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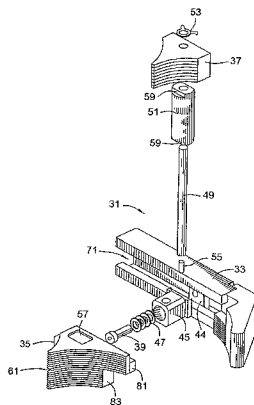
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(54) Title: SYSTEM, METHOD, AND APPARATUS FOR ADJUSTABLE STACKER BAR ASSEMBLY HAVING QUICK CHANGE FEATURES



(57) Abstract: An adjustable stacker bar assembly includes a pad assembly having a lower pad that is mounted to a push bar. The lower pad is in direct contact with and independently mounted to the push bar. An upper pad is mounted to and spaced apart from the lower pad by a spacer. The spacer is free of contact with the push bar. The pads contact and push glass articles into an annealing furnace.



WO 2007/108979 A1

**SYSTEM, METHOD, AND APPARATUS FOR ADJUSTABLE STACKER BAR
ASSEMBLY HAVING QUICK CHANGE FEATURES**

BACKGROUND OF THE INVENTION

1. Technical Field

[0001] The present invention relates in general to manufacturing glass articles and, in particular, to an improved system, method, and apparatus for an adjustable stacker bar assembly having quick change features in a hot glass article fabrication operation.

2. Description of the Related Art

[0002] To fabricate a glass article, a mass of molten glass is typically blown into a mold, partially cooled, and the resultant hot glass article transferred to an annealing oven. During transfer to the annealing oven, the hot glass articles are extremely fragile and susceptible to thermal and physical stress, contamination, and other damage. In addition, annealing or other post-forming process steps may not fully remove added stress concentrations or risers and other defects in the hot glass articles caused by the handling fixtures or transfer equipment.

[0003] Any fixtures or equipment touched by hot unannealed glass articles should be made of materials that will minimize stress concentration, contamination, deformation, cracking, or checking of the hot glass. Furthermore, the materials used to handle the hot glass articles must themselves be able to withstand the high temperature contact with the hot glass articles and be rigid enough to insure proper alignment/placement of the articles within the annealing oven.

[0004] Stainless steel and other high temperature metal alloys have been used for the body or support structure of fixtures that handle hot glass articles. However, metallic materials can cause thermal and/or physical damage if they contact hot glass articles. Therefore, various nonmetallic contact materials have typically been incorporated into fixture designs as removable inserts, pads, or spacers for contacting the hot glass articles, e.g., fabric cloth coverings capable of withstanding high temperatures) or asbestos, plastics, and graphite-

containing pads attached to a steel support bar. Unfortunately, the use of these nonmetallic materials presents drawbacks to glass manufacturers.

[0005] Although asbestos may have very good thermal and physical properties for this application, its use creates grave environmental and workplace safety concerns. Plastics are generally less well suited for this high temperature application and typically have a relatively short service life even when specially formulated to withstand the high temperatures encountered in this hot end process. Graphite may be more of an ideal nonmetallic material for handling hot glass since graphite has resistance to oxidation at temperatures typically encountered when contacting hot glass articles, nonabrasive surface integrity, and acceptable heat resistance. It is also safe for the environment and to those who work with it.

[0006] However, graphite presents several problems that must be overcome before it can be economically used as a material for handling hot glass articles. One problem graphite presents is that it is relatively brittle and therefore can chip or crack or be otherwise mechanically damaged. Another problem frequently encountered with graphite is the difficulty in removably attaching a graphite contact pad to the supporting body of a fixture. Since graphite can wear during use, the graphite contact material should be readily removable. Removability can result in the attachment to the supporting structure not holding the graphite rigidly and reliably during glass production. Another problem is the need to economically provide an array of graphite contact pads in different shapes and sizes to handle different shapes and sizes of hot glass articles, e.g., the need for machinability.

[0007] One specific device for handling hot glass articles is a stacker bar assembly that typically uses nonmetallic pads. Such an assembly is typically used to transfer glassware from a narrow, single line conveyor, known as a cross conveyor, across a transfer plate to a multi-line conveyor. The stacker bar assembly may impart motion in several directions, e.g., to properly space hot glass articles in the oven as well as push the articles into the oven.

[0008] A typical stacker bar assembly is composed of a steel support tubing, and a glass contact surface, such as attached fabric or carbon-based pads. The assembly typically forms pockets for a particular shape and size of glassware. Thus, many stacker bar assemblies are

required to handle the needs of a typical glassware manufacturing facility producing different shapes and sizes of glass articles.

[0009] Handling and other problems resulting from graphite's brittleness and relatively short life (when compared to high temperature metallic components), difficulties in rigidly attaching a brittle, low strength material to the steel support, and machining difficulties make graphite, composite graphite, and other carbon materials difficult to use as a contact material in stacker bar assemblies. Graphite or carbon materials can be combined with plastic resins or fibers, but resins and reinforcing fibers create new problems. The resins typically have limited thermal capability, and fiber reinforced compositions are typically not easily machinable, making fabrication of some complex shapes difficult if not impossible. Frequent removal of pads to adapt to different glass articles sizes also increases the risk of damage.

[0010] Currently, fabricators of glass articles select stacker bar assemblies based on many different variables, such as worker skill level, the number of different sizes of containers to produce, personal preference, etc. In the prior art, U.S. Patent 5,741,343 discloses one type of an adjustable hot glass transfer device. This device uses repositionable stacker bar pads formed from a nonmetallic material. The pads have tongue-in-groove adjoining surfaces and glass contact surfaces that are serrated. This pads also have a rough finish to minimize thermal checking and other hot glass article problems. Although this design offers a workable solution, it can be time consuming to adjust the pads to glass articles of differing size, and/or to replace worn or damaged pads. Thus, an improved solution would be desirable.

SUMMARY OF THE INVENTION

[0011] One embodiment of a system, method, and apparatus for a stacker bar assembly is both adjustable and incorporates quick change features for the pads or inserts. The stacker bar assembly includes a pad assembly having a lower pad that is mounted to a push bar. The lower pad is in direct contact with and independently mounted to the push bar. An upper pad is mounted to the lower pad and may be spaced apart from the lower pad by a spacer. The spacer is free of contact with the push bar. The pads contact and push glass articles into an annealing furnace.

[0012] The invention uses a spring-biased design that allows broken and/or worn pads to be quickly replaced, even in front of the annealing furnace. Thus, there is no need to stop production while changing even just one pad, as is currently required by existing designs. The present invention also allows a change in height of the stacker bar glass contact surface to improve support of bottles being pushed into the annealing furnace. This design incorporates a removable metal pin that can be screwed one on top of another as well as on the spring nuts.

[0013] The foregoing and other objects and advantages of the present invention will be apparent to those skilled in the art, in view of the following detailed description of the present invention, taken in conjunction with the appended claims and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] So that the manner in which the features and advantages of the invention, as well as others which will become apparent are attained and can be understood in more detail, more particular description of the invention briefly summarized above may be had by reference to the embodiment thereof which is illustrated in the appended drawings, which drawings form a part of this specification. It is to be noted, however, that the drawings illustrate only an embodiment of the invention and therefore are not to be considered limiting of its scope as the invention may admit to other equally effective embodiments.

[0015] **Figure 1** is an isometric view of equipment used to fabricate glass articles and is constructed in accordance with the present invention;

[0016] **Figure 2** is an exploded isometric view of one embodiment of a stacker bar assembly constructed in accordance with the present invention;

[0017] **Figure 3** is a sectional side view of the stacker bar assembly of **Figure 2**;

[0018] **Figure 4** is an isometric view of the stacker bar assembly of **Figure 2** illustrating various vertical adjustments thereof;

[0019] **Figure 5** is an exploded isometric view of another embodiment of a stacker bar assembly constructed in accordance with the present invention;

[0020] **Figure 6** is a sectional side view of the stacker bar assembly of **Figure 5**;

[0021] **Figure 7** is an isometric view of the stacker bar assembly of **Figure 5** illustrating various vertical adjustments thereof; and

[0022] **Figure 8** is a high level flow diagram of one embodiment of a method constructed in accordance with the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0023] The present invention incorporates a number of features found in U.S. Patent No. 5,741,343, which is incorporated herein by reference.

[0024] Referring to **Figure 1**, a hot-end equipment portion of a prior art glass article manufacturing process is shown. Molding and mold transfer equipment is not shown for clarity. Molded hot-glass articles 11, such as bottles, are transferred by a single line conveyor 13 and a cross conveyor 15 toward an annealing furnace 17 that removes stresses produced during the glass molding process. In the configuration shown, hot glass articles 11 are transferred from the single line conveyor 13 to the cross conveyor 15 by a transfer unit 19 that may change the spacing between the hot glass articles 11. Near the oven entry port 21, a stacker push bar assembly 23 pushes a plurality of the hot glass articles 11 from the cross conveyor 15 to the multi-line conveyor 25 which moves the hot glass articles 11 through the furnace 17.

[0025] Various conventional pushing mechanisms (not shown for clarity) or other means for pushing the stacker push bar assembly 23 can be used. These means can include hydraulic actuators, pneumatic cylinders, electrical actuators, magnetic actuators, and manual operators. Although a single connector portion 27 of the stacker push bar assembly 23 extending toward a pushing mechanism is shown, the stacker bar assembly may be directly pushed or actuated without a connector portion. Alternatively, multiple connector portions and/or pushing mechanisms may be used instead of the single connector portion 27 shown.

[0026] Referring now to **Figures 2 and 3**, one embodiment of a stacker bar assembly 31 constructed in accordance with the present invention is shown. The stacker bar assembly 31 comprises a support member or "push bar" 33, a plurality of glass-contacting lower pads or inserts 35, a plurality of upper pads 37, and means for slidably attaching the pads 35, 37 to the push bar 33. In one embodiment, the means for attaching includes bolts 39, nuts 41, spring retainers 43 between the nuts 41 and push bar 33, a bushing 45, and a spring 47 between bushing 45 and bolt 39. In addition, a pin 49 extends through (e.g., vertically) pads

35, 37, bushing 45, and an optional spacer 51. A spring clip 53 and screw 55 are located on opposite ends of vertical pin 49 for retention thereof.

[0027] In the embodiment shown, the lower pads 35 are mounted to the push bar 33 for contacting and pushing respective lower portions of the glass articles 11 (**Figure 1**) into the annealing furnace. Each of the lower pads 35 utilizes one bushing 45 to secure itself to the push bar 33 with one bolt 39. The pin 49 extends through the bushing 45 to secure a respective one of the lower pads 35 thereto. As an improvement over the prior art, the lower pads 35 are independently mounted to the push bar 33 relative to each other and independently removable from the bushings 45 via the pins 49 without unbolting the bushings 45 from the push bar 33.

[0028] The bushings 45 fit in an opening 79 in lower pads 35 and are shaped and dimensioned to interface with slot 71 of push bar 33 to provide rotational rigidity and support in addition to the support provided through attachment thereto. In addition, washers, spacers, lock washers, and additional springs may also be included in the attaching means. Still other alternative repositionable attaching means are also possible, including clamps, spring clips, and magnetic couplings.

[0029] The upper pads 37 are provided for contacting and pushing respective upper portions of the glass articles 11 into the annealing furnace 17. The upper pads 37 are vertically spaced apart from respective ones of the lower pads 35 on the pins 49. In one embodiment, each lower pad 35 and a respective upper pad 37 form a pair of pads 35, 37, such that each lower pad 35 is vertically separated from a respective upper pad 37 by the spacer 51. As shown in **Figure 4**, a plurality of spacers 51a-d having different vertical heights may be used to accommodate glass articles of different vertical dimensions.

[0030] The upper pads 37 are prevented from rotating relative to respective ones of the lower pads 35 by, for example, keyed features 57 formed thereon, which engage keyed features 59 on pin 51. Each of the pins 51 is secured to a respective one of the bushings 45 with a screw 55 (e.g., a set screw), and a spring clip 53 secures a respective one of the upper pads 37 to the

pin 51. In one embodiment, the pin 51 is smooth and extends through smooth bores 63, 65, 67 in lower pad 35, pin 51, and upper pad 37, respectively.

[0031] The longitudinal positions of respective pairs of the lower and upper pads 35, 37 relative to the push bar 33 are slidably adjusted by relocating the bushings 45 relative to the push bar 33. The slot 71 has an x-axis that is generally perpendicular to the pushing or y-direction. The slot 71 allows the pads 35, 37 to be slidably translated along the x-axis and repositioned to contact hot glass articles having different shapes and sizes. Repositioning allows different center-to-center spacing and contact angles for similarly sized hot glass articles as well as handling different diameter articles. Each lower pad 35 has an aperture 61 for providing torquing access to a respective one of the bolts 39, and thereby adjusting the longitudinal position thereof. The aperture 61 has a diameter that is smaller than a diameter of the bolt 39.

[0032] In one embodiment, the push bar 33 comprises a channel having a slot 71 through which the bushings 45 extend. A nut 41 attaches each respective pair of the bushings 45 and bolts 39 to the push bar 33, and a spring 43 between the nut 41 and an interior of the channel biases the nut 41 toward the slot 71. Another spring 73 is located between each pair of the bolts 39 and bushings 45 for biasing respective ones of the bolts 39 away from the nuts 41. The channel has longitudinal flanges 75 that extend inward from the slot 71. In addition, each nut 41 has longitudinal notches 77 for receiving the flanges 75 such that the flanges 75 seat in the notches 77.

[0033] Unlike the "tongue-and-groove" design described in U.S. Patent No. 5,741,343, the side edges 81, 83 on each lower pad 35 do not overlap. Rather, as shown in **Figure 4**, they are formed at orthogonal angles to permit individual removal of the lower pads 35 from the overall assembly. The side edges 81, 83 on both longitudinal sides of each lower pad 35 are complementary to and engage the side edges 81, 83 on both of the lower pads 35 adjacent thereto.

[0034] Although manual means may be used to reposition the pads 35, 37 (e.g., manual loosening of bolts, sliding pads, and tightening of bolts), other nonmanual means for

repositioning are also possible. These other repositioning means include hydraulic actuators, pneumatic positioners, and remotely operated mechanical levers.

[0035] The adjoining glass-contacting surfaces of the pads 35, 37 interact to form a mosaic or multi-element surface for contacting the hot glass articles. The multi-element surface forms glassware pockets that contact a plurality of hot glass articles as they are pushed into the annealing furnace with minimal thermal and mechanical damage. Since all of the pads 35, 37 are repositionable and in slidable contact with the push bar 33, the multi-element surface for contacting can also be continuously adjustable to handle various shapes and sizes of hot glass articles.

[0036] Referring now to Figures 5-7, another embodiment of the invention is shown. Like the preceding embodiment, this embodiment of the stacker bar assembly 231 comprises a push bar 233 and a plurality of lower pads 235 mounted to the push bar 233. The lower pads 235 and upper pads 237 (e.g., their concave surfaces) contact and push respective lower and upper portions of glass articles into an annealing furnace. The upper pads 237 may be vertically spaced apart from respective ones of the lower pads 235.

[0037] Each of the lower pads 235 has a bracket 245 that is secured directly to the push bar 233 with a bolt 239. A pin 249 is mounted to each bracket 245 to secure a respective one of the lower pads 235 thereto. The lower pads 235 are independently mounted to the push bar 233 relative to each other and independently removable from the brackets 245 via the pins 249 without unbolting the brackets 245 from the push bar 233.

[0038] The lower pads 235 may be vertically separated from the upper pads 237 by spacers 251 that are free of contact with the push bar 233. As described above, the spacers 251 may have different vertical heights to accommodate glass articles of different vertical dimensions. The upper pads 237 are prevented from rotating relative to the lower pads 235 and spacers 251 via keyed features 259 (Figure 5). The lower and upper pads 235, 237 have horizontal cross-sectional areas that define perimeters 238. A horizontal cross-sectional area 252 of the spacers 251 is located completely within the perimeters 238.

[0039] In one embodiment, lower ends 250 of the pins 249 threadingly engage threaded holes 263 in the brackets 245. Weights (see, e.g., spheres 253) secure the upper pads 237 to the pins 249. The lower pads 235 have reliefs 236 on lower and rear surfaces thereof that are complementary in shape to the brackets 245.

[0040] The longitudinal positions of the lower and upper pads 235, 237, relative to the push bar 233, are adjusted by relocating the brackets 245 relative to the push bar 233. In one embodiment, the push bar 233 comprises a channel having a slot 271 through which the brackets 245 extend. The bolts 239 threadingly engage threaded holes 254 in the brackets 245 to push the brackets 245 against an interior (e.g., flanges 275) of the push bar 233. Springs 243 are located between push bar 233 and brackets 245 on bolts 239 to bias brackets 245 against push bar 233. Different springs 247 are located between the heads of the bolts 239 and the brackets 245 to bias the bolts 239 away from the brackets 245. The longitudinal flanges 275 of push bar 233 extend inward from the slot 271. The brackets 245 have longitudinal notches 277 for receiving at least one of the flanges 275 such that said at least one of the flanges 275 seats in one of the notches 277.

[0041] Referring now to **Figure 8**, one embodiment of a method of handling glass articles in a glass article fabrication operation is depicted. The method begins as indicated at step 101, and comprises providing a push bar and pad assemblies, each of the pad assemblies having a lower pad and an upper pad (step 103); mounting the lower pads to the push bar independently of each other (step 105); conveying hot glass articles toward an annealing furnace (step 107); receiving the hot glass articles with the pad assemblies (step 109); contacting lower portions of the hot glass articles with the lower pads and upper portions of the hot glass articles with the upper pads (step 111); pushing the hot glass articles into the annealing furnace simultaneously with the lower and upper pads (step 113); retracting the pad assemblies to receive additional hot glass articles (step 115); repeating steps 107 through 115, before ending as indicated at step 119.

The method may further comprise spacing apart the lower and upper pads in a vertical direction and contacting the hot glass articles with concave surfaces; and/or spacing apart respective pairs of the lower and upper pads with spacers, and configuring the spacers to be

free of contact with the push bar. The method also may comprise providing each of the lower pads with a bushing that is secured to the push bar with a bolt, and securing the lower pads to the bushings with pins; and/or independently removing the lower pads from the bushings via the pins without unbolting the bushings from the push bar; and/or securing the pins to the bushings with screws, and securing the upper pads to the pins with spring clips; and/or adjusting longitudinal positions of respective pairs of the lower and upper pads relative to the push bar by relocating the bushings along the push bar; and/or torquing the bolts through apertures in the lower pads, the apertures having diameters that are smaller than diameters of heads of the bolts.

[0042] The pads are preferably composed of a ceramic material, more preferably a tough grade of graphite, which is normally substantially free of plastic or other nonmetallic resins or fibers. The contact surfaces of the pads are preferably arcuate in order to improve the glass article containment characteristics of the stacker bar assembly. Although a constant curvature across the thickness of the pads is preferred for substantially cylindrical hot glass articles such as typical bottles, alternative contact surface shapes are also possible. Alternative contact surface shapes may include planar surface portions (forming an adjustable and interacting saw tooth pattern when adjoining pads are secured to the support member) or more complex shapes to provide added contact surfaces for noncylindrical hot glass articles.

[0043] In one embodiment, the arcuate surfaces of the pads have a radius of curvature of about 2.25 inches. These surfaces, when combined with the adjustable pad location, allow a single stacker bar assembly to reliably push a plurality of cylindrical glass articles varying in diameter from about 1.875 to 4 inches. In another embodiment, cylindrical glass articles ranging in diameter from about 4 to 8 inches can be accommodated. The adjoining arcuate surfaces form glassware nesting pockets which are more forgiving of positional and pushing misalignments than saw tooth configurations.

[0044] In addition to the adjustable shape and materials of construction of the pads, serrating or controlling the surface finish of the contact surfaces may be varied to push and handle hot glass articles without damage. A surface roughness (of a planar or arcuate surface) of no smoother than about 125 to 250 μin , RMS, is typical. However, a smoother surface finish

may also be tolerated for some applications. If an arcuate and serrated surface of a pad is used for contacting hot glass articles having a diameter of about 3 inches, the serrated surface is preferably formed by milling to create an average ridge to trough dimension in the range of about 0.050 to 0.060 inch. Other processes for producing a serrated and/or roughened surface include grinding, abrasion, and erosion. Serrated surfaces having an average ridge to trough dimension of at least about 0.001 inch or less may be used for other contact surface applications, but typically at least about 0.010 inch.

[0045] The serrated or other rough surface finish reduces the actual hot glass-graphite contact surface of the pad and thereby significantly improves stacker bar assembly performance by reduces the actual (microscopic) glass contacting area at contact sites and increasing the distribution of the actual contact areas at these sites when compared to smoother contact surfaces. The use of serrated or roughened surfaces on the pads of the invention is possible because the pads are substantially composed of a nonmetallic ceramic material. Unlike a serrated or rough stainless steel surface which may tend to increase mechanical damage to contacting hot glass articles when compared to a smoother stainless steel surface, the thermal and physical properties of a rough or serrated graphite or other ceramic surface seem to reduce thermal and mechanical damage when compared to smoother nonmetallic contact surfaces.

[0046] Although the contact pads are typically maintained at elevated temperatures by being located near the annealing oven, the temperature of the pads is typically less than the hot glass articles, and it is believed the smaller actual contacting area of a serrated or rough contact surface reduces heat transfer from the hot glass articles to the nonmetallic pads, thereby reducing checking or other thermal stress damage. Furthermore, the arcuate shape plus rough/serrated surface plus nonmetallic composition is believed to better distribute mechanical loads to reduce mechanical damage.

[0047] Although some alternative embodiments have been described, other alternative embodiments are also possible. These include: using porous or ported pads which may be combined with a fluid flow through the pads (e.g., similar to air table handling); using separate contact surfaces on the pad instead of a continuous (radius of curvature) contact

surface across the thickness of the pad (e.g., a top and a bottom contact surfaces on the pads); adding a heating element for heating the pad to elevate the temperature of the pad and minimize heat transfer from the hot glass articles, especially if a fluid is flowing near the pads; and attaching the pad to other glass handling or other equipment. Moreover, the various features of the different embodiments are substantially interchangeable.

[0048] While the invention has been shown or described in only some of its forms, it should be apparent to those skilled in the art that it is not so limited, but is susceptible to various changes without departing from the scope of the invention.

CLAIMS

What is claimed is:

1. A stacker bar assembly for glass article fabrication, comprising:
 - a push bar;
 - a pad assembly mounted to the push bar for contacting and pushing a glass article into an annealing furnace; the pad assembly comprising:
 - a lower pad for contacting a lower portion of the glass article, the lower pad being in direct contact with the push bar; and
 - an upper pad located vertically above the lower pad for contacting an upper portion of the glass article.
2. A stacker bar assembly according to Claim 1, wherein the lower pad is independently mounted to the push bar, and portions of the lower and upper pads that contact the glass article are concave in shape.
3. A stacker bar assembly according to Claim 1, wherein the lower pad is separated from the upper pad by a spacer that is free of contact with the push bar.
4. A stacker bar assembly according to Claim 3, wherein the lower and upper pads have horizontal cross-sectional areas that define perimeters, and a horizontal cross-sectional area of the spacer is located completely within the perimeters.
5. A stacker bar assembly according to Claim 1, wherein the upper pad is prevented from rotating relative to the lower pad.

6. A stacker bar assembly according to Claim 5, wherein the lower and upper pads have keyed features to prevent rotation therebetween.
7. A stacker bar assembly according to Claim 1, wherein the lower pad has a bushing that is secured to the push bar with a bolt, and a pin extends vertically through the bushing to interconnect the pad assembly.
8. A stacker bar assembly according to Claim 7, wherein the pin is secured to the bushing with a screw, and a spring clip secures the upper pad to the pin.
9. A stacker bar assembly according to Claim 8, wherein a longitudinal position of the lower and upper pads relative to the push bar is adjusted by relocating the bushing relative to the push bar.
10. A stacker bar assembly according to Claim 7, wherein the lower pad is independently removable from the bushing via the pin without unbolting the bushing from the push bar.
11. A stacker bar assembly according to Claim 7, wherein the lower pad has an aperture for providing torquing access to the bolt, and the aperture has a diameter that is smaller than a diameter of a head of the bolt.
12. A stacker bar assembly according to Claim 7, wherein the push bar comprises a channel having a slot through which the bushing extends, a nut for the bushing and the bolt, and a spring between the nut and an interior of the channel for biasing the nut toward the slot, and further comprising a spring located between each the bolt and the bushing for biasing the bolt away from the nut.

13. A stacker bar assembly according to Claim 12, wherein the channel has longitudinal flanges that extend inward from the slot, and the nut has longitudinal notches for receiving the flanges such that the flanges seat in the notches.

14. A stacker bar assembly according to Claim 7, wherein the lower and upper pads have apertures through which the pin extends, and the apertures have non-uniform cross-sectional areas over a vertical length of each of the lower and upper pads.

15. A stacker bar assembly for glass article fabrication, comprising:

a push bar;

a plurality of lower pads mounted to the push bar for contacting and pushing respective lower portions of glass articles into an annealing furnace, each of the lower pads having a bushing that is secured directly to the push bar with a bolt, and a pin extending through the bushing to secure a respective one of the lower pads thereto;

the lower pads are independently mounted to the push bar relative to each other and independently removable from the bushings via the pins without unbolting the bushings from the push bar; and

a plurality of upper pads for contacting and pushing respective upper portions of the glass articles into the annealing furnace, the upper pads being located vertically above the lower pads on the pins.

16. A stacker bar assembly according to Claim 15, wherein each lower pad and a respective upper pad form a pair of pads, and said each lower pad is separated from said respective upper pad by a spacer that is free of contact with the push bar.

17. A stacker bar assembly according to Claim 16, wherein a plurality of spacers having different vertical heights are used to accommodate glass articles of different vertical dimensions.

18. A stacker bar assembly according to Claim 17, wherein the upper pads are prevented from rotating relative to respective ones of the lower pads and spacers via keyed features, and the lower and upper pads have horizontal cross-sectional areas that define perimeters, and a horizontal cross-sectional area of the spacers is located completely within the perimeters.

19. A stacker bar assembly according to Claim 15, wherein each of the pins is secured to a respective one of the bushings with a screw, and a spring clip secures a respective one of the upper pads to the pin.

20. A stacker bar assembly according to Claim 15, wherein longitudinal positions of respective pairs of the lower and upper pads, relative to the push bar, are adjusted by relocating the bushings relative to the push bar.

21. A stacker bar assembly according to Claim 15, wherein each lower pad has an aperture for providing torquing access to a respective one of the bolts, and the aperture has a diameter that is smaller than a diameter of a head of the bolt.

22. A stacker bar assembly according to Claim 15, wherein the push bar comprises a channel having a slot through which the bushings extend, a nut for attaching each respective pair of the bushings and bolts, and a spring between the nut and an interior of the channel for biasing the nut toward the slot, and further comprising a spring located between each pair of the bolts and bushings for biasing respective ones of the bolts away from the nuts.

23. A stacker bar assembly according to Claim 22, wherein the channel has longitudinal flanges that extend inward from the slot, and each nut has longitudinal notches for receiving the flanges such that the flanges seat in the notches.

24. A stacker bar assembly according to Claim 15, wherein each lower pad has orthogonal longitudinal edges that are complementary in shape to adjacent ones of the lower pads such that the lower pads engage each other but are independently removable from the push bar.

25. A stacker bar assembly for glass article fabrication, comprising:

a push bar;

a plurality of lower pads mounted to the push bar for contacting and pushing respective lower portions of glass articles into an annealing furnace, each of the lower pads having a bracket that is secured directly to the push bar with a bolt, and a pin mounted to the bracket to secure a respective one of the lower pads thereto;

the lower pads are independently mounted to the push bar relative to each other and independently removable from the brackets via the pins without unbolting the brackets from the push bar; and

a plurality of upper pads for contacting and pushing respective upper portions of the glass articles into the annealing furnace, the upper pads being located vertically above the lower pads on the pins.

26. A stacker bar assembly according to Claim 25, wherein each lower pad and a respective upper pad form a pair of pads, and said each lower pad is separated from said respective upper pad by a spacer that is free of contact with the push bar.

27. A stacker bar assembly according to Claim 25, wherein a plurality of spacers having different vertical heights are used to accommodate glass articles of different vertical dimensions, the upper pads are prevented from rotating relative to respective ones of the lower pads and spacers via keyed features, the lower and upper pads have horizontal cross-sectional areas that define perimeters, and a horizontal cross-sectional area of the spacers is located completely within the perimeters.

28. A stacker bar assembly according to Claim 25, wherein the pins threadingly engage respective ones of the brackets, weights secure respective ones of the upper pads to the pins, and the lower pads have reliefs on lower and rear surfaces thereof that are complementary in shape to the brackets.

29. A stacker bar assembly according to Claim 25, wherein longitudinal positions of respective pairs of the lower and upper pads, relative to the push bar, are adjusted by relocating the brackets relative to the push bar, and portions of the lower and upper pads that contact the glass articles are concave in shape.

30. A stacker bar assembly according to Claim 25, wherein the push bar comprises a channel having a slot through which the brackets extend, the bolts threadingly engage the brackets to push the brackets against an interior of the push bar, springs between heads of the bolts and the brackets bias the bolts away from the brackets, the channel has longitudinal flanges that extend inward from the slot, and the brackets have longitudinal notches for receiving at least one of the flanges such that said at least one of the flanges seats in one of the notches.

31. A method of handling glass articles in a glass article fabrication operation, comprising:

- (a) providing a push bar and pad assemblies, each of the pad assemblies having a lower pad and an upper pad;
- (b) mounting the lower pads to the push bar independently of each other;
- (c) conveying hot glass articles toward an annealing furnace;
- (d) receiving the hot glass articles with the pad assemblies;
- (e) contacting lower portions of the hot glass articles with the lower pads and upper portions of the hot glass articles with the upper pads;
- (f) pushing the hot glass articles into the annealing furnace simultaneously with the lower and upper pads;
- (g) retracting the pad assemblies to receive additional hot glass articles; and then
- (h) repeating steps (c) through (g).

32. A method according to Claim 31, further comprising spacing apart the lower and upper pads in a vertical direction and contacting the hot glass articles with concave surfaces.

33. A method according to Claim 31, further comprising providing each of the lower pads with a bushing that is secured to the push bar with a bolt, and securing the lower pads to the bushings with pins.

34. A method according to Claim 33, further comprising independently removing the lower pads from the bushings via the pins without unbolting the bushings from the push bar.

35. A method according to Claim 33, further comprising securing the pins to the bushings with screws, and securing the upper pads to the pins with spring clips.

36. A method according to Claim 33, further comprising adjusting longitudinal positions of respective pairs of the lower and upper pads relative to the push bar by relocating the bushings along the push bar.

37. A method according to Claim 33, further comprising torquing the bolts through apertures in the lower pads, the apertures having diameters that are smaller than diameters of heads of the bolts.

38. A method according to Claim 32, further comprising spacing apart respective pairs of the lower and upper pads with spacers, and configuring the spacers to be free of contact with the push bar.

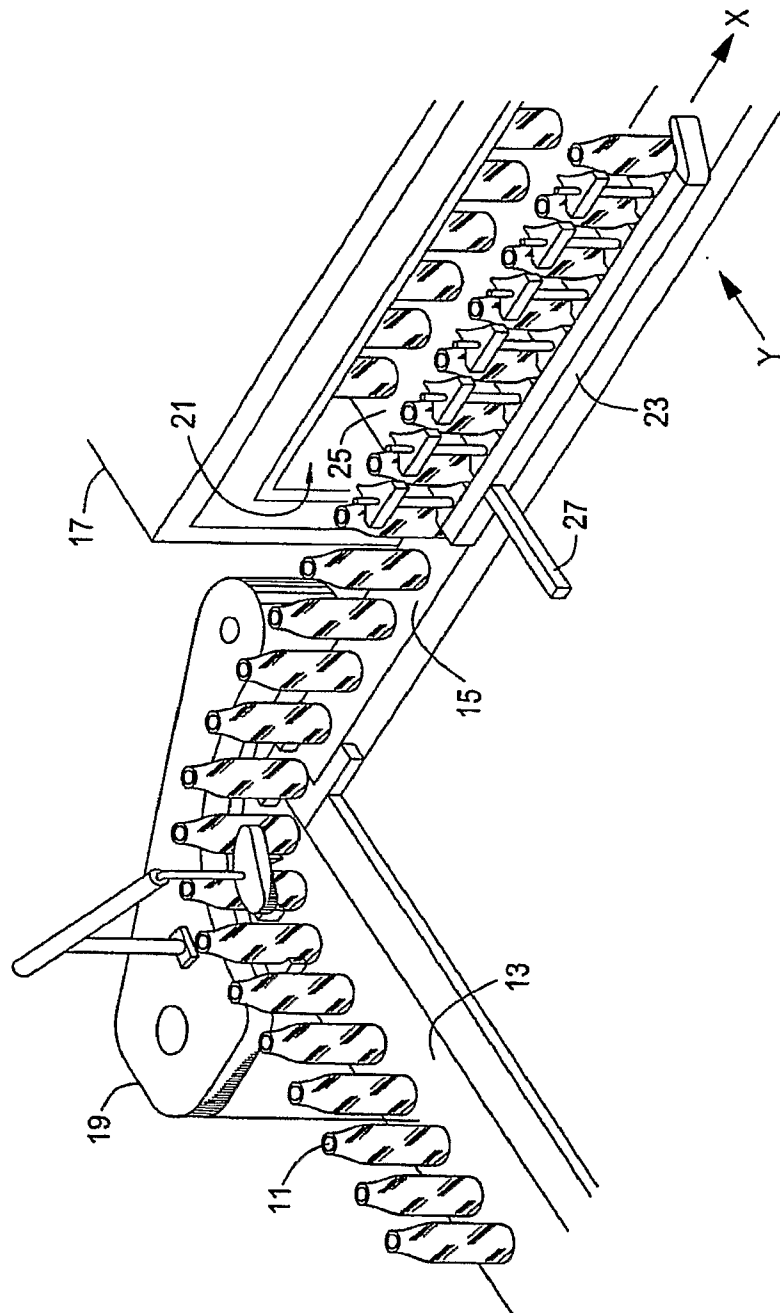
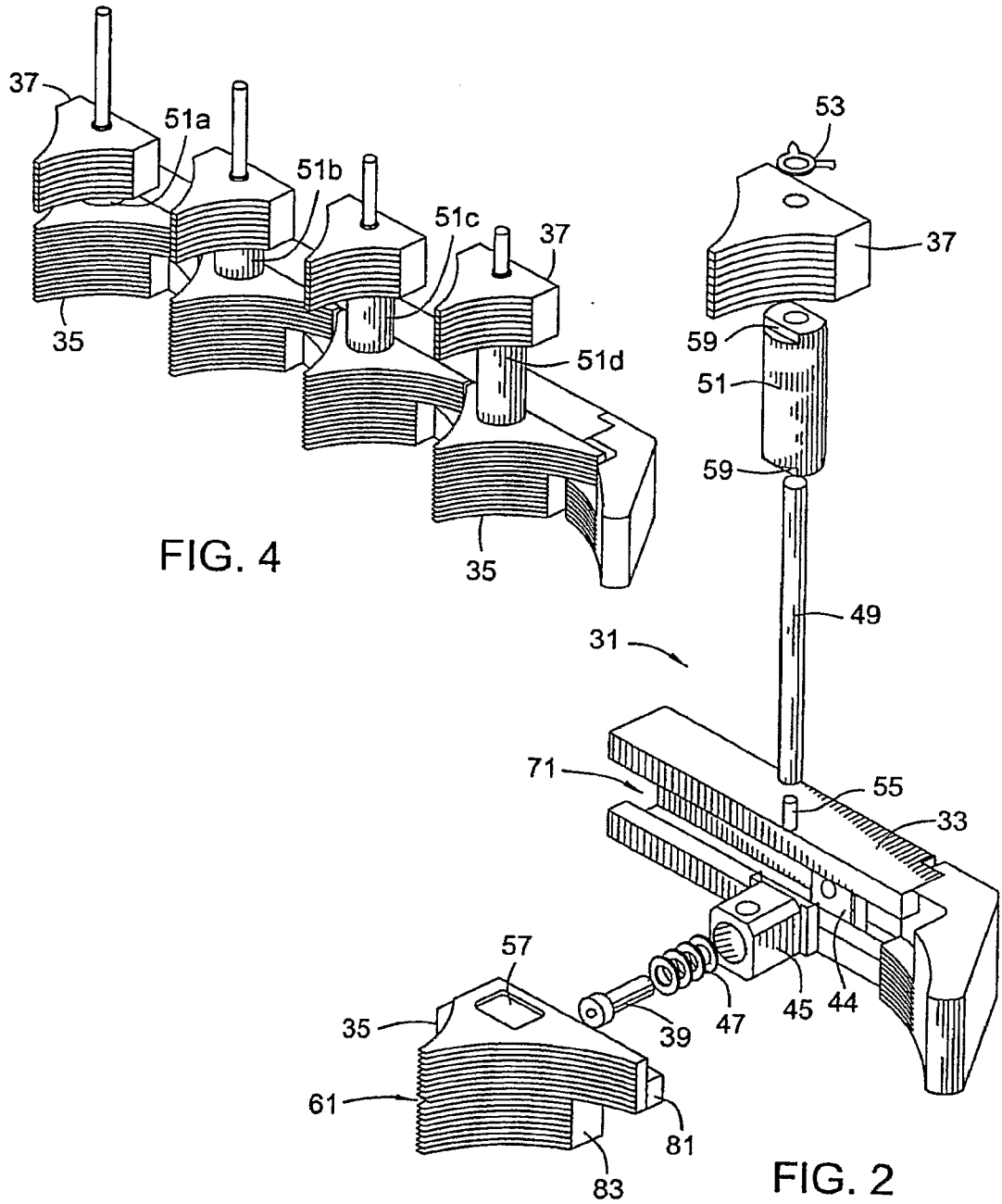


FIG. 1



3/6

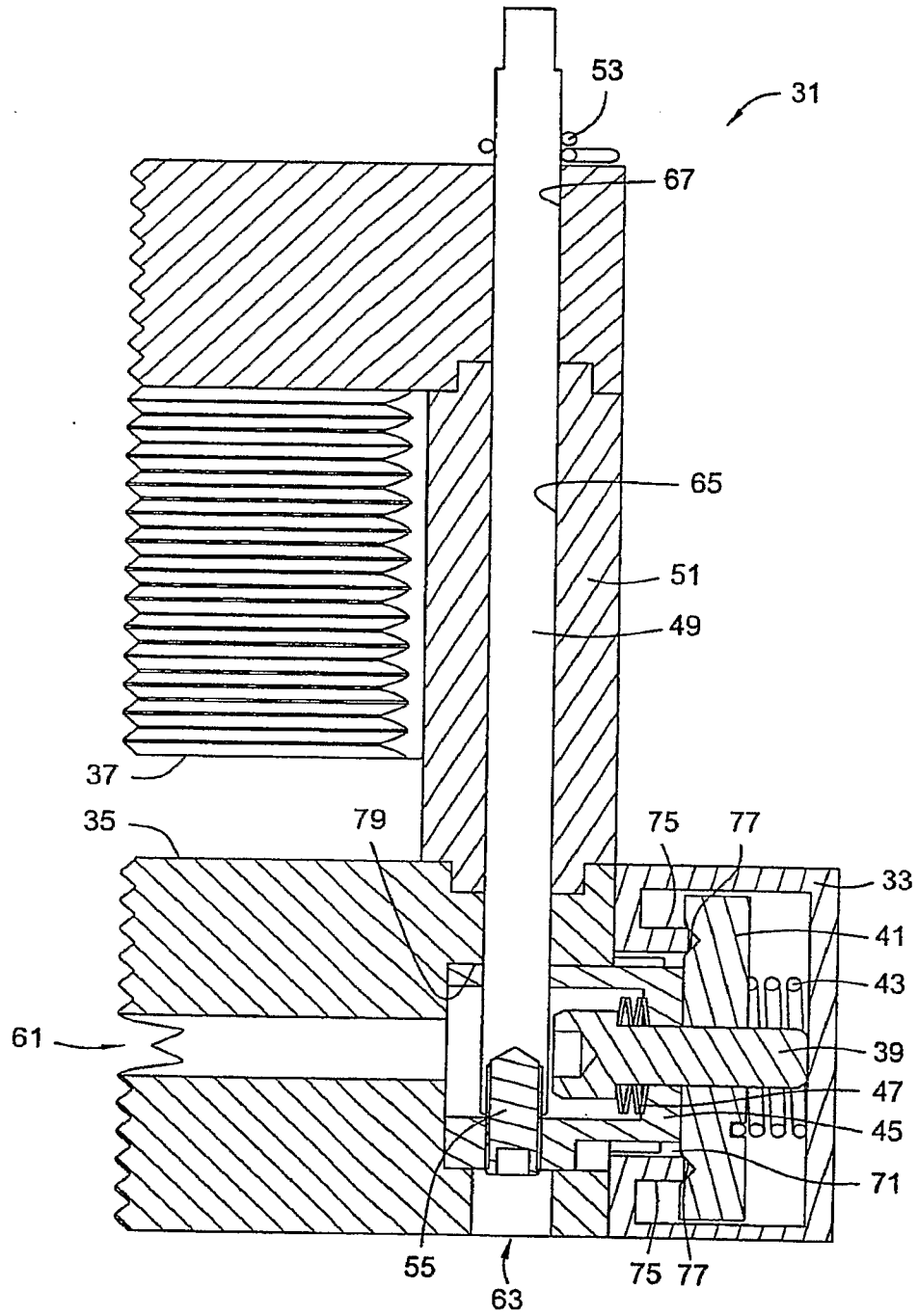


FIG. 3

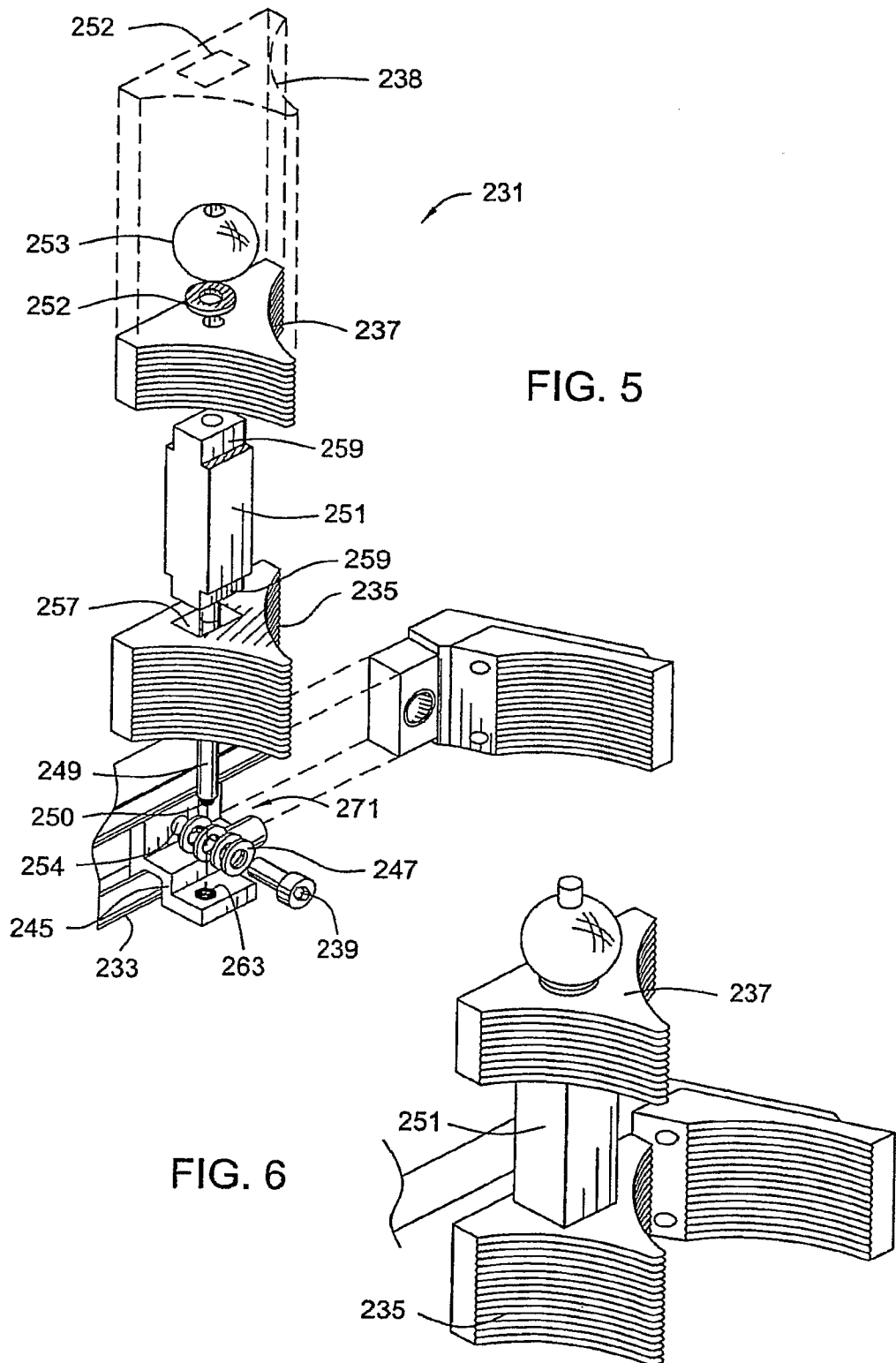


FIG. 5

FIG. 6

5/6

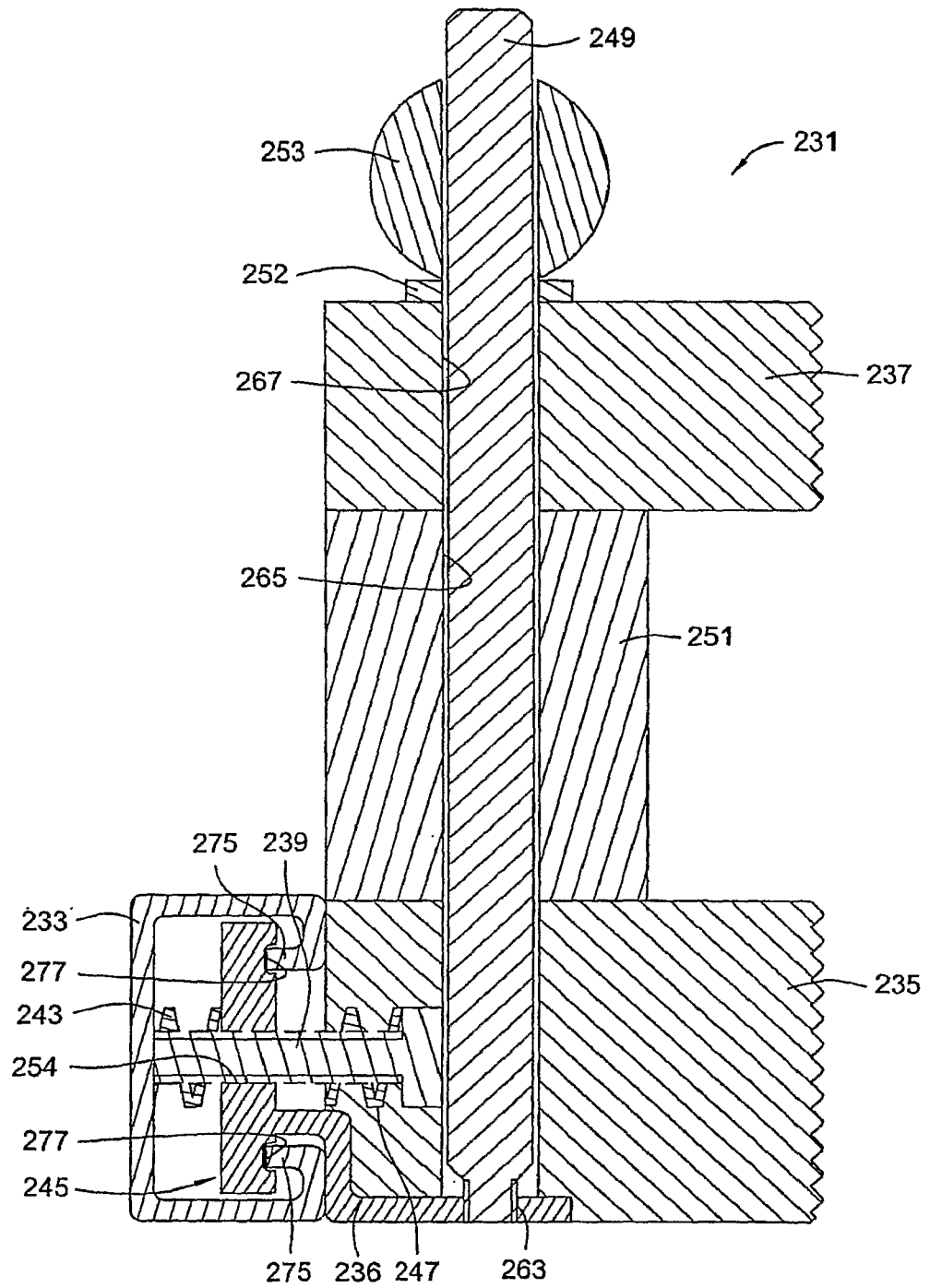


FIG. 7

6/6

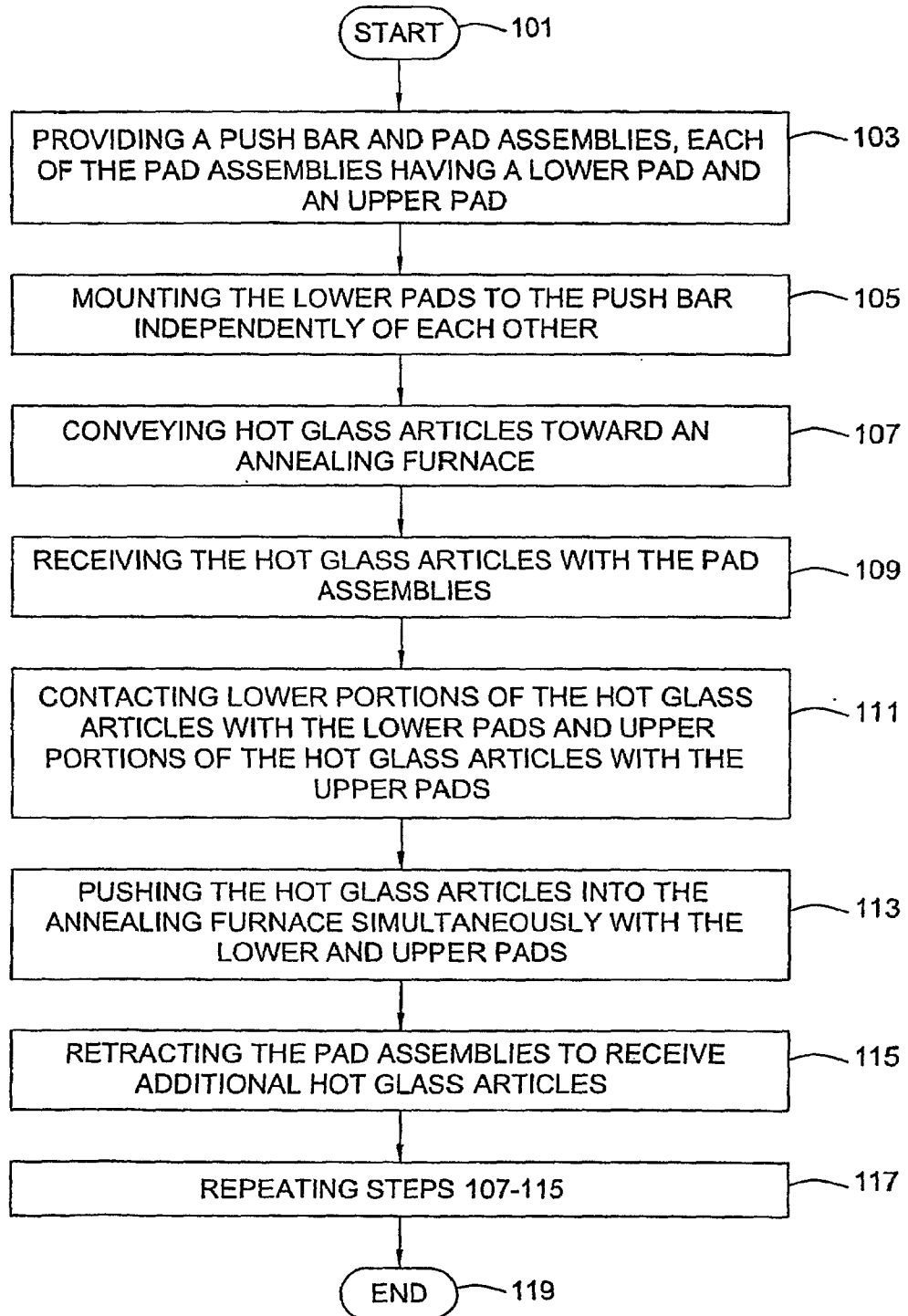


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2007/006161

A. CLASSIFICATION OF SUBJECT MATTER
INV. C03B35/10

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
C03B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X A	US 6 044 962 A (VAUGHN JAMES H [US]) 4 April 2000 (2000-04-04) figures 8-10	1, 2, 5, 6, 31, 32 3, 4, 7-30, 33-38
A	----- US 5 741 343 A (LLOYD PATRICK H [US] ET AL) 21 April 1998 (1998-04-21) cited in the application figure 2 ----- -/--	1-38

Further documents are listed in the continuation of Box C. See patent family annex.

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X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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Date of the actual completion of the international search 1 August 2007	Date of mailing of the international search report 09/08/2007
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer Marrec, Patrick

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2007/006161

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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A	US 5 755 847 A (QUAYLE DAVID [US]) 26 May 1998 (1998-05-26) figure 2	
A	WO 2005/100271 A (SKLOSTROJ TURNOV CZ S R O [CZ]; COUFAL MARTIN [CZ]; KUBAT JAROSLAV [CZ]) 27 October 2005 (2005-10-27) figures 3,4	
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