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GLASS-TO-METAL SEALS

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It is known that in the fusing between metal and glass, the condition of the surface of the metal portion exerts an essential influence on the rigidity of the connection between the metal and the glass. It is also known that a surface oxidation of the metal portion is very essential for the adhesion of the glass. The present invention is a method for producing fusions between glass and metal by which easily reproducible requirements for the adhesion of the glass is afforded. According to the invention, the metal part is covered by a thin layer of glass containing an adhesion oxide at least at the fusing position before carrying out the actual fusing; the layer of glass has the same expansion coefficient as the fusing glass itself. Naturally, the thin layer may be constructed of the fusing glass inself.

For the purpose of covering the metal part at least at the fusing position with a thin glass layer containing oxide, we proceed by depositing on the positions to be covered with a glass layer, glass powder, preferably in the form of a plastic mass. For this purpose, a suitable glass, for example, a fusing glass, of which it is known that it gives, with the metal under consideration, a vacuum-tight connection, is pulverized and set with the adhesion oxide. If, for example, the production of a connection between iron, nickel or chromium containing metals or alloys and glass is involved, 5% cobalt oxide and 1% nickel oxide is added to the glass powder for example.

To obtain from the glass powder and the added adhering oxide, a plastic mass, it is desirable to use protective colloids. For example, the above-named glass powder may be set with 6% clay and approximately 1% soda and stirred in a plastic mass with water. This mass is deposited on the glass portion to be fused, and preferably while on the fusing position, dried and then fused into a glassy coating. If not only the fusing position is covered with such a coating, but also the zones surrounding the actual fusing position to an extent of one or several centimeters, an insulating coating is at the same time obtained which prevents the deposit of undesired discharge on the metal portions. This applies as well for fuse-in bars or wires, as, for example, parts which surround a particular plug-type glass portion (plug fusing).

After the production of a glass coating, the fusing process is carried out in the usual manner. If the so-called plug fusings are involved, for example, the metal ring of the plug fusing is first provided with a glass coating; then the fusing bar or wire is fastened within the metal ring and the space between the metal ring and the fusing wire is filled with glass. The glass part is then preferably fused in an electric furnace, under certain circumstances, in the presence of oxygen. Also, the fusing bar or wire may, before carrying out of the actual fusing process, be covered in the described manner with a glass layer.

The method, according to the invention, has the advantage that we may start with metal parts that are oxidized in well defined manner. By the covering of the metal parts with a mass that may be put on by stroking, and which by heating is converted into a glassy coating, the essential variation of the condition of the surface of the metal part to be fused is prevented. This has, as a consequence, that under the glass coating at all points, a base is present which avails an intimate connection between glass and metal. For this reason, difficulties are avoided in the construction of the final fusing which, under certain circumstances, may arise by reason of the fact that even before the metal part is covered with glass, oxidation or reduction processes take place which may injure the connection between the glass and the metal.

For the production of fusings of glass with metals, such as molybdenum, are cobalt nickel and iron containing alloys with a cobalt content of approximately 20%, a nickel content of 30% and an iron content of approximately 50%, hard glass comes into consideration which has an expansion coefficient of approximately 50×10^{-7}. The glass on the metal part, in accordance with the invention, is constructed of a glass which has the same expansion coefficient, or which deviates by a small amount. Preferably, the coating is constructed of the same glass which is used for the construction of the other parts of the fusing. For the fusing of glass with chromium iron or nickel iron alloys, platinum EMK and the like, soft glass must, on the other hand, be utilized, and it has an expansion coefficient of 100×10^{-7} In this case also, such glass is used for producing the glass coating.

The method, according to the invention, may naturally also be used when glass with iron or nickel parts which contain no essential addition of other metals are to be fused. In this case, provision must be made by properly forming the metal and glass parts that no considerable tensional stresses be set up after the cooling of the fusing in the glass part. In such a case, we may operate with glass, the expansion coefficient of which deviates appreciably, for example, by 30° from the expansion coefficients of the metal parts. Also in these cases may the fusing process be essentially facilitated by using the method according to the invention.

It is essential for the invention that the glass coating on the metal part be free from components which, under certain circumstances, when being heated, give up gas, or may be decomposed. Such components are contained in the usual enamels in the form of flux means or turbidity means.

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