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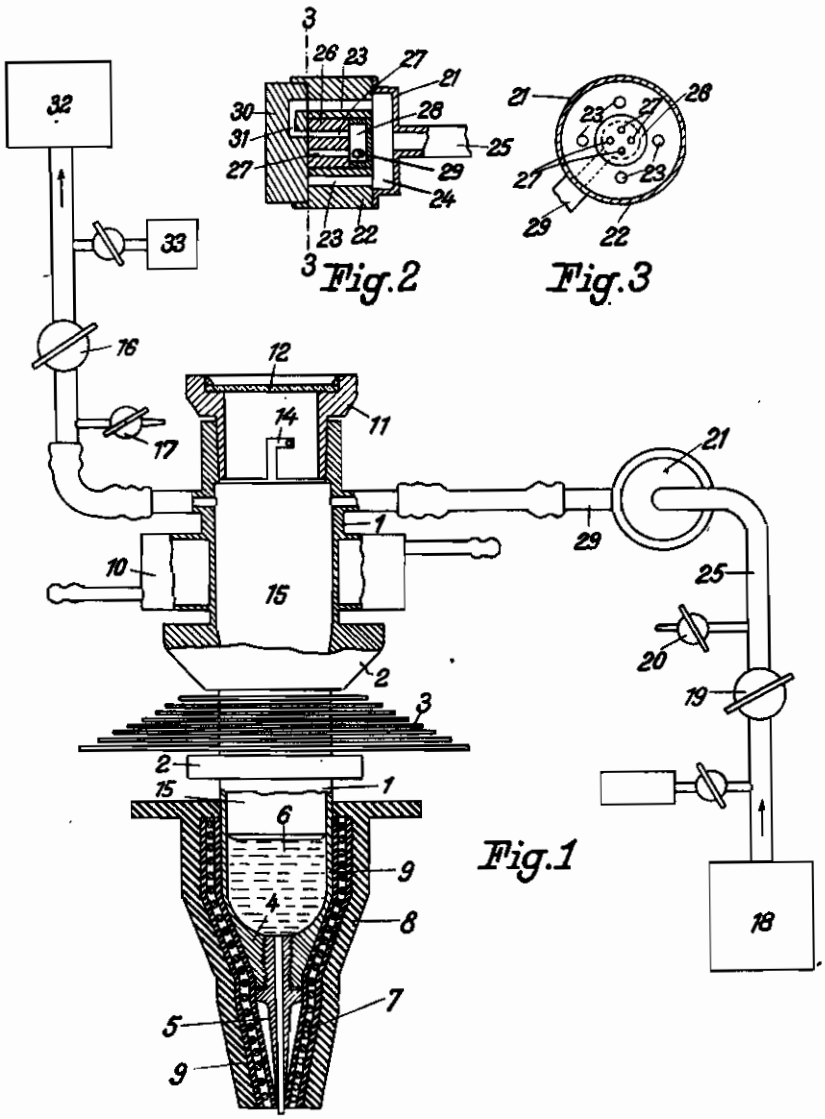

Fig.1

Fig.2

Fig.3

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METHODS OF SEALING ELECTRIC DISCHARGE VESSELS

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As is well known the casing or envelope of electric discharge vessels may be composed of two parts sealed, welded or soldered together, thus insuring the necessary vacuum tightness, or a cover may be arranged which softens when heated. However, the heat employed to such end is able to affect the electrode system and also constitutes an undesirable expenditure of energy. Such a cover may comprise an insulating body and a glass disc fixed to this by melting. In the case of a metal bulb forming part of the discharge vessel such glass disc must be heated two times in general and by two sources of heat acting one after the other. This adds to the cost of manufacture. Where such cover also serves to support the electrode system a special device is necessary for manufacturing it in a separate operation while in another operation the leads to the electrode system are sealed into the cover. Still another operation is necessary to cool down the cover or support so obtained. After all these operations have been finished the electrode system is fitted to the cover. The cover is then slowly heated and is thereupon sealed into the bulb of the discharge vessel. In the case of a metal bulb this must be heated to a temperature that depends upon the softening point of the glass forming part of the cover. Such heating is necessary in order to firmly unite the metal bulb and glass together. Even with the usual soft lead glass that part of the metal bulb which is to be engaged by such glass must be bright red hot, that is, must be heated to at least 800° C.

Temperatures lower than this would suffice if a sealing glass still softer than lead glass were employed. However, the lower the melting point of the glass the greater are the difficulties encountered when manufacturing the said assembly of insulating body and glass disc by means of the aforesaid device. In fact, the glass disc, when melting it onto the insulating body, loses its plane shape the more readily the easier it is to soften. The same difficulties arise when pressing an extremely soft glass onto the insulating body and arise also in other methods of providing the insulating body with a glass disc.

The invention described hereafter does not require the insulating body or cover, which may also serve to support the electrode system and preferably is of a ceramic material, to be united with any glass body intended to act as sealing material. In fact, the invention provides for applying a sealing glass to both the insulating body and the bulb of the discharge vessel, the bulb preferably having a metallic flange for this purpose.

In this way the invention enables the use of sealing glass that may be of any desired degree of softness. It does away with all the drawbacks due to low melting sealing glass and yet insures that all the advantages thereof are obtained. For instance, metal parts to which the sealing glass is applied need not be heated to temperatures by which the electrode system is affected. Cooling means for the electrode system hence need not be arranged. These advantages exist especially if the metal parts consist of an alloy of iron and at least 15% chromium. If in addition the sealing glass has the property of solving the oxides this alloy forms then the metal part has to be heated to a temperature not higher than about 40% of the temperature usually necessary for the provision of glass seals. Accordingly, the cost of manufacture is considerably reduced and the time taken by the manufacture of a discharge vessel can be rendered so short as to enable a mass production difficult to surpass.

According to the invention a flow of vitreous material is directed against the joint or spot to be sealed, as will be understood from the following description, reference being had to the accompanying drawing, in which

Fig. 1 is a partially diagrammatic sectional elevation showing one form of apparatus for effecting the invention, Fig. 2 is a sectional detail view, and Fig. 3 represents a section on line 3—3 of Fig. 2.

1 denotes a sort of melting crucible equipped with heat accumulating enlargements 2 and cooling ribs 3. The bottom part 4 of the crucible carries a squirting die 5. This die and the lower part of the crucible are located within an electric heating coil 7 which is provided with an insulating jacket 8. 6 denotes the vitreous material contained in the crucible and liquefied therein by the heat produced by coil 7. In case the parts 1, 4, 5 are of metal they are covered with layers of asbestos 9, whereby coil 7 is prevented from undergoing short-circuits. The upper part of the crucible is fitted with a cylindrical cooling vessel 10 arranged to be traversed by water. The cooling so effected enables the upper opening of the crucible to be closed by means of a greased plug 11 which may be somewhat conical, as shown, and is secured in the crucible by a bayonet joint 14. The plug 11 is hollow and has an inspection window 12 hermetically fastened therein. Through this window the behaviour of the sealing material 6 may be observed.

The space 15 above the vitreous material 6 may be connected either with a vacuum pump 32 or with a compressor 18. Pump 32 is associated with a store vessel 33.

The vacuum in space 15 is adjustable by means of a cock 16 and a valve 17 provided with a small air opening.

The pressure in space 15 is adjustable with the aid of a cock 19 and a valve 20, this being intended for fine regulation. The air from compressor 18 enters the space 15 through a conduit 25, a control valve 21 and a conduit 29.

Valve 21 is constructed as shown in Figs. 2 and 3. 22 denotes a stationary disc provided with bores 23 which are arranged in circular relation to each other. The bores 23 communicate with a chamber 24 to which the conduit 25 is connected. A disc 26, fitted with bores 27, is hermetically seated in the disc 22. The bores 27 communicate with a chamber 28 to which the conduit 29 is joined. On the side remote from chamber 24 the discs 22, 26 are flush with each other, and the flush surfaces thereof are polished. A control disc 30, having a U-shaped channel 31, is arranged to contact with these surfaces and to rotate on them. Channel 31 serves to interconnect the bores 23, 27 in such a manner that the compressor 18 is periodically connected with the space 15. The air pressure which thus enters the crucible 1 acts to force the liquefied material 6 through the die 5 during predetermined intervals of time. The duration of these depends on the speed with which the disc 30 is rotated. The flow of vitreous material thus ejected is directed against the joint or spot, not shown, to be covered therewith. To such end the device is preferably so positioned that the die 5 is located above such joint and by preference vertically to this.

The die 5 should be interchangeable. In the case represented it is screwed into the bottom part 4 of the crucible.

The opening of the die 5 is so calculated that the material 6 when in its viscous state cannot leave the die whereas when the material 6 is in its liquid state it will be able to leave it by drops. By suitably calculating the opening and shape of die 5, the pressure in space 15, the viscosity of the material 6 and the distance between die 5 and the joint or spot to be sealed the material 8 will leave the die with a speed by which it is caused firmly to adhere to the joint against which it is ejected. Where a metal flange of the bulb forms part of such joint this flange need not be heated to any high temperature. The material 6 is nevertheless as intimately and firmly united with this flange as if the latter were red hot and highly oxidized. The heating of the flange is effected some instants before accomplishing the sealing operation and conveniently is performed with the aid of high frequency eddy currents. The insulating body or cover when made of ceramic material need not at all be heated, this being due to the roughness of its surface and to its porousness.

The composition of the material 6 should be such that this is easy to liquefy and quickly solidifies when impinging upon the respective joint.

A suitable construction of the die 5 or an arrangement of points, or both these expedients may cause the material 6 to be converted into spray, and the means for mounting such points or the like may also be arranged to cover the current leads for coil 7.

Instead of inserting the finished material 6 into the crucible the component substances thereof may be arranged in the crucible in order to be heated by the coil 7 and thereby to produce the vitreous material.

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