

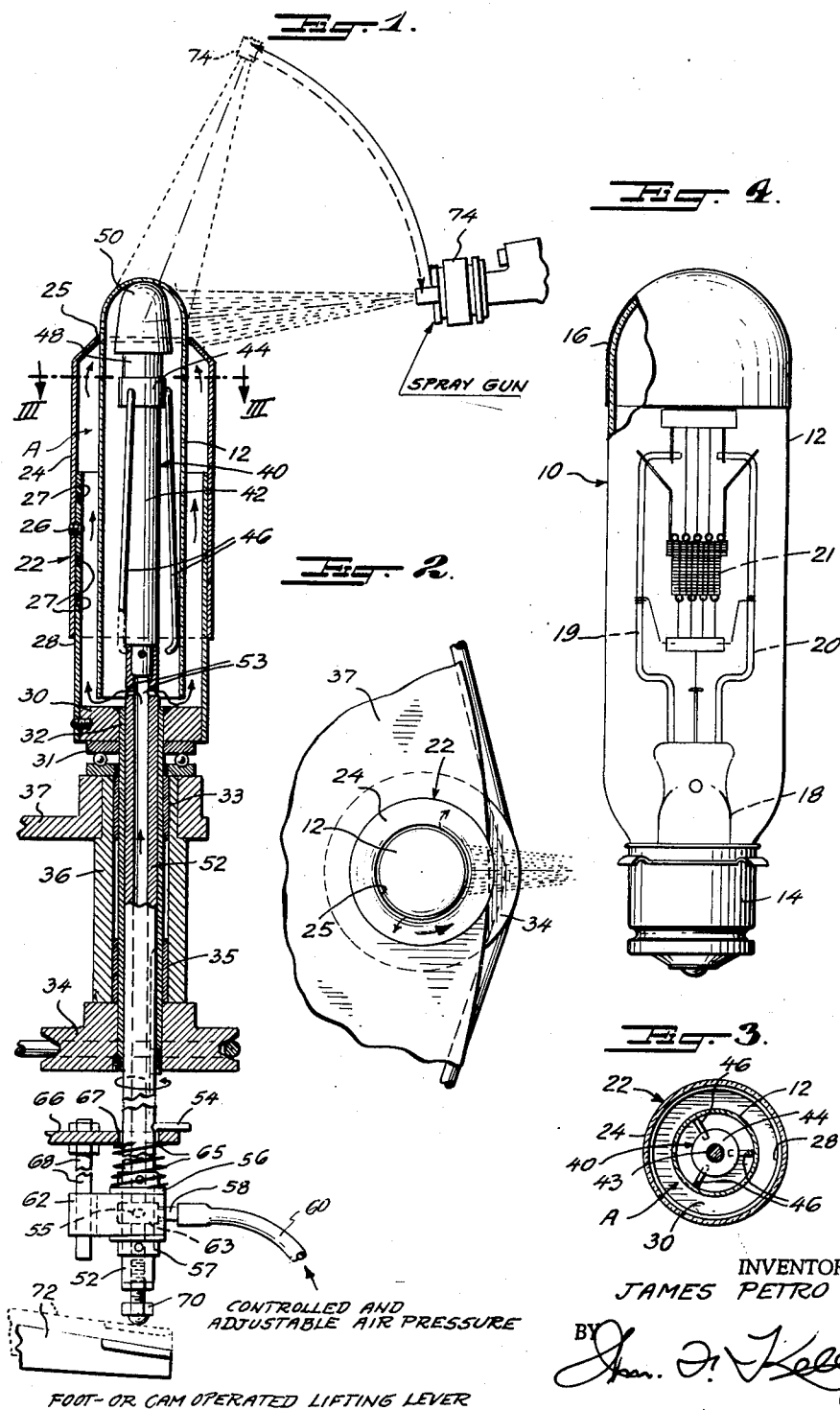
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MASKING METHOD AND APPARATUS

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MASKING METHOD AND APPARATUS

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This invention relates generally to the selective treatment of articles and, in particular, to a masking method and apparatus for shielding a selected portion of a cylindrical article such as a projection lamp bulb from sprayed coating material.

During the course of manufacturing certain articles it is often necessary or desirable for functional or purely decorative reasons to process or coat only a particular part of the article or area of its outer surface. In the electric lamp industry, for example, it has become the standard practice to coat the top of a projection lamp bulb with an opaque layer of suitable high-temperature material such as ceramic paint or the like in order to prevent the leakage of stray light upwardly through the projector housing. Heretofore, this has been accomplished by shielding the main body portion of the bulb with a tight-fitting mask of rigid material and spraying the exposed top of the bulb until a coating of the desired opacity was obtained. The utilization of a tight-fitting mask of rigid construction, however, was inherently impractical inasmuch as bulbs which were slightly oversize could not be inserted into the mask and those which were undersize were not effectively shielded, the latter condition resulting in a smeared or uneven line of demarcation between the coated and uncoated areas or so-called "cut-off" line which necessitated a time-consuming and costly cleaning operation of both bulb and mask.

In an attempt to overcome this problem the masks were made slightly oversize and lined with sponge rubber or the like to compensate for the variations in the bulb dimensions and thus maintain the intimate surface contact necessary to effectively seal off the enclosed part of the bulb from the sprayed particles. The inability of masks of this character to withstand the high ambient temperatures required to set and cure the coating, and their inherent short life, necessitated the frequent inspection and reconditioning or replacement of such masks in order to insure coatings of acceptable quality thus rendering this manner of masking not only impractical from both a quality control and cost standpoint but unsuitable for use in high-speed bulb coating equipment.

It is accordingly the general object of the present invention to provide an improved masking technique which will obviate the foregoing deficiencies of the prior art and enable articles to be partially coated or otherwise processed with greater efficiency than heretofore.

Another object of the invention is to provide means for masking a selected portion of an article from a processing medium and effecting a sharp line of demarcation between the treated and untreated areas thereof.

Another and more specific object of the invention is to provide a simple and inexpensive method for restricting the deposition of sprayed coating particles to a predetermined top section of cylindrical objects having variable dimensions, such as tubular lamp bulbs, which method can be readily adapted to high-speed automatic equipment.

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A further object of the present invention is the provision of apparatus capable of conveniently and neatly masking a selected portion of an article and withstanding repetitive use under high-temperature conditions with a minimum of maintenance and replacement of parts.

Still another object of the present invention is the provision of masking apparatus which is not only inherently simple, rugged and trouble-free but which can be readily incorporated in high-speed equipment for coating projection lamp bulbs and consistently produce a sharply defined line of cut-off at a preselected part of the bulb despite variations in the bulb diameters and length.

The aforesaid objects of the invention, and others which will become apparent as the description proceeds, are achieved by positioning the article in juxtaposed relation with a masking member of rigid non-porous material proportioned and contoured to define, in conjunction with the surface of said article to be protected, an airtight chamber open to the atmosphere and accessible to the processing medium along a line which coincides with the desired line of cut-off and then introducing a suitable pressurized gas such as air into the chamber. By properly regulating the resultant flow of gas in the space between the mask and article through the opening (which is preferably constricted), a fluid barrier or curtain of gas, so to speak, of such character is produced that the enclosed surface of said article is sealed off from the processing medium and the turbulent backwash thereof, if the medium is pressure-applied, without interfering with the processing of the exposed surface, thus sharply limiting the area treated and effecting a neat and well-defined cut-off. The desired masking effect is, accordingly, achieved by a flow of gas through and out of the chamber rather than by mechanically sealing off the area with a tight fitting shield thereby not only greatly facilitating the masking operation as a whole by simplifying the loading procedure and eliminating the difficulties heretofore presented by dimensional variations in the articles but affording a degree of durability and control heretofore unattainable.

For a better understanding of the invention reference should be made to the accompanying drawing wherein:

Fig. 1 is an elevational view, mainly in section, of a spray type bulb-coating apparatus embodying the present invention and showing the manner in which the spray gun is trained with respect to the top of a loaded bulb during the coating operation;

Fig. 2 is a plan view of the apparatus shown in Fig. 1;

Fig. 3 is a cross-sectional view of the apparatus in Fig. 1 taken along the line III—III, in the direction of the arrows, illustrating the spatial relationship between the shield, bulb-supporting assembly and the bulb when the latter is in loaded position; and

Fig. 4 is an enlarged elevational view of a projection lamp incorporating a bulb of the type being processed in Figs. 1 to 3, a segment of the bulb being broken away and in section to more clearly illustrate the character of the coating thereon.

Although the principles of this invention are broadly applicable to the selective treatment or coating of various types of articles having diverse shapes, the invention is especially adapted for use in a spray type coating machine for applying an opaque layer of finely-divided material to the tops of cylindrically hollow articles such as projection lamp bulbs and hence has been so illustrated and will be so described.

With specific reference now to the drawing, in Fig. 4 there is shown an incandescent projection lamp 10 comprising, in general, a tubular bulb 12 one end of which is closed to form a rounded or domed end portion and the other sealed to a re-entrant stem 18 and fitted with a prefocus type base 14. In accordance with the usual

construction employed in lamps of this character (a representative sample of which is shown and described in U.S. Patent No. 2,140,977), the re-entrant stem 18 axially projects into the bulb 12 and supports a pair of spaced longitudinally-extending leads 19 and 20 between which a sectionally-coiled tungsten filament 21 (of either the well-known monoplane or biplane type) is pendently supported by means of suitable top and bottom bridge assemblies. The lamp 10 is designed to be burned in the base-down position shown in Fig. 4 so that the closed end of the bulb 12 constitutes the top portion of the lamp 10 which portion, in accordance with the well-known practice, is provided with an opaque coating 16 of suitable high-temperature material such as ceramic paint or the like to intercept the upward components of stray light emanating from the filament 21. As will be obvious, it is highly desirable that the coating material be uniformly applied and that the line of demarcation between the coated and uncoated areas or the so-called "cut-off" line be even and neatly defined so that the coating "as applied" is of acceptable quality from an appearance standpoint and costly and time-consuming bulb-cleaning operations can be avoided.

The essence of this invention resides in the method and means employed to mask the body portion of the bulb 12 during the coating operation and effect a cut-off of the desired character and these will be hereinafter described.

In Fig. 1 there is shown an apparatus for coating a selected top segment of the projection lamp bulb 12 according to one embodiment of the present invention. The apparatus comprises generally a bulb-supporting assembly 40 and a centrally apertured bulb-enclosing casing or shield 22 of rigid non-porous material, such as sheet metal or the like, arranged one within the other in concentric upstanding relation so that the shield 22 is spaced from and encloses the top section of the bulb-supporting assembly 40, with the exception of the tip thereof. As shown in Figs. 1 to 3, the bulb 12 is inserted into the shield 22 and threaded over the bulb-supporting assembly 40 until firmly seated thereon so that the body portion of the bulb is enclosed by the shield and a selected top portion thereof protrudes from the shield and is exposed to the coating material, which material is preferably applied in the form of an atomized jet of finely-divided particles by means of a suitable spray gun 74 well-known in the art.

In order to insure that the coating material is applied evenly, the bulb 12 is desirably rotated at a suitable speed during the coating operation. This may be conveniently accomplished by mounting the shield 22 on a spacing ring 30 carried by a support tube 32 which is rotatably held by means of a thrust bearing 31 and bushings 33 and 35 in upstanding position within a stationary housing 36 affixed to the frame 37 of the bulb-coating machine. Thus, when the support tube 32 is rotated in the direction shown by the arrow in Fig. 1, as by a well-known drive pulley 34 secured to the end of such support tube, the shield 22, bulb-supporting assembly 40 (a portion of which is secured to the support tube 32), and the bulb 12 seated thereon, rotate as a unit. By virtue of the foregoing construction, however, the bulb-supporting assembly 40 and bulb 12 are reciprocally movable with respect to the shield 22 so that the bulb may be accurately positioned within the shield and manipulated therein by properly supporting and displacing the exposed lower end of said assembly, as viewed in Fig. 1.

In order to provide means for securely gripping the bulb 12 and introducing a suitable pressurized gas such as air into the interior of the shield 22, as contemplated by this invention, the bulb-supporting assembly 40 is desirably fabricated in two sections, namely, an upper solid spindle 42 and a lower hollow spindle 52 conjoined in coaxial relation to form an integral elongated member,

the latter spindle constituting the lower portion of the assembly and being slidably disposed within the support tube 32. The upper spindle 42 terminates in a collar 44 having three radially-spaced finger-like elements 46 arranged (as shown in Figs. 1 and 3) to provide a rigidly anchored spider assembly adapted, when the bulb 12 is forcibly threaded thereover, to be compressed inwardly and resiliently engage and grip the interior wall surface of the bulb. Accurate positioning of the bulb 12 with respect to the bulb-supporting assembly 40 is effected by means of a tip element 48 carried by the upper spindle 42 which element is covered by a thimble-like cap 50 of suitable shock-absorbing material such as rubber or the like and serves as a stop contoured to nest within the dome of the bulb 12 and centralize the bulb on the supporting assembly, as shown in Figs. 1 and 3. The end of the bulb 12 to be coated is thus used as the reference point in positioning the bulb within the shield 22 and determining the line of cut-off, as hereinafter explained, so that equal end segments of the bulbs are coated regardless of the overall bulb length prior to the sealing-in operation. The tip element 48 is desirably threadably coupled to the upper spindle 42 by means of a threaded aperture 43 (Fig. 3) in the collar 44 to facilitate the removal thereof and replacement of the cap 50.

The introduction of a suitable gas such as air under pressure into the shield 22 in accordance with the principles of this invention may be conveniently accomplished by utilizing the lower hollow spindle 52 of the elongated tubular member as a conduit by proportioning such spindle so as to project slightly beyond the upper edge of the support tube 32 and a predetermined distance beyond the lower edge thereof and the attached pulley 34, as viewed in Fig. 1. The end of the lower spindle 52 which projects into the shield 22 is provided with a plurality of apertures 53 to thus effect communication with the shield interior. The opposite end of the lower spindle 52 is closed off by an axially-depending set screw 70 and is provided with an aperture 55 which opens into a chamber 63 defined by a bracket 62 held in encircling relation with said lower spindle by a pair of flanged retaining rings 56 and 57. The chamber 63, in turn, connects with a pressured air supply (not shown) through a flexible conduit 60 attached to a nipple 58 carried by said bracket. Thus, means are provided for injecting a predetermined quantity of pressurized air into the shield 22 at a point remote from the open end thereof, the rate of flow of said air being controlled in any convenient manner as by an adjustable reducing valve (not shown) in the conduit 60.

The bracket 62 (as shown in Fig. 1) extends laterally and is suitably forked or apertured to slidingly accommodate a stud 68 fastened to a horizontally-disposed plate 66 secured to the frame 37 which stud is disposed in parallel relation with the axis of the support tube 32. Thus, the bracket 62 (in addition to coupling the lower spindle 52 to the conduit 60) serves to maintain said spindle in coaxial alignment with the support tube 32 permitting the bulb-supporting assembly 40 as a whole to move freely longitudinally with respect to said tube and the shield 22. The plate 66 projects beyond the periphery of the lower spindle 52 sufficiently to provide a stop for an appropriately located pin 54 carried by the lower spindle 52 which thus limits the downward travel of the bulb-supporting assembly 40 and accurately positions the top portion thereof with respect to the shield 22 so that when said pin and plate are seated one against the other, a bulb 12 disposed on the bulb-supporting assembly 40 will project a predetermined distance beyond the peripheral lip of the shield 22. A helical spring 65 interposed between the plate 66 and the flange of the retaining ring 56 exerts a constant downward force on the bulb-supporting assembly 40 thus maintaining the pin 54 normally in firmly seated engagement with the plate 66 and

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assuring that the desired portion of the bulb 12 is exposed during the coating operation. The set screw 70, in addition to sealing off one end of the lower spindle 52, provides means for precisely adjusting the overall length of the bulb-supporting assembly 40 so that when said set screw is contacted by a suitable lifting lever 72, as shown by the dotted outline of said lever in Fig. 1, and subsequently thrust upwardly, the bulb-supporting assembly 40 and a bulb 12 loaded on said assembly will be raised out of the shield 22 a sufficient distance to permit the shielded body portion of the bulb 12 to be grasped.

In order to accommodate bulbs of various standard lengths, the shield 22 is desirably fabricated in two sections, as shown in Figs. 1 and 3, namely, a movable sleeve 24 and a stationary sleeve 28 arranged in telescopic relation so as to vary the length of the shield by adjusting the position of a set screw 26 engageable at different points with apertures 27 in the movable sleeve. To minimize the number of sprayed particles which impinge on the gap between the bulb 12 and shield 22 and thus reduce the "incidence of leakage," so to speak, into the shield 22, the free end of the movable sleeve 24 is desirably tapered inwardly to define a central aperture which is only slightly greater in diameter than the maximum outer diameter of the bulb 12 to be accommodated thus providing, when said bulb is in centrally-loaded position on the bulb-supporting assembly 40, an annular escape-ment or constricted opening 25 (see Figs. 1 and 2). It should be noted that even though the width of the opening 25 may vary due to variations in the outer diameter of the bulb 12, the desired masking effect will still be obtained since the outward flow of air will be greatest where the opening 25 is widest. Thus, the distribution of the gaseous outflow is automatically adjusted to correct for the variations in the "incidence of leakage" occasioned by varying gap widths. As illustrated in Fig. 1, the movable sleeve 24 is of sufficient length that when the set screw 26 provided therein is disposed in the uppermost position in the stationary sleeve 28, the lowermost of the screw-apertures 27 remains covered by the movable sleeve thereby rendering the shield 22 substantially air tight regardless of the size of the bulb being processed. Thus, when the bulb 12 is seated in loaded position on the bulb-supporting assembly 40, the shield 22 in conjunction with the inner and outer surfaces of the bulb defines an air tight chamber A open to the atmosphere and sprayed particles only through an annular constricted opening 25 which encircles the bulb at a predetermined point along its longitudinal axis, as illustrated in Figs. 1 and 2, which point coincides with the preselected line of cut-off.

Operation

In processing the bulb 12 in accordance with this invention, the telescopic shield 22 is first adjusted by movement of sleeve 24 relative to the stationary sleeve 28 as determined by the length of the end segment of the bulb 12 to be processed, and which sleeve is then secured in position by the set screw 26. With the bulb-supporting assembly 40 in its normally recessed position shown in Fig. 1, the bulb 12 is then inserted into the shield 22 and forcibly threaded over the bulb-supporting assembly 40 until it rides over the finger-like extensions 46 and is firmly seated in loaded position against the cap 50 in coaxial and juxtaposed relation with the shield and bulb-supporting elements (as illustrated in Figs. 1 to 3) thus defining the air tight chamber A and constricted opening 25 as above-described. The entire assembly is then rotated at a suitable speed by the driven pulley 34 and clean dry air, at a pressure sufficient to fill the chamber A and maintain an appreciable outward flow through the afore-said opening 25 during the coating operation, is fed from a suitable pressurized source (not shown) into the end of the chamber A opposite the opening 25 by means of

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the above-mentioned conduit 60, nipple 58 and apertured lower spindle 52. In this manner a curtain of air, so to speak, is produced at the line of cut-off on the bulb 12 which prevents the influx of sprayed particles into the shield 22.

In order to avoid interfering with the coating of the exposed top portion of the bulb 12, the pressure of the air supplied to the chamber A is so adjusted that the protective curtain of air produced is easily penetrated by the heavier globules or particles of the main spray but of sufficient velocity to deflect the finer and lighter particles that fan out from the main stream and form the turbulent fringe or side portion of the spray which portion, by virtue of the arcuate path of its constituent particles, would otherwise skirt the edge of the shield 22 and blur the line of cut-off. An outward current of air of this character may be conveniently achieved by operating the spray gun 74 at a suitable pressure above that of the air supplied to the chamber A, the exact pressure differential depending on the range of particle size of the coating material, the spacing of the various elements, etc.

The spray gun 74 is then triggered and progressively swung along a diametric plane and in an arcuate path around the top of the bulb 12 from a position slightly above the horizontal to one just short of the vertical and back again, as shown in Figs. 1 and 2, until a coating 16 (Fig. 4) of the desired opacity is obtained. By virtue of the selective deflection of the sprayed particles effected by the air flowing from the opening 25, only the preselected top portion of the bulb 12 left exposed is subjected to the spray and the coating 16 sharply terminated at the desired line of cut-off.

After the coating operation has been completed and the coating 16 sufficiently set, the apparatus is brought to a stop and the lifting lever 72 actuated thus raising the bulb-supporting assembly 40 and bulb 12 thereon a sufficient additional distance out of the shield 22 to permit the uncoated body portion of the bulb 12 to be grasped and the bulb removed without smearing or otherwise disturbing the coating 16, which coating is then cured as by baking in the usual manner. It will, of course, be obvious that the air fed into the chamber A, in addition to being clean and dry, may be heated sufficiently to accelerate the setting-up of the coating material at the line of cut-off to further facilitate the coating operation, or means may be provided for applying the necessary heat to the bulb 12 while it is still being rotated to thus complete the curing process while the bulb is on the machine. After the coated bulb 12 has been removed, the lifting lever 72 is released whereupon the bulb-supporting assembly 40 in response to the action of the spring 65 returns to its normally-recessed loading position and the aforementioned loading operation is repeated.

As will be apparent from the foregoing, the objects of the invention have been achieved by providing an improved method and means for masking a preselected portion of an article which are not only simple and inexpensive but facilitate the operation as a whole and provide a degree of control heretofore unattainable. In addition, by utilizing a loose-fitting shield of rigid construction in combination with a pressurized air flow that serves as the primary masking or protective means, a masking apparatus is provided which is not only inherently trouble-free and durable but exceptionally easy to load and adapted for use in automated equipment.

While the present invention has been described in some detail by way of illustration and example for purposes of clarity and understanding in accordance with the patent statutes, it is understood that various changes and modifications may be made without departing from the spirit and scope of the invention.

I claim:

1. The method of masking a selected portion of an article from a processing medium which method consists of inserting said article into an apertured shielding member adapted to loosely receive said article, positioning said

article within and in spaced relationship with said shielding member to expose the portion of said article to be processed and define with the surrounding edge of said member a relatively narrow opening which coincides with a predetermined line of cut-off on said article, and then passing a fluid medium through said opening at a sufficient velocity to substantially prevent the processing medium from entering said opening and producing an uneven line of demarcation between the processed and unprocessed portions of said article.

2. The method of masking a selected part of an article from a processing medium which method consists of inserting said article into a shielding member adapted to loosely receive the selected part to be masked, positioning said article within and in wholly spaced relationship with said shielding member to define with the encircled part of said article an opening which coincides with a predetermined line of cut-off on said article, rotating said article and shielding member while so positioned, and then passing a fluid medium through said opening to prevent the influx of said processing medium into said opening and thereby restrict said processing medium to the exposed part of said article above the aforesaid line of cut-off.

3. The method of masking a selected body portion of a cylindrically hollow article such as a tubular lamp bulb from an atomized jet of finely-divided particles which method consists of inserting the part of said article to be masked into a shielding member adapted to loosely receive said part, positioning said article within and in wholly spaced relationship with said shielding member to define with the enclosed surface of the selected body portion of said article a chamber normally accessible to the atmosphere and said atomized jet through a constricted opening which coincides with a predetermined line of cut-off on said article, rotating said article and shielding member while so positioned about the longitudinal axis of said article, and then passing a pressurized gas through said chamber and said opening at a rate such that any of said finely-divided particles impinging thereat will be deflected toward the exposed portion of said article and said jet sharply terminated at the aforesaid predetermined line of cut-off.

4. Apparatus for masking a selected portion of an article from a processing medium, consisting of an apertured masking member adapted to loosely receive the portion of the article to be protected and expose the portion of the article to be processed, the aperture in said masking member being of such configuration that the definitive edge of said member will be adjacent to but spaced from said article when the latter is in its inserted position and define with said article a relatively narrow passage, and means for providing a flow of gas through said passage to substantially prevent the influx of the processing medium into said passage.

5. Apparatus for masking a selected body portion of an article from a processing medium, consisting of an apertured shielding member dimensioned to loosely receive the part of said article to be protected and contoured to define therewith an opening accessible to the atmosphere and normally accessible to said processing medium along a predetermined line, means for accurately positioning said article within but spaced from said shielding member so that the opening thus defined coincides with a preselected line of cut-off on said article, and means for providing a controlled flow of gas through said opening to substantially prevent the influx of the processing medium into said opening and beyond the aforesaid line of cut-off.

6. Apparatus for masking a selected body part of a cylindrically hollow article such as a tubular lamp bulb from a processing medium, consisting of an apertured shielding member dimensioned to loosely receive the part

of said article to be protected and contoured to define therewith a chamber open to the atmosphere and normally accessible to said processing medium along a predetermined line, means for supporting said article within but wholly spaced from said shielding member so that the opening of the chamber thus defined encircles said article at a predetermined line of cut-off thereon, and means for providing a controlled flow of gas through said chamber and opening to substantially prevent the influx of the processing medium into said opening and beyond the aforesaid line of cut-off.

7. Apparatus for masking a selected body part of a cylindrically hollow article such as a tubular lamp bulb from a pressure-applied processing medium, consisting of an apertured generally cylindrical shielding member dimensioned to loosely receive the part of said article to be protected and contoured to define therewith a chamber accessible to the atmosphere and normally accessible to said processing medium through a constricted opening, an elongated article supporting member disposed in said shielding member in coaxial relation therewith, said article-supporting member being insertable into said article and of such length that when said article is firmly seated thereon it will be wholly spaced from and so positioned with respect to the aforesaid shielding member that the constricted opening of the chamber thus defined will encircle said article at a predetermined line of cut-off thereon, and means for introducing into said chamber a pressurized gas and maintaining a controlled flow of gas through said opening to substantially prevent the influx of the processing medium into said chamber and beyond the aforesaid line of cut-off.

8. Apparatus for masking a selected body part of a cylindrically hollow article such as a tubular lamp bulb from a spray of finely-divided particles, consisting of an apertured generally cylindrical shield dimensioned to loosely receive the part of said article to be protected and contoured to define therewith a chamber accessible to the atmosphere and normally accessible to said spray through a constricted opening, an elongated article-supporting member disposed in said shield in coaxial relation therewith and extending a predetermined distance beyond the article-receiving end thereof, said article-supporting member being insertable into said article and adapted to firmly seat against the closed end thereof, means carried by said article-supporting member for centralizing and gripping said article so that the latter, when seated on said article-supporting member, will be inserted a predetermined distance into and wholly spaced from said shield such that the constricted opening of the chamber defined by said shield and article will encircle said article on a diametric plane at a point along its longitudinal axis which coincides with a predetermined line of cut-off, a portion of said article-supporting member being tubular in form and apertured to communicate with the interior of said shield, means connecting with the said tubular portion of said article-supporting member for injecting a pressurized gas into said chamber and maintaining a controlled current of gas through said chamber and constricted opening, and means for rotating said shield, article-supporting member and article as a unit during the spraying operation.

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