June 13, 1939. J. H. COX 2,162,477

VAPOR ELECTRIC DEVICE

Filed Oct. 21, 1938

Fig. 1.

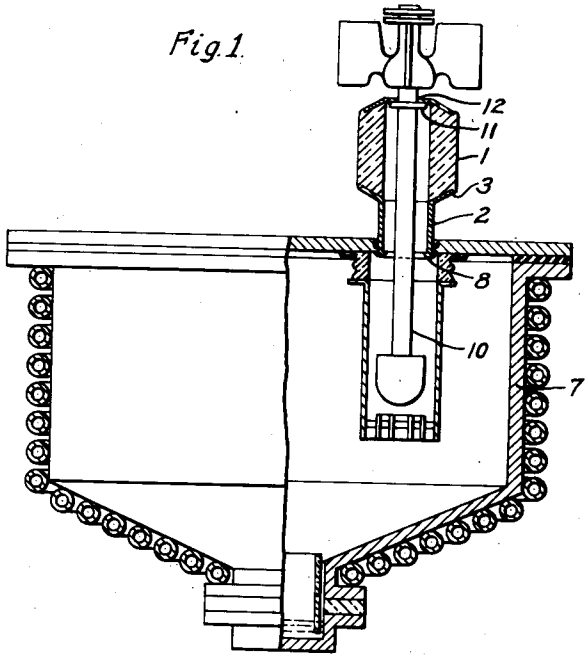


Fig. 2.

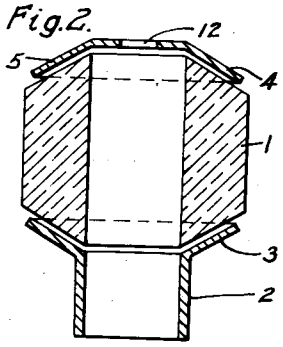


Fig. 3.

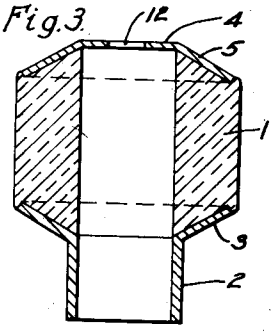


Fig. 4.

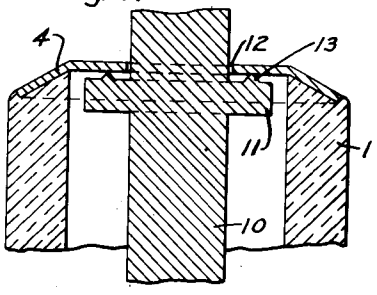
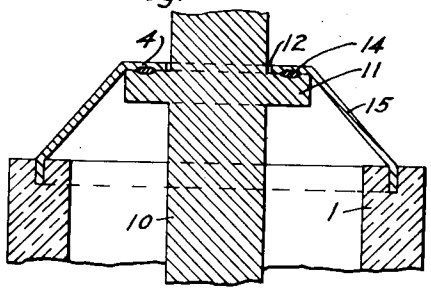


Fig. 5.



WITNESSES:

N. F. Susan.

Otto C. Groome

INVENTOR

Joseph H. Cox.

BY

S. A. Strickland

ATTORNEY

Patented June 13, 1939 2,162,477

UNITED STATES PATENT OFFICE

2,162,477

VAPOR ELECTRIC DEVICE

Joseph H. Cox, Forest Hills, Pa., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application October 21, 1938, Serial No. 236,210

5 Claims. (Cl. 250—27.5)

My invention relates to a vapor-electric device and particularly to a seal structure for metal tank converters.

In the operation of vapor-electric devices, considerable difficulty has been experienced in maintaining a suitable vacuum-tight insulating bushing between the electrode lead-ins and the metal container. These difficulties mainly arise from the intensive heat and the mechanical stresses applied to the seals which frequency cause the seals to crack, permitting leaks which destroy the vacuum and consequently the operating condition of the converter.

For many purposes, these difficulties were obviated by the nickel-cobalt steel alloys and the resulting seals, as disclosed in Scott patent, No. 2,062,335, and for many types of vapor-electric devices these Scott seals have come into general use. However, certain difficulties, mainly mechanical, have heretofore prevented the utilization of this improved seal in high power type vapor-electric devices such as steel tank converters. It has been found that when attempting to weld the seal structures into the tanks or when attempting to weld the lead-in structures with the seal proper, the localized heating frequently damages the glass metal seal. Also, the electrodes, such as the anodes, are frequently of considerable weight and supported at the end of relatively long lead-in stems, so that when the converters are shipped or otherwise handled, there is an appreciable pendulum effect which frequently causes the seal structures to flex in diaphragm action which frequently cracks or otherwise damages the glass-metal seal.

An object of my invention is to provide a seal structure which obviates these difficulties and permits the utilization of the cobalt nickel steel alloy glass seal in high powered vapor electric devices.

The seal structure, according to my invention, comprises a substantially cylindrical glass bushing, to each end of which is sealed a cobalt nickel steel cap or end pieces which are, in turn, connected respectively to the electrode lead and to the metal tank construction.

In order to prevent the diaphragm effect of the cap structure, I prefer to construct the cap of conical section so as to increase its rigidity to bending stresses.

Other objects and advantages of my invention will be apparent from the following description, taken in conjunction with the accompanying drawing, in which

Figure 1 is a fragmentary sectional view of a vapor-electric device utilizing my improved seal.

Fig. 2 is a sectional elevation showing the component parts of my seal prior to joining them together.

Fig. 3 is a fragmentary view showing the method of making the glass-metal seal.

Fig. 4 is a fragmentary view showing the assembled seal prior to the welding of the electrode lead to the seal structure, and

Fig. 5 is a similar view showing the complete welded structure.

In the illustrated embodiment of my invention, the seal comprises the glass bushing 1, preferably substantially cylindrical in shape having frusto-conical end sections, to one end of which is sealed a substantially tubular end piece 2 having a flared portion 3 corresponding in shape to the end of the glass cylinder 1. To the other end of the cylinder 1 is secured a cap piece 4 which is shaped as at 5 to conform to the end of the cylinder 1. Both the end piece 2 and the cap piece 4 are preferably somewhat smaller in diameter than the outside diameter of the glass bushing 1 so that when the glass is fused to the cobalt nickel steel pieces, the glass flows around the edges of the shaped portions 3 and 5 to increase the mechanical strength as well as the vacuum maintaining qualities of the seal.

The tubular end piece 2 is then inserted in an opening 6 in the metal tank 7 of the converter and the end remote from the glass bushing 1 welded by suitable means to the steel tank 9. Preferably this weld 8 is made in an inverted position with the major portion of the bushing 1 and the end piece 2 immersed in water so that the necessary local heating at the point of the weld 8 will not distort the end piece 2 sufficiently to damage the glass-metal seal. In order to reduce the localized heating in the cap piece 4 and the electrode lead 10, this lead 10 is preferably provided with a collar 11 or shoulder which is adapted to contact the cap portion 4 adjacent an opening 12 sufficiently large to admit the electrode stem 10. This collar piece 11 is provided with an upstanding projection 13 of relatively small cross section which is then welded directly to the bushing cap 4 by means of a so-called projection weld 14. By means of the projection weld 14, the necessary local heating is reduced to a minimum and, if desired, the bushing 1 may be immersed in water or otherwise cooled to eliminate excessive strains on the glass-metal seal during the welding process.

While I prefer to shape the cylindrical bushing 1 previous to assembly and make the glass-metal seal by means of a so-called flame weld,

it is also desirable in certain instances to die cast the glass bushing 1 on to the cobalt nickel steel seal pieces. When this is done, the end pieces are so constructed as to be more deeply embedded in the glass portion of the bushing, as more clearly illustrated in the right hand portion of Fig. 5. In order to prevent excessive vibration or diaphragm effect because of the pendulum effect of the electrode structures, I prefer to construct that portion of the cap 4 between the glass-metal union and the projection weld 14 as a frusto-conical section 15.

While for purposes of illustration, I have shown and described a preferred embodiment of my invention, it will be apparent to those skilled in the art that many changes and modification can be made therein without departing from the true spirit of my invention or the scope of the appended claims.

I claim as my invention:

1. An electrode bushing assembly for a vapor electric device comprising a tubular glass bushing having frusto-conical end surfaces, a tubular end piece having a flared end conforming in shape to the end of said bushing, a cap piece conforming in shape to the end of said bushing, said end piece and said cap piece composed of a nickel, iron, cobalt alloy containing 24% to 34% nickel and 5% to 25% cobalt and being fused to said bushing, said end piece and said cap being of less diameter than the outer diameter of said bushing so that the fused glass envelops the edge of said end and cap pieces, said cap piece having an opening therein, an electrode stem extending through said opening, a collar on said stem and a projection weld between said collar and said cap.

2. An electrode seal for a vapor electric device comprising a hollow cylinder of glass, a sheet metal cap of iron, nickel cobalt composition secured to each end of said cylinder, said cap being of less diameter than the outside of said glass cylinder, the glass of said cylinder overlapping the outer edge of said caps, said caps having openings therein for the passage of the electrode lead, an electrode lead extending through said openings, a collar in said electrode lead and a projection weld between said collar and one of said caps.

3. A lead-in assembly for a metal tank rectifier comprising a tubular glass bushing, a tubular end piece fused to one end of said glass bushing and having the edge thereof embedded in the glass a cap fused on the other end of said glass bushing and having the edge thereof embedded in the glass, said cap having an opening therein, an electrode stem passing through said opening, a collar on said stem, said collar being welded to said cap.

4. A lead-in assembly for a metal tank rectifier comprising a tubular glass bushing, a tubular end piece fused to one end of said glass bushing and having the edge thereof embedded in the glass, a cap fused on the other end of said glass bushing and having the edge thereof embedded in the glass, said cap having an opening therein, an electrode stem passing through said opening, a collar on said stem, said collar being welded to said cap, that portion of the cap between the collar and the glass bushing being conical in shape.

5. An insulator bushing assembly for a metal tank vapor electric converter comprising a tubular glass bushing having oppositely tapered frusto-conical ends, a tubular end piece having a flared end to conform to the end of the glass bushing, said end piece being fused to the glass bushing and welded to converter tank, a cap fused to the opposite end of the glass bushing, said cap and said end piece composed of an iron, nickel, cobalt alloy including 24% to 34% nickel and 5% to 25% cobalt, said cap having an opening therein, an electrode stem passing through said opening, a collar on said stem of larger diameter than said opening and a vacuum-tight weld between said cap and said collar.

JOSEPH H. COX.