

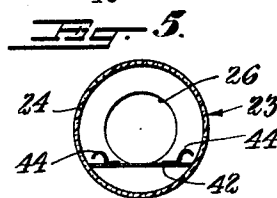
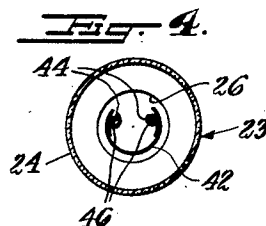
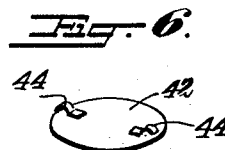
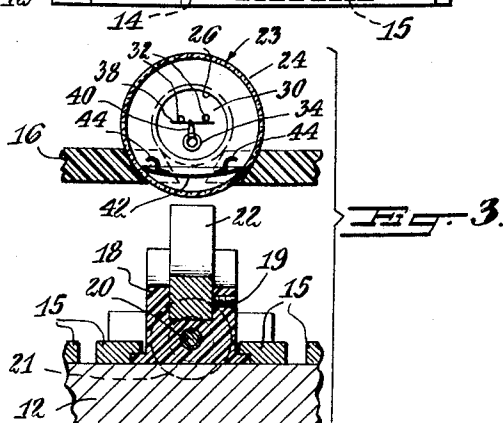
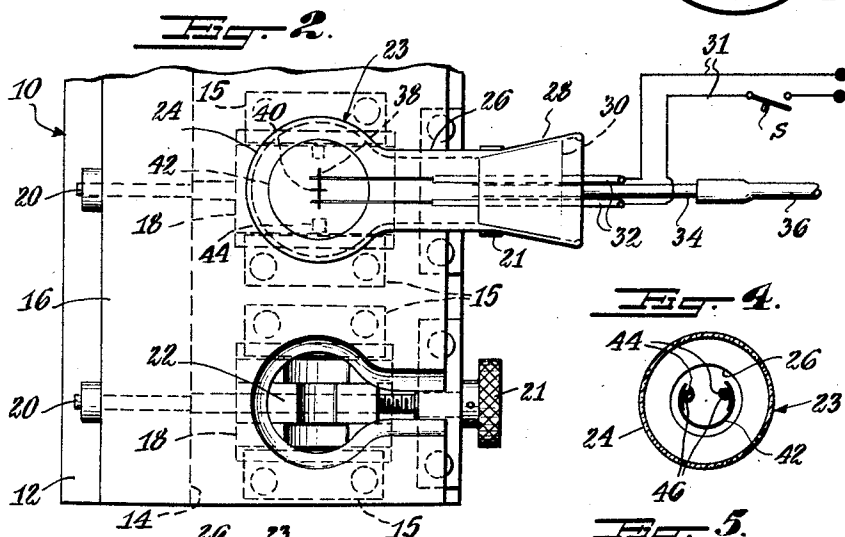
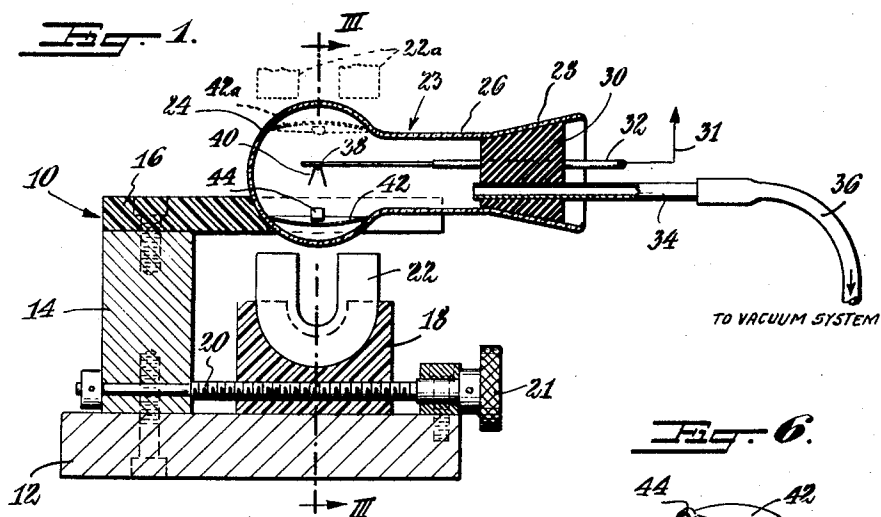
Dec. 8, 1959

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2,916,396

MASKING APPARATUS AND METHOD

Filed March 21, 1957



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2,916,396

MASKING APPARATUS AND METHOD

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Application March 21, 1957, Serial No. 647,584

9 Claims. (Cl. 117—38)

This invention relates generally to a masking apparatus and method and, more particularly, to such for shielding selected interior portions of hollow non-magnetic articles having constricted openings, such as electric lamp envelopes and the like.

It is often desirable for functional or purely decorative purposes to selectively treat the surface of an article or component parts thereof during manufacture. For example, in the electric lamp industry the envelopes of certain types of lamps are partially coated interiorly in such a manner as to control both the direction and pattern in which the light is transmitted. Where a very narrow and intense beam or pencil of light is desired, as in the illumination of gun sights or other precision devices employing an optical system for example, all but a circular portion of the inner surface of the lamp envelope is coated with an opaque layer of highly reflective material such as silver or aluminum to provide a light-transmitting area or window which, by virtue of its shape and location, confines the light emanating from the lamp to an accurately directed beam of the desired shape and brightness. In other types of lamps, such as the so-called heat and spot or flood lamps, all but the closed end wall portion of the envelope is similarly coated to provide a reflector surface of such contour that the radiations produced within the lamp are directed and distributed according to a preselected beam pattern.

Heretofore, the interior surface of the envelopes for lamps of the foregoing character was subjected in its entirety to the coating process or other treatment and selected portions thereof rendered light-transmitting by chemically or otherwise removing the coating material from these portions. A more recent and efficient procedure, however, has been to introduce a suitable shielding means into the envelope and to subsequently mechanically position and press said means into masking engagement with selected interior portions of the envelope during the coating operation to preserve their light-transmitting quality. The first-stated practice has been discontinued since it does not lend itself to the high-speed automated manufacture of lamps thus rendering it impractical from both a manufacturing and cost standpoint. Mechanically masking the envelope, on the other hand, is only practical where the envelope has an opening of sufficient size and the portion to be shielded constitutes an entire wall or a continuous segment thereof and is easily accessible, as for example, the entire closed end of a bowl-shaped envelope opposite the neck opening thereof (and would be totally ineffective where a discrete or discontinuous portion of the side wall, for example, is to be protected, particularly if such side wall is flared outwardly to form an enlarged or bulbous portion and a sharp line of demarcation between the coated and uncoated areas is required. In addition, the accurate positioning of the shield inside the envelope by mechanical means is a tedious and time consuming procedure and is inherently impractical if a multiplicity of discrete or discontinuous portions of a wall or walls are

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to be simultaneously protected without unduly complicating the masking operation or interfering with the processing of the article.

It is accordingly the general object of the present invention to overcome the foregoing deficiencies of and objections to the prior art practices by providing means for simply and conveniently masking selected interior portions of a hollow non-magnetic article regardless of the configuration or location of the portions to be shielded.

A more specific object of the invention is to provide an apparatus and method which will permit selected interior portions of a lamp envelope having a constricted neck portion to be accurately and neatly masked with a minimum amount of labor and material and without the aid of mechanical positioning or actuating means.

Another object of the invention is to provide a masking apparatus for simultaneously shielding a plurality of selected interior portions of a lamp envelope having a constricted neck opening without unduly complicating or interfering with the process required to treat the exposed surface of the envelope.

A further object of the invention is to provide a simple and inexpensive method of interiorly masking a preselected portion of a hollow non-magnetic article having a constricted opening therein, particularly when the portion to be masked is larger than the cross-sectional area of the opening in the article and a sharp cut-off line or well-defined window area is desired.

Still another object of the invention is to provide a method of interiorly masking selected portions of a lamp envelope provided with a constricted opening which method can readily be adapted to high-speed manufacturing techniques.

The foregoing objects and others which will become apparent to those skilled in the art as the description proceeds are achieved by providing a magnetically-responsive shield means of such contour that when contained by the article it is freely movable therein and automatically positioned and held in masking engagement with a preselected interior portion thereof when the article is placed in a magnetic field. If the article has a constricted opening, as in the case of the bulbous or pear-shaped envelopes commonly employed in the well-known household variety of electric lamps, and the area to be protected is substantially greater than the cross-sectional area of the opening, then the shield is preferably fabricated from resilient sheet material or made collapsible so that it may be temporarily reduced in size and conveniently inserted into the envelope through the opening.

A better understanding of the invention may be obtained by referring to the accompanying drawing in which like numerals of reference indicate similar parts throughout the several views, wherein:

Fig. 1 is a side-sectional view of an apparatus for masking selected interior segments of the bulbous portion of a lamp envelope and vacuum-metalizing the exposed areas thereof and illustrates one mode of applying the invention to the fabrication of electric lamps;

Fig. 2 is a fragmentary plan view of the apparatus illustrated in Fig. 1 showing two loading stations, one of which contains an envelope carrying the metalizing device, and illustrates in greater detail the structural features of the envelope-supporting and the magnetic-field generating portions of the masking apparatus according to one embodiment of the invention;

Fig. 3 is a cross-sectional view through a loaded station of the masking apparatus, as viewed along the line III—III of Fig. 1, illustrating the spatial arrangement of the various components of the apparatus and the envelope just before the metalizing device is energized;

Figs. 4 and 5 are cross-sectional views through the bul-

bous portion of the lamp envelope similar to the view thereof shown in Fig. 3 but illustrating the disposition of the shield during and after its insertion, respectively, through the neck portion of the lamp envelope;

Fig. 6 is a perspective view of the shield in its normally-expanded or relaxed condition.

Although the invention is broadly applicable to selectively masking the interior surfaces of other types of hollow articles fabricated from non-magnetic material, it is especially suited for use in the manufacture of electric lamps having envelopes with an enlarged or bulbous portion that is interiorly coated with a specular material except for an accurately-located and sharply-defined window or light-transmitting area and hence has been so illustrated and will be so described.

Referring now to the drawing, in Fig. 1 there is shown a fixture assembly 10 comprising generally an elongated base plate 12 having a standard 14 fastened in upstanding and coextensive relation at an upper marginal portion thereof. A platform 16 dependently secured to the upper face of the standard 14 in parallel relation with the base plate 12 provides a shelf or bench-like working surface which has a plurality of keyhole-shaped slots formed therein adapted to receive and hold a plurality of lamp envelopes 23 in spaced and horizontally-disposed relation thus providing a series of loading stations. While the envelope 23 is here shown as provided with an enlarged or bulbous portion 24 of generally spherical contour and a constricted neck portion 26 which is terminated by an outwardly flared cullet 28, it will be understood that the invention is equally applicable to other shapes and types of articles.

Each of the slots in the envelope-supporting platform 16 is contoured and provided with suitably tapered edges to nestingly accommodate the bulbous and neck portions 24 and 26, respectively, of the envelope 23 so that when the envelope is in loaded position on the fixture 10 it is firmly seated and rests in a horizontally-stabilized position on the platform 16. A block 18 may be slidably mounted on the plate 12 directly beneath each of the slotted sections in the platform 16 by means of a pair of guides 15 which are so oriented that the block 18 is movable along the longitudinal axis of the slot and envelope 23 when the latter is in loaded position therein. The block 18 is provided with a pocket adapted to receive the arcuate portion of a horseshoe-type permanent magnet 22 so that the poles of the magnet are directed toward and located adjacent the bulbous portion 24 of the envelope 23 when the latter is in loaded position on the fixture 10. The magnet 22 may be locked in its mounted position on the block 18 by means of a set screw 19 (Fig. 3) which is threadably movable into tight frictional engagement with the magnet 22 through an aperture provided in the side wall portion of the block 18. A shaft 20 rotatably secured to the standard 14 and plate 12 and threadably coupled to the block 18 may be provided so that upon rotation of the shaft 20 by means of a knob 21 the magnet 22 may be precisely positioned along the longitudinal axis of the envelope 23 when the latter is placed in loaded position. In order to prevent the weakening or distortion of the magnetic field generated by the magnet 22 it is preferable that the envelope-supporting platform 16 and the mounting block 18 be fabricated from a suitable non-magnetic material such as plastic or hard rubber or the like.

The foregoing apparatus is merely illustrative of the many arrangements which can be employed to hold the article and the magnetic-field generating means in adjustable and precisely oriented relation. One desirable feature of the foregoing arrangement, however, is that with the envelope 23 horizontally disposed the shielding means and a suitable coating device may be laterally inserted into the envelope 23 through the neck opening therein thus facilitating this phase of the operation. While other types of coating or treating means may be employed as

desired, the invention as here illustrated is utilized in conjunction with a vacuum-metalizing device comprising a pair of conductors 32 and an exhaust tube 34 which are inserted through and held in spaced relation by a tapered stopper 30 of suitable insulating material having openings therein adapted to make an air-tight fit with the aforementioned elements. The conductors 32 are of such length that when the stopper 30 is plugged into the cullet 28 of the envelope 23 the end portions of the conductors are located within the bulbous portion 24. The inward portions of the conductors 32 are connected to a vaporizing filament 38 upon which a loop 40 of suitable coating material such as silver or aluminum may be draped whereas the outer portions are controllably connected with a source of electrical power by a pair of leads 31 and a switch S (see Fig. 2). The exterior end portion of the exhaust tube 34 is coupled by a flexible conduit means 36 to a vacuum system (not shown) to permit evacuation of the envelope 23 prior to the metalizing operation.

An essential feature of the present invention resides in the masking means and in the manner in which it is inserted and positioned within the envelope 23 and these are hereinafter more fully described.

As shown in Fig. 6, the masking means may comprise a shield 42 of magnetically-responsive material which is cut to the desired shape and sufficiently resilient to permit the shield 42 when flexed to be bowed back upon itself or even rolled into tubular form. In practice, a section of spring-tempered steel foil has been found especially suitable due to its small mass, its ability to withstand repeated use, and its high degree of flexibility and responsiveness to magnetic forces. While the shield 42 is here shown as circular in shape it will be understood that it may be of any configuration depending on the geometrical shape and area of the interior portion of the article to be masked. Similarly, instead of a one-piece type shield a plurality of sections may be formed and suitably joined to provide a readily collapsible and expandable shield assembly if desired.

In accordance with the invention the shield 42 is flexedly bowed back upon itself to temporarily reduce its bulk so that its breadth is smaller than the diameter of the constricted opening at the neck portion 26 of the envelope 23 whereupon the shield is inserted through the said opening into the bulbous portion 24, in the manner illustrated in Fig. 4. The flexure of the shield 42 may be conveniently accomplished by attaching grippable means 44, such as a pair of protruding cleat-like elements, to marginal portions of the shield 42 so that upon engagement thereof by the jaws 46 of a scissor-like tool (not shown) the shield 42 is retroflexed and contorted into arcuate form (see Fig. 4). Once the neck portion 26 has been cleared the compressive force on the shield 42 is released and the scissor-like tool withdrawn. The shield 42 is thus allowed to spring back to its normally-relaxed planar configuration and assume a position of rest within the envelope 23. Since it is circular the shield 42 makes substantially line contact with the curved inner surface of the bulbous portion 24 and isolates a segment thereof, as shown more particularly in Fig. 5. Inasmuch as the shield 42 when in relaxed condition is smaller in diameter than the bulbous portion 24 and is fabricated of lightweight material, it will be apparent that it is freely movable within this portion of the envelope 23 and extremely sensitive and responsive to disturbing forces.

After the shield 42 has been inserted as heretofore described, the envelope 23 is loaded into one of the contoured slots or stations of the fixture 10 and the position of the magnet 22 adjusted by means of the knob 21 so that a magnetic field of the desired configuration and intensity is established in and proximate to the bulbous portion 24 of the envelope 23. The shield 42 under the influence of this field is accordingly attracted to and peripherally pressed against a predetermined spherical seg-

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ment of the bulbous portion 24 thus automatically sealing off and masking the area to be protected while the envelope 23 is in loaded position. Once the magnet 22 has been properly located it will, of course, remain in that position providing the same segment of the envelope 23 is to be masked. The intensity and configuration of the magnetic field produced by the magnet 22 are such that the shield 42 is precisely located along the longitudinal axis of the envelope 23 and slightly bowed or dished toward the magnet 22, as illustrated in Figs. 1 and 3, so that an accurately positioned window and a sharp cut-off between the coated and uncoated areas of the envelope 23 will be assured.

When the magnet 22 is centrally-located with respect to the bulbous portion 24 the shield 42 will be so oriented that it lies generally parallel to the longitudinal axis of the envelope 23, as shown in Figs. 1 and 3, thus masking a spherical side wall segment of the bulbous portion 24 and providing a circular window thereat which is symmetrical about an axis that is approximately perpendicular to the longitudinal axis of the envelope 23. Lateral movement of the magnet 22 within the guides 15 in either direction away from this centered position will produce a predetermined longitudinal displacement of the magnetic field and a corresponding angular displacement or tilting of the shield 42 thereby permitting the position of the window to be controllably shifted toward or away from the closed end of the envelope 23 along the longitudinal axis of said envelope. As will be apparent, by properly relocating the magnet 22 with respect to the envelope 23 a coaxially-aligned window area at the end of the bulbous portion 24 may very readily be obtained if desired. It will also be appreciated that if the surface to be protected were flat or if the shield were properly contoured, the magnetic field would compress the shield into intimate contact with the entire surface to be protected rather than with only a peripheral part thereof as in the instant case.

While the shield 42 and envelope 23 are disposed in masking engagement the metalizing or other processing means is inserted into the envelope 23 through the neck portion 26 and supportingly sealed therein by plugging the stopper 30 into the flared cullet 28. The envelope 23 is then evacuated by means of the tubulation 34 and conjoined conduit 36 to a very low pressure, as for example, approximately one micron of Hg. The switch S provided in one side of the electrical supply line 31 connecting the conductors 32 with a source of electric power is then closed energizing the filament 38 and vaporizing the coating material 40 which condenses on the exposed areas of the envelope 23 in accordance with the well-known principles of vacuum-metalizing. After the desired thickness of material has been deposited and the proper degree of opacity obtained, the switch S is opened and the evacuated envelope 23 returned to atmospheric pressure whereupon the metalizing apparatus is retracted from its inserted position. The envelope 23 is then removed from the fixture 10 and the shield 42 withdrawn through the neck portion 26 by means of a pair of tweezers or the previously-referred-to scissor-like tool, due care being exercised to prevent scratching or marring the coating, thus completing the coating and masking operations. If the jaws 46 of the scissor-like tool are fabricated from non-magnetic material the shield 42 may be withdrawn while the envelope 23 is in loaded position on the fixture 10 thus obviating any danger of inadvertently scratching or otherwise mutilating the coating. The circular side window thus provided in the bulbous portion 24 may be clear or "frosted" depending on whether or not the envelope 23 was chemically etched interiorly before the coating operation.

A very useful feature of the invention is that a plurality of separate and distinct segments of the envelope 23 may be simultaneously masked by simply positioning additional magnets 22a to produce a suitable field in and

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around the bulbous portion 24 and inserting the required number and types of shields 42a, as indicated by the broken-line sections of Fig. 1. It should also be noted that since the positioning of the shields is entirely independent from the force of gravity and accomplished without the aid of connecting mechanical means, any number of shields may be accurately oriented within the envelope while the latter is held with its longitudinal axis in any position without unduly complicating the masking operation or interfering with the coating or other treatment of the exposed surface areas.

It will be apparent to those skilled in the art that the objects of the invention have been achieved inasmuch as an improved and simplified masking apparatus and method have been provided whereby a selected interior portion of a hollow non-magnetic article, particularly a portion larger than the opening provided in said article, may be quickly and conveniently shielded during the coating or other processing of the article's interior surface. It will also be appreciated that the utilization of magnetic forces to orient and then hold the shield element in the desired position inside the article not only facilitates the processing of said article but, by virtue of the flexibility afforded by such an arrangement, permits such operation to be performed by automatic high-speed equipment.

Although one preferred embodiment of the invention has been described in accordance with the patent statutes, it is to be particularly understood that the invention is not limited thereto or thereby.

I claim:

1. As a step in the manufacture of an electric lamp having an envelope with a constricted neck portion, the method of masking a selected interior part of said envelope greater in area than the cross-sectional area of said neck portion but smaller than the major lateral dimension of said envelope which method comprises: providing a resilient magnetically-responsive shield of substantially the same configuration as the said selected interior part of said envelope to be masked; contorting said shield to temporarily reduce its lateral dimension to one smaller than the inner dimension of said neck portion; inserting said shield while so contorted through said neck portion and into the envelope proper; releasing said shield; placing said envelope and the freely-contained shield in a magnetic field of such configuration and intensity that said shield in response to such field is attracted toward and then pressed into masking engagement with the said selected interior part of said envelope to be protected; and then, after the exposed interior surface of said envelope has been processed, contorting and withdrawing said shield from said envelope through said neck portion.

2. As a step in the manufacture of an electric lamp having an envelope with a constricted neck portion and a bulbous portion, the method of simultaneously masking selected discontinuous parts of the interior surface of said bulbous portion which method comprises: providing a plurality of magnetically-responsive shields of substantially the same configuration as the parts of said bulbous portion to be masked; inserting each of said shields through the constricted neck portion of said envelope into freely-movable position within the bulbous portion thereof; placing said envelope and freely-contained shields in a magnetic field of such configuration and intensity that said shields in response to such field are attracted toward and then compressed into masking engagement with the said selected parts thereof to be protected; and then, after the exposed interior surface of said envelope has been processed, withdrawing said shields from said envelope through the neck portion thereof.

3. The method of masking a selected interior portion of a wall of a hollow non-magnetic article having an opening, said selected portion being smaller at its greatest dimension than the lateral dimension of said article, which method comprises: inserting a magnetically-responsive shield into said article through said opening, said shield

having substantially the same configuration as the selected interior portion of the article to be masked and thereby adapted when inserted into said article to be freely movable therein; placing said article and freely-contained shield in a magnetic field; orienting said article with respect to such magnetic field to cause said freely-contained shield to be attracted toward and then pressed into masking engagement with the selected interior portion of said article to be protected; and then after the exposed interior surface of said article has been processed, withdrawing said shield from said article through said opening.

4. Apparatus for masking a selected interior portion of a wall of a hollow non-magnetic article having an opening therein, said interior portion being smaller at its greatest dimension than the lateral dimension of said article, said apparatus comprising: a magnetically-responsive shield adapted to be inserted into and removed from said article through said opening, said shield having substantially the same configuration as the selected interior portion of said article and thereby adapted when inserted into said article to be freely movable therein; means for generating a magnetic field of predetermined configuration and intensity; and means for supporting said article within and in predetermined relation with such magnetic field; the disposition of said field-generating means and said article when supported being such that said shield, when inserted into said article, will be attracted toward and pressed into masking engagement with the said selected interior portion of said article to be protected.

5. Apparatus for masking a selected interior portion of a wall of a hollow non-magnetic article having an opening, said selected portion being smaller at its greatest dimension than the lateral dimension of said article, said apparatus comprising: a magnetically-responsive shield adapted to be inserted into and removed from said article through said opening, said shield having substantially the same configuration as the interior portion of said article to be masked and thereby adapted when inserted into said article to be freely movable therein; means for generating a magnetic field of predetermined configuration and intensity; and means for holding said article and field-generating means in predetermined spaced relation; the disposition of said field-generating means and said article when supported being such that said shield, when inserted into said article, will be attracted toward and pressed into masking engagement with the said selected interior portion of said article to be protected.

6. Apparatus for masking a selected interior portion of a wall of a hollow non-magnetic article having a constricted neck portion, said selected interior portion being greater in area than the cross-sectional area of said neck portion but smaller than the major lateral dimension of said article, said apparatus comprising: a shield of resilient magnetic sheet metal having substantially the same configuration as the said selected interior portion of said article to be masked; means for generating a magnetic field of predetermined configuration and intensity; and means for supporting said article within and in predetermined relation with such magnetic field; said shield when retroflexed being insertable into said article through the neck portion thereof and when in expanded condition being freely movable within said article; the disposition of said field-generating means and said article when supported being such that said shield, when inserted into

said article, will be attracted toward and pressed into masking engagement with the said selected interior portion of said article to be protected.

7. Apparatus for masking a selected interior circular part of a spherical vitreous lamp envelope having a constricted neck portion, said selected circular part being greater in area than the cross-sectional area of said neck portion but of smaller diameter than the inside diameter of said envelope, said apparatus comprising: a circular shield of resilient magnetic sheet material having a diameter equal to the diameter of the selected circular part of said envelope to be masked; means for supporting said envelope; and a permanent magnet on said supporting means; said shield when retroflexed being insertable into and removable from said envelope through the neck portion thereof and when relaxed being freely movable within said envelope; the disposition of said magnet and envelope when supported being such that said envelope is within the field produced by said magnet and in such relationship therewith that said shield, when inserted into said envelope, will be attracted toward the said selected circular part of said envelope to be protected and have its edges pressed into line contact with the inner surface of the envelope so as to seal off the spherical segment of said envelope which constitutes said selected circular part.

8. In combination, a hollow non-magnetic article having an opening, means within said article for processing the interior surface thereof, a magnet, means for holding said article and magnet in predetermined spaced relation, and means for masking a selected interior portion of a wall of said article comprising a magnetically-responsive shield of resilient sheet material adapted when retroflexed to pass through said opening and when expanded and within said article to be freely movable therein and in response to the field of said magnet be attracted toward and then pressed into masking engagement with the selected interior portion of said article to be protected from processing.

9. In combination, a vitreous lamp envelope having a constricted neck portion, means within said envelope for producing a reflective coating on the inner surface thereof, a magnet, means for holding said magnet and envelope in predetermined spaced relation, means associated with said holding means for causing relative movement between said magnet and envelope, and means for masking a selected interior part of a wall of said envelope comprising a shield of magnetic resilient sheet metal adapted when retroflexed to be inserted into said envelope through the neck portion thereof and when expanded after insertion to be freely movable in said envelope and in response to the field of said magnet be attracted toward and then pressed into masking engagement with the selected interior part of said envelope to be protected.

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