Sept. 19, 1950 P. O. CARTUN 2,522,990

METHOD OF MAKING GLASS-TO-METAL SEALS

Original Filed Feb. 16, 1945

FIG. 1

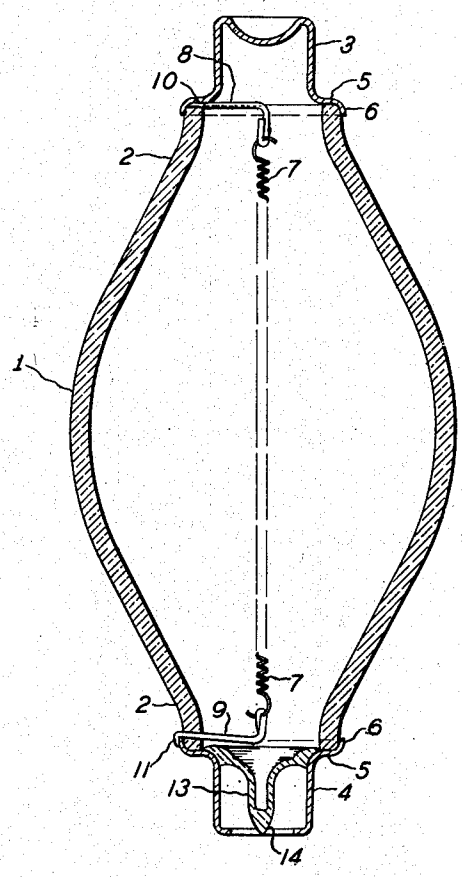


FIG. 2

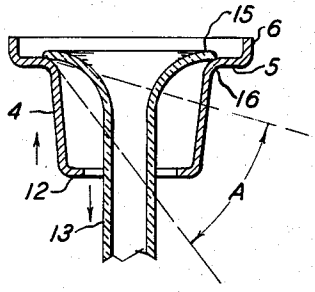
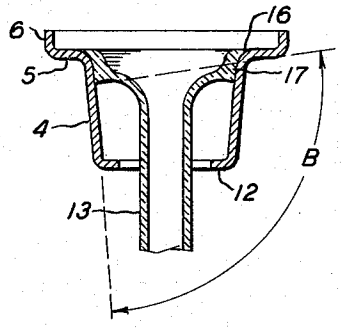


FIG. 3



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METHOD OF MAKING GLASS-TO-METAL SEALS

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Original application February 16, 1945, Serial No. 578,306. Divided and this application August 27, 1946, Serial No. 693,356

2 Claims. (Cl. 49—81)

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This invention relates to a method of uniting glass and metal parts, and is particularly useful in the manufacture of electrical devices, including incandescent lamps and various kinds of electric discharge devices. This case is a division of my pending application Serial No. 578,306, filed February 16, 1945, now Patent No. 2,427,711.

An object of the invention is to improve and simplify such devices and their manufacture, including their bases or contact terminals and their exhaust connections and seals. Another object is to provide a method of sealing an end of a tubular glass member to the interior of a tubular metal member in a manner to prevent cracks in the resulting joint. The invention is especially adaptable and advantageous for the manufacture of rather small lamps and devices, and particularly lamps useful for decorative purposes, such as Christmas tree lighting strings and the like, as well as lamps for automobile dome or dash lighting. Lamps of this character are exemplified in U. S. Patents Nos. 2,191,346 to Geiger, 2,221,868 to Geiger and Davidson, and 2,240,331 to Geiger and Ayres, and I have hereinafter explained my invention as applied to such lamps. Various features and advantages of the invention will appear from the following description and from the drawings.

In the drawings, Fig. 1 shows a vertical axial section through an electric lamp conveniently embodying the invention; Figs. 2 and 3 are fragmentary axial sectional views illustrating stages in its fabrication in accordance with the invention.

The invention is illustrated in Fig. 1 as embodied in a vitreous envelope 1 provided with contact terminals at different portions thereof: viz, the rather oval glass envelope 1 shown has at opposite ends reduced portion or necks 2, 2 which are closed by attached tubular sheet metal caps 3, 4 whose main portions (as shown on a larger scale in Figs. 2 and 3) may taper somewhat to facilitate forming them by die-stamping. As shown, the tubular caps 3, 4 have external rims or flanges 5, 5 against which the bulb ends 2, 2 abut endwise and are sealed by fusion of the glass. Preferably these rims 5, 5 have marginal lips 6,6 which surround and protect the joints, and may even adhere to the fused seals. The electric translation means of this particular device consists of an incandescent filament of fine tungsten wire 7 extending more or less axially through the envelope 1, and preferably coiled in a fine helix. This filament 7 may be connected between the contact terminal caps 3, 4 by means

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of lead-wires 8, 9 clamped tight on the filament ends. As shown in Fig. 1, the upper lead 8 is welded directly to the inner surface of the rim or flange 5 of its cap 3 at 10, while the lower lead 9 extends out through the fused end of the neck 2 which seals to the cap 4 and is electrically connected to the latter outside the seal, as by spot welding the lead to the lip 6 at 11.

While the upper cap 3 is shown with a closed bottom, the lower cap 4 is shown as open ended, though with an inturned marginal lip 12 around its mouth. In manufacture, the envelope 1 may be exhausted through an exhaust tube 13 extending out through the open end of the cap 4, as shown in Fig. 3, after which the tube may be sealed off as shown at 14 in Fig. 1, substantially or approximately at the open end of the cap. In order that the ends of the caps 3, 4 may serve as contact terminals for connecting the device in circuit, as shown for instance in Patent No. 2,240,331 cited above, the originally open end of the cap 4 must, of course, be kept free of adherent glass which might prevent it from actually engaging the corresponding circuit contact. Practically, this means that the seal of the exhaust tube 13 to the cap 4 must be made inside the cap, rather than at its mouth or lip 12, so as to allow the tube to be sealed off at 14 at least partly inside the cap. This offers difficulties, which can be overcome, according to the present invention, in the following manner:

As shown in Figs. 2 and 3, the exhaust tube 13 is small enough to extend through the open lower cap end 12 with some clearance around it, but is enlarged or flared at its upper end 15 to a size which overlaps the corner or shoulder 16 where the flange 5 joins the tubular portion of the cap. If the flare 15 is simply fused to the corner 16 at the junction of the flange 5 with the cap 4 by heating the parts, the resulting seal covers only a narrow zone at the corner 16. What is more important, cracks tend to develop in the seal where the side of the flare diverges from the inner surface of the cap at an angle about corresponding to the acute angle marked A in Fig. 2. I have found, however, that by shifting or displacing the tube 13 and flare 15 relative to the cap 4 as indicated by the arrows in Fig. 2, the flare can be brought inside the tubular main portion of the cap 4, with the effect of extending its peripheral seal over a wider zone 17 of the internal cap surface extending below the corner 16, as shown in Fig. 3. This results in a larger angle B between the inner cap surface and the outer surface of the flare 15 remote from the corner 16—an angle

B, greater than acute, which is at least a right angle, or preferably an obtuse angle. Obtuseness of the angle B can if necessary be assured by reversely shifting the tube 13 upward a little after initially shifting it downward and thus extending the sealing zone 17 down inside the cap 4 as shown in Fig. 3. The shift of tube 13 and its flare 15 relative to the cap 4 may be produced by relative displacement of these parts in any suitable way, as by an actual pull or push on one or both of them. When an angle B greater than an acute angle obtains, the tendency for cracks to develop in the seal is obviated.

The sealing of the tube 13 and its flare 15 to the cap 4 may most conveniently be done before sealing the cap 4 to the bulb neck 2. After exhaustion of the bulb 1 through the tube 13, the latter may be sealed off at 14, Fig. 1, by heat from any suitable source applied to the tube 13 below the cap 4, or to the lower portion of the cap, or both. The cap 4 should be of metal that wets and seals well to the vitreous material of the bulb ends 2, 2, such as the chrome iron known commercially as "Allegany 55" for a bulb 1 of ordinary lead or lime glass.

The structure of the seal and the lamp disclosed herein is claimed separately in my patent application referred to above which is assigned to the same assignee as the present case.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. The method of sealing a vitreous tube to an externally flanged, substantially cylindrical, open-ended metal cap which comprises flaring a vitreous tube at one end to a greater size than the cylindrical portion of said cap at its flanged end, inserting the flared tube through the cap, fusing and sealing the vitreous flare to the corner of the flange, and while said flare is thus soft, shifting said tube and flare into the cap away from the flange and thus extending the seal of the flare over a wider zone of the cylindrical inner surface of the cap from which the exterior surface of the flare diverges at an angle greater than an acute angle.

2. The method of sealing a glass tube to a substantially cylindrical, open-ended metal cap having an outwardly flanged end, which comprises flaring the tube at one end to a diameter slightly larger than that of the cylindrical portion of said cap at said flared end, assembling the tube within the cap with the respective flared and flanged ends uppermost and the tube flare resting on the flanged end of the cap, heating the flare to fuse it and, while the flare is soft, moving the exhaust tube downward relative to the cap to extend the seal over a wider zone of the cylindrical inner surface of the cap.

PAUL O. CARTUN.

REFERENCES CITED

The following references are of record in the file of this patent:

FOREIGN PATENTS

Number	Country	Date
410,313	Great Britain	May 17, 1934