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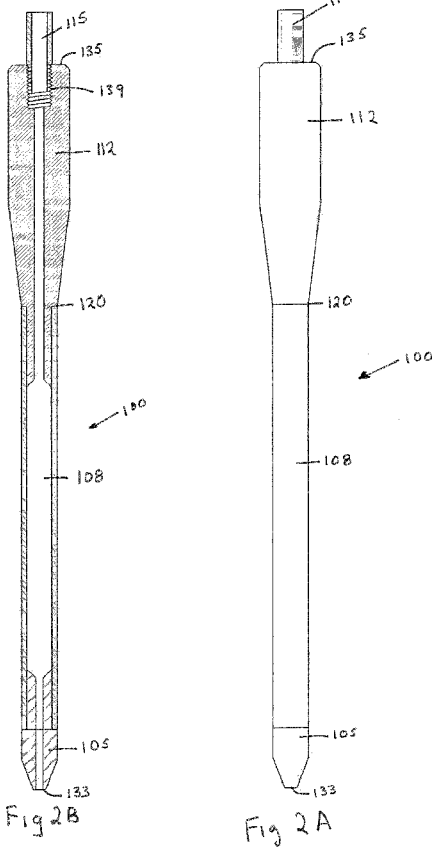
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(54) Title: GLASS BLOWING APPARATUS AND METHOD OF MAKING GLASS OBJECTS



(57) Abstract: An apparatus and method for manufacturing glass objects comprising a glass blowing pipe and a metal mounting device configured to melt with glass to form a glass piece that is easily removed from the glass blowing pipe without the need to break the glass from the headstock of the glass blowing pipe, wherein the metal mounting device comprises a contact patch and a number of slits to secure the metal mounting device to the glass. A method for manufacturing a glass object utilizing a metal mounting insert is described. A glass object having a metal mounting insert for installation and use in other applications is also described.

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GLASS BLOWING APPARATUS AND METHOD OF MAKING GLASS OBJECTS

CROSREFERENCE TO RELATED APPLICATIONS

Applicant hereby claims priority under 35 U.S.C. § 120 of co-pending United States non-provisional patent application serial number 13/555,570 entitled GLASS BLOWING APPARATUS AND METHOD OF MAKING GLASS OBJECTS filed on July 23, 2012, and of co-pending United States non-provisional patent application serial number 13/837,532 entitled GLASS BLOWING APPARATUS AND METHOD OF MAKING GLASS OBJECTS filed on March 15, 2013, which are incorporated herein by reference in their entirety.

TECHNICAL FIELD

This invention generally relates to the field of glass object manufacturing and more specifically to an apparatus for blowing glass objects and a method for manufacturing glass objects utilizing the glass blowing apparatus.

BACKGROUND ART

Glass blowing is an age old practice going back hundreds of years. The method of blowing glass objects requires a glass blowing pipe capable of withstanding extreme heat to the point that sand/silica becomes a molten soup. The headstock of the glass blowing pipe is placed in the crucible containing molten glass, gathering the molten glass on the headstock of the pipe and coating it with molten glass. The hot molten glass adheres to the head stock. The artisan then removes the molten glass from the container and blows it into shape. As the piece is blown, the artisan has to create a weak spot between the head stock and the piece of glass being made. Once the piece is completed, the artisan separates the finished piece from the headstock by breaking the glass at the weak spot. The breaking process makes it easy for the piece to break beyond the weak spot and requiring the artisan to start the process from the beginning and blow a new piece.

The prior art discloses various head stock pieces that can be detached from the glass blowing pipe and which allow the replacement of the head stock without the need to replace the entire pipe. See, for example, United States patents 233,550; 268,162; 444,160; 976,796; 1,535,168; and

1,570,695. The headstock attachments disclosed in the prior art, however, do not solve the problem that arises from the need to break the glass in order to finish the piece.

DISCLOSURE OF THE INVENTION

The present invention provides a solution to the above and other problems by enabling a method of blowing of glass objects without the need to break the object at a weak spot to separate it from the head stock of the blowing pipe. It is one object of the present invention to provide a metal mounting device, comprising an attachment element and a contact patch. In some embodiments, the contact patch has a thickness of between .01 and .07 inches. In other embodiments, the contact patch has a thickness of between 0.009 and 0.125 inches. It is a further object of the present invention to provide a metal mounting device having a contact patch that comprises vertical slits. Preferably, the slits have a thickness of between 0.007 - .025 inches. In some embodiments, the vertical slits have a length of 1/5 the length of the contact patch. The contact patch in accordance with one object of the present invention is made from a material capable of melting with molten glass, preferably of a material with a coefficient of expansion equal or near to the coefficient of expansion of glass. In preferred embodiments the coefficient of expansion of the material is within five ten-thousands (0.0005) of an inch of the coefficient of expansion of the glass being used for manufacturing the glass blown object. In other preferred embodiments, the coefficient of expansion of the material is within fifteen ten-thousands (0.0015) of an inch of the coefficient of expansion of the glass being used for manufacturing the glass blown object. In yet further embodiments, the coefficient of expansion of the material is within ten ten-thousands (0.0010) of an inch of the coefficient of expansion of the glass being used for manufacturing the glass blown object.

In accordance with a further object of the invention, a kit for manufacturing glass objects having a glass blowing pipe configured to accept a metal mounting device and a metal mounting device comprising a contact patch is provided. In some embodiments, the kit further comprises a metal mounting device having a removal tool attachment element and a tool for removing the metal mounting device from the glassblowing pipe. In accordance with another object of the invention, the

metal mounting device is configured to be removably attached to a headstock section of the glassblowing pipe.

A further object of the invention is to provide a method of blowing glass objects comprising the steps of gathering molten glass on a metal mounting device; and blowing a glass piece using the metal mounting device, wherein the metal mounting device comprises a contact patch. The method further comprises the step of removing the glass piece from a glass blowing pipe. A further step comprises attaching the glass piece to a mount. In yet a further embodiment, the method of claim comprises the step of attaching accessories to the glass piece, such as a light element.

It is one object of the present invention provide an insert for a glass blowing pipe that has a glass pipe attachment element and a glass object attachment element. Once the glass piece is blown, the insert becomes attached to the glass object and can be easily removed from the glass blowing pipe. The insert is utilized to attach the glass object to other components.

It is another object of the present invention to provide a method for making a glass object. The first step in the method is to coat the insert with molten glass. In the second step the glass piece is blown using a glass blowing pipe to which the insert is attached. In a third step, the glass piece is removed from the glass blowing pipe.

It is yet another object of the present invention to provide a kit for making glass objects comprising a glass blowing pipe and an insert. The kit may further include other elements that aid in the manufacture of glass pieces.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other features, aspects, and advantages of the present invention are considered in more detail, in relation to the following description of embodiments thereof shown in the accompanying drawings, in which:

Figure 1A is a side view of the glass blowing pipe in accordance with one object of the present invention, wherein the pipe does not have a metal mounting insert attached to it.

Figure 1B is a sectional side view of the glass blowing pipe shown in figure 1A.

Figure 2A is a side view of the glass blowing pipe in accordance with one object of the present invention with a metal mounting insert attached to it.

Figure 2B is a sectional side view of the glass blowing pipe shown in Figure 2.

Figure 3A is a side view of a metal mounting insert for use with the glass blowing pipe in accordance with one object of the present invention.

Figure 3B is a sectional representation of the side view of Figure 3A.

Figure 3C is a top view of a metal mounting insert.

Figure 3D is a side view of a metal mounting insert with a release element.

Figure 4A is an illustration of the glass blowing pipe in accordance with one object of the present invention and the removal tool for removing a metal mounting insert having a release element.

Figure 4B is a sectional view of Figure 4A.

Figure 5 is a flow chart of a method of blowing glass in accordance with one embodiment of the present invention.

Figure 6A & 6B are illustration of various glass pieces attached to frames to form functional products.

Figure 7 is an illustration of a metal mounting insert that includes lighting elements.

Figure 8A and 8B is an illustration of a glass object attached to a mount and secured by threads on the mount or a set screw.

Figure 9 is an illustration of a glass object having more than one metal mounting insert.

Figure 10 is an illustration of a glass object having a cap attached to the metal mounting insert.

Figure 11 is an illustration of a glass object mounted to a metal housing and coupled to a water pump.

Figure 12 is an illustration of a glass object with two metal mounting inserts to create a neon or fluorescent light.

Figure 13 A is a side view of a metal mounting insert.

Figure 13 B is a cross-sectional view of a metal mounting insert.

Figure 13 C is a top view of a metal mounting insert.

BEST MODE(S) FOR CARRYING OUT THE INVENTION

The invention summarized above and defined by the enumerated claims may be better understood by referring to the following description, which should be read in conjunction with the accompanying drawings and claims in which like reference numbers are used for like parts. This description of an embodiment, set out below to enable one to build and use an implementation of the invention, is not intended to limit the invention, but to serve as a particular example thereof. Those skilled in the art should appreciate that they may readily use the conception and specific embodiments disclosed as a basis for modifying or designing other methods and systems for carrying out the same purposes of the present invention. Those skilled in the art should also realize that such equivalent assemblies do not depart from the spirit and scope of the invention in its broadest form.

In an effort to avoid the above-described disadvantages, a glass blowing pipe 100 is provided, as shown on Figure 1A and 1B. The glass blowing pipe 100 has three sections: a mouth piece section 105, a pipe section 108, and a headstock section 112. The sectional view shown in Figure 1B shows a more detailed view of the glass blowing pipe 100. The glassblowing pipe 100 has an air channel 128 that runs from a distal end 133 at the end of the mouth piece section 105 through an insert end 135 of the headstock section 112.

The configuration of the transition between the pipe section 108 and the head stock section 112 is not critical to the present invention. In some embodiments, the head stock section 112 is merely the end of the glass blowing pipe 100 that is opposite of the mouth piece section 105, as shown on Figure 1. In other embodiments, the headstock section 112 has a different configuration than the pipe section 108. The headstock section 112 may be thicker, have a different shape, have a different surface, or be modified in any manner known to a person of ordinary skill in the art. In yet other embodiments, the headstock section 112 is removable from the pipe section 108, as shown in the prior art. The headstock section 112 of the glass blowing pipe 100 has a pipe section end 120 and an insert end 135, which corresponds to the distal end 135 of the headstock section as described

above. The insert end 135 is configured to accept the metal mounting insert 115 as shown in figures 2A and 2B.

A metal mounting insert 115 is shown in Figure 3. The metal mounting insert 115 is configured to attach to the headstock section 112 of the glass blowing pipe 100. In a preferred embodiment, the metal mounting insert 115 is removably attached to the headstock section 112. The metal mounting insert 115 as shown in Figures 3A through 3D, has two sections: a glassblowing pipe attachment element 169 and a glass object attachment element 177. In one preferred embodiment, as shown on Figure 3D, the glassblowing pipe attachment element 169 comprises insert threads 155 that allow the metal mounting insert 115 to be removably attached to the glassblowing pipe 100. It is contemplated that the glassblowing pipe attachment element 155 is any type of release mechanism that allows tight fit between the glassblowing pipe 100 and the metal mounting insert 115, resulting in minimum loss of air at the joint 121 between the distal end 135 of the headstock section 112 and the metal mounting insert 115.

In one preferred embodiment, as shown on Figures 1A and 1B, the distal end 135 of the head stock section 112 has head stock threads 139 that match insert threads 155 on the metal mounting insert 115. The metal mounting insert 115 is screwed into the distal end 135 of the headstock section 112 as shown on Figures 2A and 2B. The metal mounting insert 115 fits tightly in the head stock section 112 with minimal air escaping through the joint 121 between the head stock section 112 and the metal mounting insert 115. It is contemplated that the metal mounting insert 115 can be mounted to the head stock section 112 by other methods that allow a tight fit that minimizes escape of air at the joint between the metal mounting insert 115 and the head stock section 112.

In a further preferred embodiment, the metal mounting insert 115 has a release mechanism 195. The release mechanism 195, in some preferred embodiments, consists of an aperture on the metal mounting insert 115. The aperture is configured to allow a removal tool 400 as shown on Figure 4, to be inserted and aid in removal of the metal mounting insert 115 from the glassblowing pipe 100. The removal tool 400 is turned counterclockwise to release the metal mounting insert 115 and the completed piece from the headstock section 112. In preferred embodiments the coefficient of

expansion of the metal mounting insert 115 is within five ten-thousands (0.0005) of an inch of the coefficient of expansion of the glass being used for manufacturing the glass blown object. In other preferred embodiments, the coefficient of expansion of the metal mounting insert 115 is within fifteen ten-thousands (0.0015) of an inch of the coefficient of expansion of the glass being used for manufacturing the glass blown object. In yet further embodiments, the coefficient of expansion of the metal mounting insert 115 is within ten ten-thousands (0.0010) of an inch of the coefficient of expansion of the glass being used for manufacturing the glass blown object. In some embodiments, the metal mounting insert is released from the pipe by clamping and unscrewing it with a normal pair of locking pliers.

The metal mounting insert 115 is fabricated from a material that fuses and anneals with molten glass. Thus, the metal mounting insert 115 is made from a material that has a coefficient of expansion near or equal to the coefficient of expansion of glass. Some of the materials used include copper, silver, gold or a metal with similar properties. Other materials include platinum, aluminum, iridium, palladium, nickel, osmium, and bronze. In some embodiments, bronze alloys of more than 90% copper can be used. When the glass and metal are super-heated, as in the glassblowing process, the materials bond and fuse together. The heat causes the materials to expand beyond size at room temperature. Though the metal and glass are fused at high temperature the materials shrink as they cool. As the metal mounting insert cools with the glass the two materials shrink back to their room temperature size. The rate at which the material, e.g. copper, expands when heated and the rate at which glass expands when heated are nearly matched. So when it cools back to room temperature they shrink at the same rate as well. If the metal and glass did not expand and contract at the same rate the glass would shrink faster than the metal and burst apart or the metal would lose its bond to the glass and simply slide off. If the coefficients of expansion match the glass and copper are bonded at a molecular level at any temperature. As a result, the cooling process is well controlled to avoid issues that may arise with the difference in the material's expansion coefficients.

A further embodiment of the present invention comprises a method of manufacturing glass pieces using a glass blowing pipe 100 and the metal mounting insert 115 described above. The

method is described in the flowchart of Figure 5. In a first step 500, the metal mounting insert 115 is attached to the headstock section 112 of the glass pipe 100. In a second step 505, the metal mounting insert 115 is placed in the furnace and dipped directly into the crucible of molten glass. The molten glass gathers directly onto the metal mounting insert 115. In a subsequent step 510, once a sufficient amount of molten glass has been gathered upon the metal mounting insert 115, the metal mounting insert 115 is rolled on a marver to ensure full and solid contact between the molten glass and the metal mounting insert 115 and to achieve desired shape. In a subsequent step 515, additional molten glass is collected if necessary for a particular piece. In another step 520, the glass piece is blown using the glass pipe 100. In an optional step additional metal mounting insert's or spray inserts may be added to the finished glass piece. In a final step 520, once the piece is finished it is unscrewed from the pipe with the metal mounting insert 115 permanently attached.

In a preferred embodiment of the present invention, as shown on Figure 6A, the completed piece is attached to a frame 610 to form a complex piece 600 with multiple individual pieces. The metal mounting insert 115 enables the piece to be attached to the frame 610 on any direction. In some embodiments, the piece is perpendicular to the frame 610. In other embodiments the piece is placed on the frame 610 at various different angles. The metal mounting insert 115 may also be used to secure the glass blown object 609 to a mounting bracket 604 as shown in Figure 6B. In other embodiments, after the glass blown object 609 is attached to the mounting bracket 604, an accessory is attached to the metal mounting insert 115. By way of non-limiting example, the accessory can be a water coupling. The water coupling can be utilized to provide water to the glass blown object.

In another preferred embodiment, the metal mounting insert 115 is configured to fit a lighting element 710 as shown on Figure 7. The lighting element 710 allows the glass blown piece 700 to be lit from the inside. Lighting elements include, but are not limited to, incandescent light bulbs, light emission diodes (LEDs), fluorescent light bulbs, Neon, high intensity discharge light bulbs, and other light emitting components as understood by a person of ordinary skill in the art. The light element 710 has a positive 757 and a negative 756 wire that enables electricity to be used in lighting the element 710. In some embodiments a stopper 760 is used to secure the wires 757 and 756 and to

prevent moisture to enter the metal mounting insert. In other embodiments, the metal mounting insert 115 is utilized to introduce other elements inside the glass piece.

Figure 8A and 8B show a metal mounting insert 115 attached to a glass blown object 800, where the metal mounting insert 115 is attached to a mount 810. In some embodiments, as shown in Figure 8A the mount 810 has threads 820 that match the metal mounting insert 115 threads 155 so that the metal mounting insert 115 and glass blown object 800 can be screwed to the mount 810. In other preferred embodiments, as shown in Figure 8B, the mount 810 does not have threads 820. Instead, the mount 810 is configured to accept a set screw 815, through a set screw opening 845. The set screw 815 can be tightened to secure the metal mounting insert 115 to the mount 810. In some embodiments the glass blown object shown in Figures 8A and 8B has a light emitting diode 710 can be inserted through the opening in the metal mounting insert 115. It is contemplated that other accessories can be inserted through the opening in the metal mounting insert 115 that is mounted to the mount 810. In yet a further embodiment, the mount 810 has threads 820 and a set screw 815, which allows for further securing the metal mounting insert 115.

In yet a further embodiment of the present invention, two or more metal mounting inserts 115 can be used, as shown in Figure 9. A first metal mounting insert 115 is placed on one side of the glass blown object 900 and a second metal mounting insert 115 is placed on a different place in the glass blown object, 900. The first metal mounting object may include a metal mounting accessory 920. The metal mounting accessory 920, in some embodiments, may include ornamental features or functional features. In one embodiment, the metal mounting accessory is a water spout. The glass blown object 900, in some embodiments is attached to a mount 910 that, in turn, is attached to a coupling 915 for a water pipe 950. Water passes from the water pipe 950 to the glass blown object 900, and out through the metal mounting accessory 920.

In yet further embodiments of the present invention, as shown on Figure 10, a cap 1000 can be screwed to the metal mounting insert 115. It is contemplated that other accessories may be added to the metal mounting insert.

In yet a further embodiment of the present invention, a kit for manufacturing glass blown objects comprises a glass blowing pipe and a metal mounting insert. In further embodiments, the kit contains a metal mounting object removal tool. In yet further embodiments, the kit comprises accessories, mounts, mounting brackets and other components described above to manufacture glass pieces with a metal mounting insert.

In yet further embodiments of the present invention a glass blown object 1100 has a metal mounting insert 115 as shown on Figure 11. The metal mounting insert 115 connects with a coupler 1125. The coupler 1125 is attached to a water pump 1110 through a supply tube 1120. The water pump 1110 is attached to a vessel 1105 in a housing 1115, which in some embodiments is a metal casing. When the glass blown object 1100 is connected to the coupler, water 1106 is pumped through glass blown object 1100 and falls on the vessel creating a fountain where water 1106 is recirculated.

In yet further embodiments of the present invention, as shown on Figure 12, light emiting object 1200 is made by adding two metal mounting inserts 115 to a glass blown object. A first metal mounting object 115 has an anode 1211. The second metal mounting object 115 has a cathode 1210. One metal mounting object 115 has a cap 1215 and the other may connect to a socket 1205 that allows electricity to be passed through the anode 1211. The light emitting object 1200 is vacuum sealed and includes a gas that produces light when electricity is applied to the anode 1211 and cathode 1210.

It is contemplated that the metal mounting insert 115 can be utilized in a traditional glass blowing pipe or any other device that allows for blowing glass objects either by hand or automatically. When the metal mounting insert is attached to an automatic blowing device, the metal mounting insert is removed from the blowing device and remains as part of the glass blowing object.

Figure 13 shows an improved metal mounting insert 115 for use with glass blowing pipe. The improved metal mounting insert 115 includes a contact patch 1301, which is designed to provide a more reliable attachment to the glass. The contact patch 1301 has a reduced the wall thickness when compared to the body 1305 of the metal mounting insert 115. The contact patch 1301 is the area of metal that fuses with the glass, it reduces checking and fracturing through the fusion process and reduces failure rate. Optimal wall thickness around the contact patch preferably ranges approx.

between 32 – 15 gauge or .01 - .07 inches depending on the application and size of the metal mounting insert 115. It is contemplated that the metal mounting insert 115 can be as thin as 0.009 inches and as thick as 0.125 inches.

In one preferred embodiment, vertical slits 1312 are cut into the contact patch 1301 of the metal mounting insert 115. The vertical slits 1312 prevent the glass from cracking around the metal rim of the metal mounting insert 115 during the cooling process also reducing failure rate. In some embodiments, vertical slits have a thickness of between 36 - 22 gauge, or .007 - .025 inches. The length of the vertical slits 1312 may also vary, in some embodiments the length of each vertical slit 1312 is approximately 1/5 the length of the contact patch 1301. Typically, the vertical slits 1312 are shorter than the length of the contact patch 1301. In some preferred embodiments, the distance between each slit 1312 ranges between 0.125 - 0.75 inches. It is contemplated that there may be as many, or as few, slits 1312 as required for securing the glass to the metal mounting insert 1312. In some embodiments 2, 3, 4 or 5 slits 1312 may be utilized. The number of slits 1312 can be adjusted based on the size of the metal mounting insert 1312.

The invention has been described with references to a preferred embodiment. While specific values, relationships, materials and steps have been set forth for purposes of describing concepts of the invention, it will be appreciated by persons skilled in the art that numerous variations and/or modifications may be made to the invention as shown in the specific embodiments without departing from the spirit or scope of the basic concepts and operating principles of the invention as broadly described. It should be recognized that, in the light of the above teachings, those skilled in the art can modify those specifics without departing from the invention taught herein. Having now fully set forth the preferred embodiments and certain modifications of the concept underlying the present invention, various other embodiments as well as certain variations and modifications of the embodiments herein shown and described will obviously occur to those skilled in the art upon becoming familiar with such underlying concept. It is intended to include all such modifications, alternatives and other embodiments insofar as they come within the scope of the appended claims or equivalents thereof. It should be understood, therefore, that the invention may be practiced otherwise than as specifically set

forth herein. Consequently, the present embodiments are to be considered in all respects as illustrative and not restrictive.

INDUSTRIAL APPLICABILITY

The present invention is applicable to devices for molding glass. The invention discloses an apparatus, a method, and a system for molding glass objects. The device and methods disclosed can be made in industry and practice in the field of glass manufacturing.

CLAIMS

What is claimed is:

1. A metal mounting device, comprising:

an attachment element; and

a contact patch.

2. The metal mounting device of claim 1, wherein the contact patch has a thickness of between .01 and .07 inches.

3. The metal mounting device of claim 1, wherein the contact patch has a thickness of between 0.009 and 0.125 inches.

4. The metal mounting device of claim 3, wherein the contact patch further comprises vertical slits.

5. The metal mounting device of claim 4, wherein the vertical slits have a length of 1/5 the length of the contact patch.

6. The metal mounting device of claim 1, wherein the contact patch is made from a material capable of melting with molten glass.

7. The metal mounting device of claim 1, wherein at least the contact patch is made of a material with a coefficient of expansion near the coefficient of expansion of glass.

8. The metal mounting device of claim 4, wherein the slits have a thickness of between 0.007 - .025 inches.

9. A kit for manufacturing glass objects, comprising:

a glass blowing pipe configured to accept a metal mounting device; and

a metal mounting device comprising a contact patch.

10. The kit of claim 9, wherein the metal mounting device comprises a removal tool attachment element.

11. The kit of claim 10, further comprising a tool for removing the metal mounting device from the glassblowing pipe.

12. The kit of claim 11, wherein the metal mounting device is configured to be removably attached to a headstock section of the glassblowing pipe.

13. A method comprising the steps of:

gathering molten glass on a metal mounting metal mounting device; and

blowing a glass piece using the metal mounting device, wherein the metal mounting device comprises a contact patch.

14. The method of claim 13, further comprising the step of removing the glass piece from a glass blowing pipe.

15. The method of claim 13, further comprising the step of attaching the glass piece to a mount.

16. The method of claim 13, further comprising attaching accessories to the glass piece.

17. The method of claim 16, wherein the accessory is a light element.

18. The method of claim 17, wherein the light element is a light emitting diode.

19. The method of claim 13 further comprising the step of assembling multiple glass pieces having metal mounting metal mounting devices to form a complex structure.

20. An metal mounting device, comprising:

an attachment element;

a glass attachment element, wherein the glass attachment element is capable of securing a glass object that is blown using the metal mounting device.

21. The insert of claim 20, wherein the attachment element is configured to allow the metal mounting device to be removably attached to a headstock section of a glassblowing pipe.

22. The insert of claim 21, wherein the attachment element further comprises a release element.

23. The insert of claim 22, wherein the release element comprises an aperture.

24. The insert of claim 23, wherein the aperture is configured to accept a removal tool.

25. The insert of claim 20, wherein the attachment element is made from a material capable of melting with molten glass.

26. The insert of claim 20, wherein the attachment element is configured to be irremovably attached from glass object.

27. The insert of claim 20, wherein at least the attachment element is made of a material with a coefficient of expansion equal to the coefficient of expansion of glass.

28. A kit for manufacturing glass objects, comprising:

a glass blowing pipe configured to accept an insert;

an insert.

29. The kit of claim 28, further comprising a tool for removing the insert from the glassblowing pipe.

30. The kit of claim 29, wherein the insert comprises

a glassblowing pipe attachment element;

a glass object attachment element.

31. The kit of claim 30, wherein the glassblowing pipe attachment element is configured to allow the inset to be removably attached to a headstock section of the glassblowing pipe.

32. A method comprising the steps of:

gathering molten glass on a metal mounting insert; and

blowing a glass piece using the metal mounting insert.

33. The method of claim 32, further comprising the step of removing the glass piece from a glass blowing pipe.

34. The method of claim 32, further comprising the step of attaching the glass piece to a mount.

35. The method of claim 32, further comprising attaching accessories to the glass piece.

36. The method of claim 35, wherein the accessory is a light element.

1 37. The method of claim 36, wherein the light element is a light emitting diode.

1 38. The method of claim 32 further comprising the step of assembling multiple glass pieces
2 having metal mounting inserts to form a complex structure.

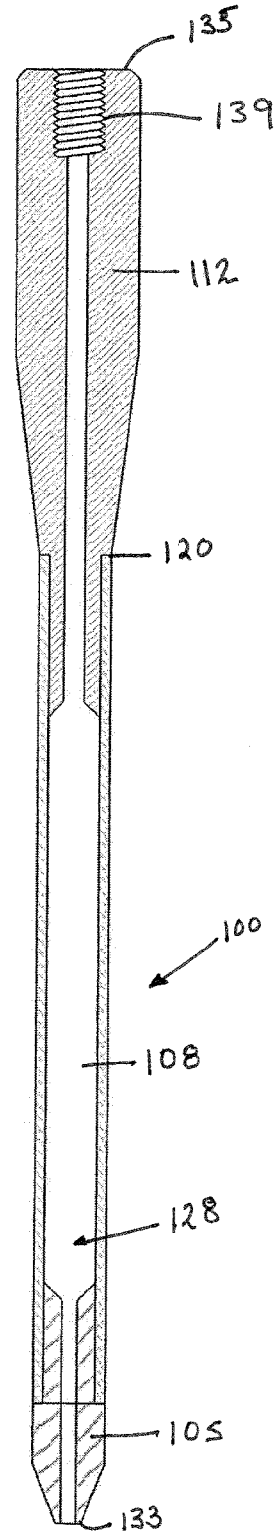


Fig 1B

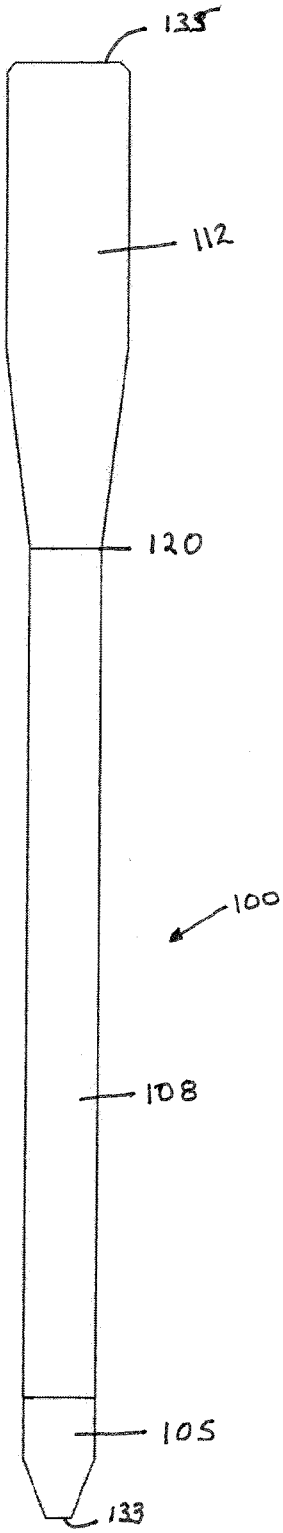


Fig 1A

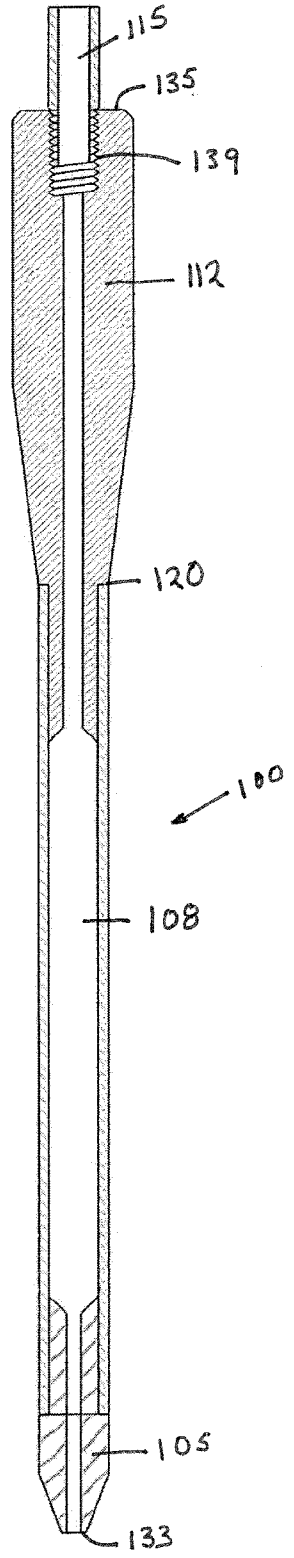

115
135
139
112
120
100
108
105
133

Fig 2B

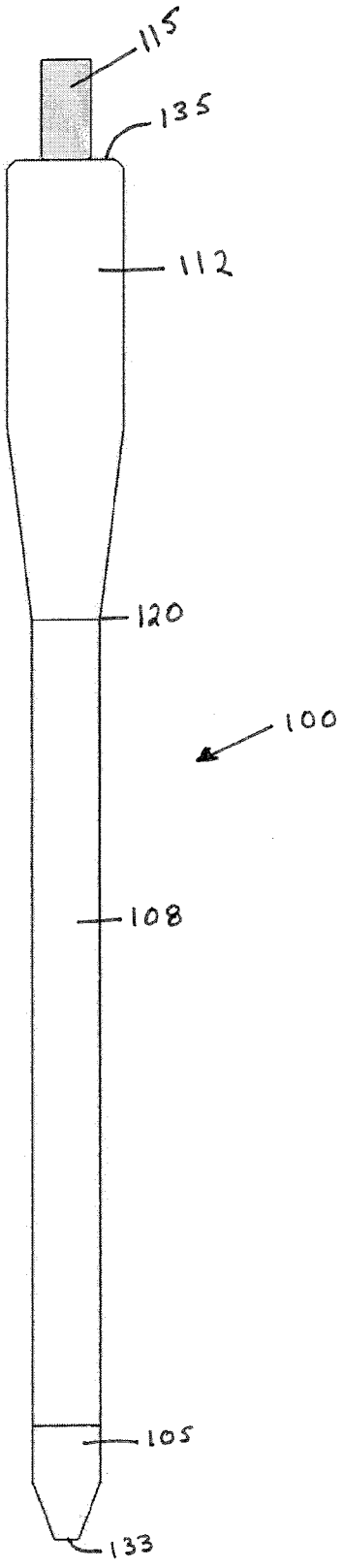

115
135
112
120
100
108
105
133

Fig 2A

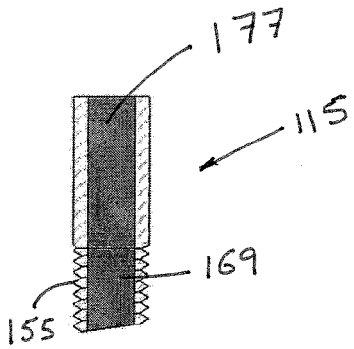


Fig 3B

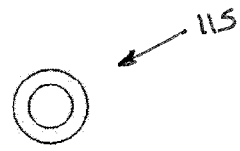


Fig 3C

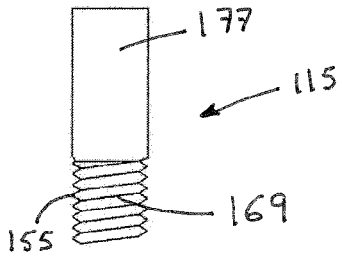


Fig 3A

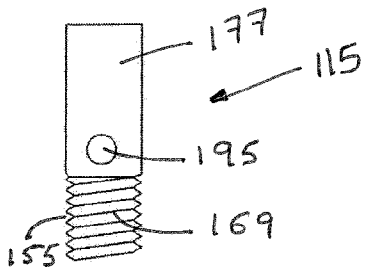
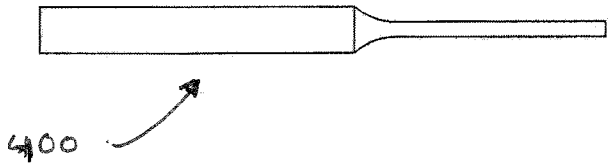


Fig 3D


400

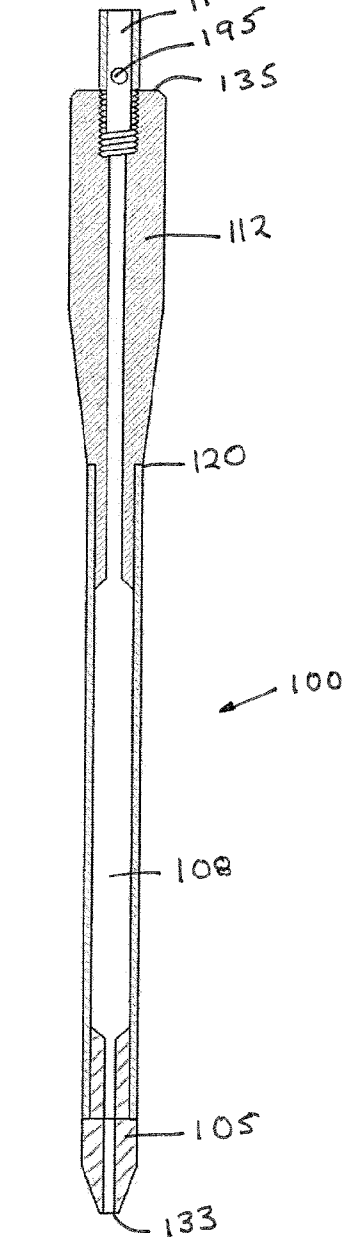

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Fig 4B

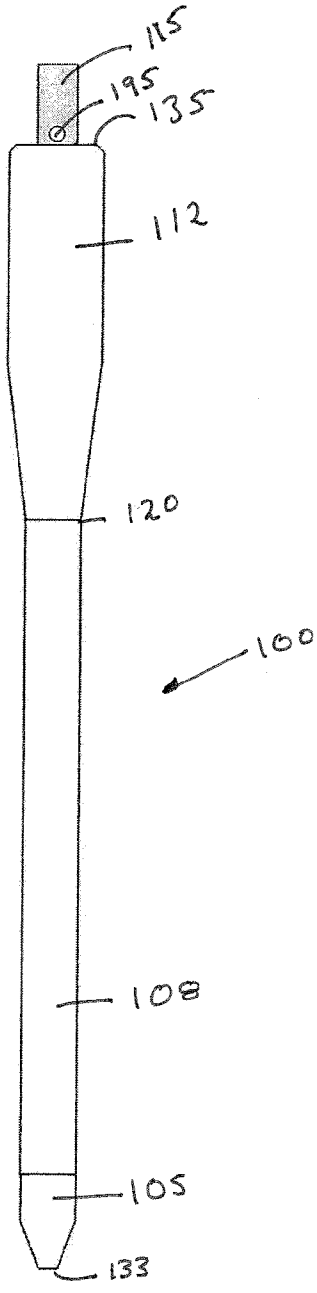

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133

Fig 4A

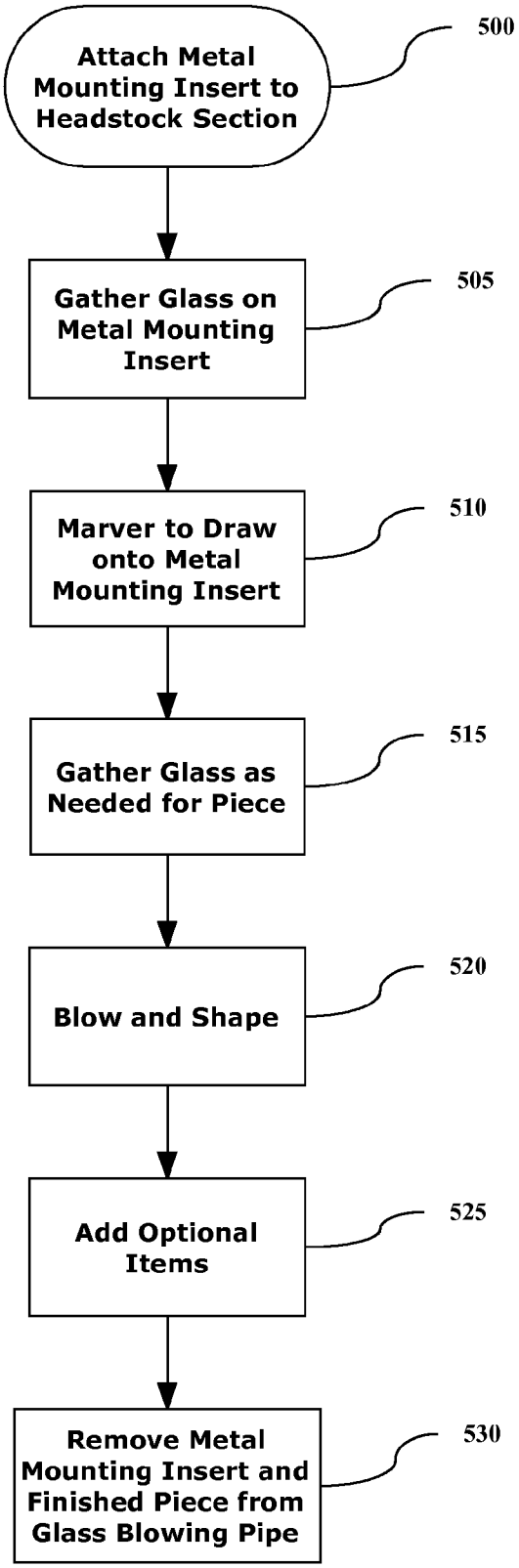

Attach Metal Mounting Insert to Headstock Section
500
Gather Glass on Metal Mounting Insert
505
Marver to Draw onto Metal Mounting Insert
510
Gather Glass as Needed for Piece
515
Blow and Shape
520
Add Optional Items
525
Remove Metal Mounting Insert and Finished Piece from Glass Blowing Pipe
530

Fig. 5

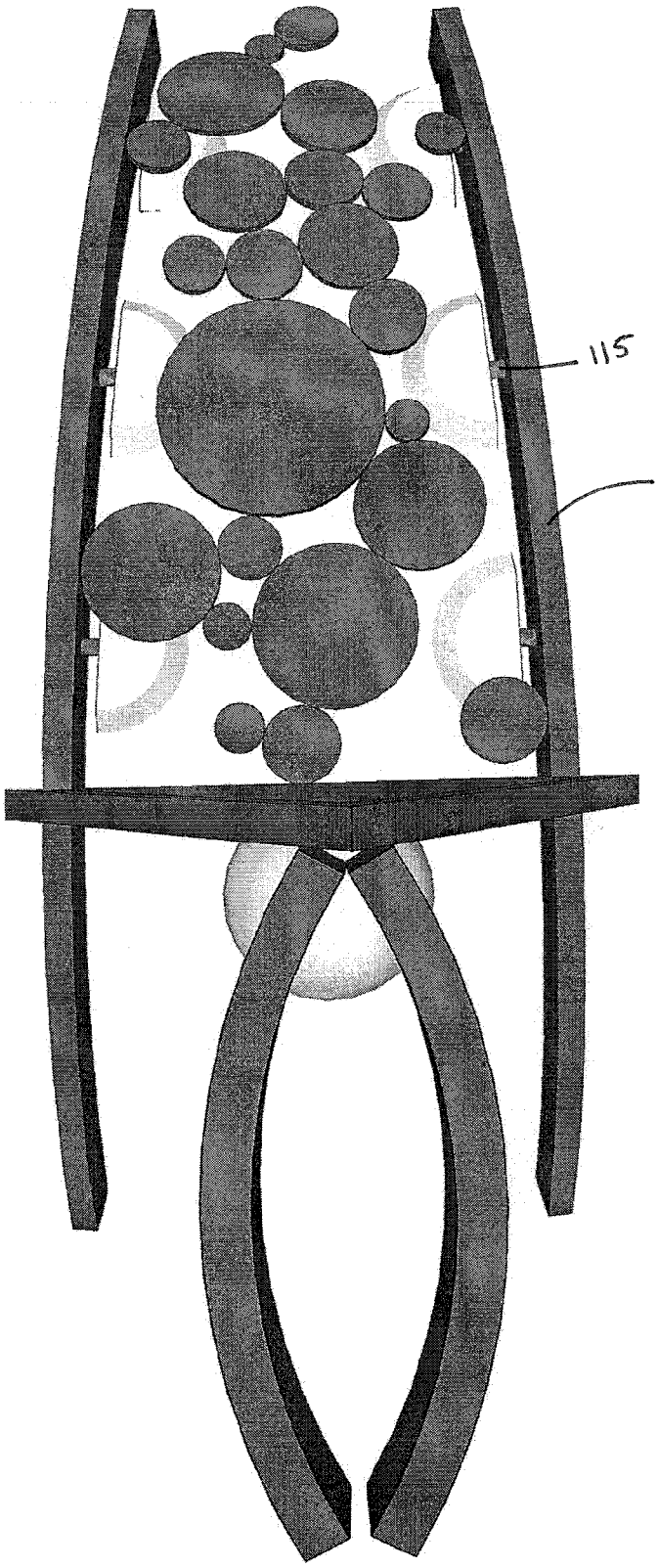


Fig 6A

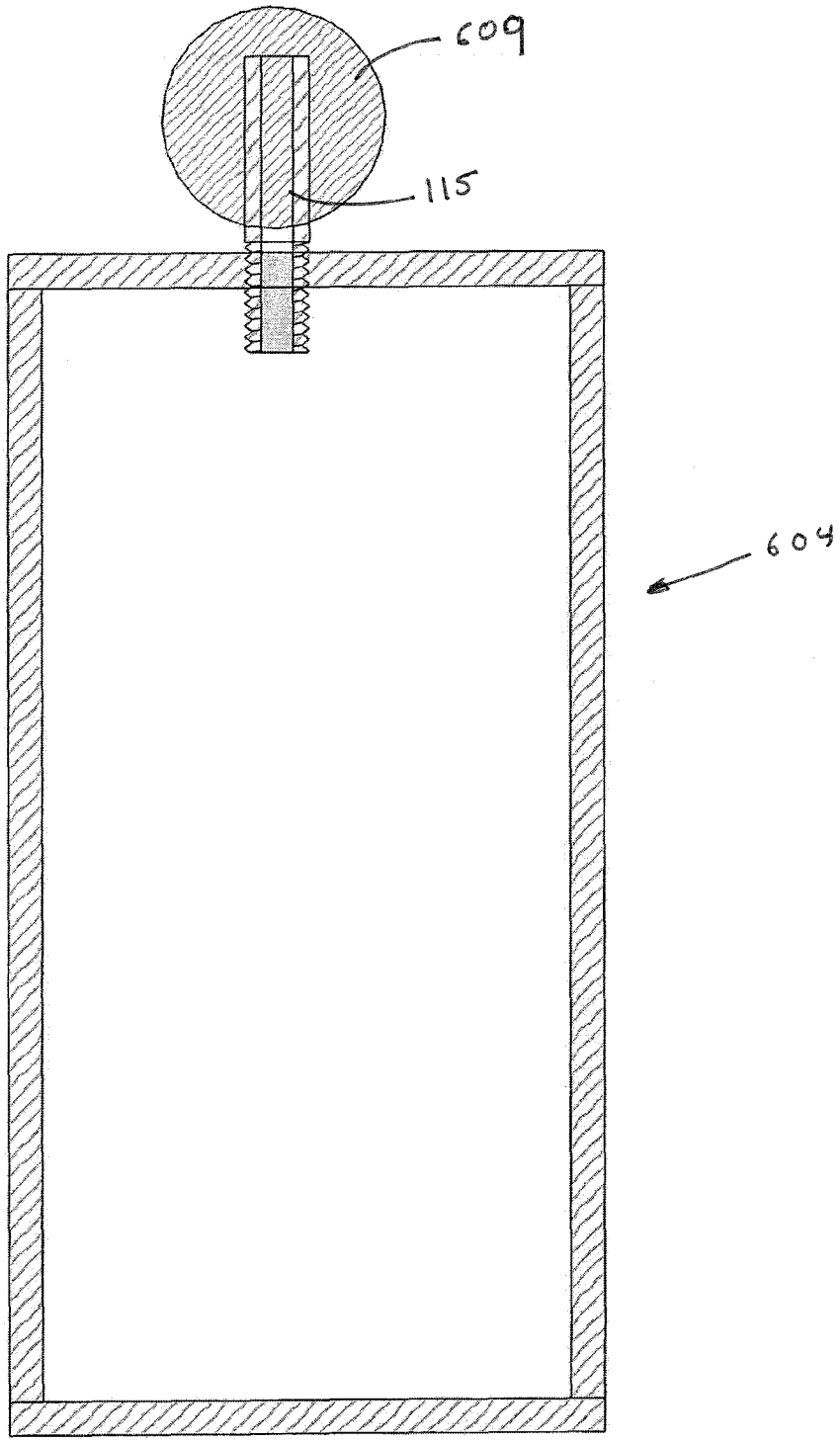


Fig 6B

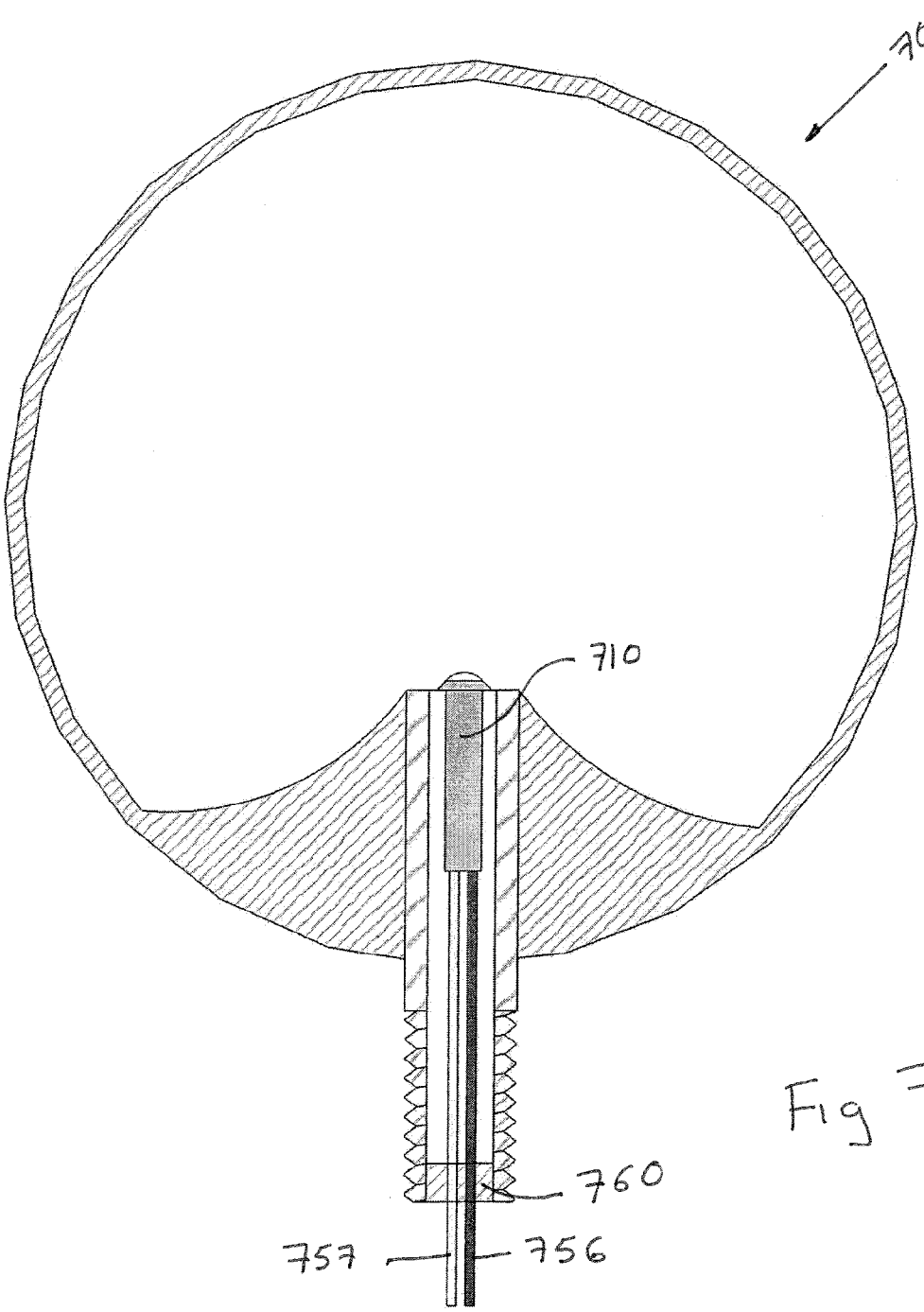


Fig 7

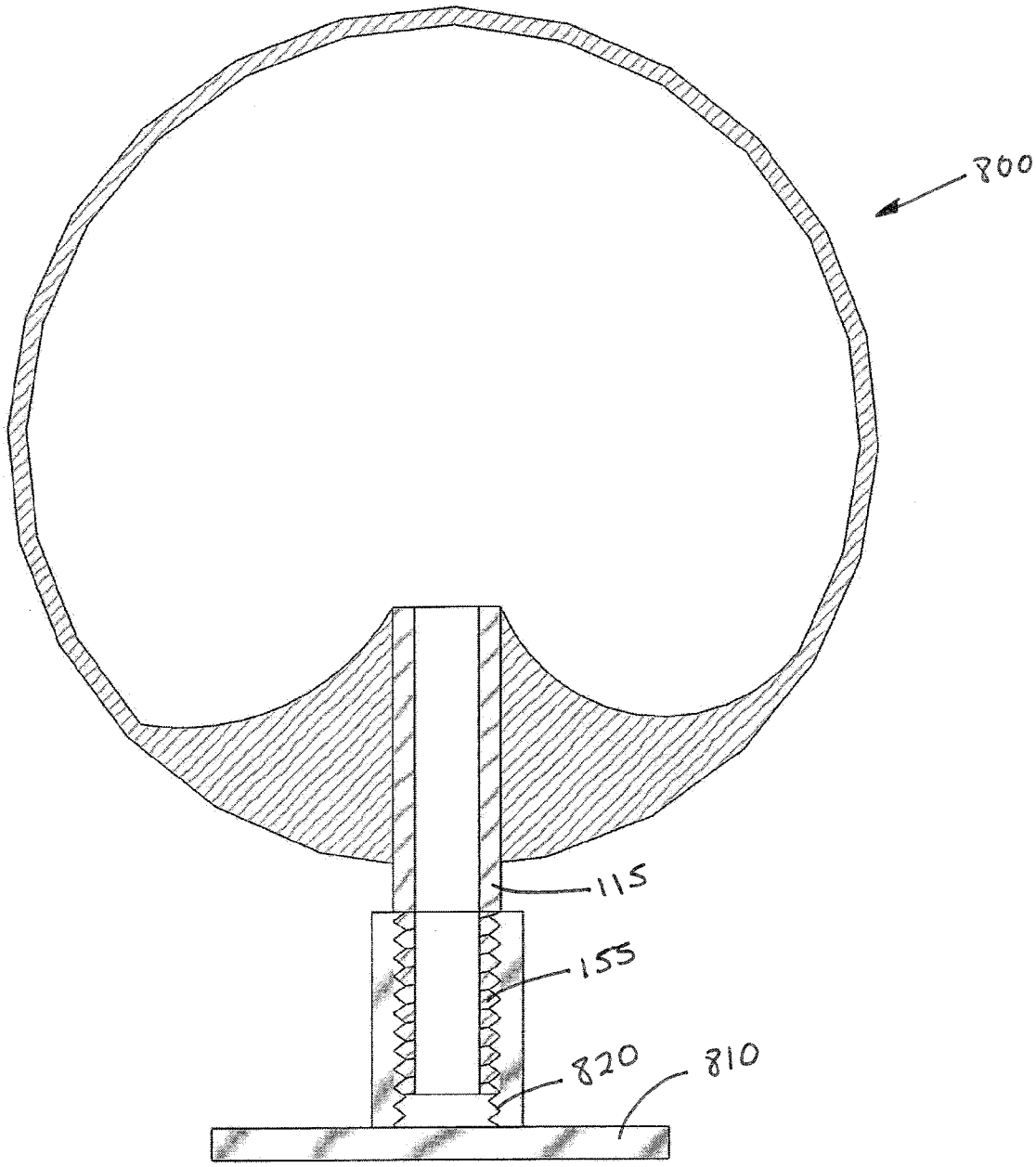


Fig 8A

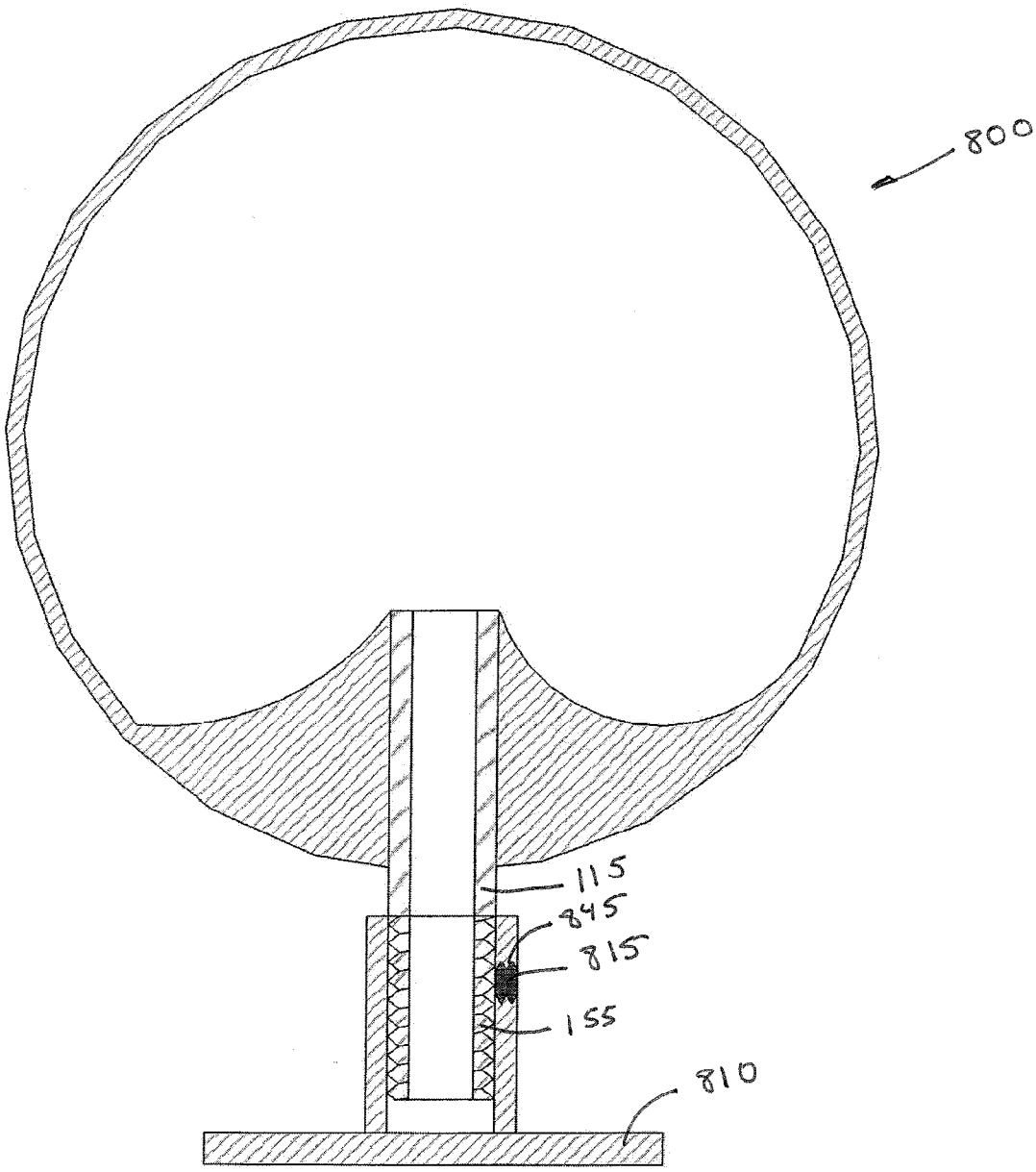


Fig 8B

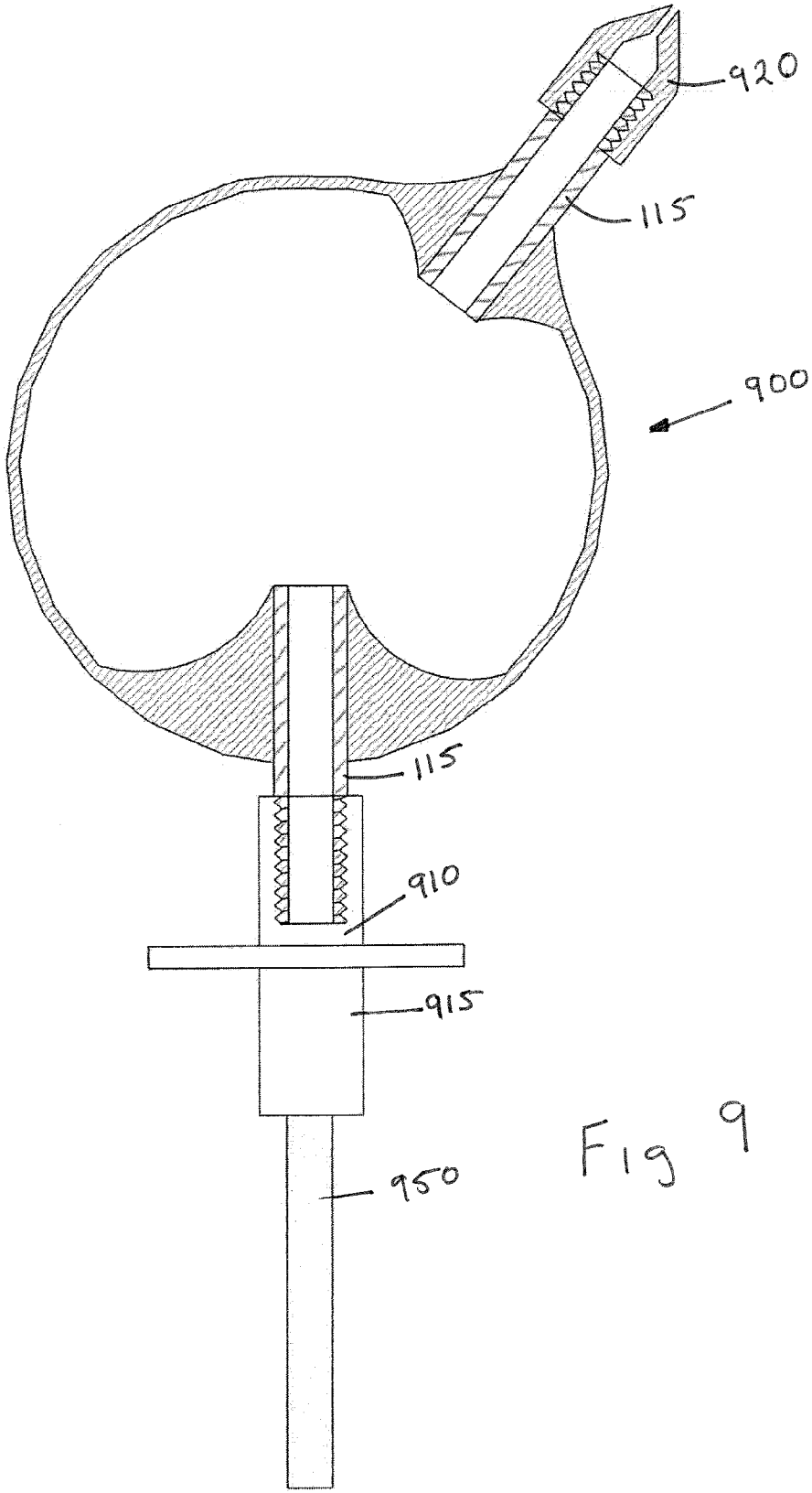


Fig 9

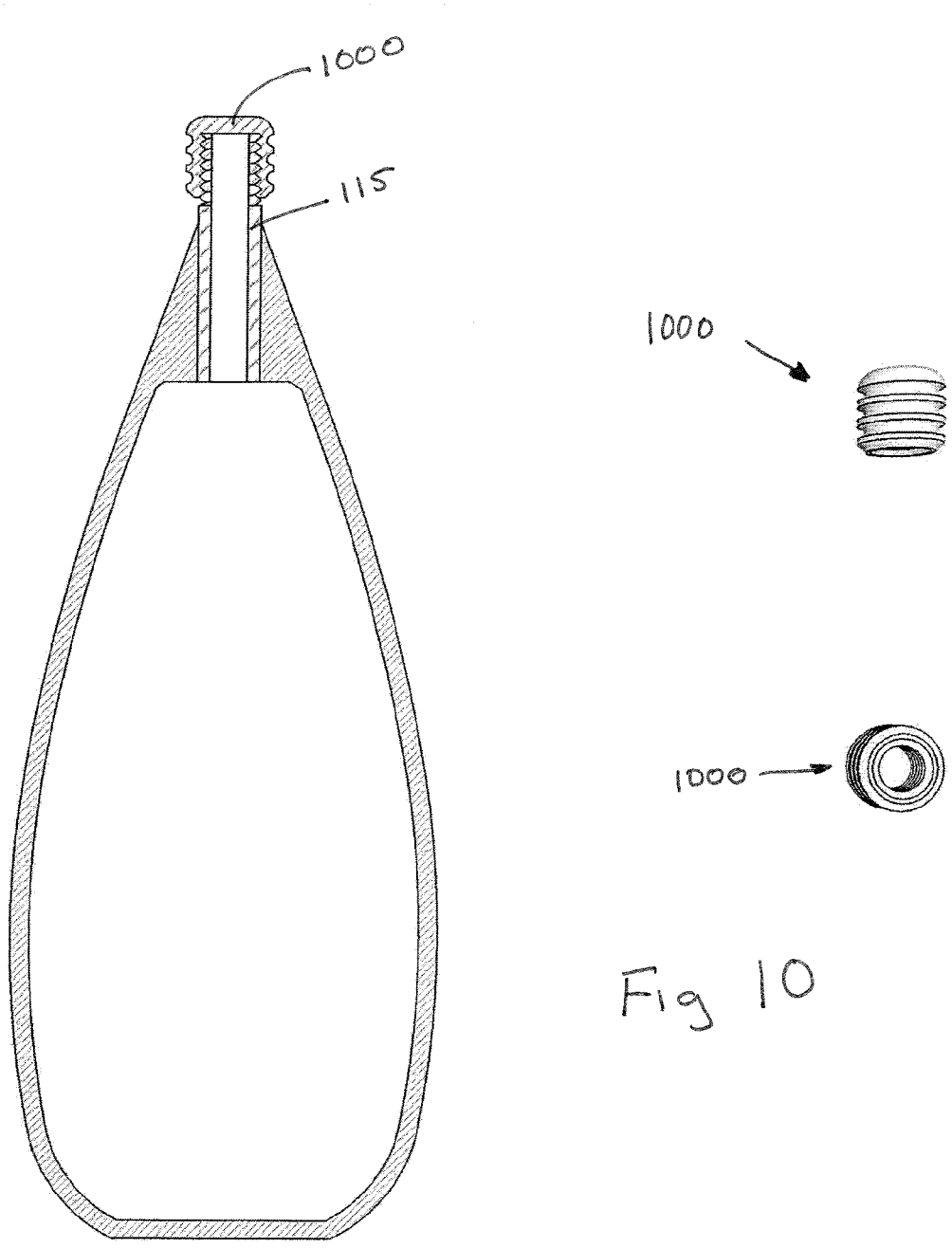


Fig 10

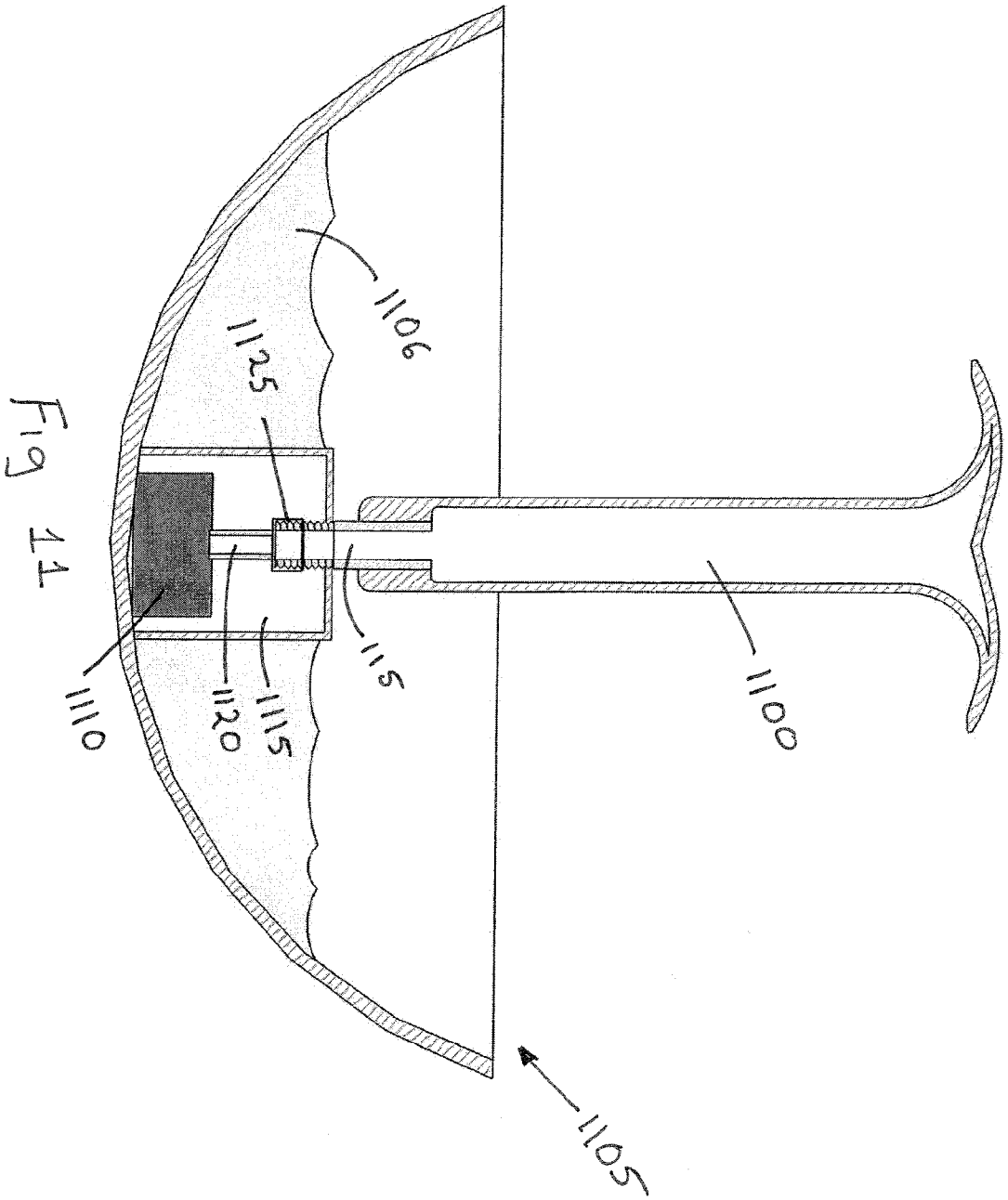


Fig 11

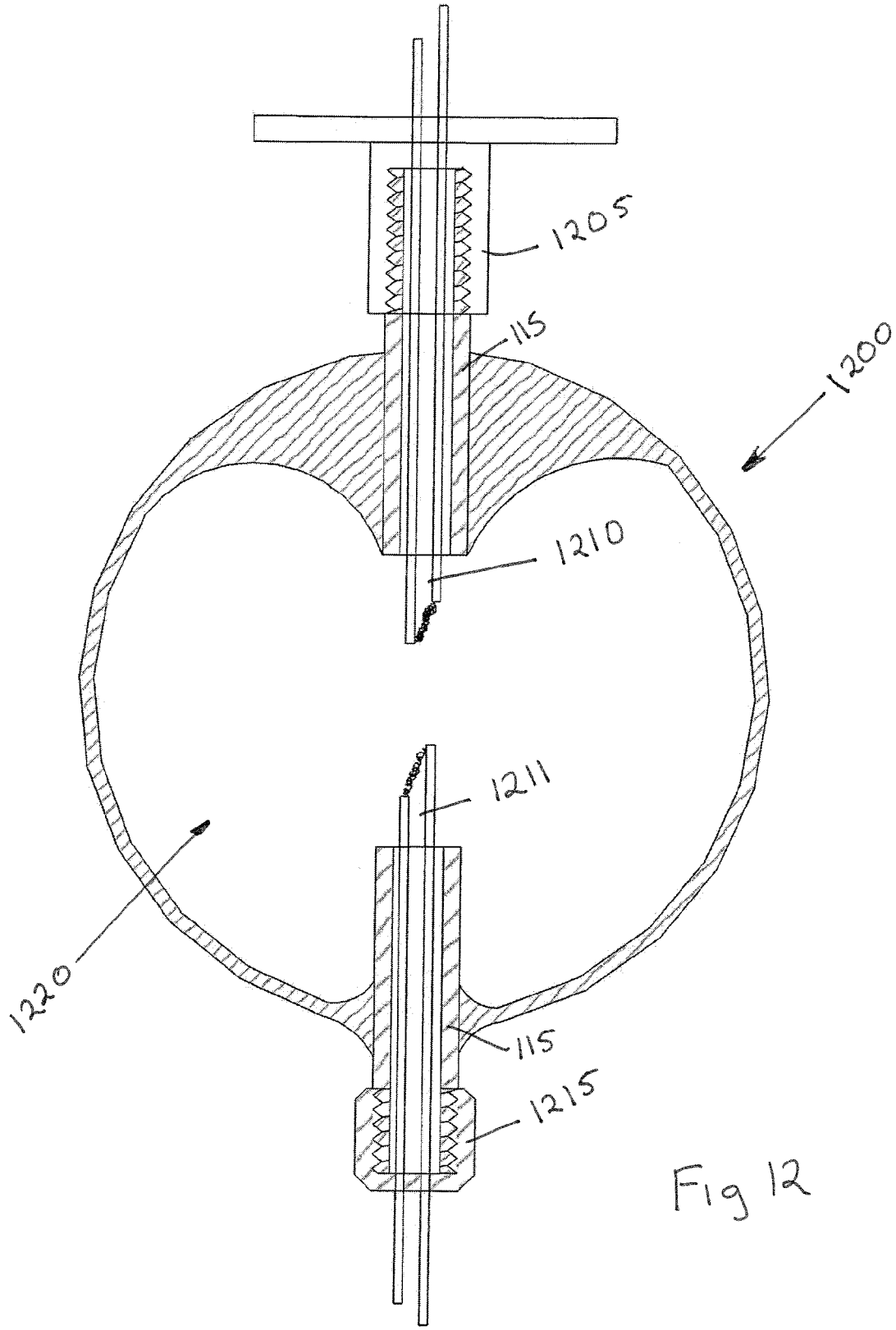
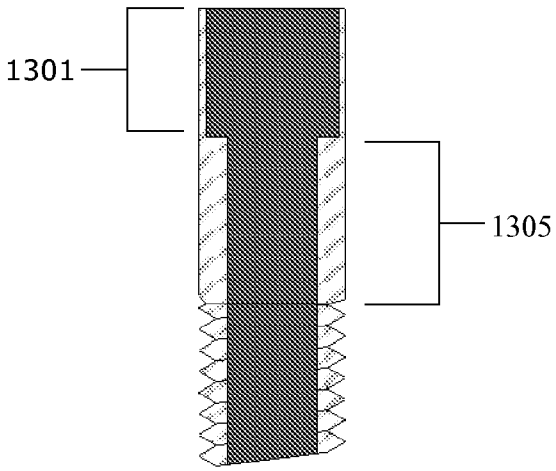
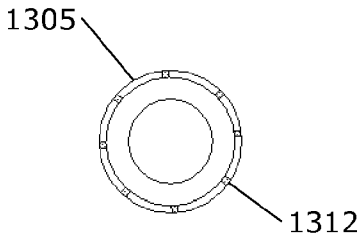


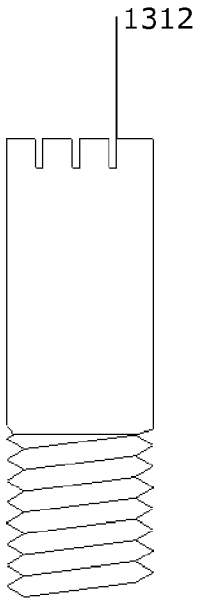
Fig 12



Continuation
Fig.13 B



Continuation
Fig.13 C



Continuation
Fig.13 A

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/051631

A. CLASSIFICATION OF SUBJECT MATTER

C03B 9/03(2006.01)i, C03B 9/30(2006.01)i

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 9/03; C03B 9/30; H01J 9/24; C03B 23/02; H01J 61/32; C03B 9/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean utility models and applications for utility models
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS(KIPO internal) & keywords: metal mounting device, contact patch, thread, screw, vertical slit, molten glass, glass blowing pipe, releasing, LED, insert, glass piece

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 268162 A (WILSON, J. B.) 28 November 1882 See figures 1-8; column 1, lines 12-24; column 1, lines 29-column 2, lines 40; claims 1-4.	1-3,6,7,20,25-30,32,33
A		4,5,8-19,21-24,31,34-38
A	US 2003-0233848 A1 (JANES, M. R.) 25 December 2003 See figures 1-4; paragraphs [0018]-[0024]; claims 1-11.	1-38
A	EP 2225768 B1 (GENERAL ELECTRIC COMPANY) 16 May 2012 See paragraphs [0017]-[0019]; claims 1-4; figures 10-12, 18, 19.	1-38
A	US 5394910 A (SWEETLAND, J. E.) 7 March 1995 See column 3, lines 21-58; column 5, lines 24-55; column 8, lines 37-column 9, lines 28; figures 1-3; claims 1-4, 9, 10.	1-38
A	KR 10-0408444 B1 (SONG, H.) 6 December 2003 See abstract; page 2, lines 43-page 3, lines 31; claim 1; figure 1.	1-38

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"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
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
09 January 2014 (09.01.2014)	**10 January 2014 (10.01.2014)**

Name and mailing address of the ISA/KR
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CHANG, Bong Ho
Telephone No. +82-42-481-3353

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/US2013/051631

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 268162 A	28/11/1882	None	
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EP 2225768 B1	16/05/2012	CN 101878513 A	03/11/2010
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KR 10-0408444 B1	06/12/2003	KR 10-2001-0074173 A	04/08/2001