Jan. 4, 1949. C. W. BROWN 2,458,052

THREE-PHASE TRANSFORMER CONSTRUCTION

Filed March 6, 1947 2 Sheets-Sheet 1

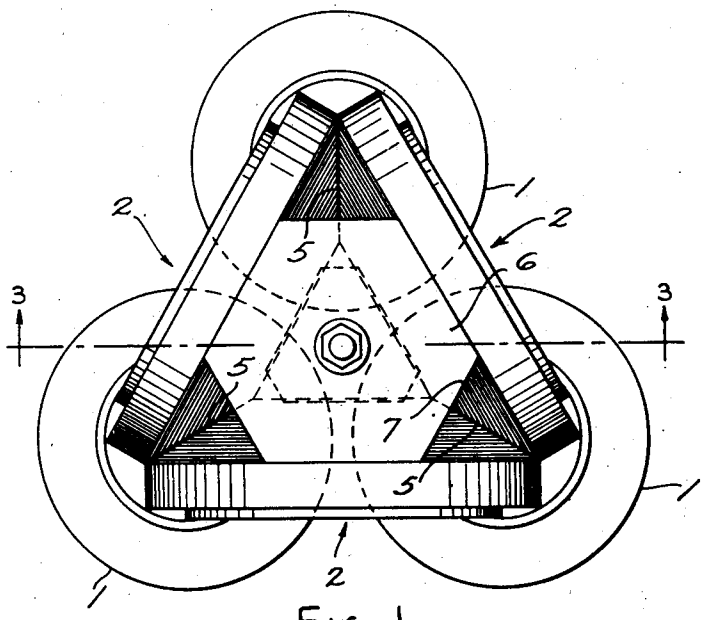

FIG. 1

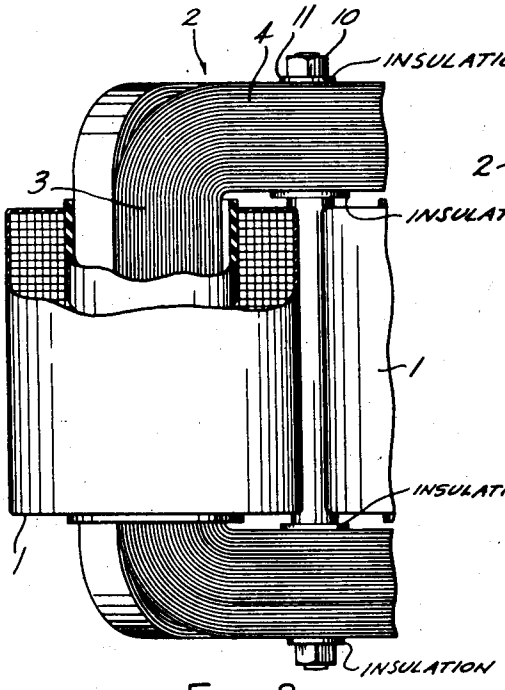

FIG. 2

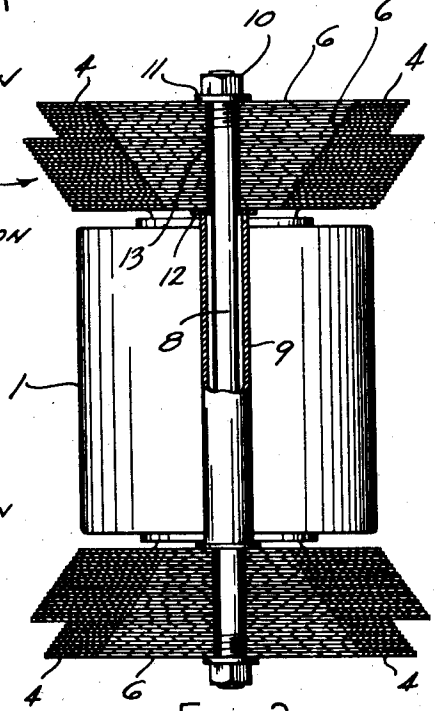

FIG. 3

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Fig. 4

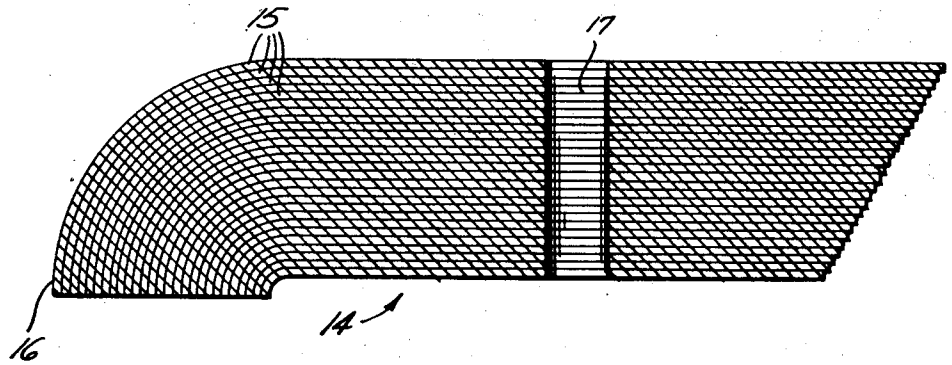
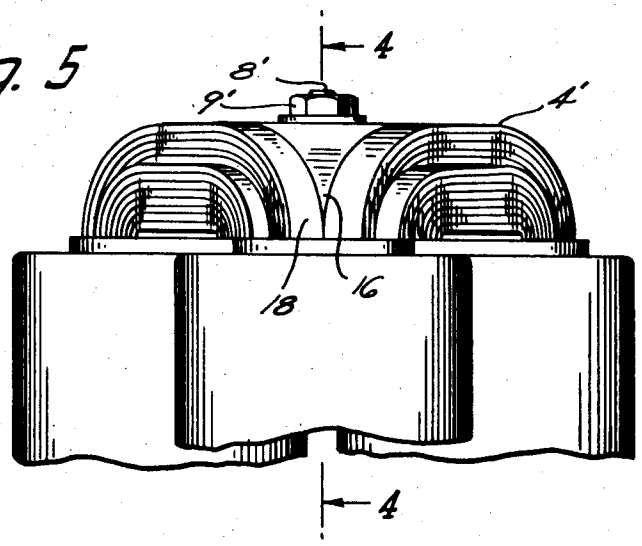


Fig. 5



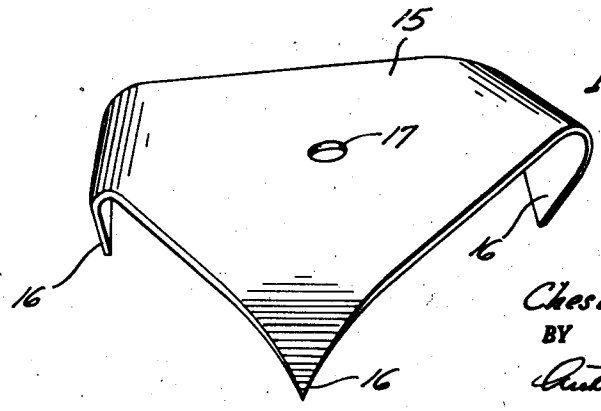


Fig. 6

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THREE-PHASE TRANSFORMER CONSTRUCTION

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6 Claims. (Cl. 175—356)

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This invention relates to three phase transformers and is particularly directed to the core construction of three phase transformers.

This invention is an improvement over that disclosed in the copending application of David E. Wiegand, Serial No. 556,546, filed September 30, 1944 for Three-phase transformers, assigned to the same assignee as that of the present invention.

In the prior invention disclosed in the copending application, a three phase transformer was provided in which the cores were wound of magnetic ribbon and each core formed a closed core interlinking two of the three conducting windings, the cores having straight leg portions passing through the conducting windings, and yokes connecting the straight leg portions, with the successive ribbons of each core being arranged in a staggered relation with the edges of adjacent cores arranged in edge to edge contact.

The purpose of having the leg portions arranged in the manner described was to provide for the transfer of flux or interchange of flux from core to core during the alternating current cycle.

This invention is designed to provide means for facilitating the transfer of magnetic flux from core to core during the successive portions of the alternating current cycle in addition to that provided by the contacting straight leg portions which pass through the conducting winding assemblies.

In greater detail, objects of this invention are to provide magnetically conducting filler means magnetically interconnecting the yoke portions of the several cores at each end of the three phase transformer so as to provide greater freedom for the free interchange or transfer of flux from one core to another core.

Embodiments of the invention are shown in the accompanying drawings, in which:

Figure 1 is a plan view of a transformer constructed in accordance with this invention.

Figure 2 is a fragmentary elevation with parts broken away and parts in section.

Figure 3 is a sectional view on the line 3—3 of Figure 1, the portion of the two coils intersected by the section line being omitted in Figure 3 and the bolt and nut being shown in full elevation.

Figure 4 is a sectional view through a further form of a filler member, such view corresponding to a view on the line 4—4 of Figure 5.

Figure 5 is a fragmentary end view of a three phase transformer with the filler section illustrated in Figure 4 in place.

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Figure 6 is a view showing one lamination of the filler section shown in Figures 4 and 5.

Referring to the drawings, particularly Figures 1, 2, and 3, it will be seen that the transformer comprises three conducting winding assemblies 1 whose axes are arranged at the apexes of an equilateral triangle. The three core sections are identical and are indicated generally by the reference character 2. These core sections each comprise straight leg portions 3 and yoke portions 4. Both are straight leg portions and the yoke portions are skewed or staggered and the adjacent staggered or slanting edges of the straight leg portions are arranged in edge to edge contact where they pass through the conducting windings, such slanting edge portions being indicated by the reference character 5 in Figure 1.

In following this invention, a plurality of roughly triangular laminations are provided and are stacked, one upon the other. The triangular laminations are of gradually increasing size and serve to form a magnetic filler or bridge roughly triangular in shape and tapering inwardly towards the center of the transformer. These filler or magnetic bridge sections are indicated by the reference character 6 and are shown clearly in Figure 3. They are, as stated, approximately triangular but have their sharp ends cut off as indicated at 7 in Figure 1. These filler sections 6 are positioned between the yoke portions at opposite ends of the transformer and thus form a magnetic bridge or path between the yoke portions of all of the cores so as to greatly facilitate the free interchange of flux from one core section to another core section. It is to be noted that the yoke portions 4 have slanting inner faces which form with the slanting faces of the filler means or portions 6 slanting joints 6' and that at these joints the laminations of the filler portions 6 and the ribbons of the yokes have an edge to edge engagement. In reality, the slanting faces of the filler sections and the slanting adjacent contacting faces of the yoke portions are stepped to thus produce these slanting faces.

The laminations forming the filler or bridge sections 6 are apertured and receive a tie bolt 8 which extends through the transformer. A spacer sleeve 9 is positioned between the upper and lower filler sections 6 and preferably both the bolt and the spacer sleeve are formed of non-magnetic material. Preferably, also the end nuts 10 of the bolt are separated from electrical contact with the filler sections by means of insulating washers 11 and similarly the upper and lower ends of the spacer sleeve 9 are separated

from the filler sections by means of insulating washers 12. It is to be noted also that where the bolt 8 passes through the filler sections an insulating sleeve 13 is provided.

The filler sections are stacked and are positioned between the yokes 4 of the core sections at opposite ends of the transformer with the spacer sleeve therebetween and with the tie rod or bolt 8 extending therethrough. The nuts 10 are tightened and thus serve to hold the successive laminations of the filler sections 6 in edge to edge contact with the edges of the ribbon forming the yoke portions 4 of the transformer.

Any suitable means may be employed to keep the core sections from spreading in accordance with the usual practice. The conducting winding assemblies themselves act to hold the several core sections in place.

In the form of the invention shown in Figures 4, 5, and 6 the filler section is indicated by the reference character 14. It is composed of a plurality of individual laminations 15 which have downwardly turned or curved end pieces 16. Similarly to the form of the invention shown in Figures 1 through 3, the filler sections 14 are of roughly triangular shape and are positioned between the yoke portions of the transformer at each end thereof and are held in place by means of the tie bolt 8' and the nuts 9', suitable insulation and a suitable spacer sleeve, the latter not shown, being employed in exactly the same manner as that illustrated in Figure 3 for the first form of the invention. Each of the filler members is centrally apertured as indicated at 17 to allow the passage of the tie bolt 8' with an insulating sleeve, corresponding to that shown at 13 in Figure 3, thereon. Each of the laminations 15 has downwardly curved pointed ends or portions 16 which fit between and contact with the curved portions 18 of the yokes indicated generally at 4' in Figure 5. In this way a greater extent of contact between the adjacent slanting faces of the filler sections 14 and the adjacent slanting faces of the yokes is obtained.

It is to be noted that the filler sections are formed of laminated strips which are successively smaller in size as the center of the transformer is approached. The edges of the laminations of the filler members at the slanting faces thereof and the contacting edges of the laminations of the slanting faces of the yoke portions are staggered and thus secure their edge to edge contact. It is to be noted that the filler members contact in an edge to edge manner the adjacent portions of the yoke throughout both their straight and curved portions.

It will be seen that this invention provides means which greatly increases the free transfer of magnetic flux from one core section to another core section by providing a magnetic filler means between the yoke portions of the several cores at each end of the three phase transformer.

It is to be noted that this invention provides a very simple means which is easily applied to three phase wound core transformers and which materially improves the freedom with which the interchange of magnetic flux from core to core can take place.

Although this invention has been described in considerable detail, it is to be understood that such description is intended as illustrative rather than limiting, as the invention may be variously embodied and is to be interpreted as claimed.

I claim:

1. A three phase transformer comprising three conducting winding assemblies, three closed cores formed of continuous magnetic ribbon having leg portions passing through the conducting winding assemblies and having yoke portions provided with slanting inner faces, said yoke portions forming the sides of an approximate triangle at each end of the transformer, and laminated magnetic filler members at each end of the transformer located between the yoke portions of the core sections and having slanting outer faces arranged adjacent the slanting inner faces of the yoke portions.

2. A three phase transformer comprising three conducting winding assemblies, three closed cores formed of continuous magnetic ribbon having leg portions passing through the conducting winding assemblies and having yoke portions provided with slanting inner faces, laminated magnetic filler members at each end of the transformer located between the yoke portions of the core sections and having slanting outer faces arranged adjacent the slanting inner faces of the yoke portions, a spacer sleeve located between the filler members, and a tie bolt extending through the filler members and spacer sleeve for holding the filler members in place.

3. A three phase transformer comprising three conducting winding assemblies, three closed cores formed of continuous magnetic ribbon having leg portions passing through the conducting winding assemblies and having yoke portions with the edges of the ribbons of each yoke portion arranged in a staggered manner to provide slanting inner faces for the yoke portions, said yoke portions forming the sides of an approximate triangle at opposite ends of said transformer, laminated magnetic filler members at opposite ends of the transformer, each filler member being composed of a plurality of laminations of successively increasing areas and having the outer edges of the laminations staggered to provide slanting outer faces engaging the slanting inner faces of the yoke portions, and means for holding the filler members in place.

4. A three phase transformer comprising three conducting winding assemblies, three closed cores formed of continuous magnetic ribbon having leg portions passing through the conducting winding assemblies and having yoke portions with the edges of the ribbons of each yoke portion arranged in a staggered manner to provide slanting inner faces for the yoke portions, said yoke portions forming the sides of an approximate triangle at opposite ends of said transformer, laminated magnetic filler members at opposite ends of the transformer, each filler member being composed of a plurality of laminations of successively increasing areas and having the outer edges of the laminations staggered to provide slanting outer faces engaging the slanting inner faces of the yoke portions, and means for holding the filler members in place, the laminations of the filler members and the ribbons of the yoke portions having edge to edge engagement.

5. A three phase transformer comprising three conducting winding assemblies, three closed cores formed of continuous magnetic ribbon having legs passing through the conducting winding assemblies and having yokes at the ends joining said legs, a part, at least, of the yokes being curved and said yokes having slanting faces, and laminated magnetic filler members at each end of the transformer located between the yoke portions of the cores and having inwardly curved ends and having slanting faces arranged adjacent

the slanting faces of the yokes with the curved ends of the filler members positioned between the curved portions of the yokes.

6. A three phase transformer comprising three conducting winding assemblies, three closed cores formed of continuous magnetic ribbon having legs passing through the conducting winding assemblies and having yokes at the ends joining said legs, a part, at least, of the yokes being curved and said yokes having slanting faces, the edges of the ribbon at the slanting faces of the yokes being stepped, and laminated magnetic filler members at each end of the transformer located between the yoke portions of the cores and having inwardly curved ends and having slanting faces arranged adjacent the slanting

faces of the yokes with the curved ends of the filler members positioned between the curved portions of the yokes, the edges of the laminations of the filler members being stepped and having edge to edge engagement with the ribbons of the yokes.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
640,314	Packard et al.	Jan. 2, 1900
1,390,050	Lee	Sept. 6, 1921
1,425,091	Horelick	Aug. 8, 1922