INVENTORS

Martin Christoffel

Ottor Wollfart

BY

Prince, Scheffler & Parker

their ATTORNEYS
ARRANGEMENT FOR PREVENTING DISCHARGES ALONG THE HIGH-VOLTAGE WINDINGS OF A HIGH-VOLTAGE TRANSFORMER

Martin Christoffel and Otto Wohlfahrt, Zurich, Switzerland, assignors to Aktiengesellschaft Brown, Boveri & Cie, Baden, Switzerland, a joint-stock company
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This invention relates to high-voltage transformers, and is concerned with the provision of means for preventing discharges along the high-voltage windings of such transformers.

It is known that partial discharges can occur in the high-voltage windings of high-voltage transformers as a result of the overheating of the oil when shock-like voltages impinge on the windings. This occurs particularly when high-voltage windings consisting of sectional coils are stressed with shock voltage, for example, in shock tests. In this case there exist at the edges of the innermost and outermost windings of the individual section coils not only the field generated by the grounded reservoir of the transformer or other windings, but also the field generated by the various potentials of the individual coils.

It is also known that the partial discharges propagate very easily along the separating surface between the oil and the solid insulation, e.g., paper or pressboard, as slip discharges.

Experience has shown that, with sufficient intensity and length of the discharges, whereby winding parts with substantially different potential are practically short-circuited, a breakdown can occur over several coils. To merely increase the winding insulation is not a productive solution for increase in the input voltage by reason of the predischARGE.

In transformers whose main insulation consists of a system of solid insulating caps and cylinders, and whose high-voltage winding is divided into two axially superposed parallel branches with the inlet of the high-voltage winding arranged in the center of the winding, it has already been suggested to arrange the insulating caps so that the complete breakdown of the voltage is prevented over the windings. However, such an arrangement does not prevent a partial breakdown.

An object of the present invention is to provide an arrangement to prevent discharges, particularly discharges with shock voltages, along the high-voltage winding of a transformer having concentric windings composed of sectional coils.

According to the invention, the above mentioned discharges are prevented in that at least a part of the high-voltage winding is provided with angle rings of insulating material which are so arranged that they effect protective insulation between at least each second sectional double coil of the high-voltage winding in the immediate vicinity of the possible origin of the predischARGE.

Two embodiments of the invention are represented schematically in the appended drawing each figure of which represents a section through a part of the windings of a high-voltage transformer. Fig. 1 shows the invention as integrated in a transformer with single-concentric winding arrangement, and Fig. 2 in a transformer with double-concentric winding arrangement.

In the figures, 1 denotes a cylindrical low-voltage winding concentrically arranged adjacent a core column of an iron support. A high-voltage winding 3, which is concentric to the low-voltage winding, is composed of series-connected pancake coils, two adjacent pancake coils each being combined by an electric jumper connection 4. Between the high-voltage and the low-voltage windings is arranged an insulation 5 wound from laminated paper. Besides, a number of angle rings of solid insulating material are so arranged, between the pancake coils of the high voltage winding 3 and the insulation 5, that they effect insulation between the pancake coils in the immediate vicinity of the possible origin of a predischARGE.

In the single-concentric winding arrangement according to Fig. 1, each pair of pancake coils is provided on the inner side face of the high-voltage winding with an angle ring 6 whose radial flange part 6a effects the shielding necessary for the interruption of axial discharges at points of highest potential stress along the winding. The angle rings extend in axial direction over only one pair of pancake coils each.

Fig. 2 shows a double-concentric transformer with an inner low-voltage winding 1' and an outer concentrically arranged low-voltage winding 10. The high-voltage winding, composed of double-sectional pancake-type coils, is again designated 3. Between the outer low-voltage winding 10 and the high-voltage winding 3 is arranged an insulation barrier 50. Besides, angle rings 6', 6'' are provided on both side faces of the high-voltage winding 3. These angle rings extend in axial direction over two double sectional coils each, and axially overlap partly (as shown in Fig. 2). This shielding of the edges of the innermost windings of the individual sectional coils results in an optimum effect with regard to the interruption of the axial path for the discharges.

The interruption of the axial path does not necessarily have to take place after each double sectional coil. It is sufficient, under certain circumstances, if an angle is arranged only after each second double sectional coil. In general it is sufficient if only a part of the high-voltage winding is equipped with angle rings. The angle rings themselves are made of any known strong insulating material.

We claim:

1. A transformer construction comprising an iron core, a tubular inner low voltage winding concentrically mounted upon said core, a high voltage winding concentrically mounted about said inner low voltage winding, a tubular outer low voltage winding mounted concentrically about said high voltage winding, main insulation barrier sleeves positioned intermediate said high voltage winding and said low voltage windings, said high voltage winding consisting of a plurality of axially-spaced pancake-type coils electrically connected in series at alternate inner and outer end portions by electrical jumper means, and axially-overlapping insulating angle rings positioned intermediate each of said main insulation barrier sleeves and said high voltage winding, alternate ones of said angle rings having flange portions radially extending outwardly and inwardly, respectively, between said high voltage winding coils only at the end portions thereof opposite the end portions connected by said electrical jumper means.

2. Apparatus as defined in claim 1 wherein said main insulation barrier sleeves consist solely of laminated paper.

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