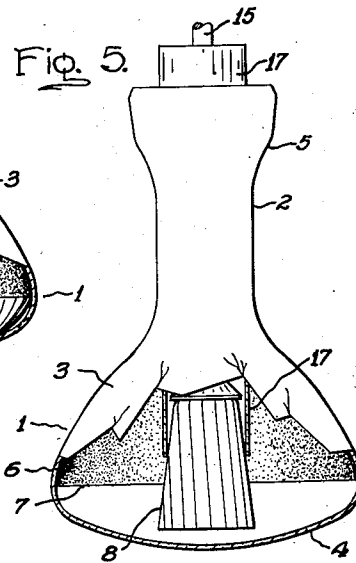
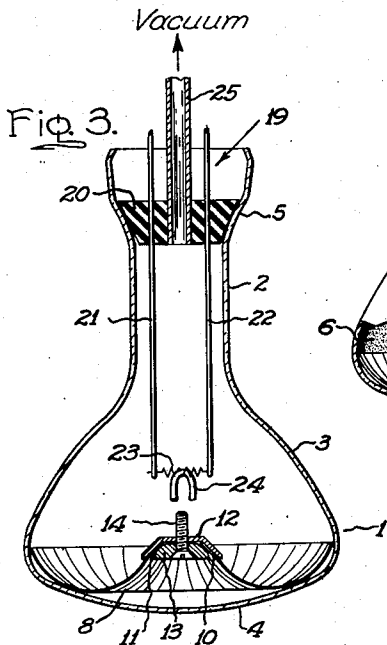
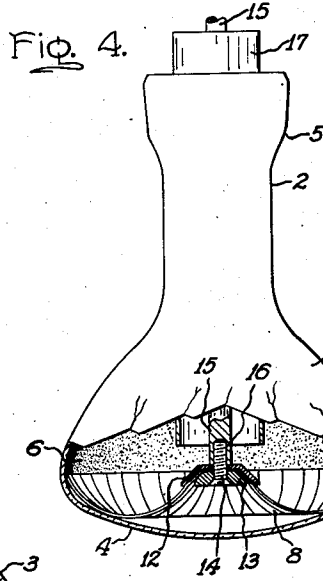
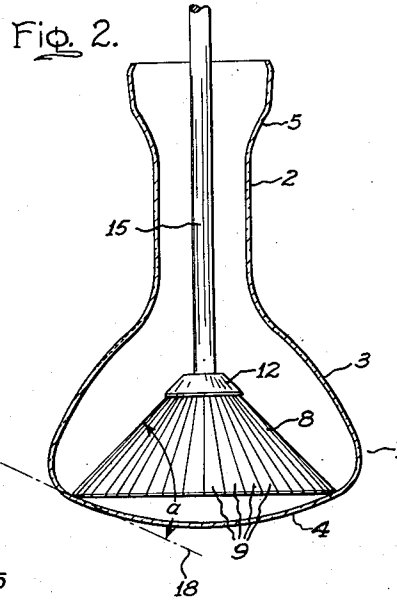
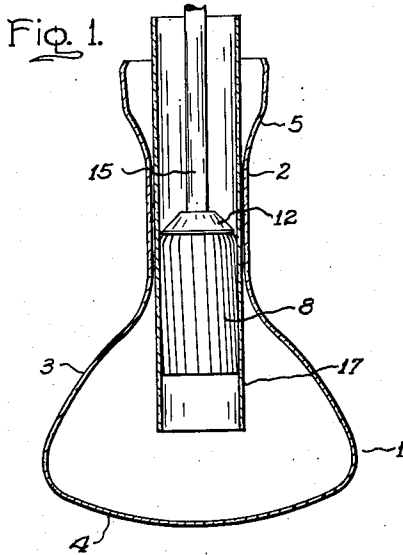


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METHOD AND MASKING SHIELD FOR INTERIORLY
COATING HOLLOW ARTICLES
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METHOD AND MASKING SHIELD FOR INTERIORLY COATING HOLLOW ARTICLES

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6 Claims. (Cl. 117—38)

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My invention relates to method and apparatus for providing coatings on localized areas of the interior wall of hollow articles, such as the glass envelopes of electric incandescent lamps, for instance.

Certain types of electric incandescent lamps in use at present are provided with light-reflecting coatings on certain confined areas of the internal wall surface of the lamp bulb. Where the bulb is of the type having a relatively long and constricted neck portion and a bulbous portion, ordinary coating methods cannot be employed where the coating is to be applied to certain areas only of the inner surface of the bulb, as to the neck and side wall portions only of the bulb. Heretofore, such partial light-reflecting coatings have generally been formed by providing the entire inner wall of the bulb with an overall coating of the light-reflecting medium and thereafter removing the coating (as by dissolving) from those areas of the bulb wall surface which are to be left clear. Such a process, however, is slow and cumbersome and for that reason is relatively expensive.

It is one object of my invention, therefore, to provide apparatus of novel character for applying a coating to a limited area of the inner wall surface of a hollow article.

Another object of my invention is to provide apparatus for applying a coating to the inner surface of the neck and side wall portions of an electric incandescent lamp bulb while leaving the bowl end thereof clear.

Still another object of my invention is to provide a novel method of applying a coating to a limited area of the inner surface of a hollow article, and especially to the neck and side wall portions only of an electric incandescent lamp bulb.

Further objects and advantages of my invention will appear from the following description of a species thereof and from the accompanying drawing.

In the drawing, Figs. 1-5 illustrate the successive steps involved in applying a coating of light-reflective material to the inner surface of the neck and side wall of an electric incandescent lamp bulb in accordance with the method comprising my invention, Fig. 1 illustrating the insertion of the masking shield into the bulb through the constricted neck thereof; Fig. 2 illustrates the masking shield in expanded condition within the bulbous portion of the lamp bulb after the withdrawal of the shield-insertion guide tube from the bulb; Fig. 3 illustrates the mask-

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ing shield in operative masking position within the bulb and the coating applicator device in position for applying light-reflective material to the exposed inner surface of the bulb; Fig. 4 illustrates the guide tube re-inserted in place within the bulb and the shield-positioning rod refastened to the shield, in readiness for withdrawal of the shield from the interiorly coated bulb; and Fig. 5 illustrates the withdrawal of the shield from the coated bulb.

Referring to the drawing, the invention is there illustrated as applied to a glass electric incandescent lamp bulb or envelope 1 of the type having a relatively long and constricted neck portion 2 and a bulbous portion comprised of a flaring side wall 3, conforming to the shape of any suitable reflector surface of revolution, and a more or less flattened bowl or face end portion 4 having a slight outward curvature or convexity. As formed on conventional type bulb-making machines, such type bulbs are also provided at their neck ends with an outwardly flaring cullet portion 5 which is subsequently cut off or removed at the time the lamp mount is sealed into the bulb. Prior to the sealing-in of the lamp mount, however, a portion of the inner wall of the bulb 1 is provided with a coating 6 which, in the particular case shown, is of light-reflecting character and covers the side wall portion 3 of the bulb and extends a short distance down into the neck 2 of the bulb. As shown in Fig. 5, the coating 6 extends upward along the side wall 3 of the bulb approximately to the maximum diameter of the bulb where it terminates, preferably with a straight line cut-off or edge as indicated at 7. If desired, however, the cut-off edge 7 may be of any other shape or configuration, such as of scalloped or saw-tooth form.

In accordance with the invention, the formation of the coating 6 on the bulb is accomplished with the aid of a normally conical collapsible masking shield 8 which is introduced into and positioned within the bulb in such manner as to mask off the portion of the inner wall thereof which is to be left clear or uncoated. The shield 8 consists of a plurality of flat spring leaves or resilient segments 9 of tapered shape (as shown in Fig. 2) which are assembled into a ring with their narrow ends inward and defining the opening of the ring and their tapering side edges overlapping. In the particular case shown, the shield 8 is formed of 36 such spring leaves 9 made of .002 inch thick spring steel. The annularly arranged overlapping spring leaves 9 are suit-

ably secured together adjacent their inner or narrow ends, as by spot-welding, for instance, to form a central web or hub holding the leaves together while permitting relative movement therebetween toward their outer end portions. The outer ends of the assembled spring leaves 9 are then trimmed to the circular or other shape required for producing the desired form of cut-off edge 7, and the ring of spring leaves then clamped at its inner periphery between cooperating annular tapered surfaces 10 and 11 on a pair of clamp rings or discs 12 and 13 which thus spring or bend the ring of spring leaves 9 into conical shape as shown in Fig. 2. The clamp surface 11 of the inner disc 13 is rounded off at the base or widest end of the disc so as to prevent undue localization of bending stresses in the individual spring leaves 9 when bent inwardly to collapse the shield 8. The clamp discs or rings 12, 13 are clamped together by means of a screw 14 which threads into the outer clamp disc 12 (i. e., the one provided with the concave conical clamp surface 10) and projects outwardly therebeyond to provide a fastening means for readily detachable connection to a positioning rod or shield-holding handle member 15 which is employed to insert the shield in the bulb.

The shield 8 is inserted in the bulb 1 by first attaching it to one end of the rod 15 which is provided for such purpose with a tapped opening 16 at one end thereof into which the clamp screw 14 of the shield is screwed. The shield 8 is then contracted and inserted in a guide tube 17, preferably made of hard glass for instance, and the guide tube then inserted through the neck 2 of the bulb and the shield pushed, collapsed end first, through the guide tube and into the enlarged or bulbous portion of the bulb by means of the rod 15, in the manner shown in Fig. 1. The guide tube 17 is then withdrawn from the bulb, whereupon the shield 8 is free to expand or spread to its original conical shape, as shown in Fig. 2, the outside diameter of the shield when in its expanded state being somewhat smaller than the maximum inside diameter of the bulb at the junction between the side wall 3 and face end 4 thereof. The center portion of the conical shield 8 is then depressed toward the face end 4 of the bulb, by means of the positioning rod 15, to distend the shield and bend the individual leaves 9 thereof outwardly until the shield settles into its operative masking position as shown in Fig. 3, in which position the shield is then in the approximate shape of a half toroid. The rod 15 is then unscrewed from the shield 8 and withdrawn from the bulb 1, the shield meanwhile remaining in its distended position. The disengagement of the positioning rod 15 from the shield 8 and its withdrawal from the bulb thus leaves the portion of the interior space of the bulb within the confines of the neck and side wall portions thereof substantially free and unobstructed, and no interference is accordingly offered to the subsequent production of a uniform coating 6 on the said portions of the bulb by vapor deposition or other similar methods wherein a layer of finely divided coating material is deposited on the interior wall of the bulb from a cloud or mist of such material filling the bulb.

In order to assure the ready distention or outward bending of the spring leaves 9 of the shield 8 in the manner indicated, it is preferable that the individual leaves 9 of the shield, when in its

normal conical position shown in Fig. 2, subtend an angle α of less than 90° with the tangent 18 to the curved inner surface of the bulb at the point of contact with each shield leaf 9.

With the shield 8 in operative masking position within the bulb 1, the latter is then ready for the application of the coating 6 to the inner wall thereof. This may be performed, in the case of a light-reflecting coating, by heating and evacuating the bulb and then vaporizing a suitable metallic light-reflecting material, such as aluminum, within the evacuated bulb to cause the deposition of a coating of such material on the exposed inner side wall 3 and neck 2 of the bulb. For this purpose, any suitable vaporizing and bulb-evacuating apparatus 19 may be employed, a simplified form being indicated in Fig. 3 and comprising a rubber stopper 20 having a pair of lead-in wires 21 and 22 extending therethrough in an air-tight manner. At their inner ends, the lead-in wires 21, 22 are connected to a filament 23 of tungsten on which is draped a small loop or bar 24 of the aluminum or other metal to be vaporized. The rubber stopper 20 is also provided with an exhaust tube 25 which extends therethrough in an air-tight manner and is connected at one end to a vacuum pump and communicates at its other end with the interior of the bulb. The rubber stopper 20 is inserted in the bulb neck 2 and seated in vacuum-tight manner against the flaring cullet 5 of the bulb neck, with the filament 23 located within the hollow interior of the bulb. The bulb 1 is then evacuated through the exhaust tube 25 and simultaneously heated to dry out any occluded gases and prevent cracking of the glass by contact with hot metal particles during the subsequent metal vaporization operation, and when the required degree of vacuum is attained in the bulb, the filament 23 is energized and heated, by the application of an electric current across the lead-in wires 21, 22, to cause the vaporization of the loop 24 of aluminum or other metal on the filament. The metal vapors condense quickly upon the exposed portions of the inner surface of the bulb to thereby form the reflecting coating 6 thereon. When the filament 23 has cooled sufficiently so as not to oxidize when exposed to the atmosphere, the coating apparatus 19 is removed from the bulb.

After the bulb 1 has been thus provided with the coating 6, the shield 8 is withdrawn from the bulb by first inserting the guide tube 17 through the neck 2 of the bulb and then passing the rod 15 through the guide tube 17 and screwing it to the shield clamp screw 14. The shield 8 is then pulled out through the guide tube 17 (Fig. 5) which is held stationary relative to the bulb until the shield is drawn within the guide tube, thereby preventing the shield leaves 9 from scratching or marring the coating 6 on the inner wall of the bulb.

It will be understood that the invention is not limited to the provision of a coating 6 solely of light-reflecting character, but may be also applicable to the provision of a coating of light-diffusing or other character and applied by spraying, dusting or like methods as, for example, by the combustion of a volatile compound within the hollow article, as disclosed and claimed in co-pending U. S. application Serial No. 878, Pipkin, filed January 7, 1948 now Patent No. 2,545,896 and assigned to the assignee of the present application.

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

1. The method of producing an internal coating on a wall portion other than the closed end wall of a hollow article having a constricted opening thereinto which method comprises, introducing into the article a normally conical-shaped collapsible shield and positioning the shield within the article to expand against the wall of the article and mask off the inner surface of the closed end wall portion to be left clear, coating the exposed portion of the inner wall of the article by depositing thereon a layer of finely divided coating material from a cloud of such material filling the hollow interior of the article, and then removing the shield from the article without the shield contacting and injuring the coating by inserting in the article a guide tube through the constricted opening in the article and collapsing the shield into and withdrawing it through the said guide tube.

2. The method of producing a coating on the inner surface of the side wall portion of a lamp bulb having a constricted open neck, while leaving clear the bowl end thereof opposite said neck, which method comprises collapsing and introducing into the bulb through said neck, wide end first, a normally conical-shaped collapsible and distensible shield, pressing the wide end of the shield against the bowl end of the bulb to effect a distension and retroversion of the shield into a half-toroidal shape with its periphery engaging the bulb wall approximately at its maximum diameter so as to mask off the bowl end of the bulb, coating the exposed portion of the inner wall of the article by depositing thereon a layer of finely divided coating material from a cloud of such material filling the bulb, and then removing the shield from the bulb without the shield contacting and injuring the coating by inserting in the bulb a guide tube through the constricted neck of the bulb and collapsing the shield into and withdrawing it through the said guide tube.

3. The method of producing a coating on the inner surface of the side wall portion of a lamp bulb having a constricted open neck while leaving clear the bowl end thereof opposite said neck, which method comprises collapsing and introducing into the bulb through said neck, wide end first, a normally conical-shaped collapsible and distensible shield by means of an inserting tool detachably connected therewith, pressing the wide end of said shield against the bowl end of the bulb to effect a distension and retroversion of the shield into a half-toroidal shape with its periphery engaging the bulb wall approximately at its maximum diameter so as to mask off the bowl end of the bulb, detaching the inserting tool from the positioned shield and removing said tool from the bulb to leave the hollow interior thereof substantially unobstructed except for the shield therein, exhausting the bulb and vaporizing onto the unmasked portion of the inner wall thereof a coating of finely divided material, and then removing the shield from the bulb without the shield contacting and injuring the coating by first inserting into the bulb a guide tube through the constricted neck of the bulb and then collapsing

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the shield into and withdrawing it through the said guide tube by means of said tool.

4. A shield for masking the interior spherically shaped end wall of a lamp bulb comprising a series of spring leaves arranged side-by-side in annular overlapping flared relation and joined together adjacent their inner ends to form an annulus, a pair of discs clamping the said annulus therebetween around its inner periphery and holding the annulus in frusto-conical shape, the said spring leaves being bendable outwardly at their free ends to form the annulus into an approximately half-toroidal shaped annular body with the leaves in overlapping relation, and external fastening means on the outer one of said discs for disengageable connection with a shield-holding handle member.

5. The method of producing an internal coating on a wall portion other than the closed end wall of a hollow article having a constricted opening thereinto opposite said end wall which method comprises, introducing into the article through said opening a normally conical-shaped collapsible shield and positioning the shield within the article to expand against the wall of the article and mask off the inner surface of the closed end wall portion to be left clear, coating the exposed portion of the inner wall of the article by depositing thereon a layer of finely divided coating material from a cloud of such material filling the hollow interior of the article, and then withdrawing the shield through a restricted passage within and separate from the hollow article to collapse the shield to a size smaller than the said constricted opening and maintain it out of contact with the coated wall portion of the article during said withdrawal.

6. The method of producing a coating on the inner surface of the side wall portion of a lamp bulb having a constricted open neck, while leaving clear the bowl end thereof opposite said neck, which method comprises collapsing and introducing into the bulb through said neck, wide end first, a normally conical-shaped collapsible and distensible shield, pressing the wide end of said shield against the bowl end of the bulb to effect a distension and retroversion of the shield into a half-toroidal shape with its periphery engaging the bulb wall approximately at its maximum diameter so as to mask off the bowl end of the bulb, coating the exposed portion of the inner wall of the article by depositing thereon a layer of finely divided coating material from a cloud of such material filling the bulb, and then withdrawing the shield through a restricted passage within and separate from the bulb to collapse the shield to a size smaller than the said constricted neck and maintain it out of contact with the coated side wall portion of the bulb during said withdrawal.

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