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COMPOSITE CERAMIC AND METAL STRUCTURE AND METHOD OF MAKING THE SAME

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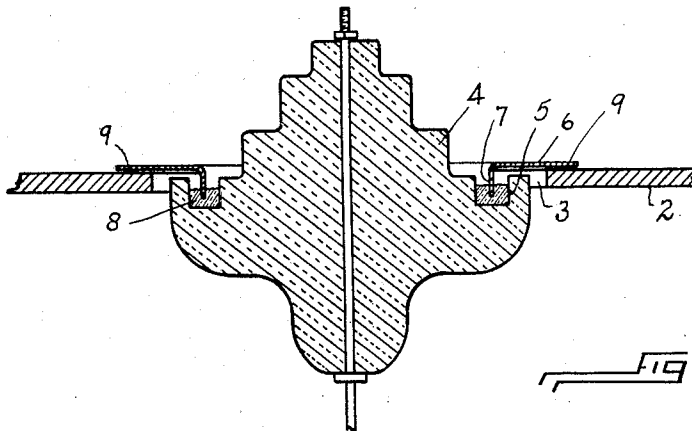


FIG. 1.

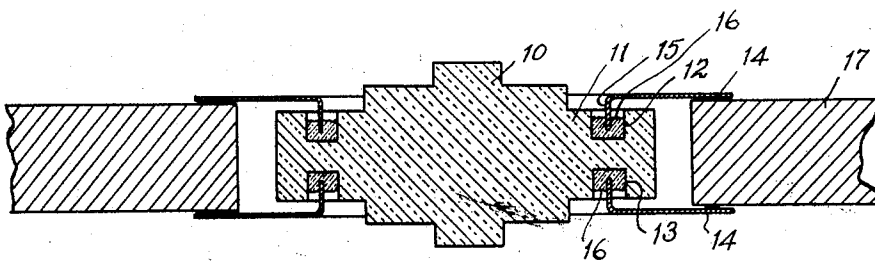


FIG. 2.

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COMPOSITE CERAMIC AND METAL STRUCTURE AND METHOD OF MAKING THE SAME

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Application August 2, 1940, Serial No. 349,875

1 Claim. (Cl. 174—152)

This invention pertains to composite ceramic and metal structures and to the method of making the same, and relates particularly to a structure and method wherein a mechanically strong and hermetically tight seal may be provided between the metal and ceramic parts.

In various types of apparatus, particularly electrical apparatus, it is desirable to have a ceramic body such as a porcelain insulator passing through a metal shell or plate and to have a hermetic seal between the two. For example, it is frequently desirable to mount a porcelain insulator in a metal shell such as a transformer shell and to have a hermetic seal between the two. While many attempts have heretofore been made to secure this result by some method of fusion, the results generally have not, prior to the present invention, been satisfactory because the joints failed to have the necessary mechanical strength.

According to the present invention it is contemplated that the body of ceramic material shall be provided with a trough. A flanged connecting member of metal has its flange received in this trough. A mass of glass is fused into the trough to join the ceramic body with the metal connecting piece. The metal connecting piece is then brazed or welded or otherwise secured to the metal structure in which the insulator or ceramic body is to be mounted. The metal connecting member is made of a metal whose coefficient of expansion is matched to that of the glass which is fused into the trough, and the glass is one which will "wet" and cling to the metal.

My invention may be more fully understood by reference to the accompanying drawing in which Figure 1 represents a section through a composite metal and ceramic structure constructed in accordance with my invention; and

Figure 2 is a similar view of a modified form of the invention.

In the drawing, 2 designates a portion of a metal structure as for example, a metal plate or a portion of a metal casing. The structure 2 may, for example, be a portion of a transformer casing or housing or a shell for enclosing some other electrical equipment. It is provided with an opening 3 through which passes a body of ceramic material such for example, as the insulator 4. The ceramic body 4 is provided with an annular groove or channel 5 therein. An annulus 6 having a depending flange 7 is positioned about the insulator 4 with the flange 7 projecting into the groove 5. In the groove 5 there is a mass of glass 8 which is fused to the flange 7 and fused to the walls of the groove of the in-

ulator. The connecting body 6 extends over the structure 2 and is welded or brazed or soldered or otherwise secured at 9 to the body 2.

The connecting piece 6 is of a metal which has a coefficient of thermal expansion which is matched to that of the glass 8 and which is of a character such that it will be wetted by the glass to form a strong union between the metal and the glass as well as a hermetically tight seal. One metal which may be used is a metal which is available commercially under the trade-mark "Kovar" and which is disclosed in United States patent to Howard Scott No. 1,942,260, and suitable glass for use with Kovar is well-known to the art. A low silicate glass is usually employed. Particular examples of metals and glasses are disclosed in my copending application Serial No. 129,881 filed March 9, 1937, now Letters Patent No. 2,220,690, and such metals and glasses are now well-known and commercially available in the art.

In constructing the assembly shown in Figure 1, the insulator is of course separately formed and the annulus 6 is separately formed. The glass may be put into the channel 5 and heated to the melting point. While the glass is soft, the annulus 6 is set into place. It may be allowed to sink by its own weight into the glass or pressure may be applied to force it into the glass. Heat is applied to the glass during the time that the two parts are being joined. The joint which is formed is an exceptionally strong one because any force exerted on the edge of the unsealed part of the metal body 6 is resolved into radial force on the projecting flange, and the joint between the glass and the flange is put under compression so that such forces do not tend to break or weaken the seal. Another advantage of this type of seal is that the glass is sealed on both sides of the metal flange 7. This makes a stronger joint than where the glass contacts only one surface of the metal, and it insures a hermetically tighter joint.

After the connecting annulus 6 has been secured to the insulator, the insulator may be set into the opening 3 in the plate 2 and the portion of the annulus which overlaps the plate or structure 2 can be soldered or welded directly to the metal 2 or otherwise joined to it. Since the coefficient of expansion of the metal 6 and the glass 8 are matched, the raising of the edge of the annulus 6 to a welding temperature progressively around the edge of the annulus does not crack or break the glass 8.

In the modification shown in Figure 2, the assembly is generally the same except that the

ceramic body is shown as having grooves in its opposite faces, and there are two connectors instead of one. This arrangement may be used where a mechanically stronger seal is necessary than that provided by the structure shown in Figure 1.

In the arrangement shown in Figure 2, the insulator or other ceramic body is designated generally as 10. It is provided with a projecting flange 11 having grooves 12 and 13 in the opposite faces thereof. Connectors 14 are provided on each face of the ceramic body similar to connector 6 of Figure 1, and these connectors have flanges 15 which project into the grooves 13. Glass 16 is fused into the grooves 12 and 13 in the manner hereinbefore described. The two annuli 14 may be welded in the manner described in connection with Figure 1 to a supporting structure 17 which may be of any suitable character but which is illustrated as comprising a thick single plate of metal.

In both forms of the invention, the insulator has a radially extended portion in which is an annular groove. The metal disk or diaphragm has an opening therein, with the insulator passing through the opening. The diaphragm has a flange portion surrounding said opening that projects into the annular groove and a body of glass integrates the diaphragm and insulator. The metal diaphragm extends peripherally beyond the insulator to provide a welding surface. The body of the diaphragm in effect forms a continuation of the radially extended portion of the insulator.

While I have illustrated certain specific embodiments of my invention, it will be understood that this is merely by way of illustration and that various changes and modifications may be made in the design and construction of the various parts depending upon the nature of the device in which the seal is to be incorporated, all within the contemplation of my invention and within the scope of the following claim.

10 I claim as my invention:

15 An insulator device for welded attachment in an opening in a metal wall, said device comprising an insulator body and an orificed diaphragm of weldable sheet metal, the insulator extending through the orifice in the diaphragm and having a radially extended circumferential portion thereon with the body of the diaphragm arranged to form an outwardly extending continuation of the said radially extended portion of the insulator, thereby providing a welding surface beyond the periphery of the insulator, said radially extended portion of the insulator having an annular groove in a radial face thereof, the groove being spaced inwardly from the periphery of the said radially extended portion, said diaphragm having a flange thereon normal to the plane of the body of the diaphragm about the orifice therein, with the edge of the flange being received in said groove, and a body of glass in the groove fused to the metal flange and to the insulator, the glass having a thermal coefficient of expansion matched to that of the flange.

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