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COIL CASING COMPRISING INTERCONNECTING SHELLS

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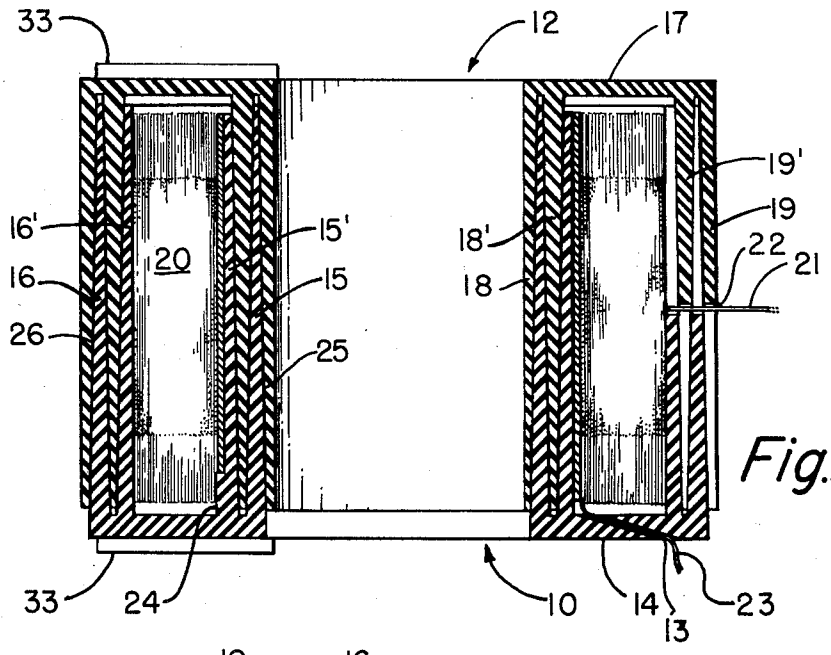


Fig.1

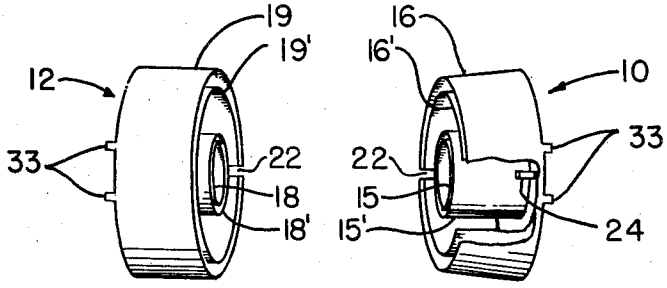


Fig. 2

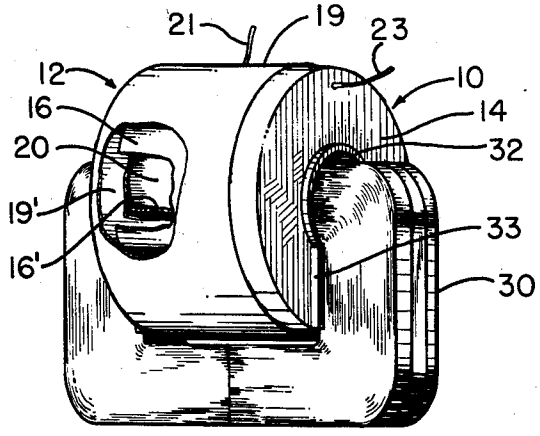


Fig. 3

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COIL CASING COMPRISING INTERCONNECTING SHELLS

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This invention relates to electrical apparatus and more particularly to a high voltage insulating barrier.

In high voltage transformers one method heretofore commonly used to insulate the secondary coil of the transformer is to mount it on a tube of insulating material near the center thereof, with a primary coil carried within said tube. The insulating tube, with the secondary coil carried around it and the primary coil carried within it, is mounted on a leg of the transformer core and the entire assembly is immersed in a bath of insulating oil. In this manner, the thickness of the insulating tube provides an insulating barrier between the two coils, and the portions of the tube projecting outwardly from either side of the secondary coil provide an extended surface insulation path to the grounded core and the low voltage primary coil. The insulating oil bath filling the space between the secondary coil and the core provides the necessary insulation between said coil and the core. As will be apparent, to provide adequate insulating thicknesses and surface insulation paths of adequate length in this type of construction, it is necessary to employ a transformer core having a large window. This requires the core legs to have excessive lengths, which thus renders such construction relatively expensive, and necessitates the use of a large, cumbersome transformer housing.

It is thus the general object of this invention to provide an insulating barrier for a high voltage coil which will overcome the disadvantages described above. More specifically, it is an object of this invention to provide an insulating barrier for a high voltage coil which will have a high dielectric strength, and which will be of compact size while still providing substantial insulating thicknesses and relatively long surface insulation paths. It is still a further object of this invention to provide such an insulating barrier which can be easily manufactured from inexpensive plastic material, and which can be quickly and easily mounted around a high voltage coil.

In accordance with one form of the invention, there is provided a pair of mating shells of insulating material, each of which comprises an annular web interconnecting a plurality of rims extending axially outwardly from one face of said web. The rims have diameters which permit the two shells to be inserted one within the other in opposed relationship. In this opposed relationship, the shells define an enclosed annulus for encasing a high voltage coil to insulate said coil from the associated electrical components with which it may be employed, as the primary coil and core of a high voltage transformer. Desirably, the walls of the shell rims abut each other in interfitting engagement to releasably retain the shells in their opposed relationship.

Other objects and features of the invention will become apparent from the more detailed description which follows and from the accompanying drawing, in which:

FIG. 1 is a transverse cross-sectional view of an insulating barrier embodying the invention, and showing a high voltage coil carried therein:

FIG. 2 is an exploded isometric view of the insulating barrier shown in FIG. 1, but with portions thereof broken away; and

FIG. 3 is an isometric view of the insulating barrier shown in FIG. 1, with portions of said barrier broken

away, and showing said barrier in association with a transformer core and coil assembly.

My invention comprises an insulating barrier for a high voltage coil and includes a pair of mating shells **10** and **12**. Conveniently, the shells **10** and **12** may be molded from a plastic insulating material having a high dielectric strength, for example, polyethylene, polypropylene, or the like. In the embodiment illustrated in FIGS. 1 and 2, the shell **10** includes an annular web **14** integrally connected to an inner pair of cylindrical rims **15** and **15'** projecting axially from the inner edge of the web **14**, and an outer pair of cylindrical rims **16** and **16'** projecting axially from the outer edge of the web **14**. Likewise, the shell **12** includes an annular web **17** interconnecting an inner pair of cylindrical rims **18** and **18'** projecting axially from the inner edge of said web, and an outer pair of cylindrical rims **19** and **19'** projecting axially from the outer edge of the web **17**. Desirably, the pairs of rims on both shells **10** and **12** have the same axial lengths, and their webs **14** and **17** have substantially equal radii.

As shown in FIG. 1, the rims are spaced from the common axis of the two shells to permit said rims to be received one over the other in an interleaved relationship, so that the shells **10** and **12** define an enclosed annulus which will encase a high voltage coil **20**. It is of course necessary that the coil connecting wires **21** and **23** project outwarly through the barrier. Accordingly, each of said coil wires may project through a small opening formed in one of the shell webs, as illustrated at **13**; or alternatively, the rims on the shells may be provided with notches, as illustrated at **22**, which will overlap when the shells are assembled in their opposed relationship to provide a small wire-carrying opening. Conveniently, a riser **24** may be formed on the inner face of the rim **15'** for reception in a mating depression in the coil **20** to prevent said coil from rotating within said barrier and thus disconnecting the terminal connections of the wires **21** and **23**.

When the rims on the shells **10** and **12** are interleaved their axially extending faces abut each other and frictionally retain the shells in interfitting opposed relationship. As shown in FIG. 1, the faces of the rims on one or both of the shells **10** and **12** may be tapered, as at **25** and **26**, to enhance the frictional engagement of the rims and insure retention of the shells in interfitting engagement. More importantly, however, such a tapered rim configuration provides a greater insulating effectiveness for any given thickness of overlapping rims than if the individual overlapping rims had uniform thicknesses.

Present day molding techniques preclude the use of insulating plastic material to form thick walled shell webs and rims. If the shell walls are molded to a thickness in excess of about one-quarter of an inch, air pockets may be formed in the plastic which reduce its effective insulating thickness, and because of their small dielectric strength, such air pockets form internal spark gaps within the plastic. Sparking across air pockets causes the plastic material surrounding them to erode, resulting in a further reduction in insulating thickness, and eventually resulting in a puncture extending completely through the plastic destroying its effectiveness as an insulating barrier.

Thus, when the shells are formed as plastic moldings, the thicknesses of their walls becomes a limiting factor, and it is desirable to form the shells with rims and webs having wall thicknesses in the range of from about one thirty-second of an inch to one-quarter of an inch. When the barrier is to be used with a coil operating at a voltage higher than that which a single wall of insulation can protect against, it is necessary to employ shells having pluralities of rims at the inner and outer circumferences of their webs. The use of shells having such plu-

ralities of rims also provides an insulating barrier with spark paths of extended lengths. The embodiment of my invention illustrated in the drawings shows a barrier employing such pluralities of rims in which each of the shells has a pair of rims at both the inner and outer edges of its web, with the outer pairs of rims **16** and **16'** and **19** and **19'** interleaved to form an insulating thickness extending around the outer periphery of the coil **20**, and the inner pairs of rims **15** and **15'** and **18** and **18'** interleaved to form an insulating thickness extending around the inner periphery of the coil. This interleaving arrangement of my shell rims also provides long surface insulation paths. As will be apparent from FIG. 1, any surface-tracking spark from the coil **20** has to follow a sinuous path along the mating surfaces of the interleaving rims on the two shells.

These annular insulating thicknesses and spark path lengths defined by the shell rims may be increased or decreased by the number of rims formed on the shells. However, to provide the necessary insulating thicknesses at the shell webs, it may be necessary to employ more than two shells. Where more than two shells are employed, they are nested together with their rims disposed one over the other in overlapping relationship in the same manner as shown in the drawings. The use of such additional shells will also necessarily increase the annular insulating thicknesses and spark path lengths defined by the shell rims. However, it is to be understood that any desired number of rims may be formed at the inner and outer edges of the shell webs and that any number of shells greater than two may be employed without departing from the scope of my invention.

In FIG. 3, my insulating barrier is shown in association with a transformer core **30** and a primary low voltage coil **32**. The configuration of my barrier is such that the coil **32** may be received in the axially extending opening defined by the inner pairs of shell rims, and the coil **32** with the surrounding insulating barrier containing the secondary coil **20** may thus be disposed around one leg of the core **30**. The interleaving shell rims provide an insulating thickness insulating the secondary coil **20** carried within the shells from the primary coil **32** and from the adjacent legs of the core **30**. Conveniently, to prevent rotation of the barrier on the core **30**, each of the shell webs **14** and **17** may be provided on its outer face with a pair of parallel ribs **33** which abut the side faces of one of the core legs adjacent the leg upon which the barrier is carried.

It is to be understood that it is still contemplated that the assembly shown in FIG. 3 is to be immersed in a bath of insulating oil, and that the interfitting relationship of the shells **10** ad **12** will allow the oil to fill the voids between said shells and the coil carried within them.

I claim:

1. An insulating barrier for a high voltage coil, comprising a pair of shells formed of an insulating material and defining an enclosed annulus for encasing a high voltage coil, each of said shells comprising an annular web interconnecting a plurality of rims projecting axially of said web, said shells being disposed in opposed relationship with their rims overlapping each other.

2. An insulating barrier as set forth in claim 1 in which the faces of the rims on said shells are adapted to mate with each other.

3. An insulating barrier as set forth in claim 1 in which the faces of the rims on said shells are provided with mating tapers.

4. An insulating barrier as set forth in claim 1 in which at least one of said shells has a plurality of said rims adjacent the outer peripheral edge of its web, and the rims on said shells adjacent their outer peripheral edges are interleaved.

5. An insulating barrier as set forth in claim 1 in which at least one of said shells has a plurality of said rims adjacent the inner peripheral edge of its web, and the rims on said shells adjacent their inner peripheral edges are interleaved.

6. An insulating barrier as set forth in claim 1 in which each of said shells has a plurality of said rims adjacent the inner peripheral edge of its web and a plurality of said rims adjacent the outer peripheral edge of its web, and the rims on said shells are interleaved.

7. An insulating barrier for a high voltage coil, comprising a pair of shells formed of a plastic insulating material and defining an enclosed annulus for encasing a high voltage coil, each of said shells comprising an annular web interconnecting a plurality of concentric rims projecting axially from the inner and outer peripheral edges of said web, the rims on said pair of shells being interleaved in frictional engagement with each other for releasably retaining said shells joined together in opposed relationship, and means on at least one of said shells lockingly engageable with a coil carried in said barrier for retaining said coil in a fixed angular position about the axis of the barrier.

8. An insulating barrier for a high voltage coil, comprising a pair of shells formed of a plastic insulating material and defining an enclosed annulus for encasing a high voltage coil, each of said shells comprising an annular web interconnecting a plurality of concentric rims projecting axially from the inner and outer peripheral edges of said web, the rims on said pair of shells being interleaved in frictional engagement with each other for releasably retaining said shells joined together in opposed relationship, and means on the outer face of at least one of said shells lockingly engageable with a transformer core for retaining said barrier in a fixed position thereon.

9. An insulating barrier for a high voltage coil, comprising a pair of shells formed from a plastic insulating material and defining an enclosed annulus for encasing a high voltage coil and for reception on the leg of a core, each of said shells comprising an annular web having one or more concentric rims projecting axially from its outer peripheral edge and one or more concentric rims projecting axially from its inner peripheral edge, the rims on said pair of shells being interleaved in frictional engagement with each other for releasably retaining said shells joined together around said coil, at least one of said rims being engageable with said coil and having a riser lockingly engageable with said coil for retaining said coil from rotation within said barrier, and a pair of parallel ribs formed on the outwardly presented faces of said webs, whereby the rims adjacent the inner edges of the webs will support the barrier on said core leg and said ribs will engage an adjacent pair of core legs for retaining said barrier in a fixed position on said core.

10. An insulating barrier for a high voltage coil, comprising a pair of shells formed of a plastic insulating material and defining an enclosed annulus for encasing a high voltage coil, each of said shells comprising an annular web interconnecting a plurality of concentric rims projecting axially from the inner and outer peripheral edges of said web, the faces of the rims on said pair of shells frictionally engaging each other to releasably retain said shells joined together in opposed relationship.

11. An insulating barrier for a high voltage coil, comprising a plurality of shells formed of plastic insulating material and defining an enclosed annulus for a high voltage coil, each of said shells comprising an annular web interconnecting a plurality of rims projecting axially of said web, said shells being disposed in opposed relationships with their rims overlapping each other.

12. An insulating barrier for a high voltage coil, comprising a pair of shells formed of an insulating material and defining an enclosed annulus for encasing a high voltage coil, each of said shells comprising an annular web interconnecting a plurality of rims projecting axially of said web, said shells being disposed in opposed relationship with their rims overlapping each other, and at least

one of said shells being provided with one or more openings through which the connecting wires for said coil may extend.

13. An insulating barrier for a high voltage coil, comprising a pair of shells formed of an insulating material and defining an enclosed annulus for encasing a high voltage coil, each of said shells comprising an annular web interconnecting a plurality of rims projecting axially of said web, said shells being disposed in opposed relationship with their rims overlapping each other, and the rims on said shells being provided with elongated slots operatively associated with each other when said rims are in

their overlapping relationship to define one or more openings through which the connecting wires for said coil may extend.

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