MULTIPLE UNIT POWER TRANSFORMER WITH WINDINGS CONNECTED IN PARALLEL

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Filed Jan. 31, 1962, Ser. No. 179,150

1 Claim. (Cl. 356—212)

This invention relates to power transformers and more particularly to large size single-phase power transformers.

Power transformers primary and secondary windings are being called on by the electric power industry to supply ever larger transformers. However, there are practical limits to the physical size of an article which can be shipped. For example, railroad and highway under clearances impose definite limits on maximum height and width and there are practical limits on weight and length, the latter being dictated by curvature of the roadway. The size limit for three-phase power transformers has already been reached so that recourse has had to be had to the less economical use of single-phase transformers which are banked for three-phase operation. However, the width and height limits of single-phase power transformers are being closely approached, if not already reached, but the length and weight limits are further away.

In accordance with this invention, the capacity or rating of a single-phase power transformer of any given width and height is increased by providing it with an n-legged core type core where n is at least six and maybe seven, eight or more, there being n—2 equal size wound legs and two end legs of half the size or width of the wound legs.

An object of the invention is to increase the capacity of a power transformer without increasing its height or width.

Another object of the invention is to produce a single-phase power transformer having a core with at least six legs of which at least four are full size wound legs and two are half-size end legs.

The invention will be better understood from the following description taken in connection with the accompanying drawings, and its scope will be pointed out in the appended claims.

In the drawing FIG. 1 is a side elevation view of a preferred embodiment of the invention and FIG. 2 is a fragmentary edge view of the core showing a suitable form of joint therein.

Referring now to FIG. 1 there is shown therein a single-phase power core type transformer 1 having a magnetic core 2 provided with eight legs identified as 3, 4, 5, 6, 7, 8, 9 and 10 respectively. The core is also provided with yoke portions 11 joining the ends of the legs. As shown, the legs are all of equal size and, although not shown, the thickness of the core is uniform for all its parts. However, the six legs 4—9 inclusive are so-called wound legs and are of equal full size width, the remaining or end legs 3 and 10 and the yoke portions 11 are of half the width of the wound legs. Mounted on each of the wound legs 4—9 inclusive is an electrical winding or coil, these being designated respectively as 12, 13, 14, 15, 16, and 17. Each of them may constitute an autotransformer winding having primary and secondary winding sections, or as will be well understood, separate or insulated primary and secondary windings may be provided if desired. The windings 12—17 inclusive are connected in aparatral to the conductors of an external circuit 18 in such a manner that the direction of the magnetic fluxes they produce are in opposite directions in pairs of adjacent ones of the wound legs. These fluxes are shown by the arrows in FIG. 1 and it will be seen that with this arrangement there is twice as much flux in each wound leg as in the rest of the core, but as the cross-section area of each wound leg is twice that of the rest of the core, the flux density is uniform in all parts of the core.

With such a construction, the capacity or rating of the transformer is six times the capacity or rating of each wound leg including its coil or coils. In other words, the capacity of the transformer is the same as that of six transformers each having a wound leg width equaling that of the same size, but the arrangement is more economical because less magnetic material is needed for the portions of the core for carrying the return fluxes such as the yoke portions 11 and the outer legs 3 and 10 which latter are common to the entire transformer.

On the basis of 133 mva. (one mva. = 1000 kva. = one million volt-amperes) per wound leg, the transformer shown in FIG. 1 would have a rating of about 800 mva. and would weigh about 583,000 pounds and be about 720 inches long without vacuum bracing. Such a unit would fit on the largest of railroad flat cars with slight overloading.

By providing the core with joints as indicated at 19 and 19’ and at 20 and 20’ in the yoke portions 11, a smaller six legged core having four wound legs and two end legs can easily be made by eliminating the center section comprising the wound legs 6 and 7 and their associated yoke portions 11. Similarly by providing joints 21 and 21’, a seven-legged core having six wound legs and two end legs can be made by removing or eliminating the wound leg 6 or the wound leg 7. Of course, six and seven legged cores could obviously be made without joints, if desired, but in the larger size units, the use of joints will facilitate shipment by dividing the unit into smaller components and then reassembling it by closing the joints after delivery.

A seven-legged core having 133 mva. per wound leg would have a total mva. rating of about 666 and would weigh about 500,000 pounds, and be about 465 inches long over all and this would easily be accommodated by the largest of railroad flat cars.

A suitable form of joint is shown in FIG. 2 in which the core laminations of a left-hand yoke portion 11 and the core laminations of a right-hand yoke portion 11 each have long laminations 22 alternating in the stack with short laminations 23. Laminations 22 and 23 may be individual lamination pieces or they may be groups or packets of two or more individual lamination pieces, typically four. The joint is made by bringing the ends of the long lamination pieces 22 into approximate abutting relation and then filling the space between the ends of the short laminations 23 with inserts 24 of magnetic lamination pieces which in effect bridge the gaps between the ends of the short lamination pieces 23.

While there have been shown and described particular embodiments of the invention, it will be obvious to those skilled in the art that changes and modifications may be made without departing from the invention, and therefore it is intended by the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

A single-phase core type transformer having a core with n parallel legs whose corresponding ends are joined by separate straight yoke members and n being at least six, the two outer legs and the yoke members having the same width, the remaining legs each having a width which is twice the width of the yokes and outer legs, identical windings on said remaining legs, said windings being so connected in parallel as to produce reverse direction flux in adjacent ones of said remaining legs when said parallel connected windings are connected to a common
external circuit whereby the flux density is the same in all parts of said core, the yokes between at least one pair of adjacent legs comprising magnetic core laminations having long and short yoke portions, said long yoke portions abutting each other, said short yoke portions spaced from each other so as to form gaps therebetween, said gaps being bridged with magnetic lamination inserts, whereby said transformer can be shipped in multiple units and assembled by abutting said long yoke portions and bridging said gaps between said short yoke portions by said magnetic lamination inserts.

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