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E. C. ILKER ET AL

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TRANSFORMER BUSHING

Filed May 30, 1944

Fig. 1

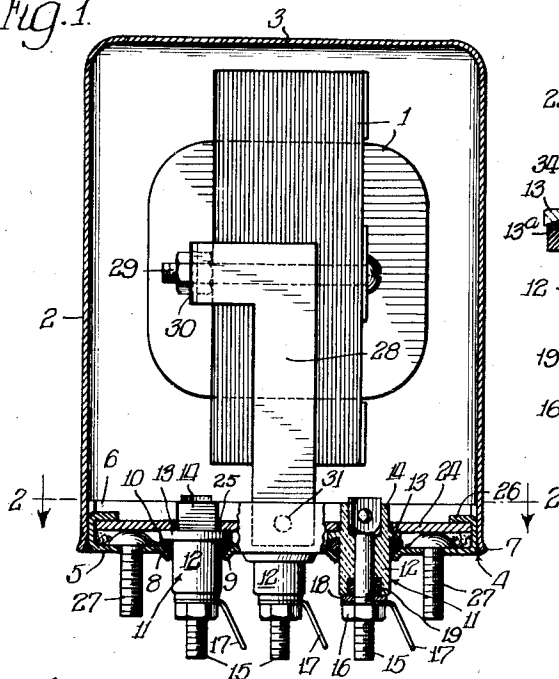


Fig. 3

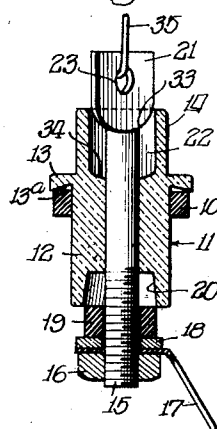


Fig. 5

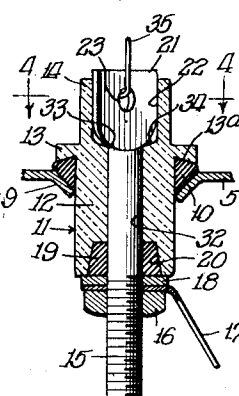


Fig. 4

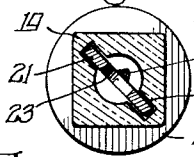


Fig. 2

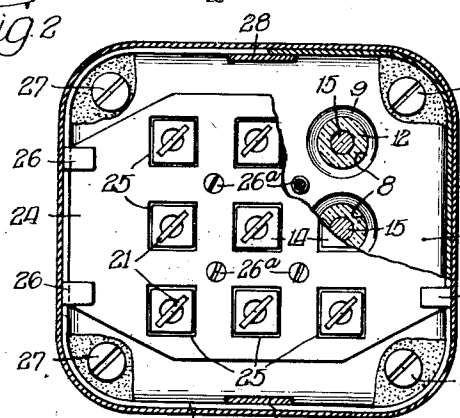


Fig. 6

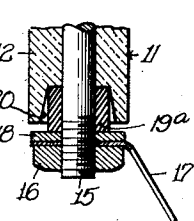


Fig. 7

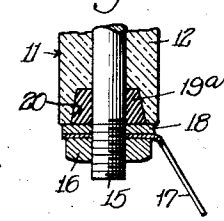


Fig. 8

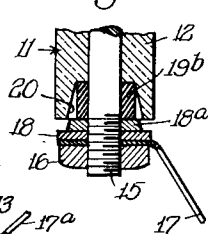


Fig. 9

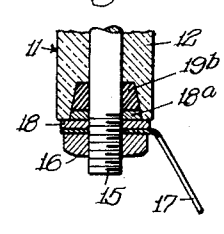


Fig. 10

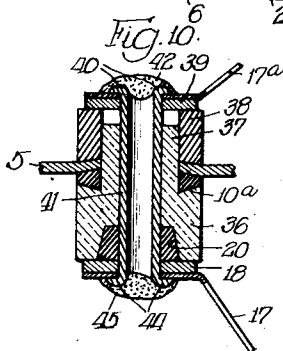
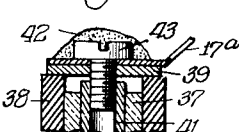


Fig. 11



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TRANSFORMER BUSHING

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1 Claim. (Cl. 174—153)

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The present invention relates to an insulating bushing for electrical connectors or binding posts.

In certain electrical devices, such as transformers, or the like, it is necessary that the devices be hermetically sealed, as when used in war planes which operate in widely changing temperatures and atmospheric pressures. The conductors for such devices must pass through insulation to the exterior for connection to other parts of the electrical circuit. There must be a good seal between the conducting element and the insulator, and between the insulator and the housing of the device, as a wall portion thereof, where the conductors pass through.

Among the objects of the invention is to provide a novel electrical insulating bushing, which may be of one piece or of two pieces as herein disclosed, in hermetically sealed relationship, as by way of a gasket composed of suitable material, with the bushing and the wall, as an end wall part or portion, of the casing or housing for the transformer; and also such a bushing with a gasket provided in a well formed in an end portion of the bushing where the gasket will be pressed in sealed engagement with the conducting terminal extending through the bushing and the wall of the well of the bushing; and also the provision of any of such bushing and sealing means with a backing plate for holding the bushing and the sealing means to the wall portion of the housing. Either or both of such novel means are particularly adapted for use with a non-rotatable type of insulator bushing and terminal. Also, the invention comprehends the provision of the one piece type of insulator bushing with means for preventing relative rotation of the conducting terminal and the bushing, as by providing the bushing with a transverse slot or the like and the terminal with a flat end head to fit into the slot.

The flat end head part may have a hole for facilitating the making of a solder joint with a wire connected to the flat end head, so that the latter with the wire and the solder may be drawn into the slot in the insulator bushing to further effect a tight assembly.

A further object of the invention is to provide a novel structure having the externally round or cylindrical shank portion of the insulator or bushing separated from the non-circular, such as square in cross section, portion of the insulator bushing, by a preferably integral annular shoulder or collar. An annular gasket is placed over the cylindrical portion and in contact with the annular flange or collar portion, and then

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the cylindrical portion is inserted through a hole in the housing to bring the gasket in contact with the wall of the housing around the hole therein. By pressing against the other side of the shoulder or collar a tight connection will be established between the insulator bushing and the housing. The contacting parts of the collar and the housing wall with the gasket are preferably inclined so as to press the gasket componently with a firm sealing contact with the bushing and the housing wall surrounding the opening or hole through which the bushing extends.

Another object of the invention is to provide a novel structure comprising a two-piece insulating bushing in which the parts are telescopically connected, as by a conducting terminal extending through them and headed to hold the parts together and against the opposite sides of the housing wall with a sealing means, as a gasket pressed between the shoulder part of one of the pieces of the bushing and the housing wall where the bushing extends through said wall, the shoulder part being preferably formed with an inclined or sloping face to enhance the pressing of the gasket against the bushing and to the housing wall to form an efficient sealing between the bushing and the housing wall. This type of bushing also has a well at its outer end with a sealing gasket in and around the conducting terminal, as in the cases referred to above.

Other objects, advantages, capabilities, features, and the like, are comprehended by the invention as will later appear and as are inherently possessed by the invention.

Referring to the drawings:

Figure 1 is a longitudinal sectional view with parts shown in elevation of a device embodying the invention;

Figure 2 is a transverse sectional view taken in a plane represented by line 2—2 in Figure 1 of the drawings;

Figure 3 is a longitudinal sectional view of an insulator bushing and terminal assembly constructed in accordance with the invention;

Figure 4 is a transverse sectional view taken in a plane represented by line 4—4 in Figure 5 of the drawings;

Figure 5 is a longitudinal sectional view of the bushing and terminal assembly in finished condition;

Figures 6 and 7 are fragmentary sectional views of an end portion of the bushing and terminal in different stages of assembly;

Figures 8 and 9 are similar views of an alternative form;

Figure 10 is a longitudinal sectional view of an alternative form of bushing and terminal assembly; and

Figure 11 is a fragmentary sectional view of an alternative form of part of the devices shown in Figure 10.

Referring more in detail to the drawings, the embodiments chosen to illustrate the invention are shown with a transformer 1 in a housing 2 having a closed end wall 3 and an open end 4, all parts being within the side wall or the side wall extended of the housing 2. Closing the open end 4 of the housing 2 is an end wall portion 5 having a peripheral flange 6 extending inwardly of the housing 2 and fitting within the open end 4, with the outer face of the end wall portion 5 substantially flush with or in the plane of the edge 7 of the open end portion 4 of the housing 2. The edge 7 is preferably flared to afford space for directly applying solder between the end portion 4 and the flange 6 to effect a hermetical seal therebetween.

The end wall portion 5 is provided with a plurality of round or circular holes 8 and with annular flared rims 9 which form inclined seats for the seating of the gaskets or sealing rings 10. Extending through each hole 8 is an insulator or bushing 11 having a round or cylindrical shank 12, an integral annular collar or flange 13, and an integral non-circular, such as square, head 14. The collar 13 preferably has an inclined wall 13a for retaining the gasket in sealing relation to the inclined rim 9 and the shank 12 of the insulator bushing 11. Extending longitudinally through the connector 11 is a conducting terminal 15 which is threaded in part to receive a binding nut 16 for clamping a solder lug 17 and a thrust washer 18, the latter for pressing a gasket or sealing ring 19 into a socket or well 20 provided in the outer end portion of the bushing 11. The inner side wall of this well is preferably inclined. The other end of the terminal 15 is provided with a flat end head 21 adapted to fit into a slot 22 provided, preferably diagonally, in the head 14, so as to prevent the rotating of the element 15 when the nut 16 is turned, yet to permit longitudinal or axial movement of the element 15 when desired. The head 21 is preferably provided with a hole 23 for the passage of an end of a conductor or wire 35 (Figs. 3 and 5) running from the transformer 1.

For the purpose of holding the bushings 11 in proper relation and in sealed condition to the wall portion 5 the invention comprehends the provision of a retaining plate 24 provided with a plurality of non-circular, such as square, holes 25, corresponding in position and number with the round or circular holes 8 in the wall portion 5, for the extending through said holes 25 of the heads 14. By fitting the square heads 14 in the square holes 25 turning of the bushings 11 will be prevented when the nut 16 is turned. The retaining plate 24 is disposed parallel to the wall portion 5 with the collars or flanges 13 of the bushings abutting the plate 24 and the gaskets or sealing rings 10 being pressed in sealing condition between the surfaces 13a of the collars or flanges 13 and the rims 9 of the holes 8 in the plate 5. The surfaces 13a and the rims 9 may be inclined when desired. The retaining plate 24 is held pressed against the collars or flanges 13 by suitable connecting and anchoring means, such as struck-out tongues or lugs 26, rigid with the wall portion 5 and hooked over the ends of the plate 24, as shown in Figures 1 and 2, or by suitable connecting elements such as rivets or

screws with nuts 26a extending through the plate 24 and fixed to the wall 5.

The wall part 5 may be provided with suitable securing elements 27, such as screws, bolts, or the like, for connecting the unit in place.

The transformer 1 may be connected to and supported by the end wall part 5 by way of brackets 28 located at the sides of the transformer 1 and connected to the transformer by suitable bolts 29 extending through a part of the transformer body and through toe parts 30 of the brackets 28. The outer end of the brackets 28 are preferably secured, as by spot welding, as loci 31 to the flange 6 of the wall part 5. This provides for a rigid support for the transformer 1.

Referring particularly to Figures 3, 4 and 5, the insulator bushing 11 is shown as provided with a longitudinal bore 33 through which the conducting element or terminal 15 extends, the outer end portion of the element 15 being threaded to receive a nut 16, and the inner end of the element 15 having the flat end head 21 integral therewith and capable of being drawn from the position shown in Figure 3 into the diagonal slot 22 as shown in Figure 5, whereby a shoulder part 33 of the flat end head 21 will seat or abut against the bottom or seat 34 of the slot or recess 22. The inner end of the bore 32 (see Figure 4) is sufficiently large for the entry of the part of the wire 35 soldered to the flat end head 21 as also the solder itself.

At the other end, as the nut 16 is tightened on the threaded part of the terminal 15, it draws the terminal from the relation shown in Figure 3 to that shown in Figure 5, and incidentally the gasket or sealing ring 19 is forced into the socket or well 20, the thrust washer 18 pressing against the sealing ring 19. This ring 19 seals the terminal 15 and the insulator bushing 11 against the passage of any fluid, whether air, gas or liquid, to and along the terminal 15.

Referring to Figures 6, 7, 8 and 9, it will be seen that a long gasket 19a may be used (see Figures 6 and 7), which may be of more or less stiff or firm material, and which when it is forced into the well 20 by the thrust washer 19 it will fill the well 20 and be firmly pressed with sealing engagement with the terminal 15, the bottom of the well 20, and the inside wall of the well, as shown in Figure 7; and that a short gasket 19b may be used (see Figures 8 and 9), which may be of more or less soft or pliant material, and which when forced into the well 20 has a pressing washer or the like 18a of a size to enter into the well 20 and close it against the escape of the material of the gasket 19b, when the nut 16 is tightened against the solder lug 17 and the washer 18, the latter pressing the washer 18a, as above described, whereby the gasket 19b is pressed into the well 20 to be firmly held therein with sealing engagement with the terminal 15, the bottom of the well 20, and the inside inclined wall of the well, as shown in Figure 9.

When the bushings 11 are in place the retaining plate presses against the collars or flanges 13 which in turn press against the gaskets or sealing rings 10 which in turn are pressed and sealed against the inclined rims 9 around the holes 8 in the wall part 5. Thus passage of fluid, whether air, gas or liquid, is prevented between the bushing 11 and the wall part 5.

Referring to Figure 10, a two-piece insulator bushing is shown comprising a body portion 36 having a reduced diameter portion 37 for extending through a hole in the wall part 5, shoulder

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38 being provided at the inner end of the bushing portion 36, as shown, the surface of the shoulder being preferably inclined, as shown, so as to componently press the gasket 10a with a sealing contact with the extension 37. The rim portion 9 of the wall 5 may also be flared, if desired, and as shown in Figure 10, to also componently press the gasket 10a with its sealing contact with the extension 37, as also to press firmly against the shoulder 37 and the flared part 9 for an effective sealing effect. On the opposite side of the wall part 5 and rim 9 and fitting over the bushing part 37 is an insulating shoulder 38 pressed against the rim 9, as by a washer 39, which in turn is pressed against the shoulder 38 by a spun over end portion 40 of a conducting terminal 41 which may be in the form of a long hollow rivet or the like and extending through the bushing 36—37. A solder lug 17a may be interposed between the washer 39 and the rivet head 10. Also, solder 42 may be applied to fix the parts 40, 17a and 39 together and also to close and seal the terminal 41, as shown in Figure 10. In lieu of spinning over the end of the terminal 41, a binding screw 43 (see Figure 11), threaded into the end of the extension 37, may be used, and as is clearly shown in Figure 11. Solder 42 may also be applied to the screw 43 and parts 17 and 39 to fix them together.

The other end of the bushing 36 has a well 23 with a gasket 19 held in compressed condition by a washer 18, as in the forms shown in Figures 1, 3 and 5, but in lieu of the nut 16 the washer 18, as also the solder lug 17, are held in place by a spun over end portion 44 of the terminal 41. Solder 45 is applied to fix the parts 44, 17 and 18 together and to close and seal the end of the terminal 41.

While we have herein described and upon the drawings shown illustrative embodiments of the invention, it is to be understood that the invention is not limited thereto but comprehends other constructions, details, arrangements of parts, features, and the like, without departing from the spirit of the invention.

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Having thus disclosed the invention, we claim:

In a transformer having a housing provided with an apertured wall part with an inclined rim; an electrical insulating seal comprising a cylindrical body portion of rigid insulating material extending through the aperture of said wall part, said body portion having a centrally disposed longitudinal bore therethrough and having an annular under cut shoulder overlapping the rim portion of the wall part about the aperture therein, said rim inclination and under-cut shoulder cooperating to produce an annular region having a generally wedge-shaped cross section with the widest part of the wedge being nearer the center, a sealing gasket of flexible insulating material around said body between said shoulder and rim portion, a conducting terminal extending in said bore through said insulating body, means on said terminal engaging one end of said insulating body for retaining said terminal in said body, a sealing gasket of flexible insulating material around said terminal and engaging the other end of said insulating body for sealing said terminal to said insulating body, and means for pressing said insulating body, terminal and apertured wall part together for sealing engagement.

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