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CORONA SHIELD

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Fig. 1.

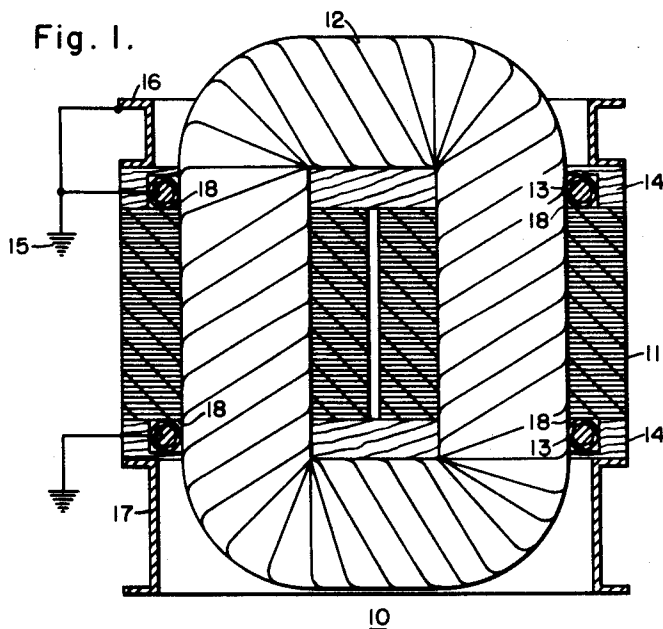
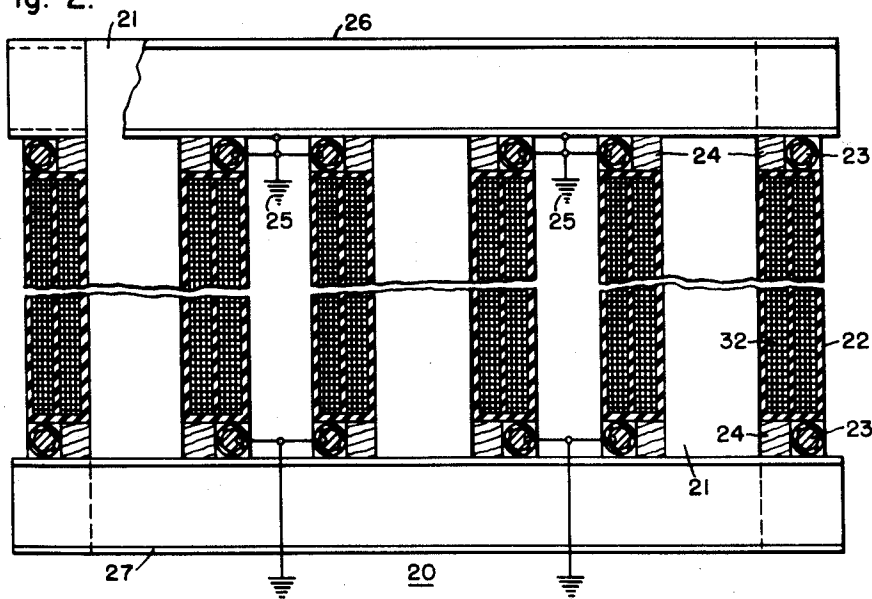


Fig. 2.



WITNESSES

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1

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CORONA SHIELD

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The invention relates generally to transformers, and more particularly to shields for distributing the dielectric stress adjacent to transformer windings subjected to high potentials.

The object of this invention is to provide for distributing the dielectric stress which builds up on edges of metal parts adjacent to transformer windings subjected to high potentials to prevent corona.

Other objects of the invention will, in part, be obvious and will, in part, appear hereinafter.

The invention accordingly comprises the features of construction, combinations of elements, and arrangement of parts, which will be exemplified in the construction hereinafter set forth and the scope of the application which will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawing, in which:

Figure 1 is a view, in section, of the core and windings of a shell form transformer, showing a corona shield constructed in accordance with the teachings of this invention, and

Fig. 2 is a view, in section, of a core and windings of a three phase, core form transformer showing the disposition of corona shields.

Referring now to the drawing and Fig. 1 in particular, the core and windings of a shell form transformer shown generally at 10 having a magnetic core 11, upper and lower supporting structures 16 and 17, and windings 12. The windings 12 are subjected to high potentials in operation. Corona shields 13 are disposed in the V-notch which defines the junction of the core 11 and the coil 12. In this particular embodiment of the invention, the corona shields 13 are disposed to follow the contours of the edges 18 of the core 11.

It has been found that when the core of a transformer, such as shown in this embodiment, is maintained at ground potential relative to the windings, that as the operating potential of the windings is increased, a point is reached where the dielectric stress causes corona at the edges of the core. This dielectric stress is a result of the voltage difference existing between the high voltage windings and the edges of the grounded core and supporting structures.

It has been found that the corona thus indicated causes radio interference, deterioration of the adjacent winding insulation, and in extreme cases, winding failure.

It has been found that this corona at the edges of the core may be prevented by the use of corona shields. The corona shields 13 are disposed near the edges 18 of the core 11 adjacent to the windings 12, which are subjected to high potentials. By the use of such corona shields 13, dielectric stresses between the edges 18 of the core 11 and the windings 12 may be reduced below the point where corona takes place adjacent to the edges 18 of the core 11 and the windings 12.

Referring to Fig. 1, in the case of shell form trans-

2

formers, the corona shields 13 are disposed along the contours of the edges 18 of the core 11 and fit as snugly as possible in the V formed by the juncture of the core 11 and the windings 12. A wood block 14 is used as a filler surrounding the corona shields 13.

The corona shields 13 each consist of an insulated, cylindrical, conducting member. Each shield is connected to a ground 15 at one point. It has been found that the required diameter of the shield necessary to reduce the dielectric stress below the corona point increases with the operating potential. The thickness of the insulating tape also increases with the operating potential.

It has been found that the smaller diameter shields can be made of conducting rods; larger diameter shields can best be made of conducting tubing. When tubing is used, the end of the tube which is not attached to the ground should have a fiber plug with a small hole drilled in it underneath the tape. When a solid rod is used, an insulating disc of fiber should be taped against the free end of the rod. This insures that the conducting rod never forms an electrical short between portions of the magnetic core.

In the case of shell form transformers, for example, for intermediate test voltages, corona shields along the edges of the interphase iron and the end iron parallel to the interphase iron, will be sufficient to produce very satisfactory results. For higher test voltages, corona shields must also be used along the length of the iron opening, as well as the width of the iron opening.

Referring to Fig. 2, the core and windings of a three phase, core form transformer shown generally at 20 having a magnetic core 21, upper and lower end frames 26 and 27, low voltage windings 32 and high voltage windings 22, subjected to high potentials, are provided with corona shields 23 which are connected to ground as indicated at 25. In the embodiment applied to core form transformers the corona shields 23 may be conveniently mounted around the periphery of the pressure plates 24 above and below the high and low voltage windings 22 and 32 respectively. It may be desirable to shield other metal corners where corona may occur in core form transformers.

Since certain changes may be made in the above construction and different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

We claim as our invention:

1. In a transformer having a magnetic core, electrical windings associated with said core to which high potentials are applied in operation, end frame members disposed adjacent said core and windings in such relationship that corona tends to take place at said end frame members, a shield comprising an insulated, conducting member disposed between said windings and end frame members and adjacent said core to collect and distribute the potential stress and prevent corona at said end frame members, and means connecting said shield member to ground potential.

2. In a shell-form transformer, a magnetic core, a coil inductively related to said core to which high potentials are applied in operation, end frame members located adjacent said coil and said core, a shield comprising an insulated, conducting member disposed adjacent said coil and said core, said shield being positioned between said core and said end member to collect and distribute the potential stresses and prevent corona adjacent to said core and adjacent to said end frame members, and means for connecting said shield to ground potential.

3. In a core-form transformer, a magnetic core, elec-

3

trical windings associated with said core and to which high potentials are applied in operation, end frame members adjacent said core and said windings, a shield comprising an insulated, conducting member disposed around said windings adjacent the edges of said core, said shield being positioned between said windings and said end frame members to collect and distribute the potential stress between said windings and said end frame members and prevent corona at said end frame members, and means connecting said shield to ground potential.

4. In a shell-form transformer, a magnetic core, electrical windings associated with said core to which high potentials are applied in operation, an end frame member adjacent said windings and core, said windings being so disposed that dielectric stresses build up between said windings and said end frame member which tend to cause corona adjacent to said end frame member, a shield consisting of an insulated metallic member disposed adjacent the juncture of said windings and said core and located between said windings and said end frame member to collect and distribute the potential stress existing between said windings and said end frame member to prevent corona adjacent to said end frame member, and means to connect said shield to ground potential.

5. In a core form transformer having a magnetic core, end frames, pressure plates and windings, said windings being subjected to high potentials in operation, in combination, a shield consisting of an insulated metallic member disposed around the periphery of the pressure plates near the edges of said core and end frame where the dielectric stress builds up, to collect and distribute the dielectric stress to prevent corona and a ground means connected to said shield to cooperate in the distribution of the dielectric stress.

6. In a transformer having a magnetic core, electrical windings associated with said core to which high potentials are applied in operation, said windings and said core being so related that corona tends to take place at the extremities of said core, a shield located adjacent to the extremities of said core and so disposed relative to said windings as to collect and distribute the potential stress between said winding and said core and prevent corona adjacent to said core, and means connecting said shield to ground potential.

7. In a transformer having a magnetic core, electrical windings associated with said core to which high potentials are applied during operation, end frame members located adjacent to said core and windings in such relationship that corona tends to take place adjacent to said end frame members and said core, an insulated shield disposed between said coil and end frame members and adjacent to the edges of said core to collect and distribute the potential stress and prevent corona adjacent to said end frame members and adjacent to said core, said shield comprising a cylindrical, insulated conducting member, and means for connecting said shield to ground potential.

8. In a transformer having a magnetic core, electrical windings associated with said core to which high potentials are applied during operation, end frame members located adjacent to said core and windings in such relationship that corona tends to take place adjacent to said end frame members and said core, an insulated shield disposed between said coil and end frame members and adjacent to the edges of said core to collect and distribute the potential stress and prevent corona adjacent to said end frame members and to said core, said shield comprising a cylindrical and insulated conducting rod, and means for connecting said shield to ground potential.

9. In a transformer having a magnetic core, electrical windings associated with said core to which high potentials are applied during operation, end frame members located adjacent to said core and windings in such relationship that corona tends to take place adjacent to said end frame members and said core, an insulated shield

4

disposed between said coil and end frame members and adjacent to the edges of said core to collect and distribute the potential stress and prevent corona adjacent to said end frame members and adjacent to said core, said shield comprising a cylindrical and insulated conducting hollow tubing, and means for connecting said shield to ground potential.

10. In a transformer having a magnetic core, electrical windings associated with said core to which high potentials are applied during operation, end frame members located adjacent to said core and windings in such relationship that corona tends to take place adjacent to said end frame members and said core, an insulated shield disposed between said coil and end frame members and adjacent to the edges of said core to collect and distribute the potential stress and prevent corona adjacent to said end frame members and adjacent to said core, said shield comprising an insulated cylindrical conducting member, said shield being of such diameter as to reduce the dielectric stress below the corona point, and means for connecting said shield to ground potential.

11. In a corona shield for shell form type transformer having a magnetic core of the shell form type and windings inductively disposed thereon which are subjected to high potentials during operation, the combination comprising a cylindrical, metallic, conducting member disposed in the V-notch which defines the junction of said core and windings to follow the contours of the edges of said magnetic core to distribute the dielectric stress between said windings and said core which builds up at the edges of said core and to prevent corona at the edges of said core, insulation covering said member, the ends of said member being insulated from each other to prevent an electrical short between portions of said core, and means for connecting said member to said core.

12. In a corona shield for shell form type transformer having a magnetic core of the shell form type and windings inductively disposed thereon which are subjected to high potentials during operation, the combination comprising a cylindrical, metallic, conducting member disposed in the V-notch which defines the junction of said core and windings to follow the contours of the edges of said magnetic core to distribute the dielectric stress between said windings and said core which builds up at the edges of said core and to prevent corona at the edges of said core, the diameter of said member being sufficient to reduce the dielectric stress below the corona point, insulation covering said member, the ends of said member being insulated from each other to prevent an electrical short between portions of said core, and means for connecting said member to said core.

13. In a corona shield for shell form type transformer having a magnetic core of the shell form type and windings inductively disposed thereon which are subjected to high potentials during operation, the combination comprising a metallic, conducting rod having a substantially circular cross-section disposed in the V-notch which defines the junction of said core and windings to follow the contours of the edges of said magnetic core to distribute the dielectric stress between said windings and said core which builds up at the edges of said core and to prevent corona at the edges of said core, insulation covering said rod, the ends of said rod being insulated from each other to prevent an electrical short between portions of said core, and means for connecting said rod to said core.

14. In a corona shield for shell form type transformer having a magnetic core of the shell form type and windings inductively disposed thereon which are subjected to high potentials during operation, the combination comprising a metallic, conducting rod having a substantially circular cross-section disposed in the V-notch which defines the junction of said core and windings to follow the contours of the edges of said magnetic

5

core to distribute the dielectric stress between said windings and said core which builds up at the edges of said core and to prevent corona at the edges of said core, the diameter of said rod being sufficient to reduce the dielectric stress below the corona point, insulation covering said rod, the ends of said rod being insulated from each other to prevent an electrical short between portions of said core, and means for connecting said rod to said core.

15. In a corona shield for shell form type transformer having a magnetic core of the shell form type and windings inductively disposed thereon which are subjected to high potentials during operation, the combination comprising a metallic, conducting tube having a substantially circular cross-section disposed in the V-notch which defines the junction of said core and windings to follow the contours of the edges of said magnetic core to distribute the dielectric stress between said windings and said core which builds up at the edges of said core and to prevent corona at the edges of said core, insulation covering said tube, the ends of said tube being insulated from each other to prevent an electrical short between portions of said core, and means for connecting said tube to said core.

16. In a corona shield for shell form type transformer having a magnetic core of the shell form type and windings inductively disposed thereon which are subjected to high potentials during operation, the combination comprising a metallic, conducting tube having a substantially circular cross-section disposed in the V-notch which defines the junction of said core and windings to follow the contours of the edges of said magnetic core to distribute the dielectric stress between said windings and said core which builds up at the edges of said core and to prevent corona at the edges of said core, the diameter of said tube being sufficient to reduce the dielectric stress below the corona point, insulation covering said tube, the ends of said tube being insulated from each other to prevent an electrical short between portions of said core, and means for connecting said tube to said core.

17. In a corona shield for a core form type transformer having a magnetic core of the core form type and windings inductively disposed thereon which are subjected to high potentials during operation, the combination comprising, pressure plates disposed above and below said windings between said windings and said core, a cylindrical, metallic, conducting member disposed to follow the periphery of at least one of said plates to distribute the dielectric stress between said windings and said core

6

which builds up at the edges of said core and said plates and to prevent corona at said edges, insulation covering said member, the ends of said member being insulated from each other to prevent an electrical short between portions of said core, and means for connecting said member to said core.

18. In a corona shield for a core form type transformer having a magnetic core of the core form type and windings inductively disposed thereon which are subjected to high potentials during operation, the combination comprising, pressure plates disposed above and below said windings between said windings and said core, a metallic, conducting rod having a substantially circular cross-section disposed to follow the periphery of at least one of said plates to distribute the dielectric stress between said windings and said core which builds up at the edges of said core and said plates and to prevent corona at said edges, insulation covering said rod, the ends of said rod being insulated from each other to prevent an electrical short between portions of said core, and means for connecting said rod to said core.

19. In a corona shield for a core form type transformer having a magnetic core of the core form type and windings inductively disposed thereon which are subjected to high potentials during operation, the combination comprising, pressure plates disposed above and below said windings between said windings and said core, a metallic, conducting tube having a substantially circular cross-section disposed to follow the periphery of at least one of said plates to distribute the dielectric stress between said windings and said core which builds up at the edges of said core and said plates and to prevent corona at said edges, insulation covering said tube, the ends of said tube being insulated from each other to prevent an electrical short between portions of said core, and means for connecting said tube to said core.

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