

[54] **APPARATUS FOR ORNAMENTING
GLASS ARTICLES**

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[51] Int. Cl. **B24c 3/10**

[58] Field of Search **51/227, 14; 269/47, 48, 52**

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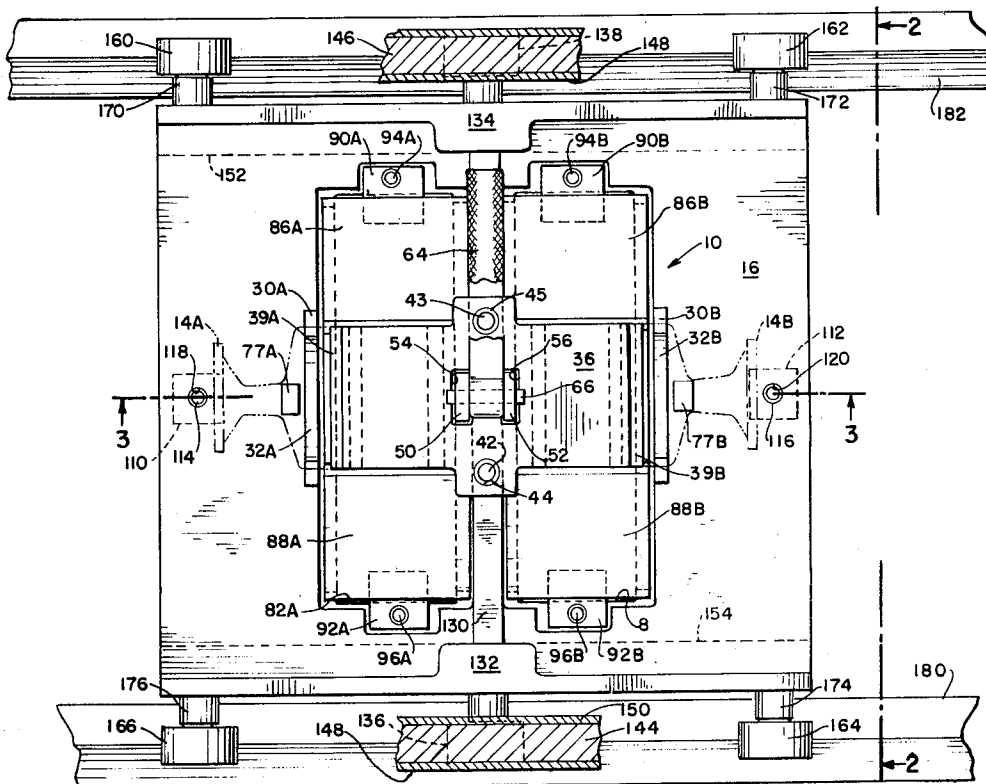
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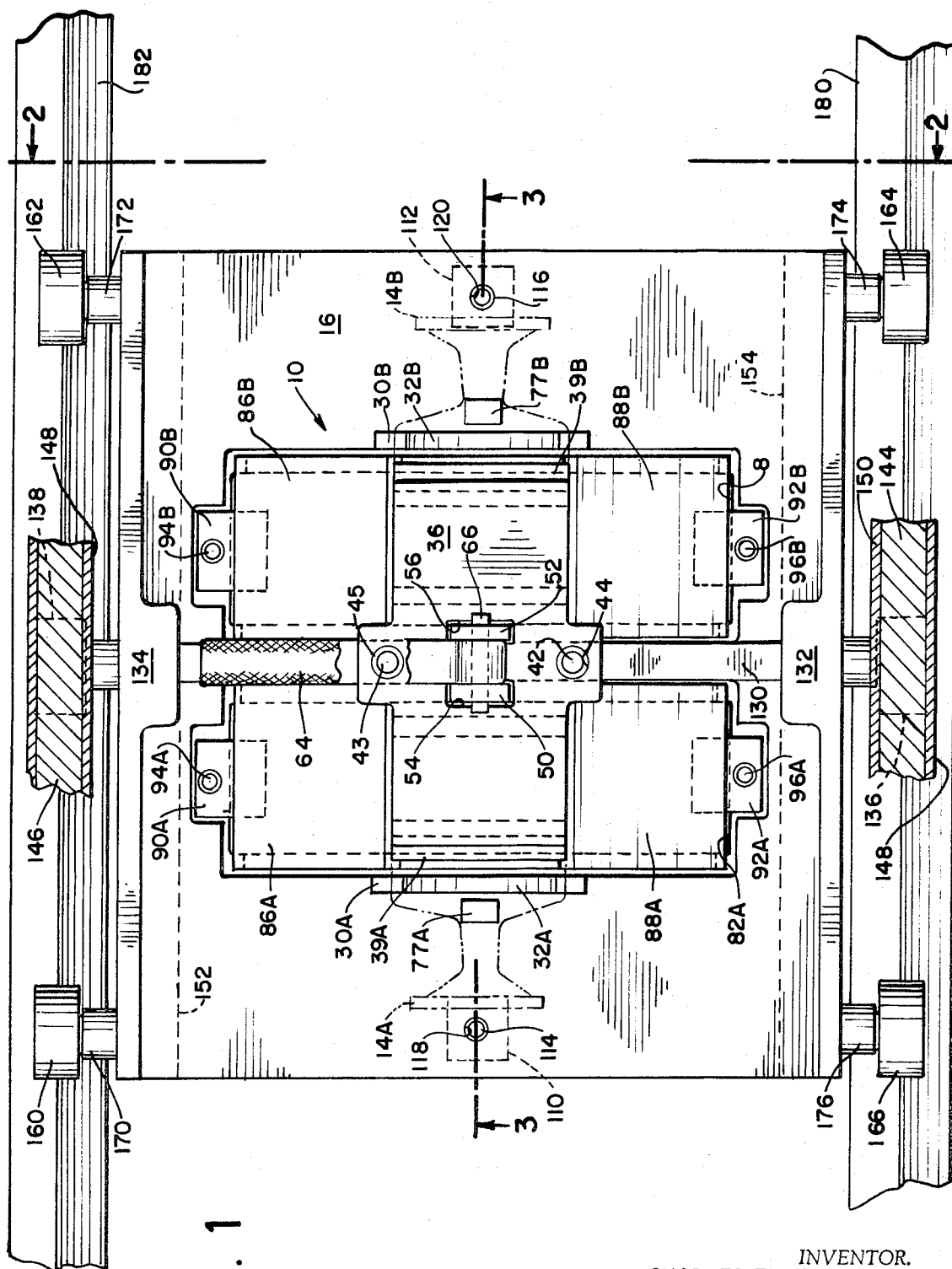
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[57] **ABSTRACT**

Apparatus for ornamenting glass articles by abrasive blasting techniques comprises an article holding and masking arrangement useful for the mass production of ornamented glass tumblers of high quality. The glass tumblers are clamped within the article holder which includes mounting members for supporting the interior and exterior surfaces of the tumbler. Clamping pressure is applied to the exterior surface of the tumbler so that a mask can be applied with considerable force to an opposite portion of the exterior surface. The construction is such that during the process there is little or no relative displacement between the tumbler and the article holder. Consequently, after a first design has been blasted into the glass, a second mask can be applied to the article in accurate registry with the design formed through the first mask.

9 Claims, 5 Drawing Figures





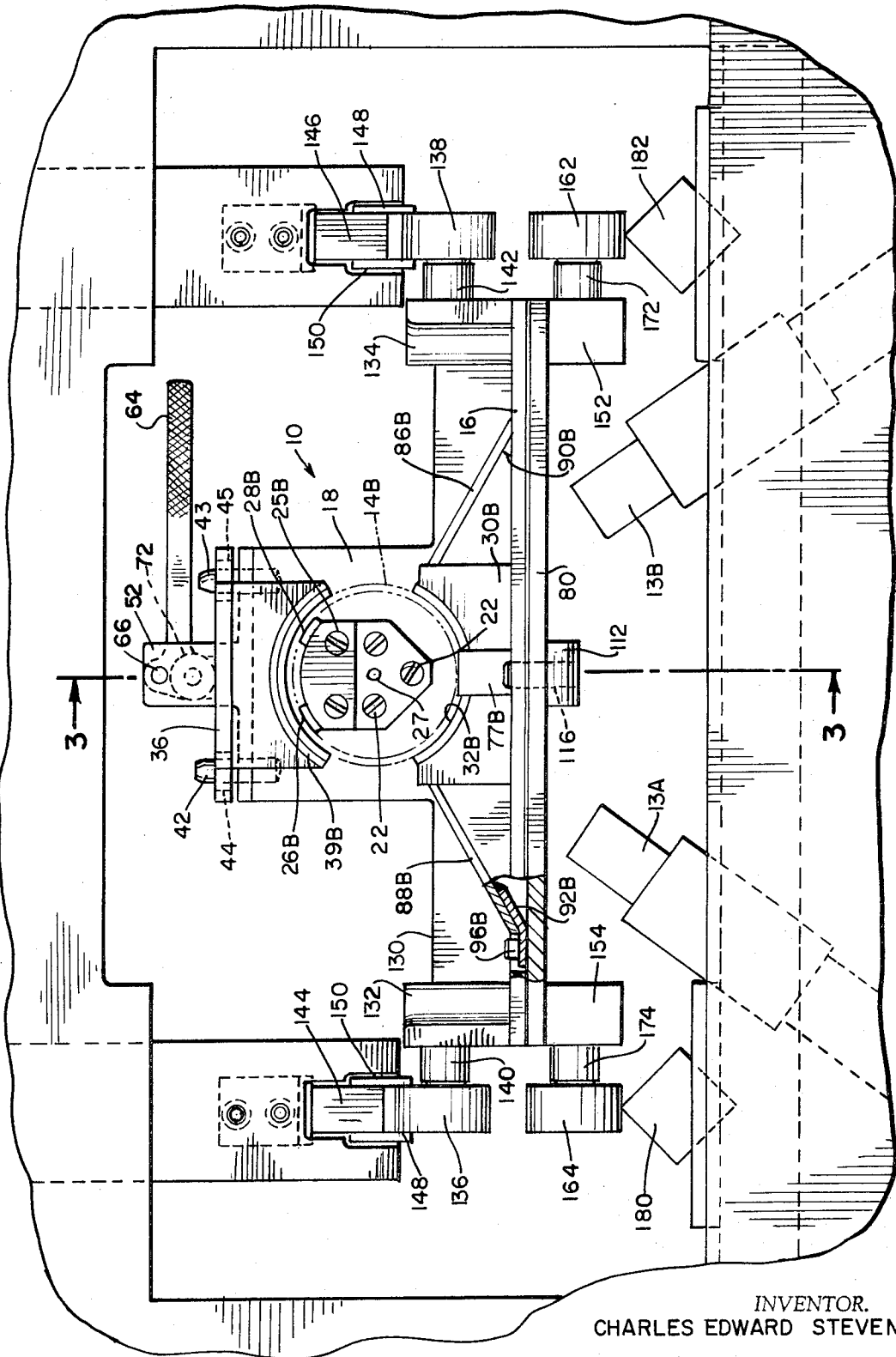
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FIG. 2

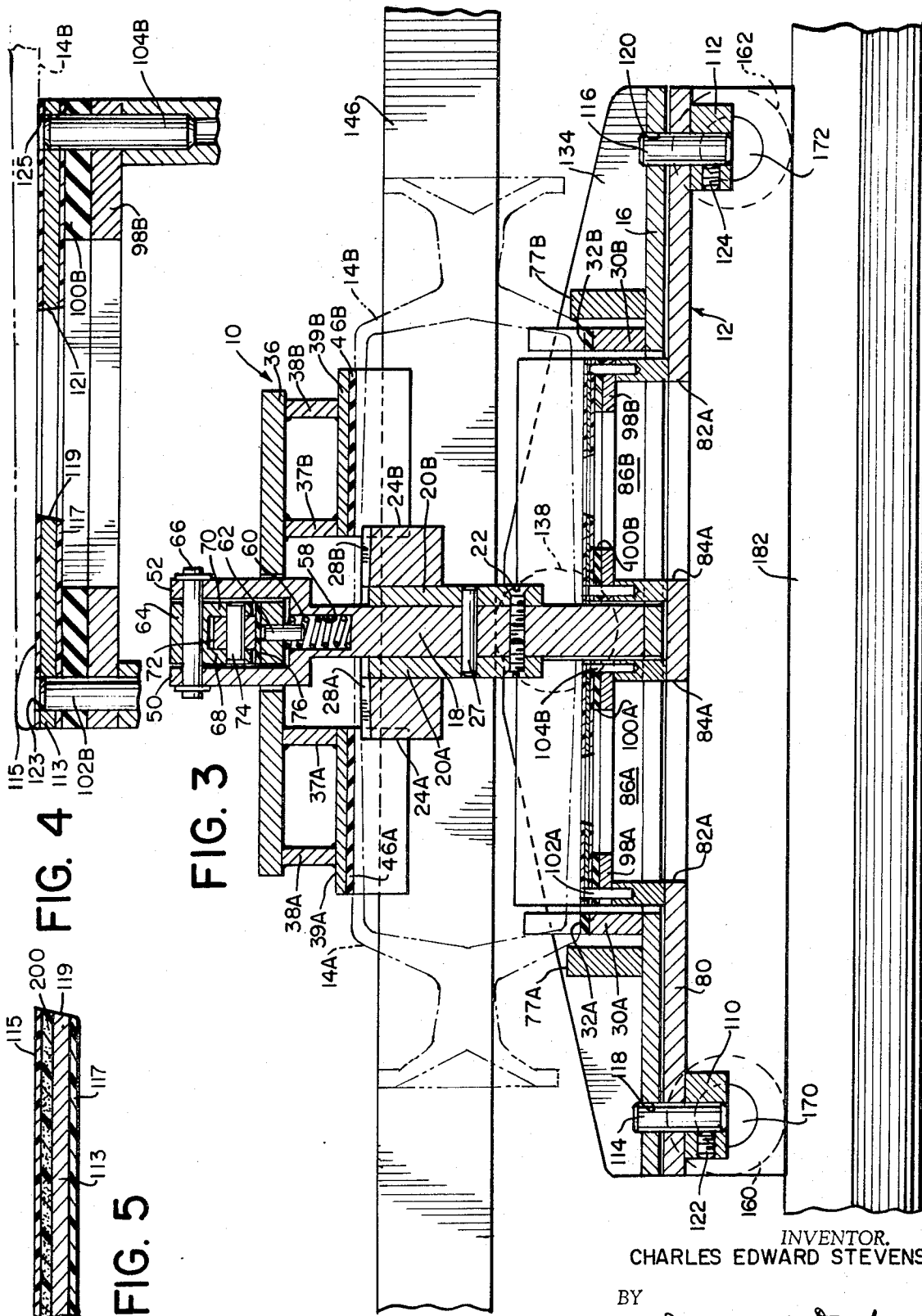


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APPARATUS FOR ORNAMENTING GLASS ARTICLES

This invention is related to U.S. Pat. No. 3,520,086 issued on July 14, 1970, in the name of Charles Edward Stevens, Jr. and entitled APPARATUS FOR ORNAMENTING ARTICLES (hereinafter referred to as the Stevens patent).

The present invention relates to methods and apparatus for ornamenting glass articles by abrasive blasting techniques and, in its more specific aspects, is an improvement over the methods and apparatus disclosed in the Stevens patent.

The apparatus disclosed in the Stevens patent was designed primarily for the purpose of implementing the glass engraving process described in U.S. Pat. No. 3,328,295 of Arthur W. Hewitt although its utility was not limited to any specific process. Among other things, it describes and claims an arrangement in which a glass article can be retained in an article holder and successive masks applied to the glass for the purpose of blasting successive designs on a single article in accordance with the Hewitt process or other processes either known or described in the Stevens patent.

Although the apparatus disclosed in the Stevens patent has operated satisfactorily, the specific apparatus illustrated has been found to lack advantage with respect to certain types of glass articles such as stemware. This is due to the difficulty of securely holding the stemware in the type of article holder illustrated in the Stevens patent without causing excessive breakage of the delicate stems of such glassware. Also, slight problems of registration may exist when it is desired to apply more than one mask to a single glass article. Experimental work established that this problem of registration was caused by slight movement of the article within the article holder during blasting. For example, slight rotation was found to be caused, at least in part, by a lack of perfect roundness of the glass articles and by the article being lifted from the supporting surface of the article holder during the blasting operation. This lack of perfect roundness, and other factors, may cause the article to be returned to the supporting surface of the article holder in a slightly different position when the stream of abrasive particles is removed, resulting in a slight loss of registration.

Although, from a commercial viewpoint, the registration provided by the apparatus disclosed in the Stevens patent is acceptable, the present invention provides apparatus which is feasible for use with all types of glass articles, including stemware, wherein a glass article can be held in extremely accurate registration within an article holder during a multistage abrasive blasting process. As a result, successive designs may be blasted onto the article in exact registry to provide a finished product of improved quality.

The present invention also is an improvement over the apparatus disclosed in the Stevens patent in that it enables ornamentation of a larger area of any given article.

Briefly, in accordance with the invention, an article holder, which is adapted to receive a mask carrier on which a replaceable mask is mounted, includes members for supporting a glass tumbler on a portion of its upper interior surface and an axially displaced portion of its lower exterior surface. During blasting, clamping pressure is applied to the tumbler over a portion of its upper exterior surface.

The invention is described in further detail below with reference to the attached drawings wherein:

FIG. 1 is a top plan view of a preferred embodiment of the invention;

FIG. 2 is a front view of the apparatus illustrated in FIG. 1;

FIG. 3 is a sectional view along the line 3—3 of FIG. 1;

FIG. 4 is an enlarged sectional view also taken along line 3—3 and illustrating the mask construction and the manner in which it is secured to a mask carrier; and

FIG. 5 is a view similar to FIG. 4 of another embodiment of a mask construction.

In the following description and the appended claims, the term "glass tumbler" is used in a broad sense to include glassware which may be considered to have interior and exterior surfaces, such as drinking glasses, most stemware, coffee cups, or bowls of any description. The term is not intended to in-

clude flat objects such as plates wherein the article holding arrangement of the present invention would not ordinarily be the preferred construction to use.

In the drawings, the article holder is shown generally at 10 and the mask carrier shown at 12. Two tumblers 14A and 14B, illustrated in phantom lines, are shown mounted in the article holder. In the following description of the preferred embodiment, the article holder is capable of holding two separate articles. Similarly, the mask carrier 12 supports two separate masks so that the two articles can be simultaneously engraved. Both sections of article holder 10 and mask carrier 12 are identical and, in the following description, the letters A and B are used to designate a component which serves to effect the ornamentation of only one of the glasses. Where neither the letter A nor B is used, the enumerated component generally is associated with both sections of the device.

In FIG. 2, the article holder 10 and mask carrier 12 are shown located within a cabinet (not numbered) with two upwardly directed abrasive blasting nozzles 13A and 13B mounted within the cabinet to provide respective streams of abrasive particles. The blasting process per se forms no part of this invention and is not described in further detail.

Article holder 10 includes a generally rectangular base plate 16 arrayed in a horizontal plane. A central post 18 (FIG. 3) extends upwardly from the center of base plate 16. Post 18 may be square or rectangular in cross section. Two oppositely disposed mounting plates 20A and 20B are secured to opposite sides of post 18 by means of three flathead screws 22 (FIG. 2). Two mounting blocks 24A and 24B, having convex curved upper surfaces, are secured in turn to the mounting plates 20A and 20B, respectively, by pairs of flathead screws 25A and 25B. These mounting members may be accurately positioned on post 18 by means of a dowel 27 (FIGS. 2 and 3) passing through reamed holes (not numbered) in plates 20A and 20B and post 18. On top of each of mounting blocks 24A and 24B two resilient pads 26A, 28A and 26B, 28B are secured in circumferentially spaced relation (see FIG. 2).

Two article supporting walls 30A and 30B, having concave upper surfaces, extend upwardly from base plate 16 of article holder 10. A pair of resilient mounting pads 32A and 32B are retained on the upper surfaces of walls 30A and 30B, respectively, so that, as shown in FIG. 2, the pads 32A and 32B correspond generally to the shape of tumblers 14A and 14B. The walls 30A, 30B (with pads 32A, 32B) and blocks 24A, 24B (with pads 26A, 26B and 28A, 28B) serve as article retaining means, with pads 26A, 26B and 28A, 28B engaging the inner surfaces of the tumblers 14A, 14B in the region adjacent the rim or open end of the tumbler, while pads 32A, 32B engage the opposite (i.e. closed) ends of the tumblers (see FIG. 3).

The clamping mechanism comprises a horizontal rectangular plate 36 having spaced apart downwardly extending walls 37A, 38A and 37B, 38B welded to its bottom surface. Concave metal sleeves 40A and 40B, conforming to the tumbler shape, are welded to the complementary lowermost surface of walls 37A, 38A and 37B, 38B, respectively. Sleeves 40A and 40B should be accurately positioned to cause uniform clamping pressure to be applied over the surfaces of the tumblers. Sheet-like cushions 41A and 41B are adhered to the inner surfaces of the sleeves 40A and 40B and are adapted to contact the respective tumblers. The cushions 41A and 41B may be made of foam rubber or like material for obvious purposes.

A pair of dowels 42 and 43 extend upwardly from the top of center post 18 into respective bushings 44 and 45 within plate 36. This arrangement serves to still further restrict the clamp from movement in all directions except vertical. This restriction of movement helps to prevent movement of the tumblers and thus maintain registration during successive blasting steps.

The center post 18 includes an enlarged upper end which forms a yoke consisting of legs 50 and 52. These legs are rectangular in cross section (see FIG. 1) and extend through similarly shaped openings 54 and 56 in plate 36. A cylindrical bore 58 (FIG. 3) is formed in post 18 beneath clamp plate 36, and a coil spring 60 is mounted within bore 58 to urge plate 36

in an upward direction. A dowel 62 may be provided to retain the spring 60 in its proper position.

Clamping pressure is applied by means of a lever 64 (FIG. 2) which rotates about an axle 66 journaled within the yoke legs 50 and 52 of center post 18. The lever 64 includes two integrally formed downwardly extending lugs 68 and 70 (FIG. 3) in which a camming roller 72 is journaled on a pin 74. When lever 64 is rotated downwardly into the position shown in FIGS. 2 and 3, the roller 76 is cammed against a wear-resistance, low-friction plastic sheet 76 on top of plate 36 to force the plate downwardly against the pressure of spring 60. This clamps the tumblers 14A and 14B tightly against the interior pads 26, 28 and exterior pads 32A and 32B. In this way, the tumblers are securely held in the article holder 10.

Despite the foregoing construction for retaining the tumbler within the article holder, in practice, a slight longitudinal movement of the tumbler may result in a loss of registration. Accordingly, two upstanding locating blocks 77A and 77B are secured to the top of base plate 16 so that they rest against the closed end of tumblers 14A and 14B, respectively. These blocks serve to limit longitudinal movement of the tumblers to a virtually negligible amount and thus serve an important function. The height of the blocks should be such as not to interfere with insertion and removal of the tumbler from the article holder. Blocks 77A and 77B may be shaped and/or made of a non-abrasive material to avoid marring the tumblers.

The mask carrier 12 includes a base 80 which generally underlies the base plate 16 of article holder 10. A first blasting opening for tumbler 14A is defined by an outer wall 82A and an inner wall 84A (FIG. 3). Outer wall 82B and inner wall 84B define a similar blasting opening for tumbler 14B. The walls 82A and 84A are part of a four-walled mask supporting construction, the other two walls being formed by slanted plates 86A and 88A (FIGS. 1 and 2) which are secured to bent brackets 90A and 92A, respectively. The brackets 90A and 92A are secured to the mask carrier base 80 by respective bolts 94A and 96A or any other suitable means.

On the top of this four-walled mask carrier construction, a supporting surface for a mask is provided. This supporting surface includes a rigid metallic plate 98A (FIG. 3), curved to correspond generally to the shape of the tumbler, and a similarly shaped rubber pad 100A. The rubber pad 100A and metal plate 98A may be bonded together by any suitable means. Plate 98A is removably supported on the tops of walls 82A, 84A, 86A and 88A with its location determined by registration pins 102A and 104A which extend upwardly from outer wall 82A and inner wall 84A, respectively, into apertures (not numbered) within plate 98A. These pins, as explained below, serve to register the position of the mask accurately with respect to the mask carrier.

It is necessary that the mask carrier 12 be accurately positioned with respect to the article holder 10. For this purpose, the mask carrier includes two blocks 110 and 112 (FIGS. 1 and 3), oppositely disposed, and welded to the undersurface of the mask carrier base 80. A pair of registration pins 114 and 116 are retained in respective blocks 110 and 112. Pins 114 and 116 may be received within complementary openings 118 and 120, respectively, of article holder 10 to position the mask carrier relative to the article holder. Setscrews 122 and 124 may be used to hold the respective registration pins 114 and 116 within blocks 110 and 112.

The construction of the mask is similar to the mask illustrated in the Stevens patent and is best shown in the enlarged drawing of FIG. 4. In the illustrated embodiment, it is rectangular and curved to correspond to the shape of the tumbler to be engraved. It consists of a metal backing 113 bonded to a tough plastic sheeting 115 which may be made of polyurethane and which is adapted to contact the tumbler. The other side of backing plate 113 may be coated with a wear-resistant plastic 117 to protect the mask construction from the stream of abrasive particles during blasting.

The edges of a typical opening cut in the mask are represented by the slanted lines 119 and 121. As explained in

the Stevens patent, divergence of the mask opening away from the article to be ornamented is an important feature of the mask construction. It has been found that where there is insufficient divergence of the edges of the mask openings, the engraved design will tend to be blurred. Where the angle of divergence is too great, excessive mask wear will result because of the relatively direct impingement of the abrasive particles on the exposed metallic and plastic surfaces. It has been discovered that an improvement in definition can be observed up to an included angle of divergence of about 4° (i.e. the angle formed at the intersection of the extensions of lines 119 and 121 is 4°). When the angle is greater than 4°, there is no noticeable improvement in definition. Hence, this value of 4° is regarded as an optimum value for the angle of divergence.

Whether the edge of the mask opening is continuous or incremental, it is important that the distance between the plastic edge defining the actual opening and the reinforcing plate be small enough so that the pressure applied by the plate to the edge is sufficient to prevent abrasive particles from reaching the glass surface beneath the plastic.

In the Stevens patent, different arrangements are illustrated to provide diverging mask openings within the context of the invention. In the arrangements illustrated therein, such divergence is provided, at least in part, by an incremental change in spacing between the opening of the metal plate and the opening in the plastic sheet. In the presently preferred embodiment it is preferred that the edges of the mask openings (shown as surfaces 119 and 121 in FIG. 4) be continuous as opposed to a steplike or incremental edge such as shown in the parent application. However, as far as the mask is concerned, the general concept of diverging mask openings is intended to include both continuous and discontinuous edges.

Each mask also includes registration holes 123 and 125 (FIG. 4) which are adapted to receive registration pins 102 and 104 so as to accurately position the mask relative to the mask carrier.

A preferred material for the plastic sheet 115 is a polyurethane sold by Armstrong Cork Co. under Spec. No. PO 652 90-92. This material has a durometer reading of 90-92 and the thickness of the sheet may be about one-sixteenth of an inch. In the illustrated embodiment, where the edges are continuous, the thickness of the plastic sheet is less important than where the edges are discontinuous. The overall thickness of the mask may thus be selected to optimize image definition and mask wear. As an example, where sheet 115 is one thirty-second of an inch thick, backing plate 113 may be made of 22 gauge steel.

The coating 117 provides abrasion resistance for the bottom of the metal plate 113. Preferably, coating 117 comprises another sheet of polyurethane such as used for sheet 115. Alternatively, a liquid coating of a urethane elastomer (for example) may be applied to the exposed metal and permitted to dry. Sheet 115 and coating 117 may be adhered to plate 113 by means of a urethane elastomer adhesive in accordance with known practice and as described more fully in application Ser. No. 64,466 filed Aug. 24, 1970 in the name of Charles Edward Stevens.

If problems are still encountered with abrasive material getting under the mask during the blasting operation, the mask may be wetted with a volatile liquid such as an alcohol, in which case the problem will be completely eliminated. Water is not usable with fine abrasives for this purpose.

In the Stevens patent, the openings are cut in the mask before it is bent or formed to the desired configuration, and it has been observed that in some cases a loss of definition may occur because of the difficulty in bending a narrow strip of metal to a desired radius of curvature. For example, if two slots are cut in a flat mask forming a relatively narrow strip therebetween, with the strip lying generally parallel to the axis about which the mask is to be curved, the narrow strip may not actually bend when the curved mask is formed. As a result, the edges of the strip will not be in close contact with the glass, causing image blurring around these edges.

This problem has been solved by a mask-making process in which the image areas are cut after the mask has been formed to the desired radius of curvature. In this way, regardless of how narrow any longitudinal "strip" may be, it will have assumed the curve of the completed mask prior to cutting. Consequently, the entire strip can be urged tightly against the glass thus avoiding any problems of blurring or other loss of definition.

In the preferred embodiment, the entire mask construction including the metal plate 113, the plastic sheeting 115 and the coating 117 is bent before cutting. However, it would be possible to apply the coating 117 after the metal plate 113 and plastic sheet 115 have been formed.

The manner in which the glass tumblers 14 are firmly secured within the article holder 10 has been described above. It is also necessary to apply the mask with substantial pressure against the tumbler during the blasting process. The basic approach to this problem as practiced by the illustrated embodiment is similar to that used in the Stevens patent, but in this respect also additional steps are taken to further improve the quality of the finished product by virtue of improved registration techniques. This is described in the following.

The article holder includes a center wall 130 (FIG. 2) which terminates in left and right side walls 132 and 134 extending the full length of the base plate 16 (FIG. 1). A pair of upper bearings 136 and 138 are rotatably mounted on respective shafts 140 and 142 extending from the central portions of side walls 132 and 134. The upper bearings 136 and 138 are adapted to contact downwardly extending rails 144 and 146 which are suitably mounted within the blasting cabinet. Each of the rails 144 and 146 contains a pair of guide flanges 148 and 150 which extend downwardly adjacent opposite ends of each bearing 136 and 138, thus minimizing lateral displacement of the mask carrier and article holder 10.

The mask carrier 12 includes two downwardly extending side plates 152 and 154. Four lower bearings 160, 162, 164 and 166 are rotatably retained on respective shafts 170, 172, 174 and 176 extending from the ends of these side plates. The lower bearings 160, 162, 164 and 166 are adapted to engage the upwardly extending edges of solid square rails 180 and 182 (see FIG. 2) mounted at the bottom of the cabinet. The spacing between the rails 144 and 180 and between rails 146 and 182 is carefully controlled so that during passage of the tumblers through the cabinet, the mask will be applied against the tumblers with sufficient pressure to provide the desired image definition without excessive breakage.

The pressure required to produce satisfactory results is quite high. Surprisingly, apparently delicate glass tumblers can readily withstand these pressures. In the preferred embodiment, the pressure is such as to actually lift the tumblers 14A and 14B off the pads 32A and 32B. Because of this, if a tumbler is "out-of-round" the tumbler may have a tendency to rotate slightly when it is returned to the pad 32. This minute change in position of the tumbler relative to the article holder will result in a corresponding lack of registration at a succeeding blasting station which will affect the appearance of the finished design. This tendency of the tumbler to rotate, however, is substantially reduced by the use of two separate pads 26 and 28 providing, in effect, a two-point support for the interior surface of the tumbler as opposed to a linear supporting surface which, because of its larger locating area, is more likely to result in a change of position if the glass is out-of-round or uneven.

It has also been observed that the glass position can be more readily retained if the clamp, as illustrated in the drawings, is a rigid device. That is, relative movement between the cushion 46 and plate 36 should be minimized.

The guide flanges 148 and 150, which prevent lateral displacement of the retained tumblers relative to the nozzles 13A and 13B, serve an important function as far as uniformity of design is concerned. If successive articles were in different lateral positions relative to the operable blasting nozzle, the designs imparted by the nozzle might be noticeably different. This is a serious drawback as far as marketability is concerned where a set of similar items is to be produced.

It is important that the distance between the upper rails 144 and 146 and the respective lower rails 180 and 182 be accurately controlled. Where a flange or the like is used in place of the solid rails 180 and 182, the bending of the flange will result in a loss of registration due to the resultant change in this distance. This occurs because such bending will necessarily be of a random nature as a result of which the dimensions between rail 144 and 180 will differ from the distance between upper rail 146 and lower rail 182. Because the article holder is retained against lateral movement by the flanges 148 and 150, this spacing differential may result in movement of the article holder 10 relative to mask carrier 12. Under these circumstances (note that during this phase of the operation, the tumbler will be lifted from the article holder pad 32), the glass will tend to move relative to the mask or relative to the pads 26 and 28. Because of the relatively smooth surface of the mask, the article generally will rotate with respect to the mask, resulting in a loss of registration for successive blasting steps.

In FIG. 2, two separate blasting nozzles 13A and 13B are shown diagrammatically in the general position which they would occupy within the blasting cabinet (not numbered). It has been discovered that the speed of the process can be materially increased by having only a single nozzle blasting through one opening at any given time. Thus, although two separate nozzles 13A and 13B (or more if desired) may be provided within the cabinet, during the actual ornamenting process, only one of these nozzles 13A or 13B will be blasting through a given mask at any time. This increase in speed is believed due to the reduction in turbulence as compared with a situation in which more than a single nozzle is firing into one opening at any given time.

Because of the need for extreme accuracy in registering a mask relative to the article to be ornamented, the means provided for positioning the article holder relative to the mask carrier is important. As shown in the drawings, this means includes the registration pins 114 and 116 which extend from the mask carrier 12 into respective openings 119 and 121 within article holder 10. It has been discovered that the optimum positions of these registration pins lie generally on a line directly beneath the axis of rotation of the articles to be ornamented, i.e. in the same vertical plane as that axis. It has been found that if these registration pins are moved away from this plane (i.e. left or right in FIG. 2), the problem of registration can become so acute as to preclude the use of this relatively simple arrangement, requiring instead relatively complex manually operable registration and clamping devices. Even where more than two registration pins are used, optimum results are not achieved (within ordinary manufacturing tolerances) unless the foregoing relationship is included.

A further embodiment of the mask is shown in FIG. 5. In FIG. 5, the parts corresponding to the mask components illustrated in FIG. 4 are indicated by the same numerals. In this embodiment, a thin sheet of foam 200 is provided between the polyurethane sheet 115 and backing plate 113 for the purpose of improving definition where the glass to be ornamented is not perfectly round. This advantage is provided because of the compressibility of the foam sheet which can accommodate uneven spots or lack of roundness. Where the foam is between the polyurethane sheet and metal backing, wear is not a serious problem although it is also possible to locate the foam between the polyurethane sheet 115 and the tumbler. Desirably, the foam material should be as thin as possible yet still capable of accommodating off-round tolerances.

The mask constructions illustrated and described in the preferred embodiment are not limited to use with tumblers or articles of any specific shape. Where the article to be ornamented is curved, shaping the mask is described prior to cutting the design will provide the benefits enumerated above. In the case of both flat and curved articles, the mask construction illustrated herein, and in the parent application, provides improved definition and longer mask life.

The improvement provided by the present invention relates generally to the production of tumblers as defined in the foregoing. Obviously, the exact shape of the tumbler is irrele-

vant and the appropriate parts of the illustrated embodiment can readily be shaped to any desired conformation. The basic principles of the invention may be used in a fully automated, semiautomated or manual ornamenting process.

What is claimed is:

1. Apparatus for use in ornamenting glass tumblers in an abrasive blasting process wherein an article holder is provided for retaining the article to be ornamented and wherein a mask is adapted to be applied to a surface of said article through a suitable opening in said article holder, the improvement comprising,

an article holder including article interior retaining means and article exterior retaining means for holding a tumbler by means of portions of its upper interior and lower exterior surfaces, respectively, and

clamping means for clamping said article against said interior and exterior retaining means, said clamping means applying pressure to a portion of the exterior surface of said tumbler opposite the portion of the tumbler surface resting on said article exterior retaining means.

2. Apparatus according to claim 1, wherein one of said retaining means includes two spaced-apart support pads on which said tumbler rests.

3. Apparatus according to claim 2, wherein said one retaining means is said article interior retaining means.

4. Apparatus according to claim 1, further including a mask

carrier, said mask carrier including a member comprising a metallic plate and a sheet made of resilient material and contacting said mask.

5. Apparatus according to claim 1, wherein said article holder includes an upstanding post and wherein said article interior retaining means extends outwardly from said post and is adapted to be received within the open end of a tumbler.

6. Apparatus according to claim 5, wherein said article exterior retaining means comprises a supporting wall extending upwardly from said article holder and adapted to support the closed end of said tumbler.

7. Apparatus according to claim 6, wherein said clamping means is mounted for vertical movement on said post and wherein there is means rotatably mounted on said post for camming said clamping means into engagement with said tumbler.

8. Apparatus according to claim 7, wherein said clamping means includes means for preventing movement of said clamping means relative to said article holder in a horizontal plane.

9. Apparatus according to claim 1, wherein said article holder includes upstanding members adapted to contact a vertically extending portion of the tumbler to prevent longitudinal movement of said tumbler in a horizontal direction.

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