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E. MICKLEY

METHOD AND APPARATUS FOR MAKING SEALS

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Fig. 1.

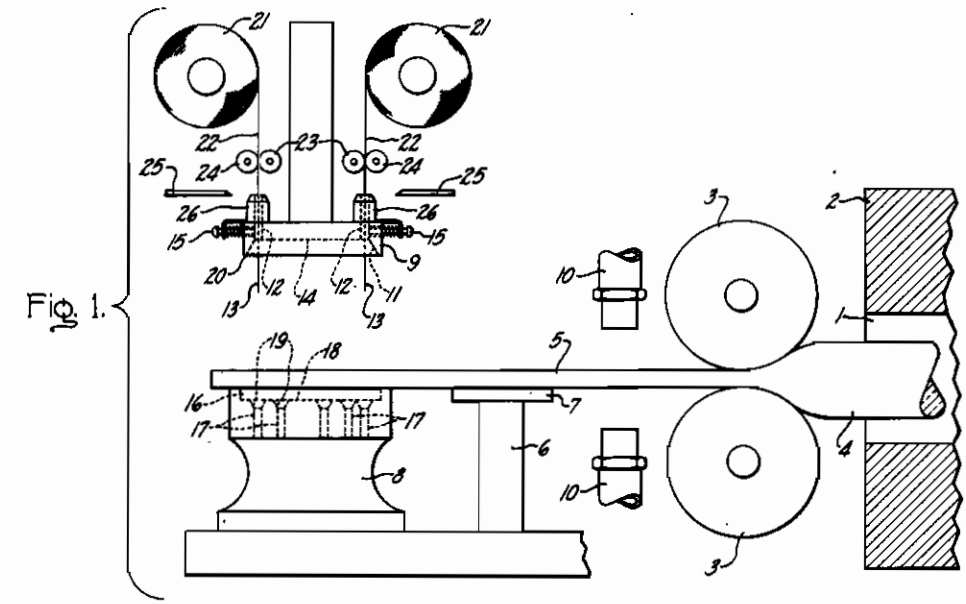


Fig. 2.

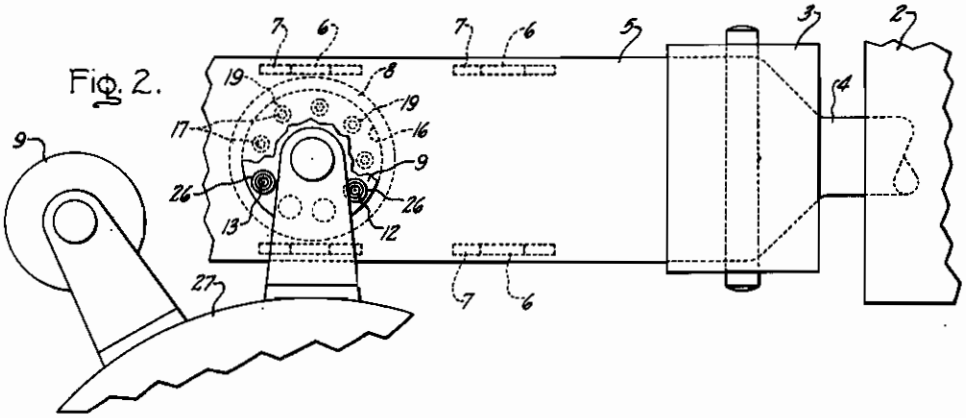
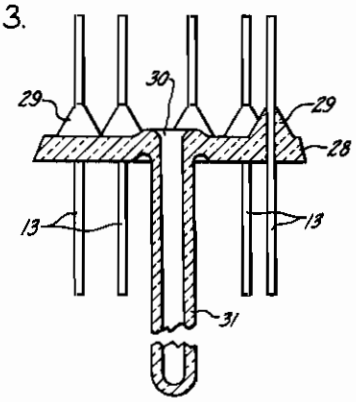


Fig. 3.



Inventor:
Erich Mickley,
by John H. Anderson
His Attorney.

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ALIEN PROPERTY CUSTODIAN

METHOD AND APPARATUS FOR MAKING SEALS

Erich Mickley, Berlin-Zehlendorf, Germany; vested in the Alien Property Custodian

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My invention relates to a method and apparatus for making seals between glass and metal members, and more particularly to the manufacture of sealing discs or closure members for electric lamps, discharge tubes or similar devices, such closure members comprising a glass disc having leading-in conductors sealed therethrough.

The bulbs or envelopes of electric lamps, discharge tubes and similar devices are frequently closed by means of flat glass sealing discs which are fused to the edge of the glass lamp bulb or envelope and which carry a multiplicity of leading-in wires. So far, such sealing discs have been usually produced by first pressing, from glass, a plate-shaped disc with a multiplicity of holes for the leading-in wires, and then inserting and sealing the leading-in wires into the holes of the glass disc,—if necessary with the help of a compensating sealing glass of lower melting point. It is also known to position the leading-in wires in a predctermined position within a mold, and to then force liquid or softened glass around the leads so that this glass constitutes the sealing disc. Both of the above described methods of producing glass sealing discs are comparatively slow and do not always permit a sufficiently tight embedding of the leading-in wires in the glass disc.

One object of my invention is to provide an improved method of producing sealing discs for electric lamps, discharge tubes and similar devices which is simpler and more rapid than methods heretofore used and which enables a more economical production of such sealing discs.

Another object of my invention is to provide apparatus for practicing the improved method according to the invention.

A feature of the invention is the punching of a glass disc from a ribbon of plastic glass, and the insertion and embedding of the leading-in wires into said disc simultaneously with the punching thereof.

Further objects and advantages of my invention will appear from the following description of a species thereof and from the accompanying schematic drawing in which:

Fig. 1 is an elevation of apparatus for practicing the method comprising my invention; Fig. 2 is a top view of the apparatus shown in Fig. 1: and Fig. 3 is a sectional view of a glass sealing disc produced by the method according to the invention and showing an exhaust tube sealed thereto.

In accordance with the invention, the sealing discs may be produced by heating a glass rod until it is soft, then rolling the softened glass rod into a band or ribbon of the desired disc or plate thickness, and leading the band between the co-operating members of a punching tool, one member of which is equipped with a multiplicity of leading-in wires protruding therefrom, after which the punching tool is actuated so as to punch a glass body or disc out of the glass band. At the same time, the leading-in wires protruding from the upper part of the punching tool are forced through the glass mass of the disc and are firmly embedded in the latter.

If the glass body or disc is to consist of hard glass, that is to say, a glass which can withstand very high temperatures and which has a low coefficient of thermal expansion, then it is advisable to cover, prior to the closing of the punching tool, the leading-in wires protruding from the upper punch member with a glass layer, especially on those portions of the leading-in wires which are to lie within the glass mass of the disc; and the coefficient of thermal expansion of such glass layer must lie between the coefficient of thermal expansion of the glass out of which the sealing disc is made and the coefficient of thermal expansion of the metal of which the leading-in wires consist.

Referring to the drawing, in front of an outlet opening 1 in an oven 2, which may be heated in any desired manner, is mounted a pair of rolls 3 through which passes a glass rod 4 which runs continuously through the oven and is heated therein to a softening temperature. The individual rolls of the system of rolls 3 are so adjusted with respect to each other that the glass rod 4 is rolled into a glass band or ribbon 5 of the thickness of the sealing disc which is to be produced. The glass band 5 resulting from the rolling process is held in a horizontal position by supporting posts 6 which are equipped with resting plates 7 or supporting rollers. The glass band 5 is led through a press and punch tool which consists of a stationary base or punch member 8 and a movable upper punch member 9 arranged to move vertically so as to close against the lower punch member 8. Between the punch tool 8, 9 and the pair of rolls 3, a set of burners 10 may be provided for the purpose of reheating the glass band 5 which is cooled during the rolling process. In this manner the band 5 of glass will have the necessary softening temperature for the molding thereof.

The upper movable punch member 9 of the punching tool has a recess 11 in its under or punching surface which corresponds to the shape of the sealing member or disc to be produced. A multiplicity of vertically extending holes 12 is provided in the body portion of the movable punch member 9 above the recess 11 therein, through which holes the leading-in wires 13 extend and are so clamped therein as to protrude freely downward beyond the under surface 14 of the movable punch member 9. The leading-in wires 13 may be cut to the desired length and may be inserted either manually or automatically in the upper movable punch member 9 of the punching tool. Suitable clamping members, for in-

stance, spring actuated bolts 15, are provided on the upper movable punch member 9 for the purpose of securing the leading-in wires 13 in place within the holes 12 in the said movable punch member 9.

The stationary lower punch member 8 of the punching tool has its upper or punching surface provided with a recess 16 which, when the punching tool is closed, receives the upper movable punch member 9 so as to complete the recess 11 of the upper punch member, thus forming a closed mold. The lower punch member 8 is also provided with a multiplicity of vertical holes 17 extending downward from the upwardly facing or bottom surface 18 of the recess 16, the said holes 17 corresponding to and being in vertical alignment with the holes 12 in the upper punch member 9. The uppermost ends of the holes 17 are preferably countersunk, as indicated at 19 in Fig. 1, to provide upwardly flaring enlarged recesses in the bottom surface of the recess 16.

When the punching tool is closed, the edge or rim 20 of the upper movable punch member 9 punches from the glass band 5 which lies between the cooperating punch members, a plate-shaped disc or glass body, and at the same time the leading-in wires 13 protruding from the upper punch member 9 penetrate through the soft glass mass of the band 5 and enter the holes 17 in the lower punch member 8. The free ends of the leading-in wires 13 protruding from the upper punch member 9 are thus received within the holes 17, the said holes 17 being made of slightly larger diameter than that of the leading-in wires so as to permit free entry of the leading-in wires thereinto. In passing through the plastic glass band or ribbon 5, the leading-in wires 13 carry a certain amount of the plastic glass along therewith and into the countersunk recesses 19 of the holes 17 where it is formed into the shape of the said countersunk recesses by the compression of the punching tool to thereby form conical shaped seal reinforcing extensions or nipples 29 (Fig. 3) on the sealing disc 28. During the punching operation, the clamping members 15 which secure the leading-in wires 13 in the upper punch member 9 are released, an operation which may take place at the last moment when the mold or punching tool is closed and which may be accomplished by a limiting or stopping device. When the clamping members 15 are so released, the upper punch member 9 is then moved upwardly and returned to its normal starting or inoperative position. During the upward or return movement of the upper punch member 9, the leading-in wires 13 remain in the punched glass disc whereupon they become hermetically sealed within the glass mass of the disc while the latter is gradually cooling.

In order to eliminate the insertion of the leading-in wires 13 after each upward movement of the upper punch member 9, a number of spools or coils 21 of wire corresponding to the desired number of leading-in wires may be arranged above the upper punch member 9 of the punching tool. From these spools of wire, a corresponding number of wire sections 22, all of exactly the same size and length, can be rolled or fed off during or after the upward movement of the upper punch member 9 and can be introduced positively into the holes 12 of the upper punch member, for instance, by means of two rollers 23, 24 which grasp the wire elastically between themselves and which may be moved by means of a ratchet wheel (not shown). After the wire sections 22 have been reeled off the wire spools 21 and have been introduced in the holes 12 in the upper punch member 9, the ends of such wire sections may be cut off, by means of a coacting knife 25, closely above the upper punch member 9; or they may be cut immediately adjacent the nozzles 26 which project upwardly from the upper punch member 9 and through which the wires 22 enter.

As indicated in Fig. 2, the lower punch member 8 of the punching tool may co-operate alternately with several upper punch members 9 instead of with only one upper punch member, and these upper punch members 9 can then be mounted on a support or turret 27 which is rotated intermittently. It then becomes possible to introduce wires 22 in other upper punch members 9, to cut these wires 22 to the desired length to form the leading-in wires 13, and to check up the relation of the various parts of the upper punch member,—all this during the time when a sealing member is produced by the actuation of that movable punch member 9 which is in co-operating punching relation with the lower punch member 8.

In those cases where the embedding of the leading-in wires 13 in the solidified glass body or disc proves to be unsatisfactory (this might easily occur when the glass discs are made of hard glass), the upper punch members 8 of the punching tool are preferably so designed that they can be swung away in order that, in one operating position of the intermittently rotating supports for the upper punch members 9, the corresponding upper punch member 9 may be swung up so as to become inverted, thus permitting the placing of glass rings (not shown) on the then upwardly protruding leading-in wires 13. The coefficient of thermal expansion of the said glass rings should, of course, lie between the coefficient of thermal expansion of the hard glass of which the sealing discs are to be made and that of the metal out of which the leading-in wires 13 are made. In the said operating position, the glass rings are fused by means of suitable burners in such a way that the portions of the leading-in wires 13 within the recess 11 in the upper punch member will be provided with a strongly adhering glass layer which, later on, during the closing of the punching tool and the insertion of the leading-in wires into the glass band 5, will lie within the glass mass of the said band. Such glass rings thus form an intermediate coating between the metal of the leading-in wires 13 and the glass of the sealing disc, which coating guarantees a vacuum tight embedding of the leading-in wires in the sealing disc.

The number of leading-in wires to be inserted, their placement with respect to one another, and the final shape of the punched glass sealing member all may, of course, be optional.

In the center part of the punched sealing disc 28 (Fig. 3) produced as described hereinabove, a hole 30 may be subsequently formed, by means of a burner, and an exhaust tube 31 sealed to the edge of such hole. It is also possible to produce the hole 30 at the same time as the sealing disc is punched out. Alternatively, the exhaust tube hole 30 in the sealing disc can be produced by heating an exhaust tube fused at one end to the center of the disc and closed at its other end, the hole resulting from the expansion of the heated air trapped within the closed exhaust tube out through the plastic glass at the center of the disc.

ERICH MICKLEY.