E. E. EBY.

SEAL.

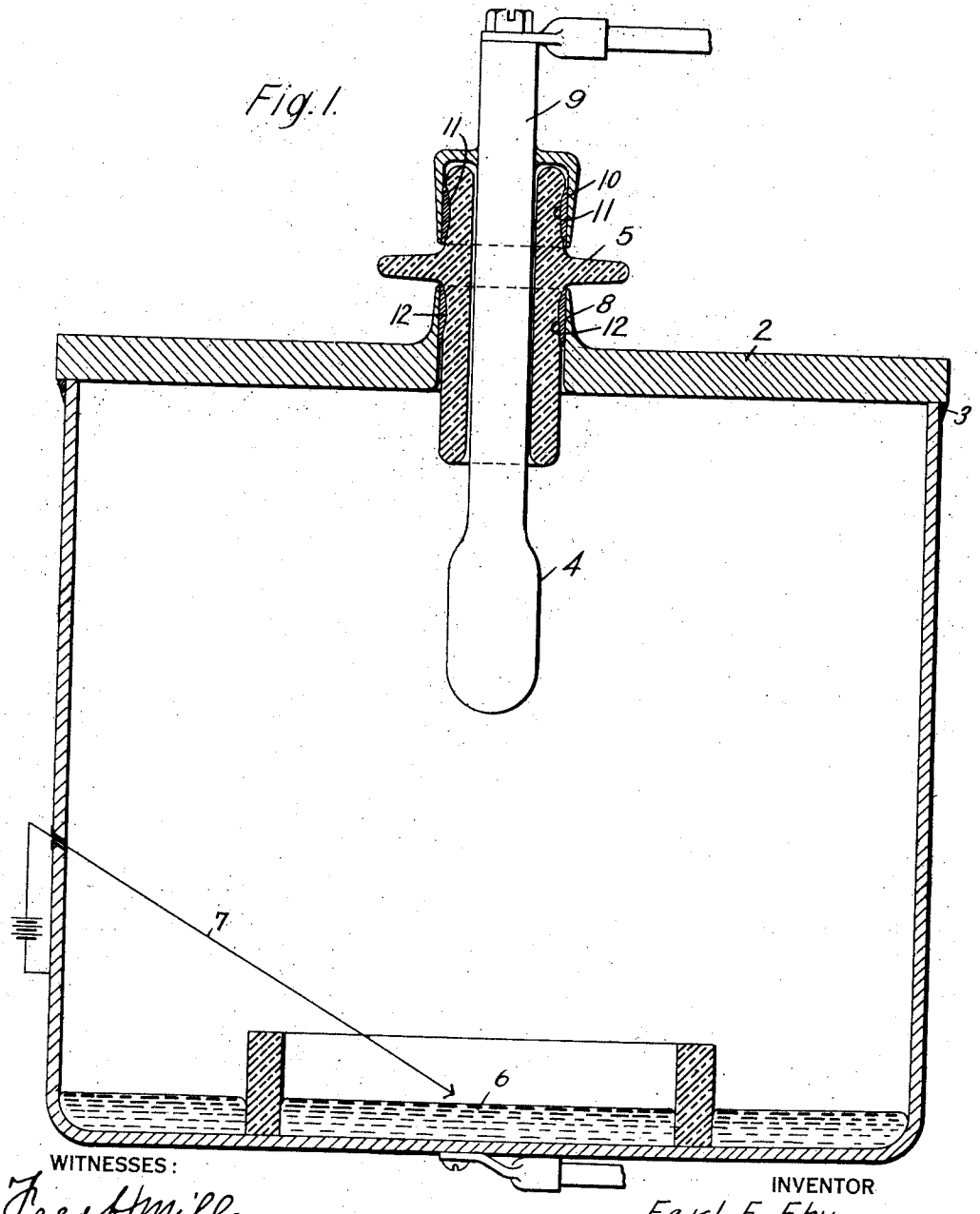
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1,281,917.

Patented Oct. 15, 1918.

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS—SHEET 2.

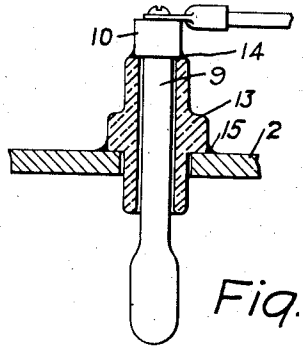


Fig. 2.

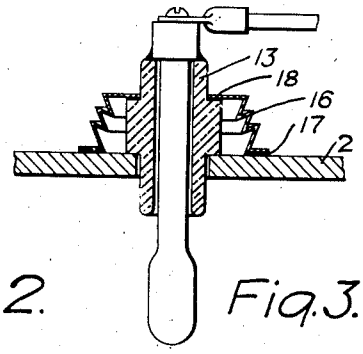


Fig. 3.

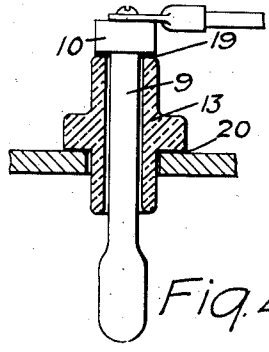


Fig. 4.

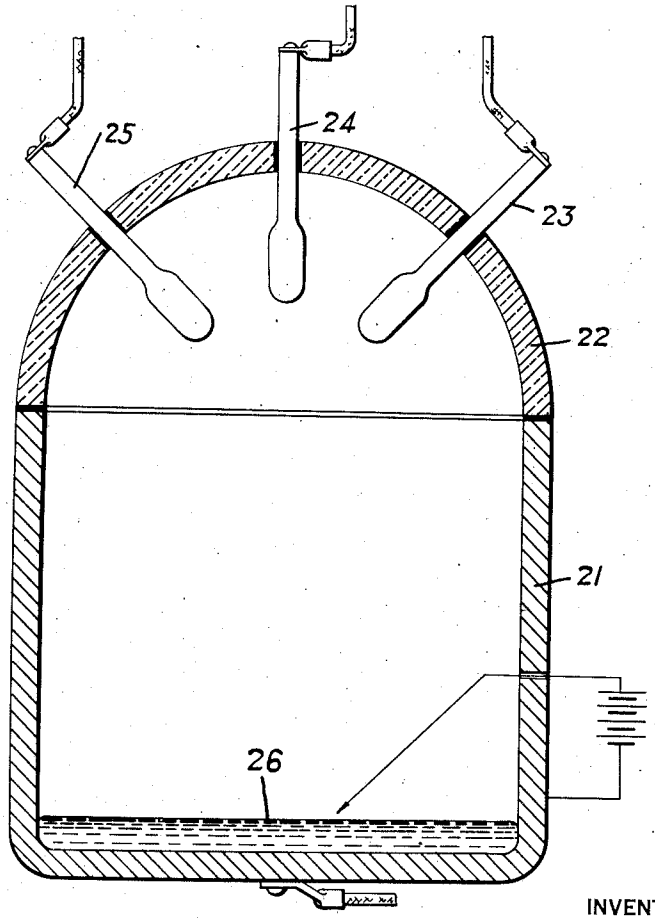


Fig. 5.

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SEAL.

1,281,917. Specification of Letters Patent. Patented Oct. 15, 1918.

Application filed December 29, 1915. Serial No. 69,197.

To all whom it may concern:

Be it known that I, EARL E. EBY, a citizen of the United States, and a resident of Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Seals, of which the following is a specification.

My invention relates to means for forming a hermetic joint between vitreous material, such, for example, as porcelain, and bodies of metal, and it is particularly adapted for forming vacuum-tight joints with the bushings employed to insulate the leading-in conductors of vapor electric apparatus of the metal-case type.

In the accompanying drawing, Figure 1 is a side view, partially in section and partially in elevation, of a vapor converter embodying a preferred form of my invention. Figs. 2, 3 and 4 are side views, partially in section and partially in elevation, of modifications of the seal shown in Fig. 1; and Fig. 5 is a side view, partially in section and partially in elevation, of a radically different type of converter from that shown in Fig. 1 but still embodying my invention.

In the construction of vapor converters and like apparatus, it is customary to employ metal containers because of the mechanical strength and heat-radiating properties thereof and to introduce electric current within said containers by means of suitable leads projecting through, and insulated from, the walls. It is further customary to operate apparatus of the character described with a high degree of vacuum within said container, and considerable difficulty has been encountered in maintaining a tight insulating joint about said current leads under the joint action of mechanical blows, of expansion and contraction due to extreme heat changes and of the high degree of vacuum within the container. I find that, by producing suitable metallic deposits upon a bushing of vitreous insulating material, such, for example, as porcelain and, by then soldering or brazing the wall of the container and the leading-in wire to said deposit, an extremely tight and effective joint may be produced.

Referring to Fig. 1 of the accompanying drawing for a more detailed understanding of my invention, I show the body of the container of a vapor converter of the metal-case type at 1, said body being surmounted by a cover 2 attached thereto by any suitable means, as by welding or soldering, as indicated at 3. An anode 4 projects through said cover 2 and is insulated therefrom by a suitable bushing 5 constructed preferably of porcelain. A liquid cathode 6 lies in the bottom of the container 1 and a power arc flows through said device between said electrodes in the usual manner, the cathode 6 being maintained in an active condition by any suitable means, such, for example, as a keep-alive circuit 7.

The cover 2 is provided with an upwardly extending flange 8 of tapering thickness, closely surrounding the lower portion of the bushing 5 and, in like manner, the stem 9 of the anode 4 is provided with a downwardly extending flange 10 of tapering thickness closely surrounding the upper portion of the bushing 5. The bushing 5 is provided with two circumferential bands of closely adherent metal, shown in exaggerated section at 11—11 and 12—12, at the points of attachment to the flanges 8 and 10. Said bands of metal may be produced in a great number of ways but I preferably employ therefor either a deposit produced from an ammoniacal silver solution, as in the ordinary process of silvering mirrors, or a "luster" of metal as is employed in the decoration of china-ware. Said "lusters" are produced by painting the so-called "ceramic lustrous preparations of metal" upon the insulating body in question and then applying heat, whereby a chemical decomposition ensues and the desired metallic deposit is produced. Said lustrous preparations preferably embody resin-acid or sulfurized resin-acid compounds of the desired metals, being produced by the decomposition of metal chlorids by heating them with lavender oil, as is well known in the ceramic art.

While I have described some preferred methods of producing the metal body in question, it should be distinctly understood that I am not restricted thereto but may employ any of the well known methods of producing like results.

Having deposited the bands 11—11 and 12—12 upon the bushing 5, the surfaces thereof may be tinned in order to facilitate the subsequent application of solder thereto although, in certain cases, the tinning step

may be omitted. The seal is then assembled in the form shown and molten solder flowed into the spaces intervening between the flanges 8 and 10 and the bushing 5, whereupon an exceedingly intimate connection is produced between said bushing and said flanges and a resultant joint formed which is highly suitable for resisting both leakage and mechanical stress. If a deposit of refractory metal, such, as platinum, is employed, the seal may be closed by brazing, rather than by soldering.

By tapering the flanges 8 and 10 in thickness, as shown, desirable resiliency is imported into the joint structure and thus the strains tending to be set up by expansion and contraction are avoided and a tight seal is maintained. Furthermore, by forming said flanges of relatively thin material, little difficulty is encountered in applying sufficient heat to the soldered or brazed joint without injuring neighboring parts.

In the form of my invention shown in Fig. 2, the cover 2 of a vapor converter is provided with an opening in which is seated a bushing 13 constructed preferably of porcelain. An anode stem 9 projects through the bushing 13 and is provided with an enlargement 10 at its upper end overlying the upper end of the bushing 13. The portion 10 of the anode stem 9 is soldered, or otherwise attached, to the bushing 13 by a fillet 14, and, in like manner, the bushing 13 is soldered to the cover 2 by a fillet 15. All porcelain surfaces underlying said fillets are provided with metallic deposits, as hereinbefore described.

Where excessive expansion and contraction occur, as, for example, when excessive temperature changes are encountered, a joint of the character provided by the fillet 15 in Fig. 2 may be pulled apart by differential expansion. Under these conditions, a structure such as shown in Fig. 3 may be employed wherein the bushing 13 is attached to the cover 2 by a cap member 16 circumferentially corrugated, as shown, soldered to the cover 2 at 17 and to the bushing 13 at 18.

The form of my invention shown in Fig. 4 is similar to that shown in Fig. 2 except that, instead of applying the solder in the form of a fillet, the entire seal is heated to a temperature above the fusing point of the solder employed and the solder is then flowed in between the members to be joined, as shown at 19 and 20.

My invention is readily applicable to containers formed from a metallic cathode bowl surmounted by a porcelain dome which is provided with anodes, this particular type of apparatus having first been disclosed in U. S. Patent to Peter Cooper-Hewitt, No. 1,110,546. I show a device of this character in Fig. 5 wherein a metallic bowl 21 is closed by a dome or cover 22, constructed preferably of quartz, porcelain, or lava. The members 21 and 22 are joined by soldering, as disclosed in this application, and the member 22 supports three anodes 23, 24 and 25, being preferably soldered thereto in order to secure a tight and effective seal. By placing a cathode 26 in the bottom of the bowl 21, an inexpensive and serviceable converter is provided.

By an extension of the same principle, I may, if desired construct the entire container of lava or porcelain, as is disclosed in U. S. Patents to Dempster 953,598 and Hayden 1,047,520, supplying current to each of the electrodes by soldered leading-in wires, and, if desired, joining different parts of the insulating container itself by soldering or brazing.

Furthermore, my invention is capable of wide application in the arts in joining insulating members together, or to metal, as, for example, in the construction of built-up line insulators.

I am not in a position to state definitely the exact relationship between a body of porcelain with a glaze thereupon and an additional metallic deposit as employed in my invention. Whether the metallic film adheres to the surface of the glaze or whether, at the temperature employed in precipitating the metal, the glaze is softened and the metallic particles are embedded therein, it is impossible to determine at present. I am inclined to believe that the latter action is present and, consequently, when employing porcelain provided with an extremely refractory glaze, somewhat better results may be obtained by first spreading thereupon a less refractory glaze, causing the said two layers of glaze to coalesce by fusion and, if necessary, by repeating said process until a final layer of glaze is obtained which is sufficiently fusible to soften at the temperature at which the metal deposit is formed. In this manner, a compound or graded glaze is formed which closely unites a metallic deposit with porcelains of the most refractory type.

I may, if desired, employ unglazed porcelain, and I find that the lustrous preparations employed, especially when of little viscosity, impregnate to a considerable distance thereinto and provide an extremely closely adherent film or deposit upon heating. A further advantage derived by the use of unglazed porcelain lies in the fact that glazes frequently "craze" and the presence of a "craze" crack transverse to the sealing band provides a harmful leak.

When it is undesirable to place entire reliance upon a soldered seal of the character hereinbefore set forth, use may be made of said seal to form a barrier to prevent the flow of sealing waxes or oils into the con-

verter, as described in a copending application of E. E. Rose, Serial No. 70,247, filed Jan. 4, 1916, and assigned to the Westinghouse Electric & Manufacturing Company.

While I have shown a typical form of joint, it should be distinctly understood that my invention may be applied to a wide variety of seals, embodying bushings of different shapes and connected to flanges of widely differing forms, the essence of my invention residing in the joining of insulating and metallic members by first forming a metal deposit around said insulating member and subsequently soldering said deposit to said metal member.

I claim as my invention:

1. The combination with an evacuated container provided with an opening in the wall thereof, of means for closing said opening comprising a mass of insulating material therein, said mass being provided with a metallic deposit on the surface thereof, and a layer of solder joining said deposit to the wall of said container.

2. The combination with a closed container wherein the pressure is other than atmospheric, of means for introducing electric current thereinto comprising a conductor projecting through the wall thereof, and an insulating bushing interposed between said conductor and the wall of said container, said bushing being provided with a superficial film of closely adherent metal, and a layer of readily fusible metal joining said film to the wall of said container.

3. The combination with a closed container wherein the pressure is other than atmospheric, of means for introducing electric current thereinto comprising a conductor projecting through the wall thereof and an insulating bushing interposed between said conductor and the wall of said container, said bushing being provided with a superficial film of closely adherent metal, and a layer of readily fusible material joining said film to said conductor.

4. The combination with a closed container wherein the pressure is other than atmospheric, of means for introducing electric current thereinto comprising a conductor projecting through the wall thereof, and an insulating bushing interposed between said conductor and the wall of said container, said bushing being provided with a closely adherent metallic film on each of two separated portions of the surface thereof, a layer of readily fusible metal joining one of said films to the wall of said container and an additional layer of readily fusible metal joining the remaining film to said conductor.

5. The combination with a closed container wherein the pressure is other than atmospheric, of means for introducing electric current thereinto comprising a conductor projecting through the wall thereof, an insulating bushing interposed between said conductor and the wall of said container, said bushing being provided with two separate peripheral bands of metallic deposit, a layer of readily fusible metal joining one of said bands to the wall of said container, and an additional layer of readily fusible metal joining the remaining band to said conductor.

6. The combination with a member provided with an opening therethrough, of a mass of insulating material seated in said opening, a metallic deposit upon said mass, a yielding sleeve surrounding said mass and joined to said member, and a layer of readily fusible metal joining said sleeve to said deposit and means for maintaining a difference of gaseous pressure between the two sides of said seal.

In testimony whereof, I have hereunto subscribed my name this 14th day of Dec. 1915.

EARL E. EBY.