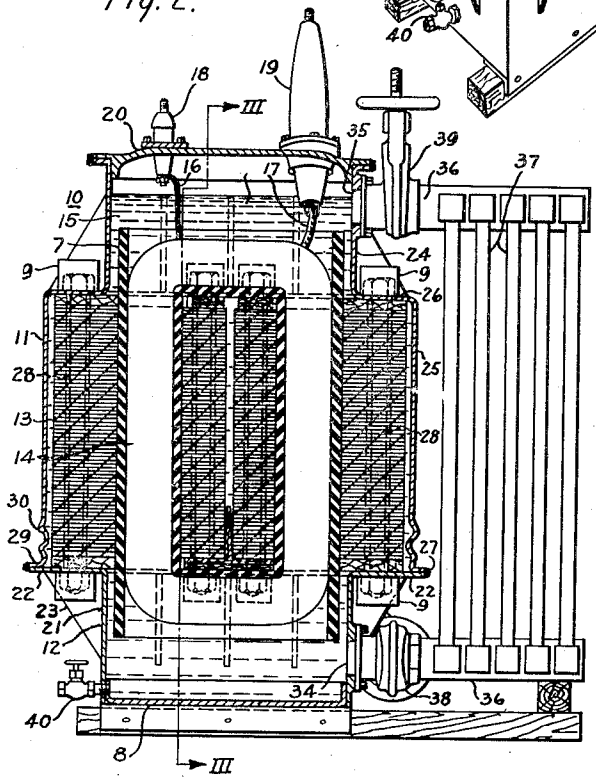
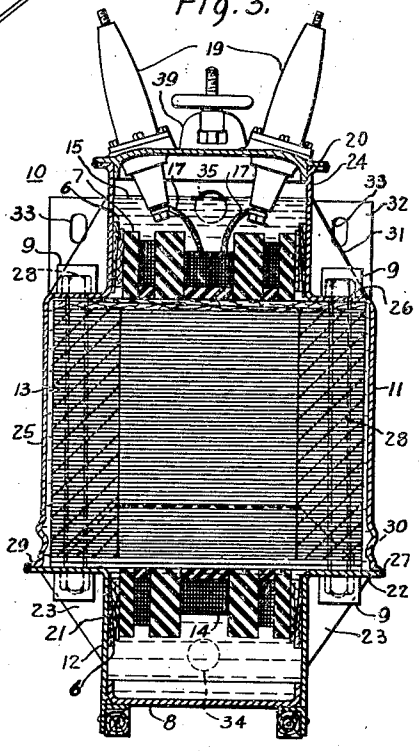


Fig. 3.



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TRANSFORMER CASE STRUCTURE

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5 Claims. (Cl. 175—361)

This invention relates to transformers and particularly, to the case structure for shell type transformers.

In the shell type transformers heretofore employed, the core and coil assembly was constructed as a complete and separate unit from the transformer case. This construction necessitated the building of strongly braced cores and coils for withstanding the stresses encountered upon short circuits, and a strong case for enclosing the core and the insulating liquids employed therewith. Braces were required for supporting the core within the case to withstand shocks encountered during shipping of the transformer. The enclosing case had to be sufficiently strong to withstand the shocks encountered during shipping or installation of the transformer, and to withstand the tremendous pressures sometimes encountered when the transformer was in use. Such construction necessarily required the duplication of strengthening and supporting means in both the core assembly and the case structure.

An object of this invention is to so construct the tank of a transformer that it may be utilized in place of the core and coil supports.

Another object of this invention is to construct the tank of a transformer to substantially conform to the shape of the core.

A further object of this invention is to provide a shell type transformer in which the core assembly and the enclosing case are constructed as an integral unit.

This invention, together with other and additional objects thereof, will be better understood from the following description when read in conjunction with the accompanying drawing, in which:

Figure 1 is a perspective view of the transformer case structure embodying the features of this invention;

Fig. 2 is a sectional view of the transformer showing the core and case structure embodying the features of this invention; and

Fig. 3 is a sectional view of the transformer taken along the lines III—III of Fig. 2.

Like reference characters indicate similar parts in the different figures of the drawing.

In constructing transformers, it is preferable to provide a sectionalized tank or case for enclosing the core and coil assembly of the transformer. Referring to the drawing, and particularly to Fig. 2 thereof, this invention is illustrated with reference to a sectionalized transformer case 10 comprising an upper case section 11 and a lower case section 12. The transformer case 10 contains the core assembly 13 and the coil assembly 14 immersed in an insulating medium 15, such as oil or other suitable insulating fluids.

The upper case section 11 extends above the core and coil assemblies and the transformer case is large enough to contain a sufficient amount of insulating liquid 15 for insulating and cooling the core and coil and the leads 16 and 17 to the low voltage terminals 18 and the high voltage terminals 19, respectively, mounted in the cover 20. The cover 20 is preferably welded to the upper edge of the upper case section 11 in order to provide a leak-proof joint therebetween.

As shown in the drawing, the lower case section 12 comprises an enclosing vertical wall 21 from the top edge of which a horizontal flange or plate 22 extends outwardly for supporting the core 13, insulation 7 and coils 14 mounted thereon. In the present embodiment, the vertical wall 21 telescopes over the bottom pan 8 and is suitably connected thereto as by welding, in order to provide leak-proof joints.

In order to so brace the horizontal flange 22 and the enclosing wall 21 that they may easily support the weight of the core and coils when assembled thereon, gusset plates 23 are provided in spaced relation about the enclosing wall and are securely welded to the enclosing wall 21 and the underside of the horizontal flange 22.

The core 13 and the coils 14 are of the usual shell type construction, the core being constructed from a plurality of stacked laminations. The laminations of the core are stacked directly on the flange 22 of the lower case section 12. As illustrated, the flange 22 performs the function of the commonly used bottom end core frame and supports the laminations in position.

In order to maintain the laminations of the core in their stacked position, the upper case section 11 is so formed that the upper case section is supported on the core, and when assembled, will function as an end frame for the core. As illustrated, the upper case section 11 comprises two vertical sections 24 and 25 which extend in opposite directions from the opposite edges of a horizontal section 26. The horizontal section 26 is parallel to the upper face of the core and is supported thereby. The vertical section 25 depending from the outer edge of the horizontal section 26, covers or completely encloses the outer surface of the core member and is secured to the outer edge of the horizontal flange 22 of the lower case section by a weld 27.

In constructing the transformer, concentric openings are provided in spaced relation in the

stacked laminations of the core 13, the horizontal flange 22 of the lower case section and the horizontal section 26 of the upper case section for receiving bolts 28. By tying them together in this manner the core and case sections are secured as an integral unit and the laminations of the core are maintained shock-proof. Machined caps 9 are provided over the terminals of the bolts 28 in order to protect the threads of the bolts and to prevent the leaking of the insulating liquid from the case around the bolts. The caps further lend a finished appearance to the case structure.

In order to make small adjustments of the nuts about the bolts 28 for tightening and loosening the laminations of the core without breaking the welded seal 27 between the case sections, the depending vertical section 25 of the upper case section terminates in an outwardly extending flange 29, the outer edge of which is welded to the lower case section. Corrugations 30 may also be provided in the depending vertical section 25 for permitting expansion or contraction of the case section, as will be understood by those skilled in the art. Either the outwardly extending flange 29 or the corrugated surface 30, or both as illustrated in the drawing, may be employed in order to provide a resilient covering over the core.

The two side walls of the vertical sections 24 and 21 of the upper and lower case sections respectively in the plane parallel to the plane of the coils 14 and insulation 7 above and below the core 13 are designed, as viewed in Fig. 3, to provide a tight fit with the coils and insulation, wedges 6 being forced between the side walls and the insulation to insure such a tight fit. The side walls of the upper and lower case sections, reinforced by the gusset plates, perform the function of the pressure plates commonly employed in shell type transformers and prevent the high voltage and low voltage coils of the coil assembly from separating under the forces sometimes encountered during short circuit.

Gusset plates 31 and 32 are provided between the horizontal section 26 and the vertical section 24 of the upper case section for strengthening the upper case section. Lifting eyes 33 are provided in gusset plates 32 for receiving the cables or hooks commonly employed in lifting the assembled transformer.

Openings 34 and 35 are provided in the lower and upper case sections, respectively, for receiving the inlet and outlet pipes to the headers 36 of a bank of radiators 37 suitable for circulating and cooling the insulating liquid employed in the transformer. Valves 38 and 39 are positioned in the inlet and outlet pipes respectively for regulating the flow of the insulating medium and for disconnecting the radiators from the transformer. In order to drain the transformer or to remove the sludge sometimes formed therein, a drain pipe 40 is provided near the bottom of the vertical enclosing wall 21 of the lower case section 12.

Since the core and case sections are constructed as an integral unit with the case conforming substantially to the shape of the core and performing the function of the core and coil supports, it is evident that the duplication of supporting and strengthening means for the core and enclosing case of the transformers is not necessary. The end frames, pressure plates, supporting legs, braces for the core and other supporting means heretofore employed are not required with the case structure of this invention.

In constructing the transformer case, it is evident that the upper case section may be made of a lighter material than the lower case section, since the only stress or strain on the upper case section will be that encountered in lifting the transformer or that caused by the internal pressure of the wedges or the insulating liquid.

By constructing the transformer in the manner hereinbefore described, it is evident that distinct advantages are encountered in that the weight of the assembled transformer is greatly reduced, the floor space required for the transformer is smaller, and the amount of the insulating liquid required for insulating and cooling the core and coils is greatly reduced. With this construction the transformer may be easily repaired in the field since heavy crane facilities are not required for tearing down or reassembling the unit, repairs being made by breaking the light welds holding the sections or the cover and the sections together and removing that portion of the transformer case.

Although this invention has been described with reference to a particular tank structure, it is, of course, understood that other and various modifications thereof are possible. This invention is, therefore, not to be restricted except insofar as is necessitated by the prior art and the scope of the appended claims.

I claim as my invention:

1. In a shell type transformer, in combination, a core and coil assembly, a case for enclosing the core and coil assembly, the case comprising an upper and a lower section, the lower case section comprising an enclosing wall having a horizontal flange extending outwardly from the top thereof for supporting the core and coil assembly, the upper case section comprising an enclosing wall having vertical sections and a horizontal section supported by the core assembly, the vertical sections extending in opposite directions from the opposite edges of the horizontal section, one of the vertical sections of the upper case section comprising a vertical wall depending from the horizontal section to cover the core assembly and a substantially horizontal flange extending outwardly from the lower edge thereof, means in the depending vertical wall for providing a resilient covering over the core assembly, means for connecting the flange extending outwardly from the depending vertical wall to the horizontal flange of the lower case section to provide a leak-proof joint therebetween, and means for clamping the core assembly between the horizontal section of the upper case section and the horizontal flange of the lower case section for preventing vibration of the core assembly.

2. In a shell type transformer, in combination, a core and coil assembly, a case for enclosing the core and coil assembly, the case comprising an upper and a lower section, the lower case section comprising an enclosing wall having a horizontal flange extending from the top thereof for supporting the core and coil assembly, the upper case section comprising an enclosing wall having vertical sections and a horizontal section, the vertical sections extending in opposite directions from the opposite edges of the horizontal section, the horizontal section of the upper case section being supported by the core assembly to support the upper case section in position about the core and coil assembly, one of the vertical sections of the upper case section depending from the outer edge of the hori-

zontal section and comprising a vertical wall which covers the core assembly and a horizontal flange extending therefrom, means for connecting the outwardly extending horizontal flange of the depending vertical section covering the core assembly to the horizontal flange of the lower case section to provide a leak-proof joint therebetween, and means in the vertical wall of the depending vertical section for providing a resilient covering over the core assembly.

3. In a shell type transformer, in combination, a core and coil assembly, a case for enclosing the core and coil assembly, the case comprising an upper and lower section, the lower case section comprising a vertical enclosing wall having a horizontal flange extending from the top thereof for supporting the core and coil assembly, means provided in spaced relation about the vertical enclosing wall for supporting the horizontal flange and strengthening the enclosing wall, the upper case section comprising an enclosing wall having two vertical sections and a horizontal section, the vertical sections extending in opposite directions from the opposite edges of the horizontal section, the horizontal section being supported by the core assembly for positioning the upper case section, one of the vertical sections of the upper case section comprising a vertical wall and a substantially horizontal flange extending outwardly from the lower edge thereof, the vertical wall depending from the outer edge of the horizontal section to cover the core assembly, means provided about the horizontal section for supporting the other of the vertical sections and for strengthening the upper case section, the outwardly extending flange of the depending vertical wall being welded to the horizontal flange of the lower case section to provide a leak-proof joint between the upper and lower case sections, means in the depending vertical wall for providing a resilient covering over the core assembly, and means for securing the core assembly between the horizontal section of the upper case section and the horizontal flange of the lower case section for preventing vibration of the core assembly.

4. In a shell type transformer, in combination, a core and coil assembly, a case for enclosing the core and coil assembly, the case comprising an upper and lower section, the lower case section comprising a vertical enclosing wall having a horizontal flange extending from the top thereof for supporting the core and coil assembly, means provided in spaced relation about the vertical enclosing wall for supporting the horizontal flange and strengthening the enclosing wall, the upper case section comprising an enclosing wall having two vertical sections and a horizontal section, the vertical sections extending in opposite directions from the opposite edges of the horizontal section, the horizontal section being supported by the core assembly for positioning the upper case section, one of the vertical sections of the upper case section comprising a vertical wall depending from the outer edge of the horizontal section and a substantially horizontal flange extending outwardly from the lower edge thereof, means provided about the horizontal section for supporting the other of the vertical sections and for strengthening the upper case section, means in the vertical wall of the depending vertical section for providing a resilient covering over the core assembly, the outwardly extending flange being welded to the horizontal flange of the lower case section to provide a leak-proof joint between the upper and lower case sections, and means for securing the core assembly between the horizontal section of the upper case section and the horizontal flange of the lower case section for preventing vibration of the core assembly.

5. In a shell type transformer, in combination, a core and coil assembly, a case for enclosing and supporting the core and coil assembly, the case comprising an upper and a lower section, the lower case section comprising a vertical enclosing wall having a horizontal flange extending outwardly from the top thereof for supporting the core and coil assembly, the upper case section comprising an enclosing wall having vertical sections and a horizontal section, the vertical sections extending in opposite directions from the opposite edges of the horizontal section, the horizontal section being parallel with and supported by the core section to support the upper case section, one of the vertical sections comprising a vertical wall depending from the outer edge of the horizontal section to cover the core assembly and a substantially horizontal flange extending outwardly from the lower edge thereof, the horizontal flange extending outwardly from the depending vertical wall being welded to the outer edge of the horizontal flange of the lower case section to provide a leak-proof joint therebetween, means for securing the core assembly between the horizontal section of the upper case section and the horizontal flange of the lower case section, and means in the depending vertical wall of the upper case section for permitting an expansion or contraction of the enclosing case in response to a movement of the means for securing the core assembly in the case.

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