June 25, 1946. S. H. STUPAKOFF 2,402,927

INSULATING SEAL

Filed June 6, 1942

Fig. 1.

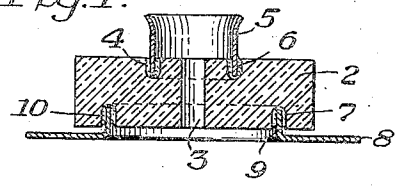


Fig. 2.

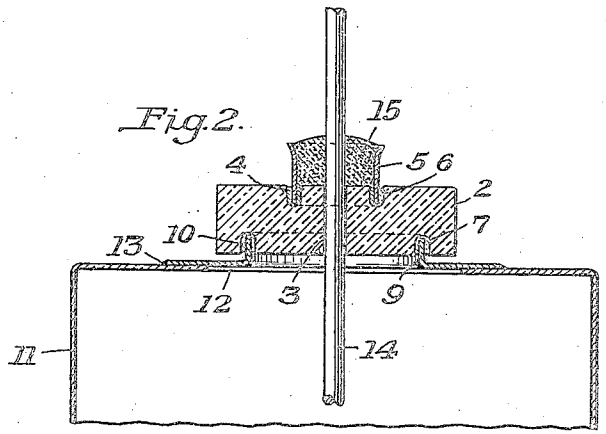


Fig. 4.

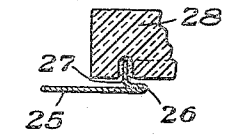


Fig. 3.

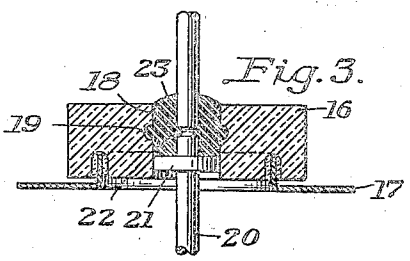
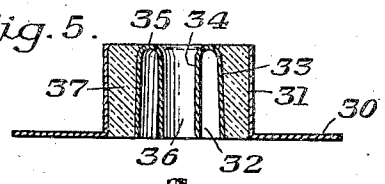


Fig. 5.



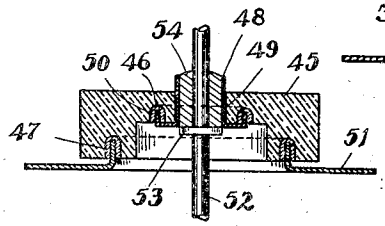
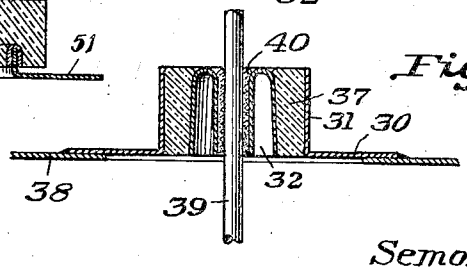


Fig. 7.

Fig. 6.



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INSULATING SEAL

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Application June 6, 1942, Serial No. 446,013

2 Claims. (Cl. 174—167)

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This invention relates to seals intended for use in various types of electrical apparatus wherein a wire or electrical conductor has to pass from the interior to the exterior of an enclosure and be electrically insulated from the enclosure.

The present invention may be explained in connection with electrical condensers or similar equipment in which there is a metal enclosing structure with an opening in one or more places therein through which a conductor must pass. It is desirable in many cases that the enclosing vessel be air-tight so that the condenser will not be affected by atmospheric moisture. In my copending applications Serial Nos. 349,875 now Patent No. 2,373,720, dated April 17, 1945, and 349,876, filed August 2, 1940, which has now issued as Patent No. 2,318,435, dated May 4, 1943, of which this application is a continuation in part, there are disclosed certain forms of seals applicable for the purpose of the present invention. It is contemplated that seals of the type disclosed in my said applications however, must be made in situ or if the seal is made at a point remote from the place where it is to be used the electrical conductor has to be mounted in the seal at the point where the seal is manufactured and the user of the seal has to make connections to this conductor. The present invention is designed to provide a seal which may be made up ready for use apart from the particular apparatus in connection with which it is to be used but with which the user may employ an electrical conductor which is sealed into place when the insulator is installed, thereby eliminating any necessity for a short separate conductor that has to be initially built into the seal itself.

According to the present invention there is provided an insulating seal which may be made up as a complete unit but can be readily installed on a condenser or other piece of electrical equipment with very little difficulty. The invention may be readily understood by reference to the accompanying drawing in which:

Figure 1 represents a section through a seal as it is made up ready for use;

Figure 2 is a view similar to Figure 1 showing the seal installed on a piece of electrical equipment;

Figure 3 is a view similar to Figure 2 of a slightly modified construction;

Figure 4 is a fragmentary sectional view of a modification which may be employed with the constructions illustrated in either Figure 1 or Figure 3;

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Figure 5 is a view similar to Figure 1 of another modification intended for use where a smaller body of insulation can be employed; and

Figure 6 is a view similar to Figure 2 showing the insulator of Figure 5 installed.

Figure 7 is a view similar to Fig. 1 showing a further modification.

Referring first to the construction shown in Figures 1 and 2, the seal comprises a body 2 of porcelain or ceramic insulating material. The body has a central hole 3' therethrough through which an electrical conductor may pass. In the outer surface of the insulator 2 surrounding the hole 3 is an annular groove 4. Set into this groove 4 is a metal ferrule 5. The ferrule 5 is sealed to the insulator 2 by a suitable bond. The bond preferably comprises a body of glass 6 within the groove 4, the metal 5 being of a character which will be wet by the glass, the glass and the ferrule having matched coefficients of thermal expansion. Any heating up of the ferrule 5 will therefore not disturb the glass 6. The glass 6 because it "wets" the metal will fuse to the metal and also to the porcelain or other refractory tube and thus form a permanent connection between the eyelet or ferrule and the body of the insulator.

In the opposite face of the body 2 is a similar annular groove 7. A metal base member in the form of a disk 8 is provided with a flange 9 that extends into the groove and a body of glass 10 in the groove similar to the glass in the groove 6 connects the metal to the insulator. The disk 8 is also preferably of a metal having its coefficient of thermal expansion matched to that of the glass.

Referring to Figure 2, 11 designates a metal shell or casing such as that used as a housing for a condenser. It is provided with an opening 12. The seal shown in Figure 1 is used by placing it over the opening 12, the size of the disk 8 being such that it will span the opening 12 and rest on the casing or receptable 11. The metal 8 may be brazed, welded or soldered to the casing 11 as indicated at 13. Due to the fact that the metal 8 has its coefficient of thermal expansion matched to that of the glass 10 the operation of brazing, welding or soldering will not cause the glass 10 to crack, even though the heat conducted to the body of the glass is substantial.

The electrical lead wire from the apparatus within the casing is designated 14. It passes through the central hole 3. When the assembly has been made the user flows a body of solder 15 into the eyelet or ferrule 5 around the conductor 14. This solder adheres to the ferrule and to

the conductor, forming a gas-tight seal and one which is mechanically strong. Because of the fact that the ferrule 5 has its coefficient of thermal expansion matched to that of the glass the introduction of hot solder does not injure the connection between the ferrule and the body of the insulator.

It will thus be seen that in commercial operations the insulating seals may be made up in quantities. They may be taken from stock as needed and used in making the assembly shown in Figure 2. The lead wire 14 is the customary lead wire which is provided in the electrical equipment and the simple operation of flowing the solder into the eyelet 5 forms a seal around the wire. The operation of brazing, soldering or welding the disk 8 to the casing is easily accomplished so that the whole operation of mounting the insulator and forming the seal in the finished equipment is very easily and quickly accomplished.

In the modification shown in Figure 3 the insulator is designated 16. A metal disk 17 is sealed to the under face of the insulator in the same way that the disk 8 of Figure 1 is sealed to the insulator. Instead however, of there being an eyelet as described in connection with Figure 1 the insulator has a relatively large central opening therein designated 18 and within this opening there is preferably an annular groove 19. The seal is used in the same way as the seal in Figure 1 by soldering, welding or brazing the disk 18 to the housing of the apparatus on which the insulator is to be mounted. The lead wire is designated 20. Fitted onto it and perhaps brazed or soldered in place is a disk or washer 21. The wire may also have an annular groove 22 therein. After the disk 17 has been secured to the metal shell on which it is to be mounted a body of plastic material 23 is filled into the opening 18. This will hold the conductor against endwise movement and will form a reasonably tight seal sufficient to prevent any substantial flow of atmospheric air through the seal. In the arrangement shown in Figure 4 the metal disk designated 25 and corresponding to the disk 8 of Figure 1 or the disk 17 of Figure 3 is folded upon itself as indicated at 26 and has a flange 27 that is sealed into the groove of the insulator 28 in the manner previously described. The fold at 26 takes care of much of the thermal expansion which occurs when the disk 25 is sealed to the metal shell or housing on which it is mounted, making it less imperative that the coefficient of expansion of the metal be matched equally to that of the glass.

In the modification shown in Figures 1 and 3 the insulator may be of substantial size. For applications where a relatively small mass of insulation is sufficient the arrangement shown in Figures 5 and 6 may be used. The seal shown in Figure 5 comprises a metal disk 30 having an upstanding flange 31 thereon. Concentrically positioned inside the flange 31 is a double-walled annulus or eyelet 32 having an outer portion 33 and an inner cylindrical portion 34, the two being connected by an end portion 35. The inner sleeve 34 provides a central opening 36 through which an electrical conductor may pass. The eyelet is secured in place inside the flange 31 by a body of glass 37, the coefficient of expansion of which is matched to that of the metal parts.

This seal is used in the same way as the one shown in Figure 1. The metal member 30 is set over the opening in the metal shell or receptacle 38 on which the insulator is mounted and the two are connected by soldering, brazing or welding, or by any like method. The conductor 39 passes through the central sleeve 34 and after the assembly has been made solder 40 is applied around the wire 39 at the outer end of the sleeve 34. This solder or molten metal 40 freezes to the conductor 39 and to the sleeve 34 forming a gas-tight seal. The body of glass 37 forms an insulator between the concentric metal parts. Due to the coefficient of expansion of the glass and of the metal in each instance being matched the heating of the metal parts for the application of solder or for the securing of the insulator to the metal shell on which it is mounted will not harm or detrimentally affect the seal.

The arrangement shown in Figure 7 is generally similar to that shown in Figure 1, except that the insulator 45 has concentric grooves 46 and 47 on the same face. The thimble 48 passes through the central hole 49 in the insulator and has a reversely turned flange 50. This flange is sealed with glass into the inner groove 46. The flanged mounting disk 51 has its flange sealed into the outer groove 47. The conductor 52 may be provided with a disk or fiber washer or like means 53 to prevent solder from flowing through the thimble. The mass of solder 54 forms the seal between the wire and the thimble, and as before indicated, may be applied after the assembly is otherwise complete. One advantage of this arrangement is that all molten glass is applied to the same side of the insulator, whereas with the arrangement shown in Figure 1, care must be taken to prevent the metal member on one side of the insulator from loosening due to possible softening of the glass when the other is being fused into place. Another advantage is the greater shock resistance of the thimble.

While I have referred especially to my invention as being applied to electrical condensers it will be understood that this is only by way of illustration and that the invention is applicable in any instance where a conductor must pass through a metal shell or support and be insulated therefrom. All of the materials employed are well known to the art and per se form no part of the present invention. My said applications above referred to disclose some of the materials which may be used. In all instances, a substantially gas-tight seal is easily and quickly provided. Also while I have illustrated and described certain specific embodiments of my invention it will be understood that these are for the purpose of illustration and that various changes and modifications may be made therein and that the invention is not restricted to the particular constructions specifically shown and described.

I claim:

1. An insulating seal comprising an integral body of insulating material having an opening therethrough, a double-wall metal annulus within the opening, the said metal annulus having an outer wall and an inner cylindrical wall, the outer wall being fused to the body of insulating material, the inner wall defining a cavity through which a conductor may pass and into which a solder may be flowed, which solder will attach itself to the conductor and to the metal annulus, and a metal base member fused to the body of insulating material and having a portion adapted to be united on a vessel on which the seal is mounted.

2. An insulating seal comprising, in combination, a flanged metal supporting member, a body of insulating material fused to the flanged supporting member, the body of insulating material having an opening therethrough, a double-walled metal annulus in the opening, the said annulus having an outer wall and a cylindrical inner wall, a conductor extending through the annulus, the said annulus having an internal diameter substantially larger than the diameter

of the conductor, whereby there is an annular space between the conductor and the inner wall of the annulus, the said outer wall of the annulus being fused to the body of the insulating material, and a body of metal solder substantially filling the annular space between the conductor and the inner wall of the annulus and fused to both the conductor and to the inner wall of the annulus.

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