US 20080272200A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2008/0272200 A1**

(43) **Pub. Date: Nov. 6, 2008**

Ordiway et al.

(54) **ROTARY SPRAYER FOR A FLUID DELIVERY DEVICE**

(76) Inventors: **Timothy R. Ordiway**, Racine, WI (US); **Michael M. Sawalski**, Racine, WI (US); **Jeffrey L. Crull**, McFarland, WI (US); **Steven Merrill Harrington**, Cardiff, CA (US); **Stephen B. Leonard**, Franksville, WI (US)

Correspondence Address:
S.C. JOHNSON & SON, INC.
1525 HOWE STREET
RACINE, WI 53403-2236 (US)

(21) Appl. No.: **11/800,501**

(22) Filed: **May 4, 2007**

Publication Classification

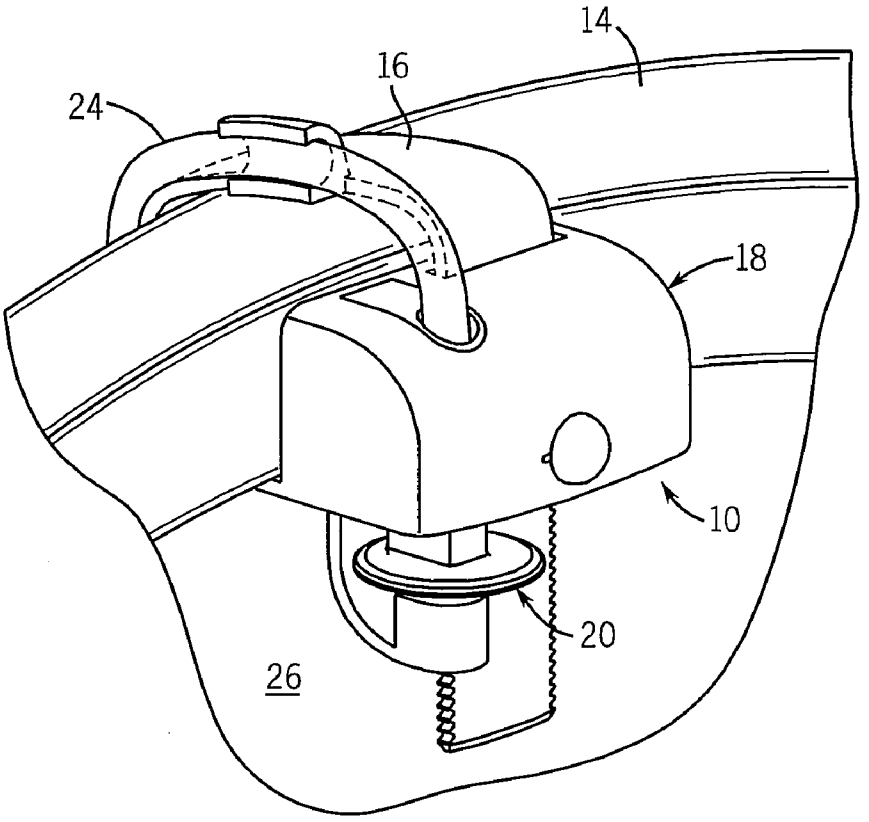
(51) **Int. Cl.**

B05B 3/04	(2006.01)
B05D 1/02	(2006.01)
E03D 9/02	(2006.01)

(52) **U.S. Cl.** **239/7**; 239/223; 4/224

(57) **ABSTRACT**

A rotary sprayer and method for spraying an inner surface of an enclosure, such as a toilet bowl, with a fluid are disclosed. The rotary sprayer includes a clip and a rotating nozzle. The clip includes a fluid inlet and an arm having a distal end section. The nozzle includes a circular deflection plate, and a pair of spaced apart walls extending away from a surface of the deflection plate. The walls define a channel on the surface of the deflection plate. A passageway is in fluid communication with the channel and an end space between the walls. The fluid inlet is positioned in the end space and a spindle of the nozzle is mounted to the distal end section of the arm. Fluid exiting the fluid inlet flows through the passageway and the channel and contacts an inner surface of at least one of the walls to rotate the nozzle and spray the inner surface wall of the enclosure with the fluid.



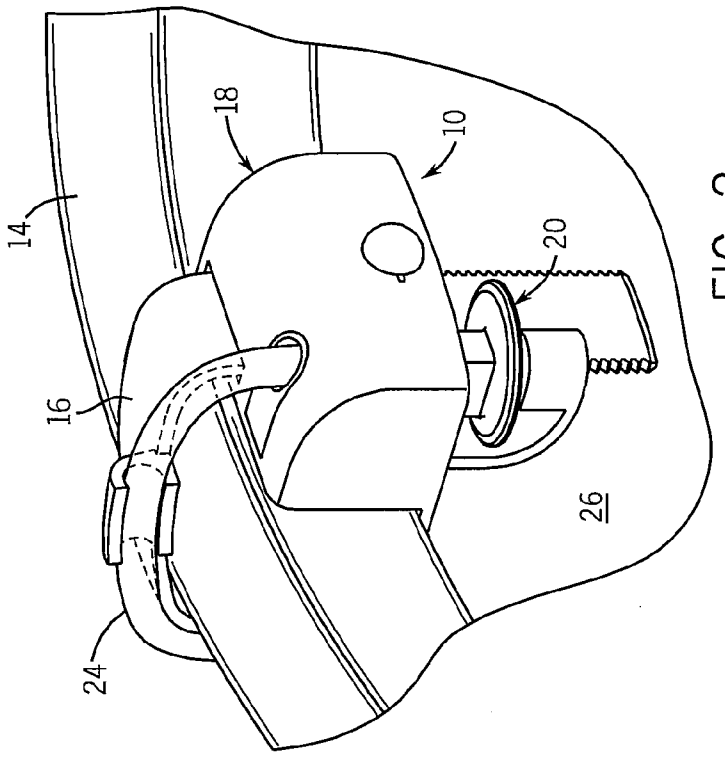


FIG. 2

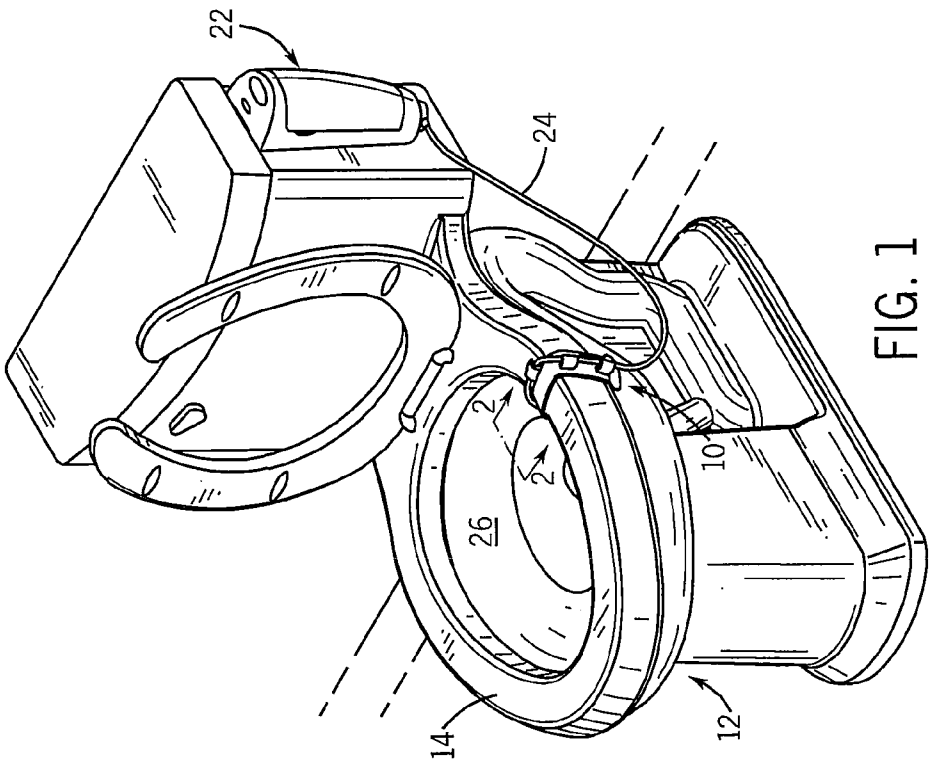


FIG. 1

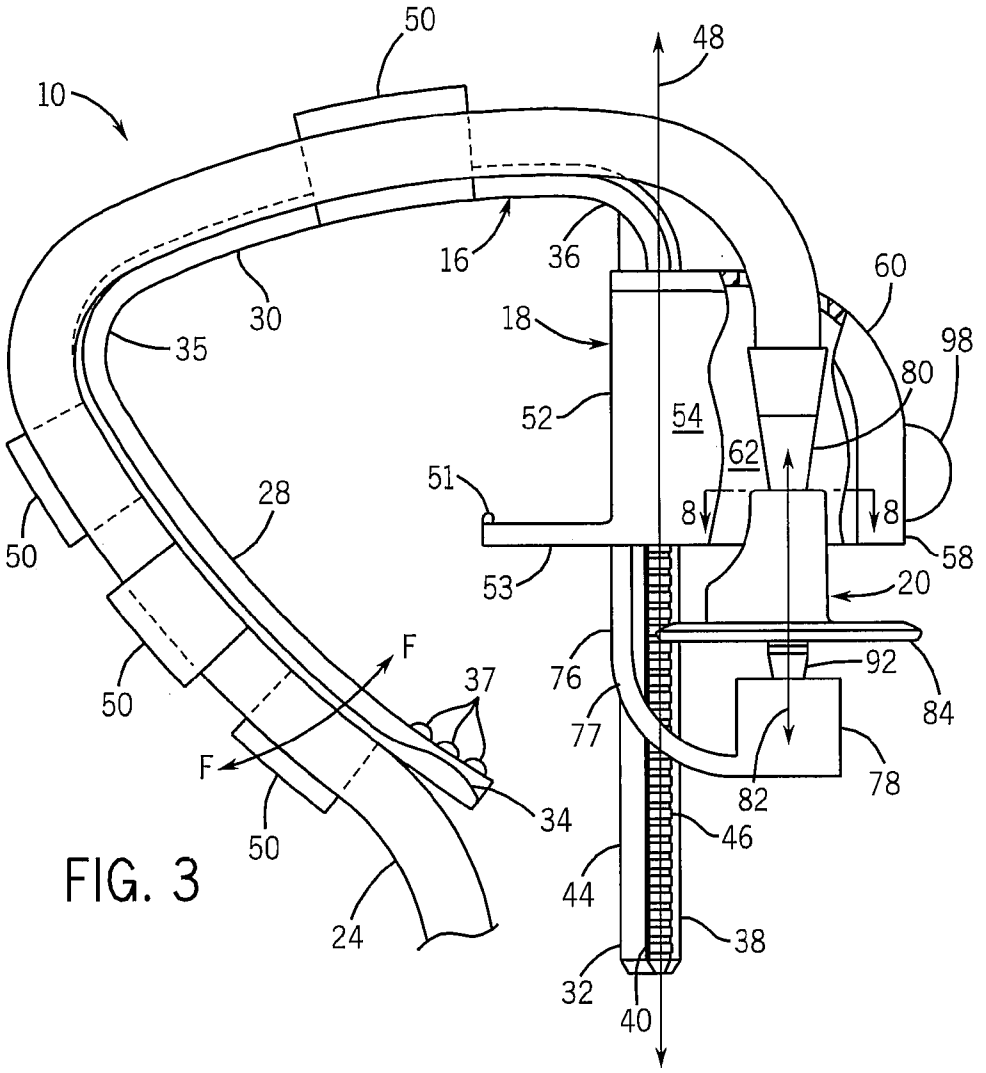

50
48
10
16
36
60
30
18
98
35
80
52
54
62
51
28
8
8
58
50
53
20
F
37
76
92
84
50
77
F
78
82
34
46
50
44
24
38
32
40

FIG. 3

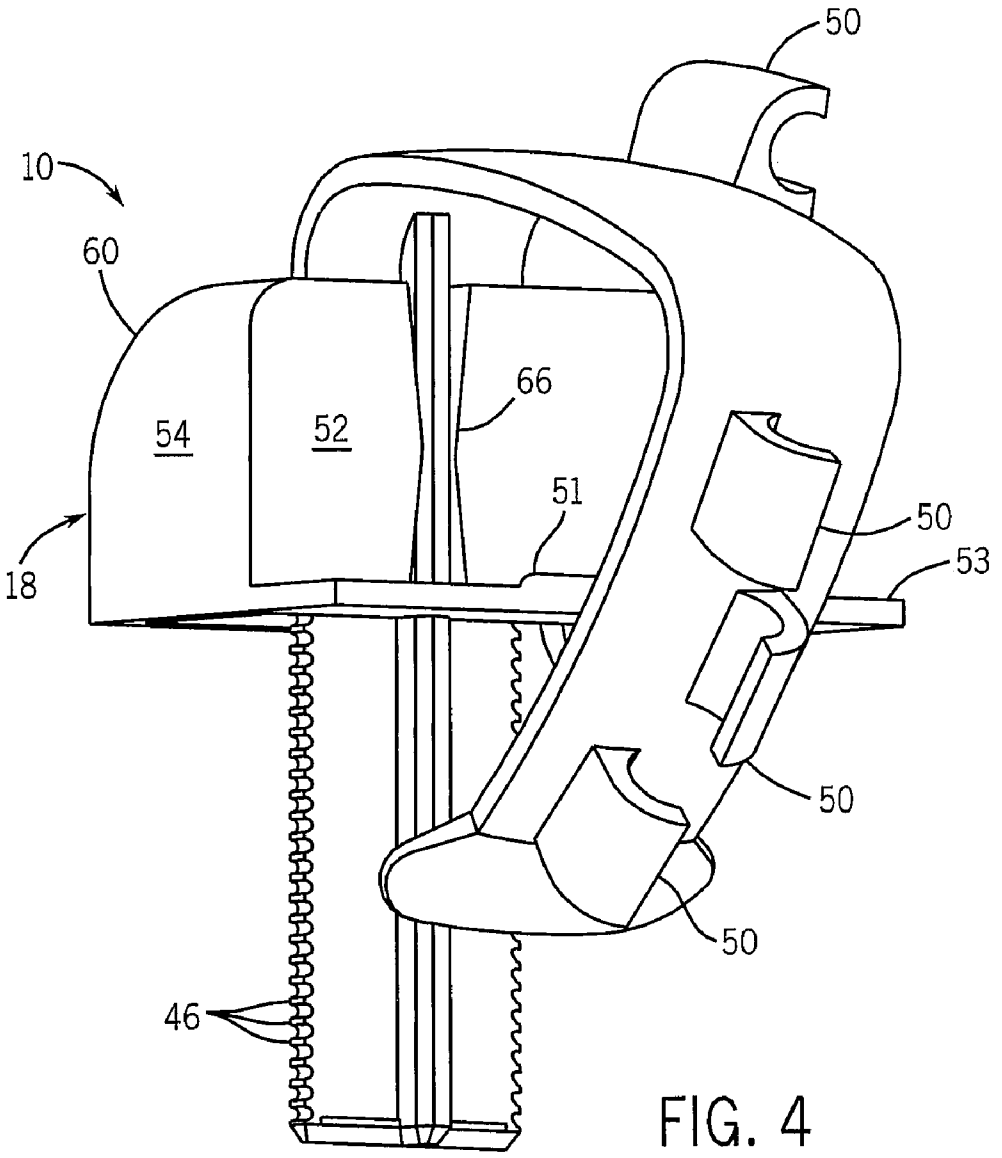


FIG. 4

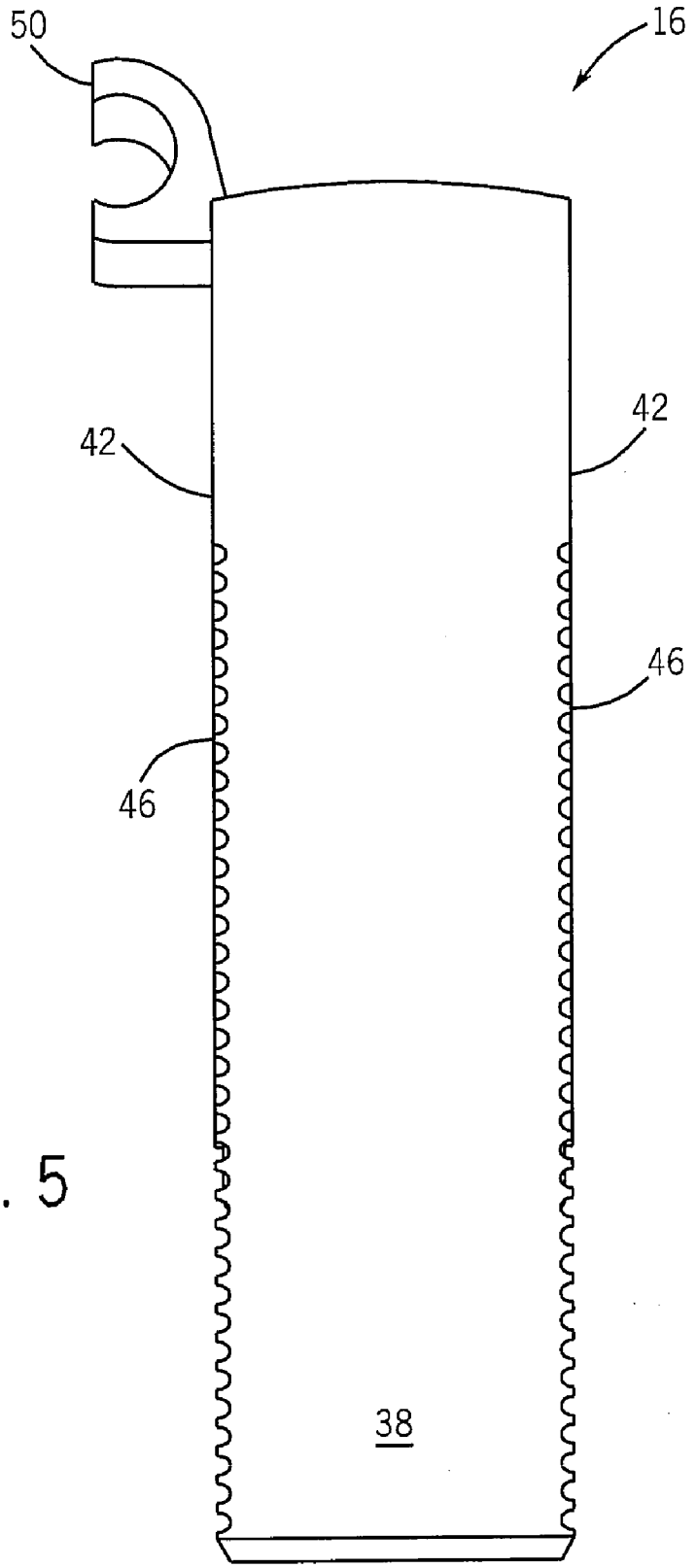


FIG. 5

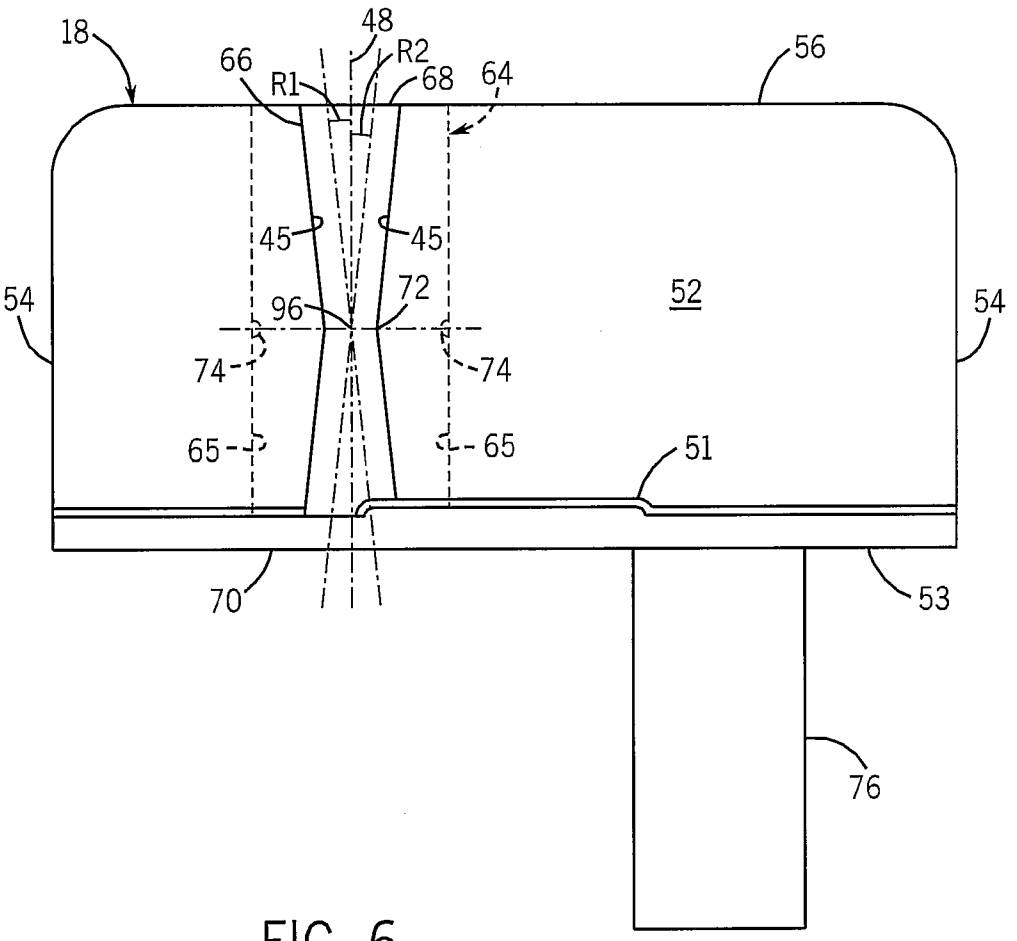


FIG. 6

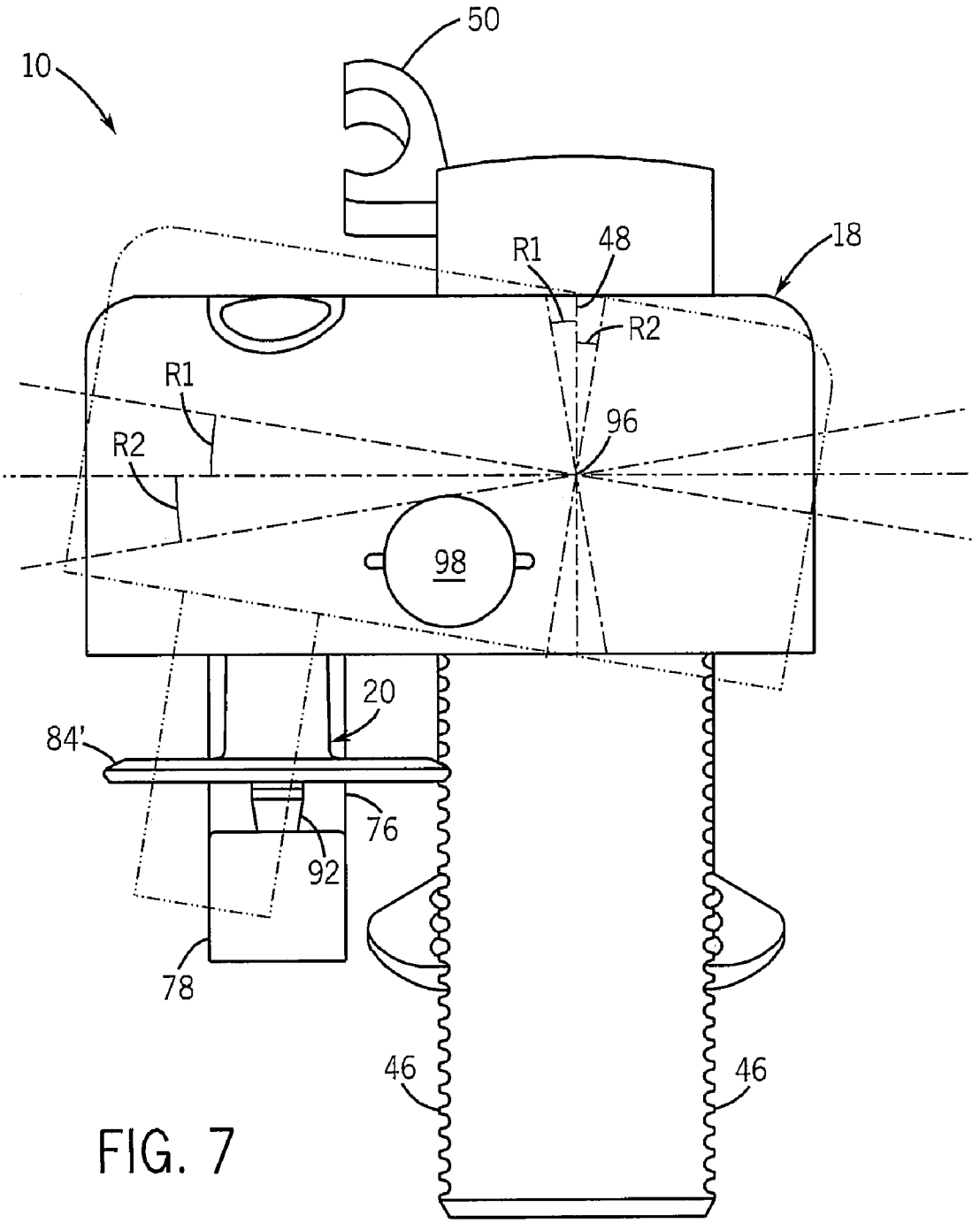


FIG. 7

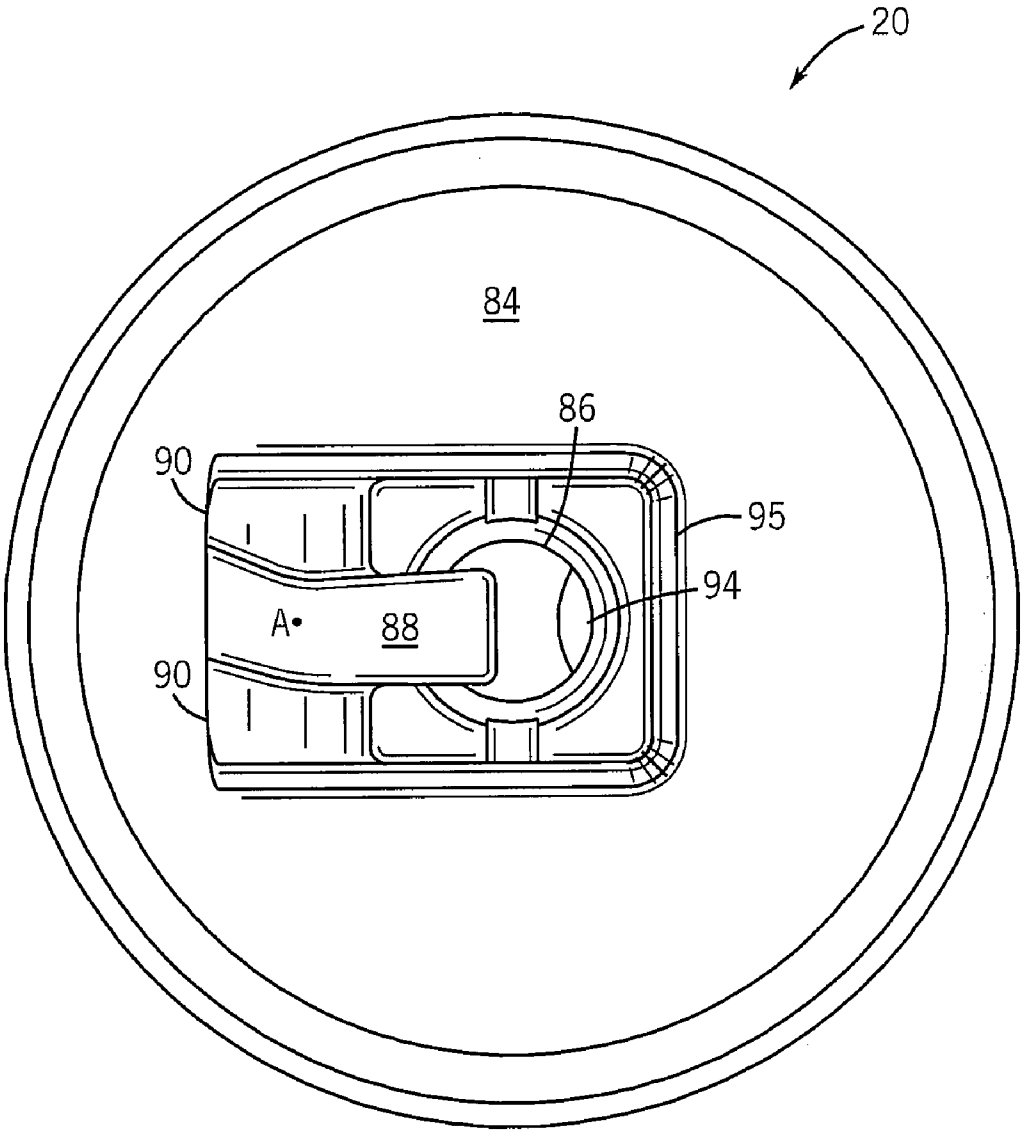


FIG. 8

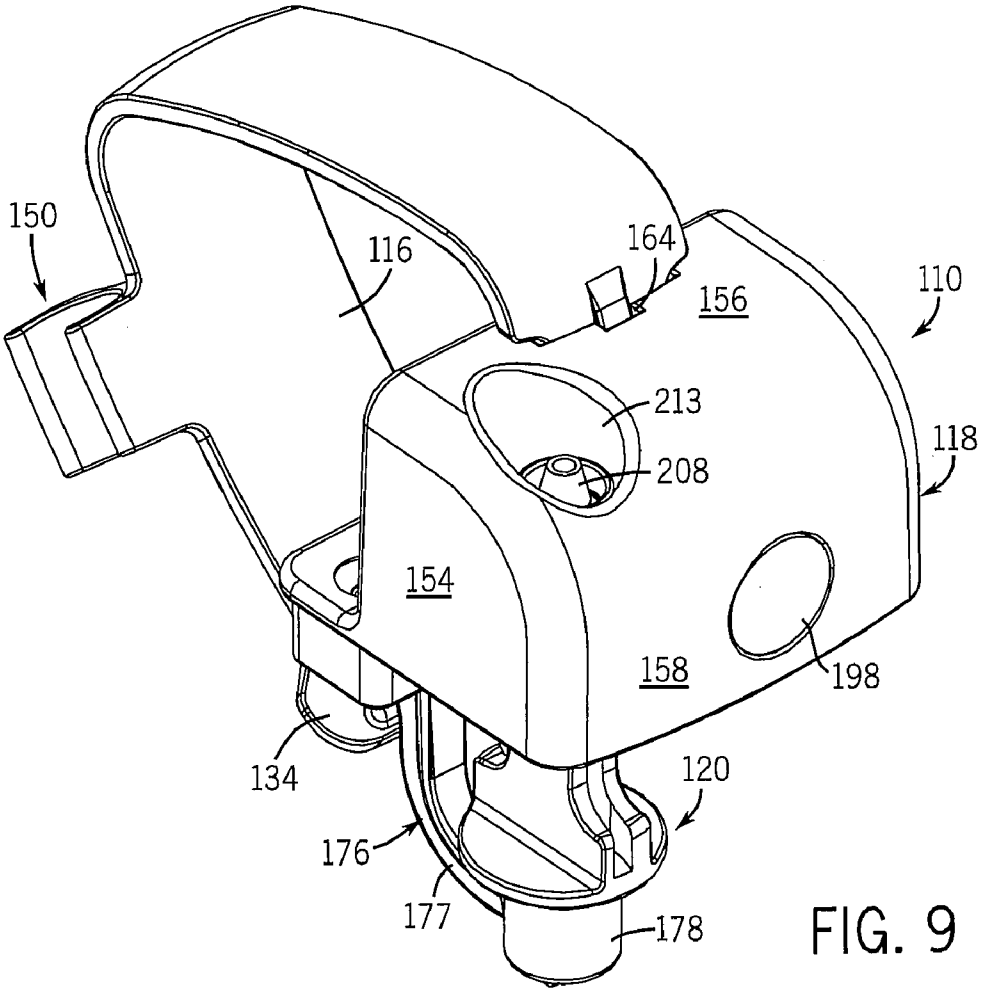


FIG. 9

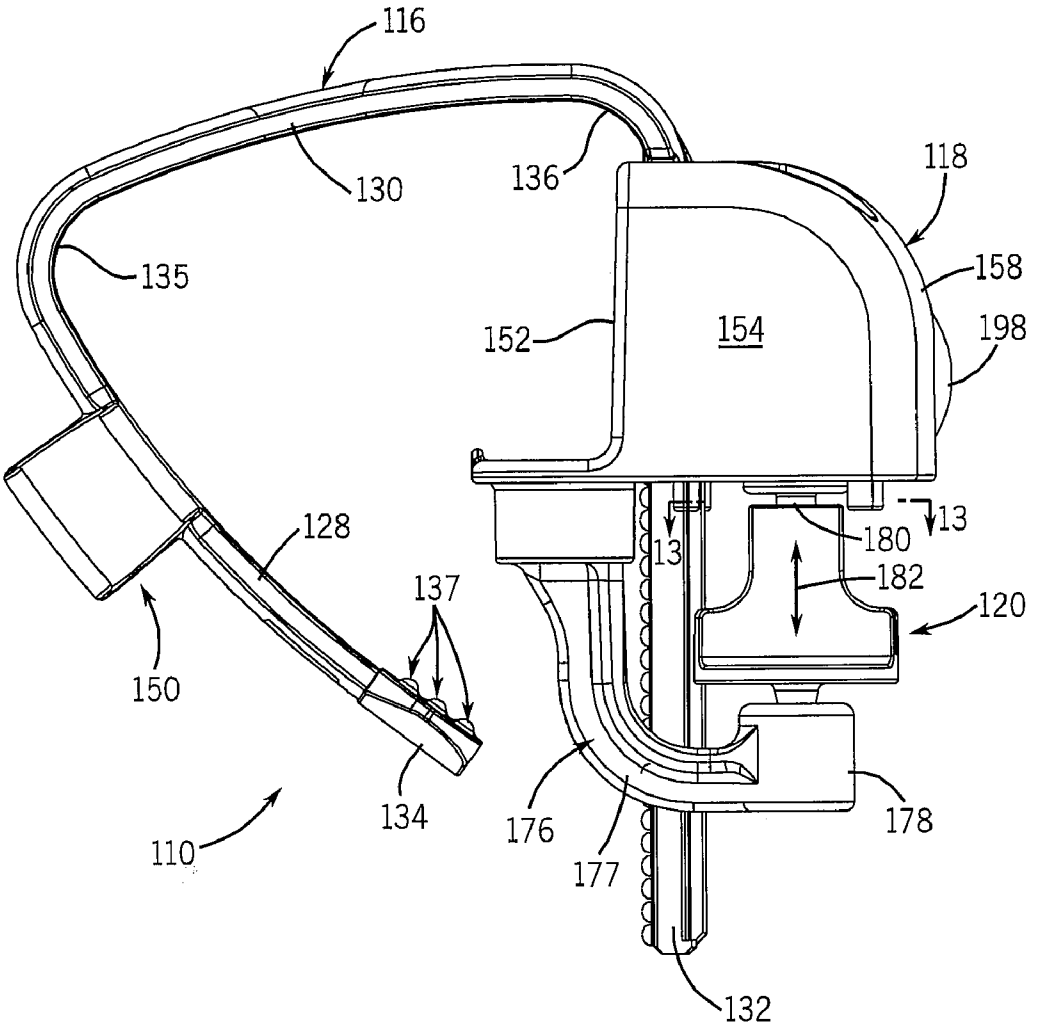

116
130
136
118
135
158
152
154
198
128
13
13
180
182
137
120
150
134
176
177
178
110
132

FIG. 10

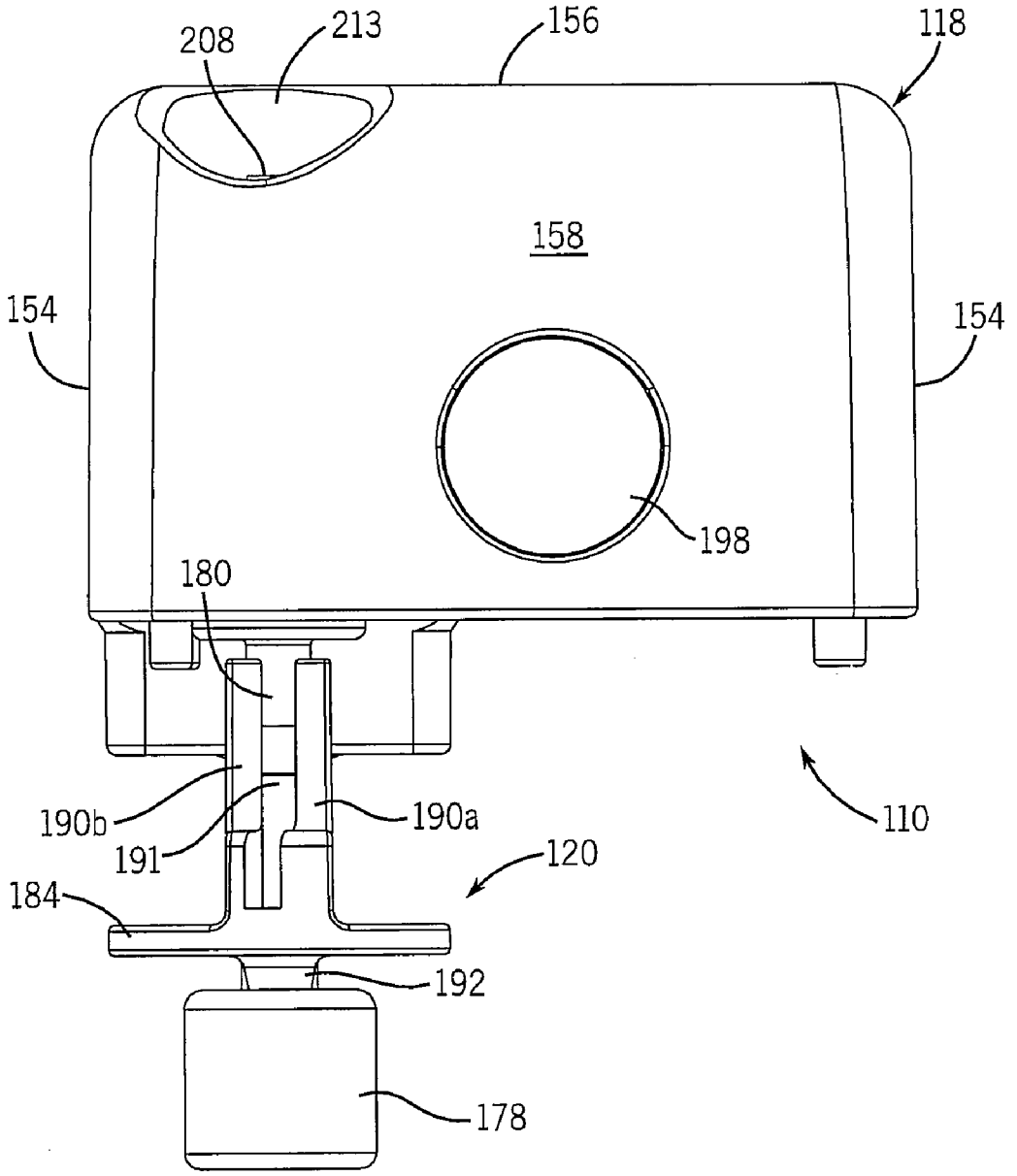

208
213
156
118
158
154
154
198
180
190b
191
190a
110
120
184
192
178

FIG. 11

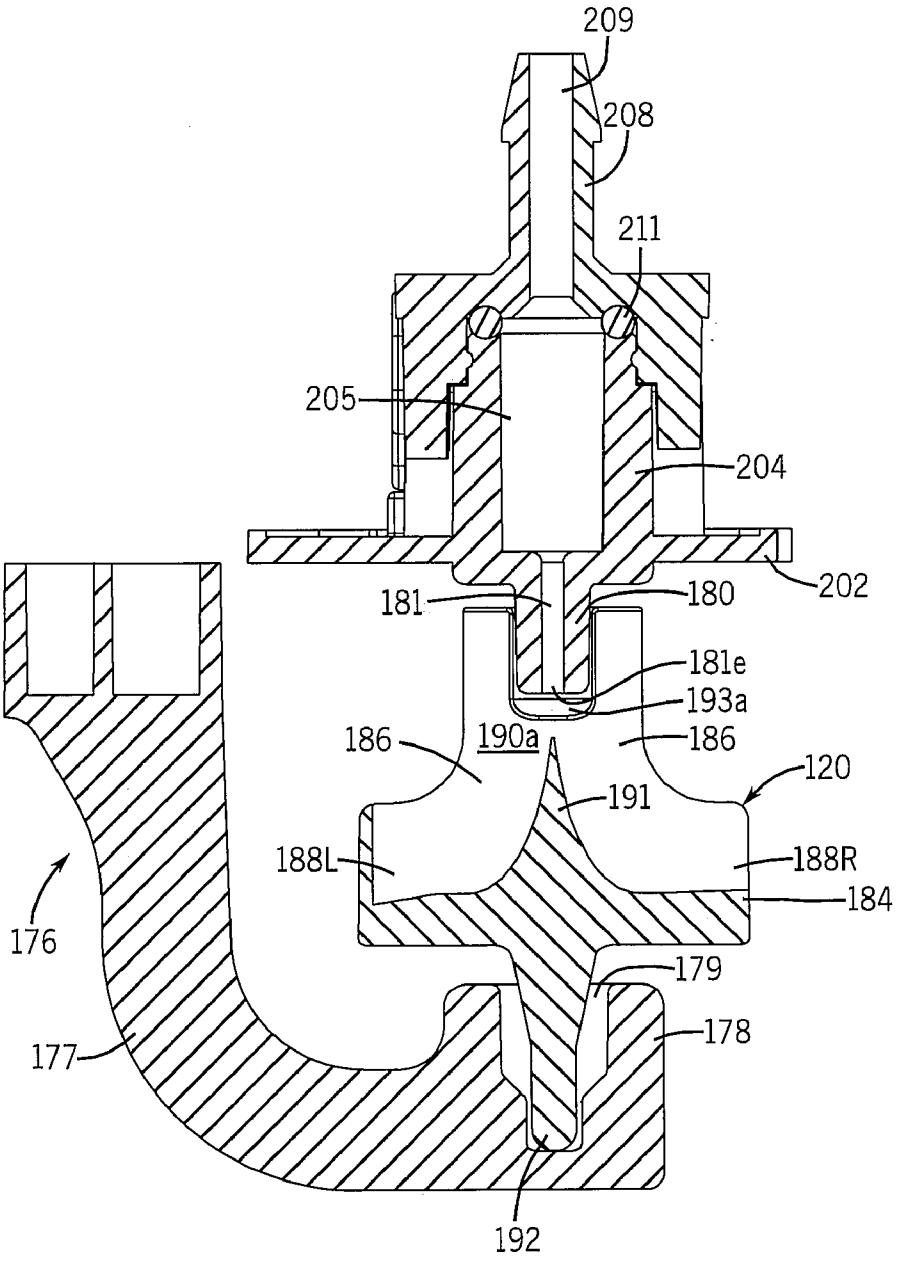

209
208
211
205
204
202
181
180
181e
193a
186
190a
186
120
191
188L
188R
184
176
179
178
177
192

FIG. 12

FIG. 13

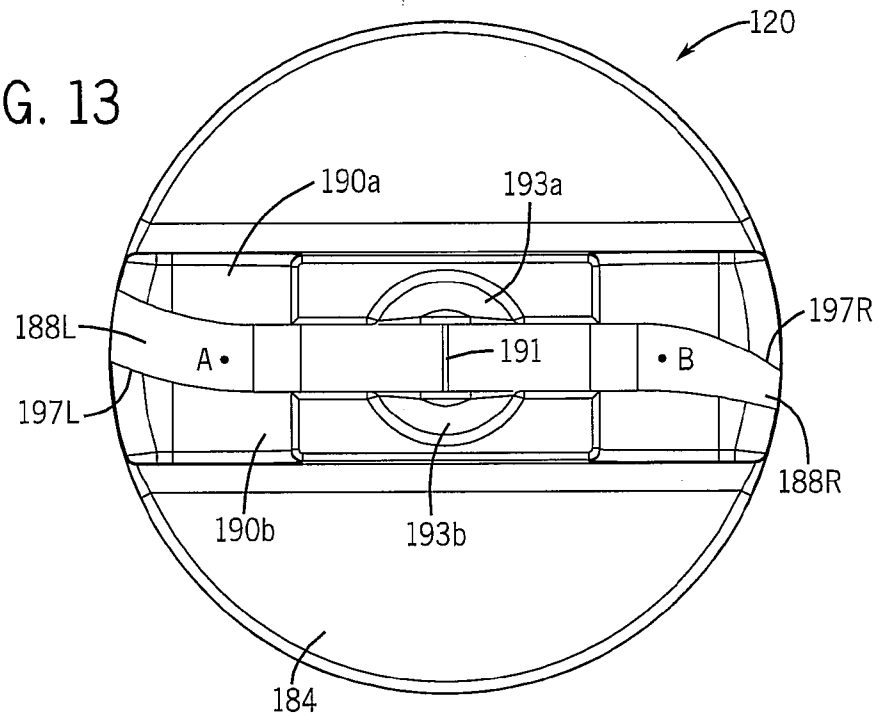

120
190a
193a
188L
A
191
B
197R
197L
188R
190b
193b
184

FIG. 14

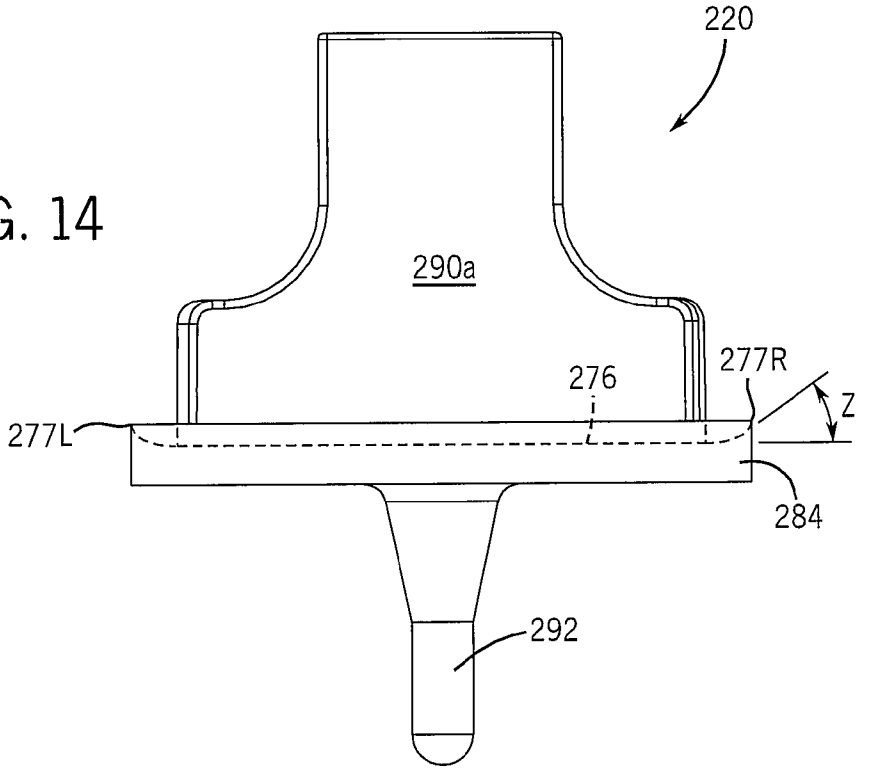

220
290a
276
277R
Z
277L
284
292

FIG. 15

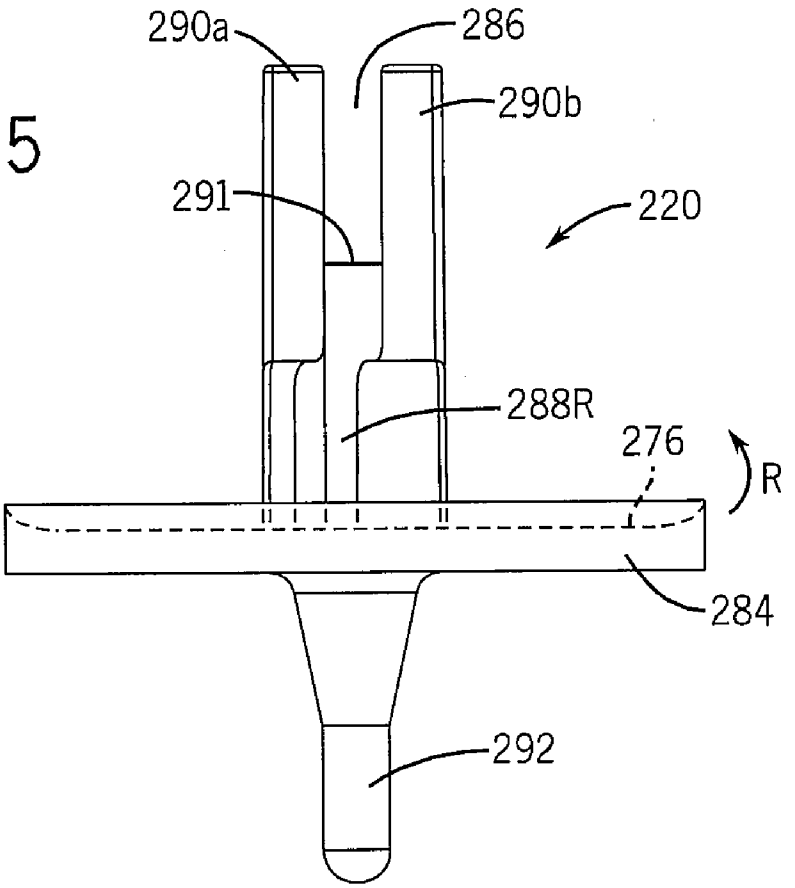
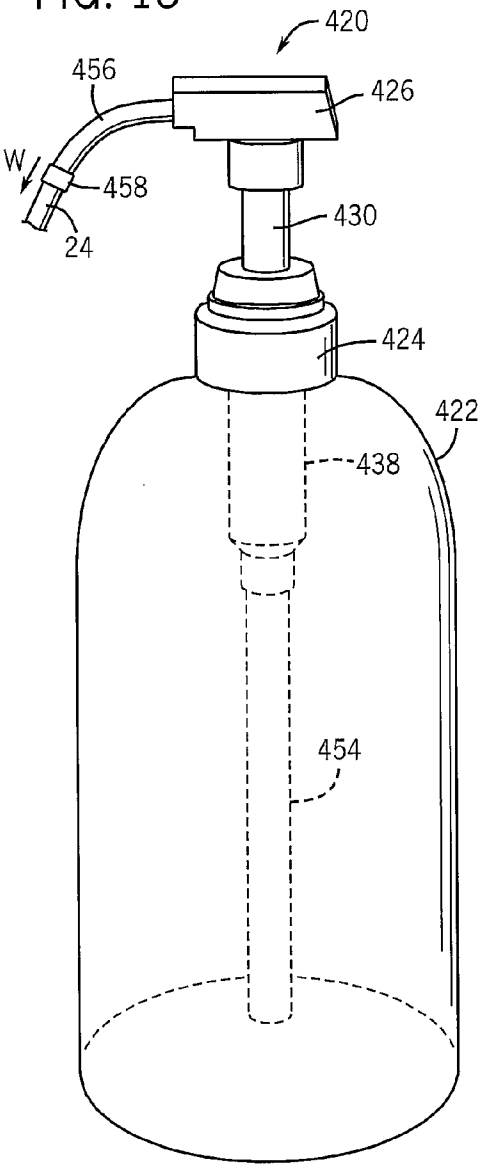


FIG. 16


420
456
426
W
458
430
24
424
422
438
454

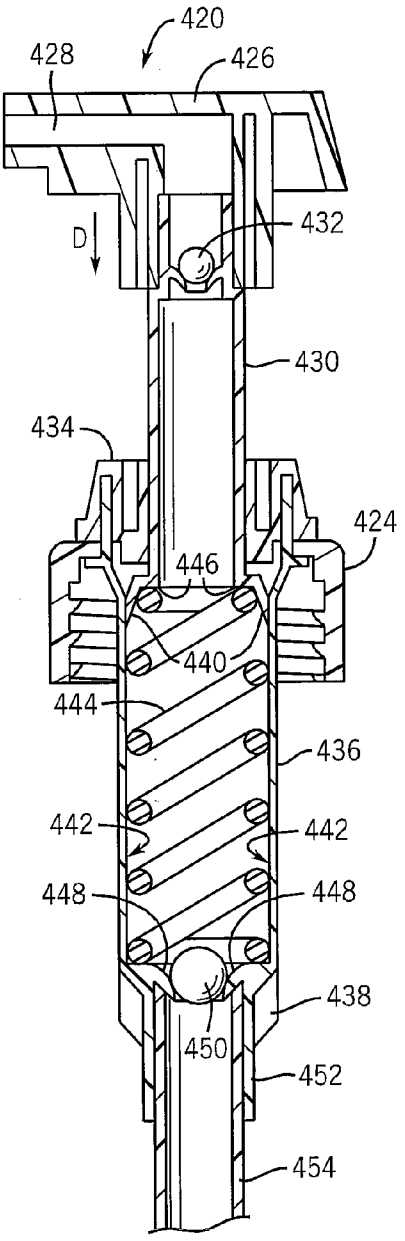

420
428
426
D
432
430
434
424
446
440
444
436
442
442
448
448
438
450
452
454

FIG. 17

FIG. 18

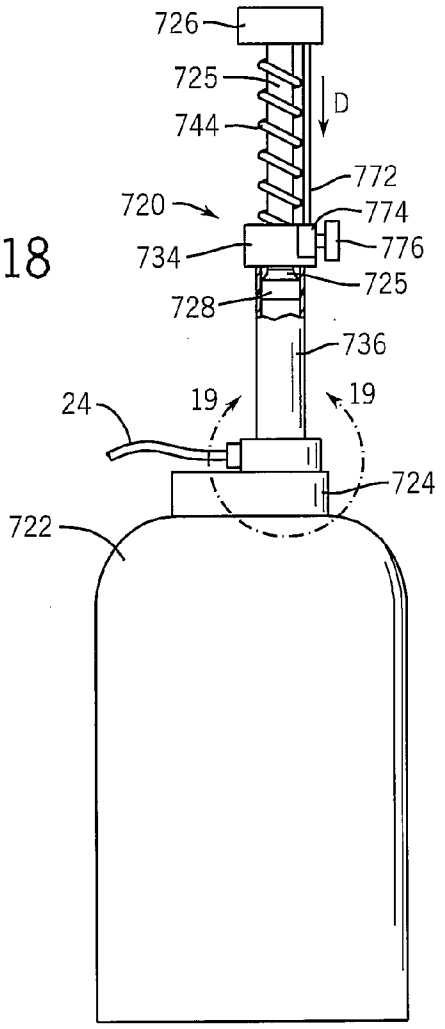
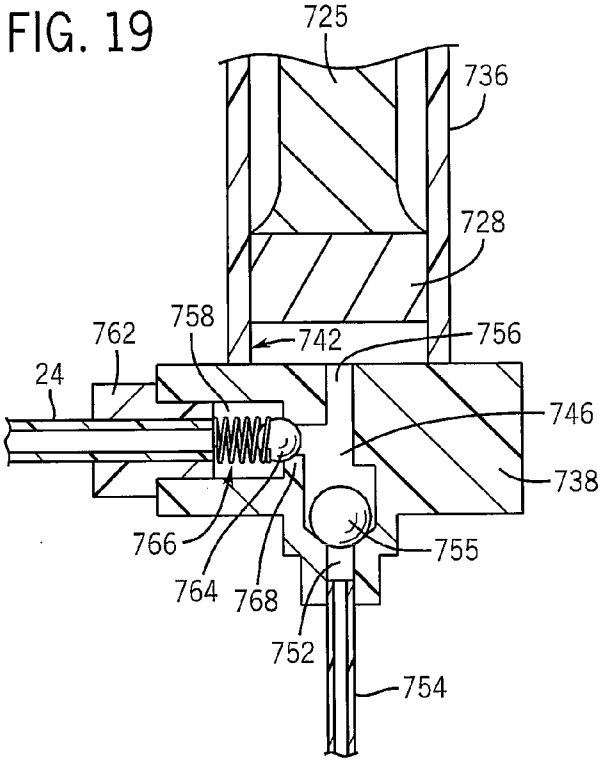

726
725
D
744
772
720
774
734
776
725
728
736
24
19
19
724
722

FIG. 19


725
736
728
762
758
742
756
24
746
738
766
755
764
768
752
754

ROTARY SPRAYER FOR A FLUID DELIVERY DEVICE

CROSS-REFERENCES TO RELATED APPLICATIONS

[0001] Not Applicable.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH

[0002] Not Applicable.

BACKGROUND OF THE INVENTION

[0003] 1. Field of the Invention

[0004] This invention relates to a rotary sprayer for a fluid delivery device for spraying a fluid, such as a cleaner or deodorizer, on the inside wall surfaces of an enclosure, such as a toilet bowl, a shower enclosure, or a bathtub enclosure.

[0005] 2. Description of the Related Art

[0006] Toilet bowls require care to prevent the buildup of unsightly deposits, to reduce odors, and to prevent bacteria growth. Traditionally, toilet bowls have been cleaned, deodorized, and disinfected by manual scrubbing with a liquid or powdered cleaning and sanitizing agent. This task has required manual labor to keep the toilet bowl clean.

[0007] In order to eliminate the detested manual scrubbing, various toilet bowl cleaner dispensers have been proposed. One type of dispenser comprises a solid block or solid particles of a cleansing and freshening substance that is suspended from the rim of a toilet bowl in a container that is placed in the path of the flushing water. U.S. Pat. No. 4,777,670 (which is incorporated herein by reference along with all other documents cited herein) shows an example of this type of toilet bowl cleaning system. Typically, a portion of the solid block is dissolved in the flush water with each flush, and the flush water having dissolved product is dispensed into the toilet bowl for cleaning the bowl.

[0008] Other toilet bowl cleaning systems use a liquid cleaning agent that is dispensed into a toilet bowl. For example, U.S. Pat. Nos. 6,178,564 and 6,230,334, and PCT International Publication Nos. WO 99/66139 and WO 99/66140 all disclose cleansing and/or freshening devices capable of being suspended from the rim of a toilet bowl for introducing liquid active substances from a bottle into the flushing water with each flush. In these under the toilet rim devices, the liquid active substances are delivered downward from a reservoir to a dispensing plate that is supported by a base that is suspended from the toilet bowl rim. The device is suspended from the toilet rim such that the flow of flush water from the toilet contacts the dispensing plate during a flush. The flush water carries the liquid active substances that are on the dispensing plate into the toilet bowl to clean and freshen the toilet.

[0009] Other toilet bowl dispensers use an aerosol deodorizing and/or cleaning agent that is dispensed into a toilet bowl through a conduit attached to the toilet bowl rim. For example, U.S. Pat. No. 3,178,070 discloses an aerosol container mounted by a bracket on a toilet rim with a tube extending over the rim; and U.S. Pat. Nos. 6,029,286 and 5,862,532 disclose dispensers for a toilet bowl including a pressurized reservoir of fluid, a conduit connected to the source of fluid, and a spray nozzle which is installed on the toilet rim.

[0010] One disadvantage with these known toilet rim dispensing devices is that these devices may only apply the deodorizing and/or cleaning agent to one location in the toilet water or a limited area in the toilet water or on the inner surface of the toilet bowl. As a result, the cleaning of the inner surface of the toilet bowl may be limited to an area of the toilet bowl near the device.

[0011] U.S. patent application Ser. No. 11/312,281, owned by the owner of the current invention, sets forth, among others, an automatic or manual toilet bowl cleaning device where the inner surface of the toilet bowl is cleaned around the entire circumference of the toilet bowl. In one embodiment illustrated in that application, the downstream end of a fluid conduit terminates in a rotating nozzle capable of spraying the fluid outwardly onto the inner surface of the toilet bowl.

[0012] In view of the advance in the art provided by the device of U.S. patent application Ser. No. 11/312,281, even further improvements to this technology would be beneficial to consumers.

SUMMARY OF THE INVENTION

[0013] The foregoing needs can be met with a rotary sprayer according to the invention for a fluid delivery device. The rotary sprayer is suitable for use in an automated or manual cleaning system for cleaning an enclosure, such as a toilet bowl, a shower enclosure, a bathtub enclosure, and the like. As used herein, the term "cleaning" also includes, without limitation, sanitizing and/or disinfecting, the term "deodorizing" also includes freshening, and the term "fluid" includes, without limitation, cleaning fluids, sanitizing fluids, disinfecting fluids, and the like. Furthermore, the term "fluid" is read broadly to include, liquids, gels, flowable powders, vapors, and the like. Without limitation, an example embodiment of the invention will be described with reference to a toilet bowl. The rotary sprayer is also suitable for use in an automated or manual cleaning system for restoring a surface of an enclosure, such as a toilet bowl, a shower enclosure, a bathtub enclosure, and the like. As used herein, the term 'restoring' includes, without limitation, filling in holes, cracks, fissures and the like in a surface. It also includes restoring brightness, shine or any other surface modification to the surface being treated.

[0014] In one aspect, the invention provides a rotary sprayer for a fluid delivery device. The rotary sprayer includes a clip and a rotating nozzle supported by the clip. The clip includes a fluid inlet having a discharge orifice and includes an arm having a distal end section axially spaced from the fluid inlet. The nozzle includes a deflection plate, a pair of spaced apart walls extending away from a first surface of the deflection plate and defining a channel on the first surface of the deflection plate, a spindle extending away from an opposite second surface of the deflection plate, and a passageway in fluid communication with the channel and an end space between the pair of walls. The first surface of the deflection plate can include a perimeter section that ramps away from the second surface of the deflection plate. The fluid inlet of the clip is positioned in the end space between the pair of walls of the nozzle, and the spindle of the nozzle is mounted to the distal end section of the arm of the clip. Fluid under pressure is provided to the fluid inlet, and fluid exiting the discharge orifice of the fluid inlet flows through the passageway and through the channel and contacts an inner surface of at least one of the pair of walls to rotate the nozzle and spray fluid around the perimeter of the nozzle.

[0015] In the rotary sprayer, the clip can include a hook for mounting the clip on an enclosure. The distal end section of the arm of the clip can include a recess opening toward the fluid inlet, and the spindle of the nozzle can be positioned in the recess.

[0016] In one form, the end space between the pair of walls of the nozzle is a depression formed in an end of one or both of the pair of walls. An outer end section of an inner surface of one of the pair of walls can be curved toward the other of the pair of walls. Fluid contacts the curved inner surface section to rotate the nozzle and spray fluid around the perimeter of the nozzle. The pair of walls can be spaced inward from a perimeter of the deflection plate, and the pair of walls can be joined by an end wall such that the channel opens toward one side of the deflection plate. Alternatively, the channel can open toward opposite sides of the deflection plate, and a deflection peak extending away from the first surface of the deflection plate can be positioned between the pair of walls to divide the channel into sections that open toward opposite sides of the deflection plate. In one form, the deflection plate is circular.

[0017] In another aspect, the invention provides a rotary sprayer for a fluid delivery device. The rotary sprayer includes a clip and a rotating nozzle supported by the clip. The clip includes a fluid inlet having a discharge orifice and includes an arm having a distal end section axially spaced from the fluid inlet. The nozzle includes a deflection plate having a perimeter, a pair of spaced apart walls extending away from a first surface of the deflection plate, and a deflection peak extending away from the first surface of the deflection plate between the pair of walls. The deflection peak and the pair of walls define oppositely outwardly directed channels on the first surface of the deflection plate. The nozzle also includes a spindle extending away from an opposite second surface of the deflection plate. The nozzle also includes a passageway in fluid communication with the channels and in fluid communication with an end space between the pair of walls which are spaced inward from the perimeter of the deflection plate. Fluid under pressure is provided to the fluid inlet, and fluid exiting the discharge orifice of the fluid inlet flows through the passageway and through the channels and contacts an inner surface of at least one of the pair of walls to rotate the nozzle and spray fluid around the perimeter of the nozzle.

[0018] In the rotary sprayer, the clip can include a hook for mounting the clip on an enclosure. The distal end section of the arm of the clip can include a recess opening toward the fluid inlet, and the spindle of the nozzle can be positioned in the recess.

[0019] In one version, an outer end section of an inner surface of a first wall of the pair of walls is curved toward a second wall of the pair of walls, and an outer end section of an inner surface of the second wall of the pair of walls is curved toward the first wall of the pair of walls. Fluid contacts the curved inner surface sections to rotate the nozzle and spray fluid around the perimeter of the nozzle. The deflection plate can be circular, and the pair of walls can be generally inverted T-shaped.

[0020] In still another aspect, the invention provides a method for spraying an inner wall surface of an enclosure with a fluid. In the method, a rotary sprayer is mounted adjacent a wall of the enclosure. The rotary sprayer includes a clip and a rotating nozzle. The clip can include a fluid inlet having a discharge orifice, and an arm having a distal end section axially spaced from the fluid inlet. The nozzle can include a deflection plate, a pair of spaced apart walls extending away from a first surface of the deflection plate and defining a channel on the first surface of the deflection plate, a spindle extending away from an opposite second surface of the deflection plate, and a passageway in fluid communication with the channel and an end space between the walls. In the rotary sprayer, the fluid inlet is positioned in the end space and the spindle is mounted to the distal end section of the arm. The fluid to be sprayed is moved into the fluid inlet such that fluid exiting the discharge orifice of the fluid inlet flows through the passageway and through the channel and contacts an inner surface of at least one of the pair of walls to rotate the nozzle and spray the inner surface of the enclosure with the fluid.

[0021] In the method, the enclosure typically extends upward from a support surface and fluid flowing through the passageway flows downward onto the first surface of the deflection plate in a direction toward the support surface. In one version of the method, the enclosure is a toilet bowl, and the inner surface of the toilet bowl is sprayed around the entire circumference of the toilet bowl. The first surface of the deflection plate can include a perimeter section that ramps away from the second surface of the deflection plate to spray the fluid under the rim of the toilet bowl. In another version of the method, the enclosure is a tub or shower.

[0022] In the method, the fluid may be moved into the fluid inlet at a pressure of 20 to 207 kilopascals and/or at a flow rate below 38 liters per hour. In one version of the method, the fluid is pumped into the fluid inlet.

[0023] It is therefore an advantage of the invention to provide a rotary sprayer for a fluid delivery device. In one advantageous form, the rotary sprayer can be used in an automatic or manual toilet bowl cleaning device where the inner surface of the toilet bowl is cleaned around the entire circumference of the toilet bowl.

[0024] These and other features, aspects, and advantages of the present invention will become better understood upon consideration of the following detailed description, drawings, and appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] FIG. **1** is a perspective view of an embodiment of a fluid delivery device according to the invention mounted to a toilet bowl.

[0026] FIG. **2** is a perspective, fragmentary view taken along line **2-2** of FIG. **1** showing the clip and rotating nozzle of a rotary sprayer according to the invention.

[0027] FIG. **3** is a side elevational view having a cutout showing a portion of the interior of the clip and the rotary sprayer of FIG. **2**.

[0028] FIG. **4** is a rear oblique view of the clip of FIG. **2**.

[0029] FIG. **5** is a front view of a portion of the clip of FIG. **2** showing a hook of the clip.

[0030] FIG. **6** is a rear view of a portion of the clip of FIG. **2** showing a base of the clip.

[0031] FIG. **7** is a front view of the clip and rotating nozzle of the rotary sprayer of FIG. **2** showing the clip in rotated (dashed lines) and non-rotated (solid lines) orientations.

[0032] FIG. **8** is a top view of the nozzle of the rotary sprayer taken along line **8-8** of FIG. **3**.

[0033] FIG. **9** is a perspective view of another embodiment of a clip and rotating nozzle of a rotary sprayer according to the invention.

[0034] FIG. **10** is a side view of the clip and rotating nozzle of the rotary sprayer of FIG. **9**.

[0035] FIG. **11** is a front view of the clip and rotating nozzle of the rotary sprayer of FIG. **9** with the hook removed.

[0036] FIG. **12** is a vertical cross-sectional view of the fluid inlet, nozzle and support arm of the rotary sprayer of FIG. **9**.

[0037] FIG. **13** is a top view of the nozzle of the rotary sprayer taken along line **13-13** of FIG. **10**.

[0038] FIG. **14** is a front elevational view of yet another nozzle suitable for use with the rotary sprayer of the invention.

[0039] FIG. **15** is a side elevational view of the nozzle of FIG. **14**.

[0040] FIG. **16** is a perspective view of a fluid dispensing pump that may be used to pump fluid from a container to the rotary sprayer of the invention.

[0041] FIG. **17** is a vertical cross-sectional view of the fluid dispensing pump of FIG. **16**.

[0042] FIG. **18** is a front view of another fluid dispensing pump that may be used to pump fluid from a container to the rotary sprayer of the invention.

[0043] FIG. **19** is a detailed vertical cross-sectional view of the fluid delivery system of the fluid dispensing pump of FIG. **18** taken along line **19-19** of FIG. **18**.

[0044] Like reference numerals will be used to refer to like parts from Figure to Figure in the following description of the drawings.

DETAILED DESCRIPTION OF THE INVENTION

[0045] A rotary sprayer according to the invention can be used in various devices that dispense fluid onto the inside surfaces of an enclosure, such as a toilet bowl, a shower enclosure, a bathtub enclosure, or the like. Various embodiments of the invention will now be described with reference to the Figures. The embodiments are shown and described for the purposes of illustration and are not intended to limit the invention in any way.

[0046] Turning to FIGS. **1** and **2**, there is shown an example embodiment of a rotary sprayer with a clip **10** for mounting the rotary sprayer to an enclosure, here a toilet bowl **12** on a support surface **13**. The clip **10** is secured to the rim **14** of the toilet bowl **12** by a hook **16**. A base **18** is supported by the hook **16** and rotatably supports a nozzle **20**. A container **22** supplies fluid via a fluid conduit **24** to the nozzle **20** to be dispensed onto the inside surface **26** of the toilet bowl **12**. The fluid can be supplied from the container **22** to the nozzle **20** in a variety of ways; for example, the fluid may be moved by a gaseous propellant, by a pump, a syringe, or any other suitable means. Furthermore, the execution of the fluid delivery from the container **22** can be controlled by a variety of methods/devices, one being a timing circuit using predetermined logic to control when the fluid is dispensed.

[0047] Turning to FIGS. **3**, **4**, and **5** the hook **16** for supporting the base **18** and attaching the clip **10** to the toilet bowl **12** has three main segments. A bowl segment **28**, a top rim segment **30**, and an inner rim segment **32**. All three segments **28**, **30**, **32** are preferably integrally molded from plastic (e.g., polyethylene or polypropylene) and form a flexible hook **16**. The bowl segment **28** has a substantially rectangular cross-section and a flared elastomeric gripping foot **34** with elastomeric ribs **37** at a lower end for helping to secure the clip **10** to the toilet bowl **12**. Suitable elastomeric materials for the gripping foot **34** and ribs **37** include, without limitation, neoprene, polyurethane rubbers, and silicone rubbers. The bowl segment **28** extends substantially vertically upward and transitions into the top rim segment **30** at a flexible elbow **35** that allows the hook **16** to flex predominantly in the F-F direction (shown on FIG. **3**) to secure the clip **10** to toilet bowls of various shapes and sizes. The top rim segment **30** has a substantially rectangular cross-section and extends horizontally across the rim **14** of the toilet bowl **12** where it transitions into the inner rim segment **32** at another flexible elbow **36**, also allowing the hook **16** to flex. The inner rim segment **32** extends vertically downward from the elbow **36** and is configured to engage and support the base **18**.

[0048] The inner rim segment **32** of the hook **16** has a front face **38** and a rear face **40** joined by two short side faces **42**. A rib **44** protrudes from the rear face **40** of the inner rim segment **32** and extends the length thereof. As discussed in detail below, the rib **44** limits the angle of rotation of the base **18** with respect to the hook **16**. The rib **44** of the example embodiment has a substantially rectangular cross-section, however, the rib **44** may have a curved cross-section, a square cross-section, comprise two spaced apart members, and the like. Additionally, the rib **44** need not extend the length of the inner rim segment **32** provided the rib **44** engages the base **18** throughout the desired adjustable range of the base **18**. The short side faces **42** have ratchet teeth **46** used in conjunction with the base **18** to restrain vertical movement of the base **18** along a vertical axis **48**. Other restraints may be used, such as a friction fit between the hook **16** and base **18**, or the like.

[0049] The bowl segment **28** and the top rim segment **30** include a series of C-shaped channels **50** that restrain the conduit **24** as it is routed around the perimeter of the hook **16** on its way to the nozzle **20** in the base **18**. The bowl segment **28** of the present embodiment includes three C-shaped channels **50** of alternating openings. The conduit **24** is pressed into the C-shaped channels **50**, however, the channels **50** could be rectangular or any other suitable shape to restrain the conduit **24**. The top rim segment **30** preferably includes one channel **50** helping to route the conduit **24**, however, more may be used if needed.

[0050] Turning to FIGS. **3**, **4**, and **6** the base **18** has a back face **52**, a pair of spaced apart side faces **54** extending forward of the back face **52**, a top face **56** and a front face **58** extending between the side faces **54**, and a curved face **60** extending between the side faces **54**, top face **56**, and front face **58**. The faces **52**, **54**, **56**, **58**, **60** define a partial cavity **62** housing a portion of the nozzle **20**. The base **18** has a tab **53** that extends rearward from the back face **52** of the base **18**. The tab **53** helps orientate the base **18** with respect to the rim **14** when the clip **10** is mounted to the toilet bowl **12**, as discussed below. The tab **53** may be one continuous member as shown in the example embodiment, or alternatively, the tab **53** may include a plurality of members extending from the base **18**. The base **18** is preferably molded from plastic (e.g., polyethylene or polypropylene).

[0051] With emphasis on FIG. **6**, the base **18** includes a channel **64** for receiving the inner rim segment **32** of the hook **16**. The channel **64** includes a slit **66** for receiving the rib **44** having an entrance **68**, an exit **70**, and an intermediate position **72** (which may or may not be equidistant from the entrance **68** and the exit **70**). The width of the slit **66** decreases from the entrance **68** to the intermediate position **72** and increases from the intermediate position **72** to the exit **70**. In one embodiment, the intermediate position **72** is approximately half way between the entrance **68** and the exit **70**; however, the narrowest point need not be halfway between

the entrance **68** and exit **70**, but may occur anywhere between the extremes of the slit **66**. Additionally, the maximum width of the slit **66** may vary depending on the desired degree of adjustment of the base **18** with respect to the hook **16**. If greater rotational adjustment of the base **18** is desired, the maximum width of the slit **66** at the entrance **68** and exit **70** may be increased; alternatively, or in addition, the width of the rib **44** may be decreased.

[0052] The channel **64** includes a pair of projections **74** extending from the walls of the short sides **65** of the channel **64** to engage the ratchet teeth **46** of the hook **16** as the inner rim segment **32** slides within the channel **64**. The projections **74** are configured to engage the ratchet teeth **46** to inhibit vertical sliding of the base **18** with respect to the hook **16**. The projections **74** may be rounded, terminate in a point, or other suitable geometry. Many other structures are capable of providing the desired restraint, such as a spring-loaded ball that is housed in a cavity formed in the channel **64** to urge the ball against a contour (e.g., ratchet teeth **46**) of the channel **64**. The engagement between the projections **74** and the ratchet teeth **46** is such that the base **18** is capable of the desired rotation (discussed below) without causing the projections **74** and ratchet teeth **46** to disengage.

[0053] The base **18** further includes a means to attach the nozzle **20**. In the example embodiment, the nozzle **20** is restrained laterally between a fluid inlet **80** and a barrel **78**. The base **18** includes an arm **76** extending downward from the base **18**. The arm **76** has a flat bar support segment **77** with a J-shaped bend extending forward with a barrel **78** located at the distal end of the support segment **77**. The barrel **78** includes a tubular recess for receiving the bottom of the nozzle **20**. The base **18** also has a fluid inlet **80** located in the curved face **60** that tapers from the opening (shown in FIG. **3**). The fluid inlet **80** and the barrel **78** are used in conjunction to restrain lateral movement of the nozzle **20**, but allow the nozzle **20** to rotate about the nozzle axis **82**.

[0054] A sensor **98** for sensing the environment surrounding the clip **10** may be mounted to the base **18** or hook **16**. Preferably, the sensor **98** is mounted substantially to the front face **58**, but may be mounted on the angled face **60** or any other suitable location providing a view, for example, of the user to accurately determine the presence or absence thereof. The sensor **98** may be a motion sensor, proximity sensor, or the like. The sensor **98** is preferably electrically connected to the container **22** and/or controller (not shown) to influence when the fluid is dispensed to the toilet bowl **12** based upon predetermined logic.

[0055] Turning to FIG. **8**, an example embodiment of the nozzle **20** is described. The nozzle **20** is preferably molded from plastic (e.g., polyethylene and polypropylene). The nozzle **20** includes a circular deflection plate **84**, a passageway **86** extending upwards from the deflection plate **84** and in fluid communication with the fluid inlet **80**. A channel **88** extends radially outward from the passageway **86** near the deflection plate **84** and angles away from the initial channel **88** path at point A as shown in FIG. **8**. The channel **88** is flanked by a pair of fins **90** that extend upwardly from the deflection plate **84**. The fins **90** extend away from an end wall **95**. An outer edge of the deflection plate **84** has a chamfer **84'** (see FIG. **7**) that ramps downward from the top of the deflection plate **84**. The contour of the chamfer **84'**, channel **88** and fins **90** may vary depending on the desired rotational speed of the nozzle **20**, pressure of the fluid, and the like.

[0056] As shown most clearly in FIGS. **3** and **8**, the nozzle **20** is restrained laterally in the base **18** by inserting a spindle **92** extending from the underside of the deflection plate **84** into the recess in the barrel **78** of the arm **76** and by inserting the tapered end of the fluid inlet **80** into the passageway **86** where it abuts a ledge **94** formed in the passageway **86**. The nozzle **20** is free to rotate about the nozzle axis **82**, but is restrained from lateral movement.

[0057] The nozzle **20** may be suspended from the base **18** without the use of an arm **76**. The nozzle **20**, may be snap-fit to the base **18**, screwed to the base **18**, wedged to the base **18**, and the like. Furthermore, an arcuate arm (not shown) may extend from the base **18** to support the nozzle **20**.

[0058] In operation, fluid is moved from the container **22** through the conduit **24**, which is routed through the channels **50** along the hook **16**, and into the fluid inlet **80** on the base **18**. Fluid flows into the top of the nozzle **20**, down the passageway **86** where it is directed radially outward by the channel **88**. As the fluid exits the channel **88** its path is altered by the angled fins **90** flanking the channel **88**. The reaction causes the nozzle **20** to rotate counterclockwise as viewed in FIG. **8**. As a result, the fluid is expelled radially outward from the nozzle **20** onto the inside surface **26** of the toilet bowl **12**.

[0059] With the general structure and operation of the fluid delivery device described, we turn our attention to the means for rotating the base **18** and thus adjusting the area covered by the fluid dispensed from the nozzle **20**. Returning to FIGS. **4** and **6**, and with reference to FIG. **7**, the base **18** can be rotated relative to the hook **16** about a horizontal axis **96** extending substantially normal from a plane defined by the vertical axis **48** and the back face **52** of the base **18**. The slit **66** formed in the channel **64** is flared at the entrance **68** and exit **70**. This allows the base **18** to rotate near the intermediate position **72** about the horizontal axis **96** until the rib **44** protruding from the hook **16** abuts the slit sides **45** formed in the back face **52**.

[0060] For example, with reference to FIG. **7**, when the base **18** is rotated by an angle R1 with respect to the vertical axis **48** (shown by dashed lines) the relative placement of the nozzle **20** is angled accordingly, thus altering the area covered by the fluid dispensed from the nozzle **20**. Additionally, when the base **18** is rotated by an angle R2 in the opposite direction, the coverage of the fluid dispensed by the nozzle **20** is again altered. As the base **18** rotates, the projections **74** slide within a respective tooth of the ratchet teeth **46**; thus, the fit between the projections **74** and the ratchet teeth **46** should allow for the base **18** to rotate freely while also inhibiting vertical movement of the base **18**. This rotational adjustment allows the clip **10** to accommodate toilets and enclosures of varying geometries.

[0061] The means for rotating the base **18** need not include a slit **66** as described. For example, the back face **52** may include several pairs of opposed fingers in the plane defined by the back face **52** for restraining the rotation of the rib **44** of the hook **16**. The opening between a pair of opposed fingers near the entrance and the opening of a pair of opposed fingers near the exit are larger than the opening between a pair of opposed fingers located between the entrance and exit fingers. As a result, the base **18** is capable of rotating until the rib **44** engages the fingers near the entrance and exit. In another embodiment, the slit **66** may have a V-shape wherein the entrance tapers to the exit, or the opposite. Thus, the point of rotation of the base **18** is located near the exit of the slit **66**, or smaller of the entrance and exit. Again, the rotation of the base **18** is limited by the rib **44** engaging the slit sides **45**.

[0062] The rotational adjustment of the base **18** may be performed manually by a user of the clip **10** or automatically as the clip **10** is mounted to the enclosure, here a toilet bowl **12**. With general reference to FIGS. **1-4**, **6**, and **7**, the clip **10** is mounted substantially as follows. The clip **10** is secured to the rim **14** of the toilet bowl **12** by urging the hook **16** in the F-F direction away from the base **18** and placing the clip **10** over the rim **14**. Once the hook **16** is secured, the base **18** is slid along the vertical axis **48** up the hook **16** and ratchet teeth **46** until the tab **53** engages the underside of the rim **14**. As the tab **53** of the base **18** continues to engage the underside of the rim **14**, the base **18** is rotated about the horizontal axis **96**, thus aligning the nozzle **20** with the plane of the underside of the rim **14** and helping to ensure that the fluid from the nozzle **20** is dispensed onto the inside surface **26** of the toilet bowl **12** (assuming the plane of the underside of the rim **14** is parallel with the plane defined by the topside of the rim **14**). The tab **53** may further include an elastomeric grip **51** protruding from the distal end of the tab **53** helping to secure the base **18** in its engaged position on the rim **14**. The base **18** need not include a tab **53**; in this embodiment, the base **18** may be manually rotated by the user to adjust the base **18** with respect to the hook **16**.

[0063] Turning now to FIGS. **9-11**, there is shown another example embodiment of a rotary sprayer with a clip **110** for mounting a nozzle to an enclosure such as a toilet bowl. The clip **110** is secured to the rim of the toilet bowl by a hook **116** (which is omitted in the view of FIG. **11**) in the same manner as the clip **10** of FIGS. **1-8**. A base **118** is supported by the hook **116** and supports a nozzle **120**. A container supplies fluid via a fluid conduit to the nozzle **120** to be dispensed onto the inside surface of the toilet bowl in the same manner as the clip **10** of FIGS. **1-8**. The fluid can be supplied from the container to the nozzle **120** in a variety of ways; for example, the fluid may be moved by a gaseous propellant, by a manual or electric pump, a syringe, or any other suitable means. Furthermore, the execution of the fluid delivery from the container can be controlled by a variety of methods/devices, one being a timing circuit using predetermined logic to control when the fluid is dispensed.

[0064] Referring still to FIGS. **9-11**, the hook **116** for supporting the base **118** and attaching the clip **110** to the toilet bowl has three main segments. A bowl segment **128**, a top rim segment **130**, and an inner rim segment **132**. All three segments **128**,**130**,**132** are preferably integrally molded from plastic (e.g., polyethylene or polypropylene) and form a flexible hook **116**. The bowl segment **128** has a substantially rectangular cross-section and a flared elastomeric gripping foot **134** with elastomeric ribs **137** at a lower end for helping to secure the clip **110** to the toilet bowl in the same manner as the clip **10** of FIGS. **1-8**. Suitable elastomeric materials for the gripping foot **134** and ribs **137** include, without limitation, neoprene, polyurethane rubbers, and silicone rubbers. The bowl segment **128** extends substantially vertically upward and transitions into the top rim segment **130** at a flexible elbow **135** that allows the hook **116** to flex (as in the F-F direction shown on FIG. **3**) to secure the clip **110** to toilet bowls of various shapes and sizes. The top rim segment **130** has a substantially rectangular cross-section and extends horizontally across the rim of the toilet bowl where it transitions into the inner rim segment **132** at another flexible elbow **136**, also allowing the hook **116** to flex. The inner rim segment **132** extends vertically downward from the elbow **136** and is configured to engage and support the base **118**. The bowl segment **128** and the top rim segment **130** include a C-shaped channel **150** that restrains the fluid conduit as it is routed around the perimeter of the hook **116** on its way to the nozzle **120** in the base **118**. The fluid conduit is pressed into the C-shaped channel **150** in the same manner as the clip **10** of FIGS. **1-8**. The base **118** has a back face **152**, a pair of spaced apart side faces **154** extending forward of the back face **152**, a top face **156** and a front face **158** extending between the side faces **154**. The faces **152**,**154**,**156**,**158** define a cavity. The base **118** is preferably molded from plastic (e.g., polyethylene or polypropylene).

[0065] The base **118** includes a channel **164** for receiving the inner rim segment **132** of the hook **116**. The channel **164** is structured similar to the channel **64** of the clip **10** of FIGS. **1-8**, and the channel **164** and the hook **116** provide rotational adjustment of the base **118** using the same construction in the same manner as the clip **10** of FIGS. **1-8** so the means for rotational adjustment of the clip **110** will not be explained further.

[0066] A sensor **198** for sensing the environment surrounding the clip **110** may be mounted to the base **118**. Preferably, the sensor **198** is mounted substantially to the front face **158**, but may be mounted on any other suitable location providing a view, for example, of the user to accurately determine the presence or absence thereof. The sensor **198** may be a motion sensor, proximity sensor, or the like. The sensor **198** is preferably electrically connected to the container and/or controller (not shown) to influence when the fluid is dispensed to the toilet bowl based upon predetermined logic.

[0067] Looking at FIG. **12**, the base **118** further includes a means to attach nozzle **120** to the base **118**. In the example embodiment, the nozzle **120** is restrained laterally between a barrel **178** and a fluid inlet **180**. The base **118** includes an arm **176** extending downward from the base **118**. The arm **176** has a curved section **177** with a J-shaped bend extending forward to the barrel **178** located at the distal end of the curved section **177**. The fluid inlet **180** and the barrel **178** are used in conjunction to restrain lateral movement of the nozzle **120**, but allow the nozzle **120** to rotate about the nozzle axis **182**. The tubular fluid inlet **180** defines a flow path **181** that terminates in a discharge orifice **181***e*, and extends downwardly from a lower base floor **202** that is attached to the base **118**. The base floor **202** includes an upwardly extending tubular sleeve **204** that defines a flow path **205**. The base **118** is also attached to a fluid supply port **208** that defines a flow path **209**. The fluid supply port **208** and the tubular sleeve **204** are snap fit together with an O-ring **211** therebetween to create fluid tight seal. The fluid supply port **208** is located in a recess **213** in the top face **156** of the base, and may be connected to a fluid conduit (such as conduit **24** in FIG. **3**).

[0068] Referring to FIGS. **10** and **12** and **13**, the nozzle **120** is shown in greater detail. The nozzle **120** is preferably molded from plastic (e.g., polyethylene and polypropylene). The nozzle **120** includes a circular deflection plate **184**. An axial spindle **192** extends downward from a bottom surface of the deflection plate **184**. Spaced apart walls **190***a*, **190***b*, which have a generally inverted T-shape, extend upward from the deflection plate **184**. In the embodiment of FIG. **13**, the walls **190***a*, **190***b*, extend all the way across the deflection plate **184** from opposed outer edges of the deflection plate **184**. A central fluid deflection peak **191** extends upward from the deflection plate **184** between the walls **190***a*, **190***b*. The top of the wall **190***a* has a generally U-shaped (when viewed in vertical cross-section) inwardly directed depression **193***a*,

and the top of the wall **190***b* has a generally U-shaped (when viewed in vertical cross-section) inwardly directed depression **193***b*. A passageway **186** is defined by the walls **190***a*, **190***b* and the passageway **186** extends upwards from the deflection plate **184** and in is fluid communication with the depressions **193***a*, **193***b*. A channel **188**L extends radially outward from the passageway **186** near the deflection plate **184** and angles rearwardly away from the initial channel **188**L path at point A as shown in FIG. **13**. A channel **188**R extends radially outward from the passageway **186** near the deflection plate **184** and angles forwardly away from the initial channel **188**R path at point B as shown in FIG. **13**. The contour of the channels **188**L, **188**R and walls **190***a*, **190***b* may vary depending on the desired rotational speed of the nozzle **120**, the pressure of the fluid, the flow rate of the fluid, and the like.

[0069] As shown most clearly in FIG. **12**, the nozzle **120** is restrained laterally by inserting a spindle **192** into a recess **179** in the barrel **178** of the arm **176** and by inserting the end of the fluid inlet **180** between depressions **193***a*, **193***b*. The nozzle **120** is free to rotate about the nozzle axis **182**, but is restrained from lateral movement.

[0070] In operation, fluid is moved from a container through a fluid conduit (see, for example, the container **22** and the conduit **24** of FIG. **1**) and into the fluid supply port **208**. Looking at FIG. **12**, the fluid flows through the flow paths **209**, **205**, and **181**, and out of the fluid inlet **180**. (The diameter of the exit orifice of the fluid inlet can dictate the pressure which helps to dictate the spin rate and the distance of fluid travel off the nozzle **120**.) Fluid flows onto the top of the fluid deflection peak **191** and down the forked passageways **186** where it is directed radially outward by the channels **188**L, **188**R. As the fluid exits the channels **188**L, **188**R, the fluid path is altered by the angled inner surfaces **197**L, **197**R flanking the channels **188**L, **188**R. The reaction causes the nozzle **120** to rotate counterclockwise as viewed in FIG. **13**. As a result, the fluid is expelled radially outward from the nozzle **120** onto the inside surface of the enclosure such as a toilet bowl.

[0071] Referring to FIGS. **14** and **15**, another embodiment of a nozzle **220** is shown in greater detail. The nozzle **220** is preferably molded from plastic (e.g., polyethylene and polypropylene). The nozzle **220** includes a circular (from a top view) deflection plate **284**. An axial spindle **292** extends downward from the bottom surface of the deflection plate **284**. Spaced apart walls **290***a*, **290***b*, which have a generally inverted T-shape, extend upward from the deflection plate **284**. In the embodiment of FIGS. **14** and **15**, the walls **290***a*, **290***b*, extend from a location spaced inward from an outer edge point **277**L of the deflection plate **284** to a location spaced inward from an outer edge point **277**R of the deflection plate **284**. A central fluid deflection peak **291** (similar to fluid deflection peak **191** of FIGS. **12** and **13**) extends upward from the deflection plate **284** between the walls **290***a*, **290***b*. The top of the wall **290***a* has a generally U-shaped inwardly directed depression (similar to inwardly directed depression **193***a* in FIGS. **12** and **13**), and the top of the wall **290***b* has a generally U-shaped inwardly directed depression (similar to inwardly directed depression **193***b* in FIGS. **12** and **13**).

[0072] Still referring to FIGS. **14** and **15**, a passageway **286** (similar to passageway **186** in FIGS. **12** and **13**) is defined by the walls **290***a*, **290***b* and the passageway **286** extends upwards from the deflection plate **284** and in is fluid communication with the depressions in the walls **290***a*, **290***b*. A channel (similar to channel **188**L in FIGS. **12** and **13**) extends radially outward from the passageway **286** near the deflection plate **284** and angles rearwardly away from the initial channel as in FIG. **13**. A channel **288**R extends radially outward from the passageway **286** (similar to channel **188**R in FIGS. **12** and **13**) and angles forwardly away from the initial channel **288**R path as shown in FIG. **15**. The deflection plate **284** has a dished upwardly facing floor **276** that creates a draft angle Z (see FIG. **14**) at the outer edge of the top of the deflection plate **284**. The contour of the draft angle Z, the channels, and the walls **290***a*, **290***b* may vary depending on the desired rotational speed of the nozzle **220**, the pressure of the fluid, the flow rate of the fluid, and the like.

[0073] Similar to FIG. **12**, the nozzle **220** may be restrained laterally by inserting the spindle **292** into a recess **179** in the barrel **178** of the arm **176** and by inserting the end of the fluid inlet **180** between upper depressions in the walls **290***a*, **290***b*. The nozzle **220** is free to rotate about the nozzle axis, but is restrained from lateral movement.

[0074] In operation, fluid is moved from a container through a fluid conduit (see, for example, the container **22** and the conduit **24** of FIG. **1**) and into the fluid supply port **208** as in FIG. **12**, the fluid flows through the flow paths **209**, **205**, and **181**, and out of the fluid inlet **180**. Fluid flows onto the top of the fluid deflection peak **291** of nozzle **220** and down the forked passageways **286** where it is directed onto the floor **276** and radially outward by the channels. As the fluid exits the channels, the fluid path is altered by the angled inner surfaces of the walls **290***a*, **290***b* flanking the channels. The reaction causes the nozzle **220** to rotate right in direction R as in FIG. **15**. The fluid continues to flow on the floor **276** and then moves up the draft angle at the edge of the deflection plate **284** to create a slightly upward travel path for the fluid. As a result, the fluid is expelled radially outward from the nozzle **220** onto the inside surface of the toilet bowl, with the slightly upward travel path for the fluid allowing for under the toilet rim contact of the fluid with the inner surface of the toilet bowl even after 18 or more inches of travel.

[0075] Comparing FIGS. **8**,**13** and **14**, the nozzle **20**, the nozzle **120**, and the nozzle **220** have differences in structure that can lead to different operating characteristics. For example, the nozzle **20** has a single channel **88** extending away from the passageway **86**, whereas nozzle **120** and nozzle **220** have two channels extending away from the central passageway. The extra passageway can serve to get maximum work out of the nozzle and improve efficiency. The nozzle **120** and nozzle **220** also have fluid deflection peaks **191**, **291** that can improve efficiency. Comparing nozzle **120** and nozzle **220**, it can be seen that the walls **190***a*, **190***b* of nozzle **120** extend all the way across the deflection plate **184** from opposed outer edges of the deflection plate **184**, whereas walls **290***a*, **290***b* of nozzle **220** are spaced inward from opposed outer edges of the deflection plate **284**. The spacing of the walls from the edge of the plate can create more tangential motion in the fluid expelled from the nozzle **220**. The centripetal force causes fluid to spin and shear off. Also, the draft angle Z at the outer edge of the nozzle **220** can provide for a spray of about 18 inches (measured radially from the outer edge of the deflection plate) without having the level of liquid spray drop down. This is advantageous as it prevents the spray from failing down so far that it does not hit under the upper areas under the toilet rim.

[0076] Various parameters of the nozzles **20**, **120**, **220** can be varied depending on the application for the nozzles. For example, in a nozzle suitable for use in a toilet cleaning

device, fluid flow is downward unto the deflection plate to create a spray that moves downward less quickly after leaving the surface of the deflection plate. The design parameters of the nozzles **20**, **120**, **220** can be varied to accommodate lower fluid pressures, such as 10 to 20 psi (69 to 138 kilopascals), and fluid travel paths of less than 24 inches (0.6096 meters) (measured radially from the outer edge of the deflection plate), and flow rates below 10 gallons per hour (about 38 liters per hour). Therefore, the operating parameters of pressure, volume, and flow rate can be accommodated by varying the design of the nozzles **20**, **120**, **220**. Fluid pressures of 3 to 30 psi (20 to 207 kilopascals) and fluid travel paths of up to 100 inches (2.54 meters) (measured radially from the outer edge of the deflection plate) are suitable for many applications. Fluid pressures of 14 to 15 psi (96 to 103 kilopascals) and fluid travel paths of up to 18 inches (0.4572 meters) (measured radially from the outer edge of the deflection plate) are most preferred in a toilet application.

[0077] Having described the clips **10**, **110** and the nozzles **20**, **120**, **220** of a rotary sprayer, various pumps for supplying fluid from the container to the nozzles **20**, **120**, **220** can be described. Referring to FIGS. **16** and **17**, there is shown a fluid dispensing pump **420** that may be used to pump fluid from a container **422** to the conduit **24** that supplies fluid to the nozzles **20**, **120**, **220** as described above. The fluid dispensing pump **420** can be mounted on the side of the toilet tank as in FIG. **1**, or placed on the top of the toilet tank, or placed on the floor. The fluid dispensing pump **420** may be attached to the container **422** by way of a threaded closure **424** in a conventional manner.

[0078] The fluid dispensing pump **420** includes a dispenser head **426** that defines an actuator and has a discharge conduit **428**. The dispenser head **426** is attached to a hollow tubular piston **430** having a ball valve **432** at its upper end. The piston **430** translates in a collar **434** that is secured in an aperture in the closure **424**. The fluid dispensing pump **420** also includes an accumulator **436** that defines a pump chamber and is contained in a housing **438**. An annular seal **440** at the bottom of the piston **430** seals against an inner surface **442** of the accumulator **436**. A helical compression spring **144** is arranged between lower shoulders **446** of the piston **430** and lower shoulders **448** of the accumulator **436**. The accumulator **436** includes a ball valve **450** at its lower end. The accumulator **436** also has a tubular inlet port **452** that receives a dip tube **454** for sucking fluid from the container **422**. The accumulator **436** is oriented collinear with a vertical (longitudinal) axis of the container **422**.

[0079] The dispenser head **426** is shown in FIG. **17** in its upper position. When the dispenser head **426** is pressed downward in direction D from its upper position by a hand (or a foot) and released, fluid from the container is suctioned into the accumulator **436** on the upstroke of the piston **430** (the upstroke being effectuated by the upward biasing force of the spring **444**). After a number of downstrokes and upstrokes of the piston **430**, sufficient fluid is present in the accumulator **436** such that subsequent downstrokes of the piston **430** force fluid upward past the ball valve **432** and out the discharge conduit **428**. The discharge conduit **428** is in fluid communication with a conduit **456** that is in fluid communication with conduit **24** by way of a one way check valve assembly **458** that only allows fluid flow in direction W shown in FIG. **16**. Fluid entering the conduit **24** is sprayed by nozzle **20** or **120** or **220** onto the inside surface **26** of the toilet bowl **12** as described above. The amount of fluid delivered by a downstroke of the fluid dispensing pump **420** can vary depending on the size of the pump components such as the piston **430** and the accumulator **436**. In one example embodiment, the fluid dispensing pump **420** delivers 8 milliliters of fluid on a downstroke of the piston **430**. Fluid pressures can be in the range of 10 to 20 psi (69 to 138 kilopascals).

[0080] Referring to FIGS. **18** and **19**, there is shown another fluid dispensing pump **720** that may be used to pump fluid from a container **722** to the conduit **24** that supplies fluid to the nozzle **20** or **120** or **220** as described above. The fluid dispensing pump **720** can be mounted on the side of the toilet tank as in FIG. **1**, or placed on the top of the toilet tank, or placed on the floor. The fluid dispensing pump **720** may be attached to the container **722** by way of a threaded closure **724** in a conventional manner.

[0081] The fluid dispensing pump **720** includes a piston **725** having an upper end grip **726** that defines an actuator. The piston **725** also has a piston head **728**. The piston **725** translates in a collar **734** that is mounted on a hollow cylinder **736** that defines a pump chamber and that is integral with a base **738** that is secured to the closure **724**. The piston head **728** seals against an inner surface **742** of the cylinder **736**. A helical compression spring **744** is arranged between a lower surface of the end grip **726** of the piston **725** and an upper surface of the collar **734**. The cylinder **736** is oriented parallel with a vertical (longitudinal) axis of the container **722**.

[0082] The base **738** has central manifold **746** in fluid communication with an inlet port **752** that receives a dip tube **754** for sucking fluid from the container **722**. A ball valve **755** seats on the inlet port **752** for preventing fluid from reentering the container **722** on a downstroke of the piston **725**. A fluid passageway **756** places the cylinder **736** and the manifold **746** in fluid communication. The base **738** also has a discharge conduit **758** in fluid communication with the central manifold **746**. The conduit **24** may be placed in fluid communication with the discharge conduit **758** by way of a coupling **762**. A ball valve **764** is biased against a valve seat **765** of the discharge conduit **758** by way of compression spring **766**. The ball valve **764** allows fluid flow out of the discharge conduit **758** on a piston downstroke but prevents fluid from reentering the central manifold **746** on an upstroke of the piston **725**.

[0083] The piston **725** is shown in FIG. **18** in its upper position. When the piston **725** is pressed downward in direction D by a hand (or foot) and released, fluid from the container **722** is suctioned into the cylinder **736** on the upstroke of the piston **725** (the upstroke being effectuated by the upward biasing force of the spring **744**). Thus, the pump **720** is primed. A subsequent downstroke of the piston **725** forces fluid past the ball valve **764** and out the discharge conduit **24**. Fluid entering the conduit **24** is sprayed by nozzle **20** or **120** or **220** onto the inside surface **26** of the toilet bowl **12** as described above.

[0084] The amount of fluid delivered by a downstroke of the piston **725** can be varied by adjusting distance between the end grip **726** of the piston **725** and the collar **734**. The means for varying the downstroke of the piston **725** comprises a shaft **772**, a collar **774** and a set screw **776**. The shaft **772** is attached to an underside of the end grip **726** of the piston **725**, and the shaft **772** translates an opening in the collar **774**. The set screw **776** is inserted in a threaded side opening in the collar **774** and can immobilize the shaft **772** in the collar **774** by way of contact of the set screw **776** with the shaft **772**. By moving the shaft **772** downward in the collar **774** and immobilizing the shaft **772** with the set screw **776**, the distance between the

end grip **726** of the piston **725** and the collar **734** is decreased and therefore, lower volumes of fluid are sucked into the cylinder **736** on the upstroke of the piston **725**. In one example embodiment, the fluid dispensing pump **720** can deliver up to 10 milliliters of fluid on a downstroke of the piston **725**, with a delivery of 5 to 10 milliliters being preferred, and a delivery of 7 to 8 milliliters being most preferred.

[0085] Thus, the present invention provides a rotary sprayer for a fluid delivery device. The rotary sprayer can be used in an automatic or manual toilet bowl cleaning device where the inner surface of the toilet bowl is sprayed with a cleaner around the entire circumference of the toilet bowl. As a result, full coverage of the fluid around the inner surface of the toilet bowl is possible.

[0086] Although the present invention has been described in detail with reference to certain embodiments, one skilled in the art will appreciate that the present invention can be practiced by other than the described embodiments, which have been presented for purposes of illustration and not of limitation. Therefore, the scope of the invention should not be limited to the description of the embodiments contained herein.

INDUSTRIAL APPLICABILITY

[0087] The present invention provides a rotary sprayer for a fluid delivery device such that fluid may be dispensed onto the inner wall surface of an enclosure.

What is claimed is:

1. A rotary sprayer for a fluid delivery device, the rotary sprayer comprising:
- a clip including a fluid inlet having a discharge orifice and including an arm having a distal end section axially spaced from the fluid inlet; and
- a nozzle including a deflection plate, a pair of spaced apart walls extending away from a first surface of the deflection plate and defining a channel on the first surface of the deflection plate, a spindle extending away from an opposite second surface of the deflection plate, and a passageway in fluid communication with the channel and an end space between the pair of walls, the first surface of the deflection plate including a perimeter section that ramps away from the second surface of the deflection plate,
- wherein the fluid inlet is positioned in the end space and the spindle is mounted to the distal end section of the arm such that fluid exiting the discharge orifice flows through the passageway and through the channel and contacts an inner surface of at least one of the pair of walls to rotate the nozzle.

2. The rotary sprayer of claim **1** wherein:
- the end space is a depression formed in an end of one or both of the pair of walls.

3. The rotary sprayer of claim **1** wherein:
- the distal end section of the arm includes a recess opening toward the fluid inlet, and
- the spindle is positioned in the recess.

4. The rotary sprayer of claim **1** wherein:
- an outer end section of an inner surface of one of the pair of walls is curved toward the other of the pair of walls.

5. The rotary sprayer of claim **1** wherein:
- the pair of walls are spaced inward from a perimeter of the deflection plate.

6. The rotary sprayer of claim **1** wherein:
- the pair of walls are joined by an end wall such that the channel opens toward one side of the deflection plate.

7. The rotary sprayer of claim **1** wherein:
- the channel opens toward opposite sides of the deflection plate.

8. The rotary sprayer of claim **1** wherein:
- a deflection peak extending away from the first surface of the deflection plate between the pair of walls divides the channel into sections that open toward opposite sides of the deflection plate.

9. The rotary sprayer of claim **1** wherein:
- the deflection plate is circular.

10. The rotary sprayer of claim **1** wherein:
- the clip includes a hook for mounting the clip on an enclosure.

11. A rotary sprayer for a fluid delivery device, the rotary sprayer comprising:
- a clip including a fluid inlet having a discharge orifice and including an arm having a distal end section axially spaced from the fluid inlet; and
- a nozzle including a deflection plate having a perimeter, a pair of spaced apart walls extending away from a first surface of the deflection plate, a deflection peak extending away from the first surface of the deflection plate between the pair of walls, the deflection peak and the pair of walls defining oppositely directed channels on the first surface of the deflection plate, a spindle extending away from an opposite second surface of the deflection plate, and a passageway in fluid communication with the channels and an end space between the pair of walls, the pair of walls being spaced inward from the perimeter of the deflection plate,
- wherein the fluid inlet is positioned in the end space and the spindle is mounted to the distal end section of the arm such that fluid exiting the discharge orifice flows through the passageway and through the channels and contacts an inner surface of at least one of the pair of walls to rotate the nozzle.

12. The rotary sprayer of claim **11** wherein:
- the end space is a depression formed in an end of one or both of the pair of walls.

13. The rotary sprayer of claim **11** wherein:
- the distal end section of the arm includes a recess opening toward the fluid inlet, and
- the spindle is positioned in the recess.

14. The rotary sprayer of claim **11** wherein:
- an outer end section of an inner surface of a first wall of the pair of walls is curved toward a second wall of the pair of walls, and
- an outer end section of an inner surface of the second wall of the pair of walls is curved toward the first wall of the pair of walls.

15. The rotary sprayer of claim **11** wherein:
- the deflection plate is circular.

16. The rotary sprayer of claim **11** wherein:
- the clip includes a hook for mounting the clip on an enclosure.

17. The rotary sprayer of claim **11** wherein:
- the pair of walls are generally inverted T-shaped.

18. A method for spraying an inner surface of an enclosure with a fluid, the method comprising:
- (a) mounting a rotary sprayer adjacent a wall of the enclosure, the rotary sprayer comprising

(i) a clip including a fluid inlet having a discharge orifice and including an arm having a distal end section axially spaced from the fluid inlet; and

(ii) a nozzle including a deflection plate, a pair of spaced apart walls extending away from a first surface of the deflection plate and defining a channel on the first surface of the deflection plate, a spindle extending away from an opposite second surface of the deflection plate, and a passageway in fluid communication with the channel and an end space between the walls, wherein the fluid inlet is positioned in the end space and the spindle is mounted to the distal end section of the arm; and

(b) moving the fluid into the fluid inlet such that fluid exiting the discharge orifice of the fluid inlet flows through the passageway and through the channel and contacts an inner surface of at least one of the pair of walls to rotate the nozzle and spray the inner surface of the enclosure with the fluid.

19. The method of claim **18** wherein:

the enclosure extends upward from a support surface and fluid flowing through the passageway flows onto the first surface of the deflection plate in a direction toward the support surface.

20. The method of claim **18** wherein:

the enclosure is a toilet bowl.

21. The method of claim **20** wherein:

the inner surface of the toilet bowl is sprayed around the entire circumference of the toilet bowl.

22. The method of claim **18** wherein:

the enclosure is one of a tub or a shower.

23. The method of claim **18** wherein:

the first surface of the deflection plate includes a perimeter section that ramps away from the second surface of the deflection plate.

24. The method of claim **18** wherein:

step (b) comprises moving the fluid into the fluid inlet at a pressure of about 20 to about 103 kilopascals.

25. The method of claim **18** wherein:

step (b) comprises moving the fluid into the fluid inlet at a pressure of about 20 to about 207 kilopascals.

26. The method of claim **18** wherein:

step (b) comprises moving the fluid into the fluid inlet at a flow rate below 38 liters per hour.

27. The method of claim **18** wherein:

step (b) comprises pumping the fluid into the fluid inlet.

* * * * *