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(54) Title: MAINTENANCE TOOL WITH FLUID DELIVERY CONTROL

(57) Abstract: A maintenance tool including a handle having a proximal end and a distal end, and a first reservoir coupled to the handle and supporting a first amount of fluid. The tool also includes a head pivotably coupled to the proximal end of the handle. The head defines a second reservoir that has a second volume to support a second amount of fluid, and a manifold communicating with the second reservoir. An inlet port is coupled to the head and fluidly connects the first reservoir to the second reservoir such that fluid flows by gravity from the first reservoir to the second reservoir. A pad is coupled to the head and is in communication with the manifold. The pad has a capillary gradient and is positionable on a surface to draw fluid from the manifold and to control delivery of fluid to the surface via capillary action.

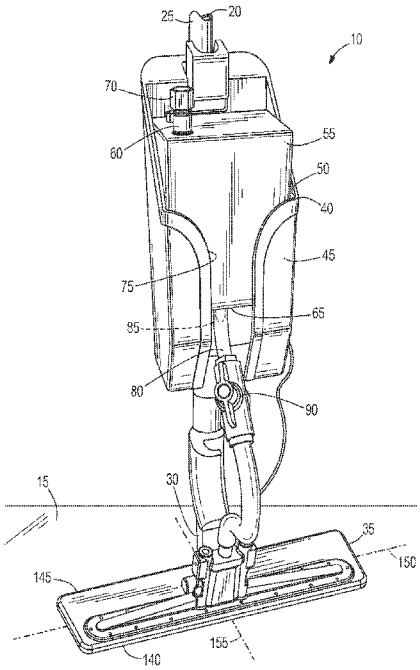


FIG. 1

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MAINTENANCE TOOL WITH FLUID DELIVERY CONTROL

BACKGROUND

[0001] The present invention relates to maintenance tools, and more particularly to a maintenance tool that controls the delivery of fluid to a surface.

[0002] A wide variety of maintenance tools exist for many applications, including cleaning various surfaces (floors, hospital bed rails, walls, sinks, counters, etc.), polishing floor surfaces, applying material to floor surfaces, stripping material from floor surfaces, and the like. Although these tools have been known for many years, the vast majority of existing tools require operation of a valve to deliver fluid (e.g., floor finish, cleaning solution, etc.) to a surface.

[0003] Some conventional tools include a tool head and a handle 20 pivotally attached to the head. A valve assembly is typically mounted on the handle 20 (e.g., adjacent the head) and in fluid communication with dispensable fluid to control the flow of floor finish from a reservoir to the floor. The valve is normally closed to stop the flow of floor finish through the valve, and can be manually opened to allow the fluid to flow through the valve to be deposited on the surface. The fluid is spread over the surface by the tool head, or more specifically, by material that is attached to the head. Sometimes, the valve can become sticky or even plugged when the tool is not in use.

[0004] Generally, conventional tools do not accurately control the amount of fluid applied to the surface. In particular, existing tools dispense fluid to the surface when the valve is open regardless of whether fluid has already been applied to the surface, which can lead to wasted fluid, over-application of fluid to the surface, or other problems. In other words, these tools typically do not provide a consistent, uniform amount of fluid to the surface. Rather, the amount of fluid that is dispensed depends largely on the position of the valve and the amount of fluid in the reservoir.

SUMMARY

[0005] In some constructions, the present invention provides a maintenance tool including an elongated handle that has a proximal end and a distal end, and a first reservoir that is coupled to

the handle and that defines a first volume to support a first amount of fluid. The maintenance tool also includes a head pivotably coupled to the proximal end of the handle. The head defines a second reservoir that has a second volume to support a second amount of fluid. The head also defines a manifold communicating with the second reservoir. An inlet port is coupled to the head and fluidly connects the first reservoir to the second reservoir such that fluid flows by gravity from the first reservoir to the second reservoir. A pad is coupled to the head and is in communication with the manifold. The pad has a capillary gradient and is positionable on a surface to draw fluid from the manifold and to control delivery of fluid to the surface via capillary action.

[0006] The present invention also provides a maintenance tool including an elongated handle that has a proximal end and a distal end, and a first reservoir that is coupled to the handle and that defines a first volume to support a first amount of fluid. The maintenance tool also includes a head pivotably coupled to the proximal end of the handle. The head defines a second reservoir that has a second volume to support a second amount of fluid. The second reservoir defines a headspace above the fluid, and an inlet port is coupled to the head and fluidly connects the first reservoir to the second reservoir such that fluid flows from the first reservoir to the second reservoir. An air restrictor is coupled to the head and is in fluid communication with the headspace. The maintenance tool also includes a pad that is coupled to the head and that is in communication with the second reservoir. The pad has a capillary gradient and is positionable on a surface to draw fluid from the second reservoir. The pad also cooperates with the air restrictor to control delivery of fluid to the surface via capillary action.

[0007] The present invention also provides a maintenance tool including a hand-held housing that has a reservoir defining a volume to support an amount of fluid, and a pad that is coupled to the housing and that is in communication with the reservoir. The pad has a capillary gradient and is positionable on a surface to draw fluid from the reservoir and to control delivery of fluid to the surface via capillary action.

[0008] Other aspects of the present invention will become apparent by consideration of the description and accompanying drawings.

DRAWINGS

[0009] Fig. 1 is a perspective view of a maintenance tool embodying the invention.

[0010] Fig. 2 is a perspective view of a tool head of the tool illustrated in Fig. 1 including a base and a handle attachment.

[0011] Fig. 3 is another perspective view of the tool head.

[0012] Fig. 4 is a top view of the tool head.

[0013] Fig. 5 is a perspective view of a portion of the tool head.

[0014] Fig. 6 is a perspective view of a lower portion of the tool head.

[0015] Fig. 7 is a bottom view of the tool head.

[0016] Fig. 8 is a section view of the tool head taken along line 8-8 of Fig. 3.

[0017] Fig. 9 is an enlarged view of a portion of the tool head of Fig. 8.

[0018] Fig. 10 is a top view of the tool head with the base removed.

[0019] Fig. 11 is a perspective view of the base.

[0020] Fig. 12 is a top view of the base.

[0021] Fig. 13 is a perspective view of the handle attachment of Fig. 2.

[0022] Fig. 14 is a perspective view of another maintenance tool including a housing, a cap, and a skirt embodying the invention.

[0023] Fig. 15 is another perspective view of the maintenance tool of Fig. 14 with the skirt removed and exposing a pad attached to the tool.

[0024] Fig. 16 is a bottom view of the maintenance tool of Fig. 14 with the skirt and the pad removed.

[0025] Fig. 17 is a perspective view of the cap.

[0026] Fig. 18 is another perspective view of the cap.

[0027] Before any embodiments of the invention are explained in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of components set forth in the following description or illustrated in the accompanying drawings. The invention is capable of other embodiments and of being practiced or of being carried out in various ways.

DETAILED DESCRIPTION

[0028] Fig. 1 illustrates an applicator or maintenance tool 10 that can be used to apply a fluid to a floor or other surface 15 (e.g., stairs, walls, ceilings, windows, bed rails, sinks, countertops, etc.) to clean the surface or apply a finish (e.g., wax, cleaning product, sealant, polish, protective coating, etc.) to the surface 15. As used herein, the term "surface" is intended to include any surface that can be maintained, and the fluid can be, for example, a composition providing a temporary or permanent protective coating to the surface 15, or a cleaning composition for the surface 15.

[0029] The maintenance tool 10 includes a handle 20 that has a first or proximal end 25 and a second or distal end 30 attached to a tool head 35. The proximal end 25 is manually engageable to move the tool head 35 along the surface 15. As illustrated, a reservoir support 40 is attached to (e.g., snap fit onto) the handle 20 and has a wall that defines an upwardly accessible sleeve 50 to support a first reservoir 55. The first reservoir 55 is disposed in the sleeve 50 and defines a first volume to support a first amount of fluid. As shown in Fig. 1, the first reservoir 55 is defined by a rigid body and is supported in the sleeve 50 near a middle of the reservoir support 40 such that a portion of the reservoir support 40 is below the reservoir 55. In other constructions, the first reservoir 55 can be arranged in other ways on the handle 20.

[0030] The first reservoir 55 has an inlet 60 located adjacent an upper end of the reservoir 55, and an outlet 65 located adjacent a lower end of the reservoir 55. The inlet 60 has a bib or connector 70 to permit filling the first reservoir 55 with additional fluid. The outlet 65 is

accessible through a partition 75 in the wall of the reservoir support 40, and a conduit 80 is connected to the outlet 65 to fluidly connect the reservoir 55 to the tool head 35. The reservoir 55 can have a restriction orifice 85 located adjacent the outlet 65 to provide controlled fluid leakage from the first reservoir 55. A valve 90 is coupled to the conduit 80 to control fluid flow from the first reservoir 55 toward the tool head 35. It is preferable to position the valve 90 as low as possible on the conduit 80 to minimize the amount of fluid that is delivered to the tool head 35 after the valve 90 is closed, although the valve 90 can be located anywhere on the conduit 80. The valve 90 can be a butterfly or ball valve, or another valve suitable for controlling fluid flow from the first reservoir 55. For example, the valve 90 can be a motor or solenoid-driven valve, or an inertia valve, instead of a manual shutoff valve. In some constructions, the tool 10 can be provided without the valve 90.

[0031] With reference to Figs. 1, 2, and 4, the tool head 35 is pivotably coupled to the proximal end of the handle 20 by a handle attachment member 95. As shown in Fig. 13, the handle attachment member 95 is defined by a pivot body 100 that has axially aligned pivots 105 located adjacent a relatively wide base end 110 and a tapered end 115 opposite the base end 110. Figs. 2 and 4 show the pivots 105 engaged with pivot supports 120 on the tool head 35 so that the handle attachment member 95 and the handle 20 can pivot relative to the tool head 35 about a pivot axis 125 (Fig. 4).

[0032] Referring back to Fig. 13, the tapered end 115 has a first hole 130 extending through the pivot body 100 in one direction to facilitate attachment of the handle 20 to the handle attachment member 95. A second hole 135 extends through a middle section of the pivot body 100 (i.e., between the base end 110 and the tapered end 115) in a direction parallel to the pivot axis 125 to accommodate attachment of another handle (not shown). The first and second holes 130, 135 and the pivots 105 cooperate to provide a universal pivot attachment between the handle 20 (or another handle) and the tool head 35.

[0033] With reference to Figs. 1, 2, and 4, the tool head 35 has an elongated body with a first or leading edge 140 and a second or trailing edge 145 opposite the leading edge 140. A longitudinal axis 150 extends along the length of the elongated body between the leading and

trailing edges 140, 145, and a cross axis 155 extends orthogonal to the longitudinal axis 150 along the width of the elongated body.

[0034] Figs. 1-11 show that the tool head 35 has a housing 160 and a base 165 that is coupled to the housing 160, although the housing 160 and the base 165 can be formed as an integral unit (e.g., by molding, co-molding, etc.). Referring to Figs. 4, 5, 8, and 10-12, the housing 160 has a flange 170 at the lower end of the tool head 35, and the base 165 has an elongated (e.g., circuitous) recess 175 to which the flange 170 is mated. Fasteners (not shown) extend through first holes 180 disposed along the periphery of the flange 170 into second blind holes 185 disposed in the base 165 to detachably couple the base 165 to the tool head 35.

[0035] With reference to Figs. 1, 4, 11, and 12, the elongated recess 175 is disposed in the base 165 adjacent the leading edge 140 such that the housing 160 is located substantially forward of the longitudinal axis 150. As shown in Figs. 2-5 and 8-10, the housing 160 is substantially upright relative to the base 165 and defines a second reservoir 190 that has a second volume to support a second amount of fluid. The second reservoir 190 is disposed in a neck area of the tool head 35 and defines a headspace 195 above the fluid and near an access opening 200 in the housing 160. With reference to Fig. 3, the illustrated tool head 35 includes indicia 205 for determining the fluid level in the second reservoir 190. In some constructions, a float valve assembly can be disposed in the second reservoir 190 to maintain a predetermined amount of fluid in the second reservoir 190.

[0036] An air restriction device 210 (e.g., an air restrictor with a continuously open, narrow passageway, a check valve, etc.) can be coupled to the tool head 35 in fluid communication with the headspace 195 via one of a plurality of passageways 215 disposed in the housing 160 to assist with metering fluid through the tool 10. As illustrated in Fig. 9, the passageway 215a to which the air restriction device 210 is attached extends vertically downward from a top of the housing 160 and intersects a second passageway 215b extending laterally into the housing 160 and in direct communication with the headspace 195. The air restriction passageway 215a has an enlarged cavity to accommodate the air restriction device 210, although the passageway can have any size suitable for attaching an instrument to the housing 160 and for providing communication with the headspace 195. The illustrated housing 160 also has two more

passageways 215c, 215d on the other side of the housing that are substantially symmetrical to the first and second passageways 215a, 215b. The four passageways 215 illustrated in Fig. 9 can accommodate several instruments (e.g., pressure sensors, gauges, etc.) or other components that can be coupled to the tool head 35 and fluidly communicating with the headspace 195 (in addition or in lieu of the air restriction device 210). Any unused passageways 215 can be closed off using a plug 220.

[0037] An inlet port 225 is coupled to the housing 160 within the access opening 200 and fluidly connects the conduit to the tool head 35 so that fluid flows by gravity from the first reservoir 55 to the second reservoir 190. As shown in Figs. 5, 8, and 9, the inlet port 225 extends into the top of the housing 160 a predetermined distance, although the distance is adjustable to vary the second amount of fluid maintained in the second reservoir 190. The valve 90 selectively controls flow of fluid from the first reservoir 55 to the second reservoir 190. The distance that the inlet port 225 extends into the tool head 35 and the amount of fluid in the conduit 80 and entering the inlet port 225 cooperatively determine the depth of the fluid supported in the second reservoir 190 and the size of the headspace 195.

[0038] With reference to Figs. 8 and 9, the housing 160 also includes a manifold 230 communicating with the second reservoir 190. The base is attached to the tool head 35 such that the manifold 230 is positioned closer to the leading edge 140 than the trailing edge 145 so fluid is dispensed in close proximity to the leading edge 140. The manifold 230 extends a substantial length of the tool head 35 parallel to the longitudinal axis 150 and is defined by a wall 235 that tapers smaller extending away from the second reservoir 190 such that the volume of the manifold 230 decreases toward the outer edges of the tool head 35. In this manner, fluid is substantially evenly distributed along the length of the tool head 35 (i.e., parallel to the longitudinal axis 150).

[0039] Internal baffles 240 are disposed between the second reservoir 190 and the manifold 230 to meter fluid from the second reservoir 190 to the manifold 230. The illustrated tool head 35 has four baffles 240, although more or fewer than four baffles can be provided in the housing 160 to meter the fluid to the manifold 230. Two centrally located baffles 240a are longer than the outermost baffles 240b, which partially define a boundary between the second reservoir 190

and the manifold 230. The baffles 240a, 240b are positioned in the housing 160 so that fluid from the second reservoir 190 meters laterally outward (i.e., generally parallel to the longitudinal axis 150) into the manifold 230 via openings 245 in the bottom of the baffles 240a, 240b.

[0040] As shown in Figs. 7 and 11, the base 165 is symmetrical about the cross axis 155. The pivot supports 120 are disposed on and extend upward from the base 165 on both sides of the cross axis 155 adjacent edges of a hole 250 that extends completely through the base 165. Fig. 12 shows a cover 255 that can be placed over the hole 250 to inhibit fluid leakage through the hole 250 after the handle attachment member 95 is coupled to the tool head 35. The pivot supports 120 are further located directly behind the housing 160 relative to the leading and trailing edges 140, 145 and offset from the longitudinal center 150 of the base 165 such that the pivot supports 120 are located closer to the trailing edge 145 than the leading edge 140.

[0041] The illustrated base 165 is elongated (e.g., rectangular) and defines the first or leading edge 140 and the second or trailing edge 145 of the tool head 35 that is substantially parallel to the leading edge 140. In other constructions, the base 165 can be defined by other shapes (e.g., circular, ovular, triangular, square, etc.). As shown in Figs. 5-9, 11, and 12, the base 165 has a plurality of fluid passages 260 spaced apart from each other along the longitudinal axis and in fluid communication with the manifold 230 to communicate fluid from the manifold 230 through the base 165 to a pad 265 that is coupled to the underside of the base 165. Each passage 260 is defined by an aperture 270 on the top side of the base 165, and an elongated channel 275 on the underside of the base 165. Each illustrated elongated channel 275 extends substantially parallel to the cross axis 155, although one or more of the elongated channels 275 can extend in other directions. With reference to Figs. 5-8, the underside of the base 165 has a recessed surface 280 that defines an elongated (e.g., rectangular) cavity 285 located closer to the leading edge 140 than the trailing edge 145. The elongated channels 275 break through the recessed surface 280 such that the passages 260 are in fluid communication with the elongated cavity 285.

[0042] As shown in Figs. 5, 6, and 8, the pad 265 is coupled to the base 165 within the cavity 285 and has a thickness that is larger than the depth of the cavity 285 so that a portion of the pad 265 protrudes outward (downward) from the base 165. The pad 265 is in communication with the second reservoir 190 via the manifold 230 and the fluid passages 260. The pad 265 is

constructed to limit fluid flow from the manifold 230 in response to a predetermined amount of fluid disposed on the surface 15. Stated another way, the pad 265 is formed from material (e.g., fibrous material such as felt, a polyolefin, cellulose, dual density, or other cleaning material or implement) that has a predetermined capillary gradient and relies on capillary action to selectively apply fluid to the surface 15. For example, when the pad 265 is placed on a relatively dry surface 15, fluid is evenly applied by the pad 265 onto the surface 15 based on the capillary gradient of the pad 265 regardless of the speed at which the tool 10 is maneuvered across the surface 15. On the other hand, when the pad 265 is placed on a wetted surface 15, little or no fluid is applied by the pad 265 to the surface 15. The capillary gradient of the pad 265 generally permits fluid flow through the pad 265 as quickly as necessary to maintain a saturated state.

[0043] With reference to Figs. 6 and 7, pad sections 290 are coupled to the underside of the base 165 within pockets 295 to balance the tool head 35 on the surface 15 in the direction of the cross axis 155 and about the longitudinal axis 150. In other words, the pad sections 290 cooperate with the pad 265 to balance the tool head 35 fore and aft when the tool head 35 is placed on or moved across the surface 15. As illustrated, the pockets 295 are located adjacent the trailing corners of the base 165. Additional pad sections 290 and corresponding pockets 295 can be provided on the base 165 to assist with balancing the tool head 35 on the surface 15. Alternatively, a wider pad 265 can be used in conjunction with a wider elongated cavity 285 to balance the tool head 35 on the surface 15 without cooperative pad sections 290 and pockets 295.

[0044] To assemble the tool 10, the handle attachment member 95 is attached to the tool head 35 by directing the pivot body 100 upward through the hole 250 so that the pivots 105 on the base end 110 engage (e.g., snap into) the pivot supports 120. The handle 20 is thereafter attached to the handle attachment member 95 using the appropriate hole 130, 135. The cover 255 is placed over the hole 250 in the base 165 to inhibit fluid leakage through the hole 250 after the handle 20 is attached to the tool head 35. In constructions of the tool 10 with a separate, detachable reservoir support 40 and first reservoir 55, the reservoir support 40 is attached to the handle 20 above the tool head 35 (e.g., by snap-fit), and the first reservoir 55 is then placed in the reservoir support 40 and oriented so that the conduit 80 extends through the partitioned wall 75 of the reservoir support 40.

[0045] The pad 265 and the pad sections 290 are attached to the tool head 35 within the cavity 285 and the pockets 295, respectively, prior to maneuvering the tool 10 along the surface 15 to clean, polish, or apply a finish to the surface 15. In constructions of the tool 10 including the air restriction device 210 and one or more gauges, the device 210 and the gauge(s) are also attached to the appropriate passageways 215 in the housing 160 before operating the tool 10.

[0046] Depending on the capillary gradient, the pad 265 can completely control the flow of fluid from the second reservoir 190 to the surface 15. Generally, fluid is metered onto the surface 15 through the pad 265 only when the surface 15 is dry or substantially dry. The relatively small apertures 270 of the passages 260 communicating with the manifold 230 control fluid flow from the manifold 230, and the elongated channels 275 distribute fluid across the width of the pad 265 to saturate the pad 265. The capillary gradient of the pad 265 maintains the pad 265 in a saturated state without over-saturation by selectively drawing fluid from the manifold 230 without fluid leakage through the pad 265 when the tool 10 is manipulated on a wetted surface 15.

[0047] The valve 90, when provided on the conduit 80, controls flow of fluid from the first reservoir 55. To apply fluid to the surface 15, the valve 90 is opened to permit fluid flow to the second reservoir 190. The restriction orifice 85, when provided in the outlet 65 of the first reservoir 55, assists with providing controlled fluid leakage from the first reservoir 55. Shortly after the valve 90 is opened, fluid fills the second reservoir 190 and the manifold 230 laterally before vertically, and the pad 265 begins to draw fluid from the second reservoir 190 through the manifold 230 and the passages 260 via capillary action. When the pad 265 is saturated with fluid, the user can then maneuver the tool 10 across the surface 15 at a desired pace to apply the fluid to the surface 15. During operation, the pad 265 continuously draws fluid from the second reservoir 190 as fluid is deposited on the surface 15. The rate at which the fluid is deposited on the surface 15 substantially depends on the wetness or dryness of the surface 15, not on the speed at which the tool 10 is maneuvered over the surface 15. That is, the pad 265 applies a relatively high rate of fluid to the surface 15 when the surface 15 is substantially dry, and applies a relatively low rate of fluid (or no fluid) to the surface 15 when the surface 15 is substantially wet. Generally, there is no "ideal" speed for applying the fluid because the pad 265 will evenly

distribute fluid to the surface 15 by capillary action based on surface conditions, not on user input.

[0048] The distance that the inlet port 60 extends into the housing 160 determines the fluid level in the second reservoir 190. The amount of fluid supported in the second reservoir 190 and the manifold 230 is relatively small so that a user can close the valve 90 and continue applying fluid onto the surface 15 for a short time after the valve 90 is closed. In doing so, the second reservoir 190 is substantially depleted of fluid so that the tool 10 can thereafter be stored in any desired location.

[0049] In constructions of the tool 10 without the valve 90, the capillary gradient of the pad 265 provides enough control of the fluid so that as long as the tool 10 is placed on a wetted surface 15, fluid flow through the pad 265 is halted. More specifically, the inlet port 60 maintains a predetermined fluid level in the second reservoir 190 such that when fluid flow through the pad 265 stops, no additional fluid is delivered to the second reservoir 190 from the first reservoir 55.

[0050] The first reservoir 55, the inlet port 60, and the pad 265 cooperate with each other to maintain a substantially constant fluid level in the second reservoir 190 (e.g., 2 inches) and a predetermined static fluid head pressure so that fluid can be evenly distributed onto the surface 15. The air restriction device 210, when used, provides smoother metering and head pressure control for fluid flowing through the pad 265 by delivering a relatively small amount of air to the headspace 195 during operation of the tool 10 to avoid a vacuum state that may otherwise occur in the tool head 35. In this manner, the air restriction device 210 and the pad 265 cooperatively control delivery of fluid to the surface 15 via capillary action.

[0051] Figs. 14-18 illustrate another maintenance tool 310 that can be used to apply a fluid to the surface 15. The illustrated tool 310 has a housing 315 and a pad 320 coupled to the housing 315. The housing 315 defines a reservoir 325 that has a volume to support dispensable fluid. As illustrated, the reservoir 325 includes a relatively narrow or tapered first end 330 and a relatively wide second end 335 with curved sidewalls 340 connecting the first end 330 to the second end 335 so that the tool 310 fits comfortably in the hand of a user. The housing 315 is further

defined by a concave portion 345 or section located between the first end 330 and the second end 335 to provide flexibility to the pad 265 relative to the housing 315 during use.

[0052] With reference to Figs. 14-16, the housing 315 has an inlet port 350 located near the uppermost point of the tool 10 and adjacent the second end 335 so that the reservoir 325 can be filled with fluid. A plug or cap 355 is disposed in the inlet port 350 to seal the reservoir 325. As shown in Figs. 17 and 18, the cap 355 is tapered to snugly fit into the inlet port 350. The illustrated cap 355 is hollow and defines an air restriction device 210 that permits entry of air into the reservoir 325 to avoid creating a vacuum in the reservoir 325 while at the same time inhibiting fluid flow from the reservoir 325 through the inlet port 350 to prevent leakage. For example, the cap 355 can include a membrane 360 that is positioned over (i.e., across) the hollow of the cap 355 to permit air flow into the reservoir 325 while inhibiting fluid flow from the reservoir 325. Generally, the membrane 360 can be formed from any suitable material (e.g., a Gore-Tex ®, manufactured by W. L. Gore & Associates, Inc., Flagstaff, AZ) that acts like a check valve.

[0053] As shown in Fig. 16, the housing 315 also has orifices or passages or outlet ports 365 located along the underside of the housing 315 and protruding outward from bottom surfaces 367 of the housing 315. The illustrated tool 310 has two outlet ports 365 spaced apart from each other, one each located adjacent the first end 330 of the housing 315 and the second end 335 of the housing 315, although the tool 310 can be provided with one outlet port or more than two outlet ports.

[0054] The pad 320 is attached to the housing 315 by pad attachment arms 370 that extend outward and downward from the bottom surfaces 367 of the housing 315. The pad attachment arms 370 can be formed as part of the housing 315 (e.g., by molding or co-molding), or the pad attachment arms 370 can be attached to the housing 315 using a suitable attachment mechanism (e.g., adhesion, fasteners, etc.). The illustrated pad attachment arms 370 include one portion of a hook and loop fastening mechanism 375 that is engaged by the pad 320 so that the pad 320 is removably secured to the underside of the housing 315. Other attachment mechanisms can be used in place of the hook and loop fastening system 375 to removably attach the pad 320 to the housing 315. As shown, a cleaning skirt 380 that is formed of a non-woven material (e.g.,

microfiber) encapsulates or covers the pad 320 to apply fluid to the surface 15. The skirt 380 has an elastic opening or perimeter 385 and can be reusable or disposable. In some constructions, the tool 310 can be provided without the skirt 380.

[0055] Referring back to Figs. 14-16, the illustrated pad 320 is generally contoured to the shape of the housing 315 (i.e., the pad has a tapered front portion and a relatively wide rear portion). The pad 320 has a thickness that is larger than the distance that the pad attachment arms 370 extend downward from the bottom surface of the housing 315 so that a portion of the pad 320 protrudes outward (downward) from the housing 315. The pad 320 is constructed to limit fluid flow from the manifold 230 in response to a predetermined amount of fluid disposed on the surface 15. Like the pad 265 described with regard to Figs. 1-13, the pad 320 illustrated in Figs. 14 and 15 is formed from material (e.g., fibrous material such as felt, a cleaning cloth, or other cleaning material or implement) that has a predetermined capillary gradient and that relies on capillary action to selectively apply fluid to the surface 15. For example, when the pad 320 is placed on a relatively dry surface 15, fluid is evenly applied by the pad 320 onto the surface 15 based on the capillary gradient of the pad 320 regardless of the speed at which the tool 310 is maneuvered across the surface 15. On the other hand, when the pad 320 is placed on a wetted surface 15, little or no fluid is applied by the pad 320 onto the surface 15. The capillary gradient of the pad 320 permits fluid flow through the pad 320 as quickly as necessary to maintain a saturated state. There is no "ideal" speed for applying the fluid because the pad 320 will evenly distribute fluid to the surface by capillary action based on surface 15 conditions, not on user input.

[0056] When the pad 320 is attached to the housing 315, the outlet ports 365 extend into and are engaged with the pad 320 so that fluid is drawn into the pad 320 by capillary action. Also, the concave portion 345 of the housing 315 permits flexing of the pad 320 so that the pad 320 can conform to a curved surface 15 (e.g., bed rails, etc.) Like the pad 265, the capillary gradient of the pad 320 controls the flow of fluid from the reservoir 325 to the surface 15. Fluid is metered onto the surface 15 through the pad 320 only when the surface 15 is dry or substantially dry. In other words, the pad 320 draws fluid from the reservoir 325 through the outlet ports 365 as necessary to apply fluid to the surface 15.

[0057] In the event the tool 310 is manipulated over a wetted portion of the surface 15, the capillary gradient of the pad 320 limits the amount of fluid drawn by the pad 320 as well as the amount of fluid applied by the pad 320 to the surface 15. In this manner, the pad 320 acts as a valve to control fluid delivery to the surface 15 based on the dryness (or wetness) of the surface 15. The capillary draw of fluid from the reservoir 325 may slow or stop when the tool 310 is maneuvered over substantially wetted surfaces 15 for a length of time. The capillary gradient of the pad 320 maintains the pad 320 in a saturated state without over-saturation by selectively drawing fluid from the manifold 230 without fluid leakage through the pad 320 when the tool 310 is manipulated on a wetted surface 15.

[0058] After the pad 320 is saturated with fluid, the pad 320 can be used to apply fluid to the surface 15 without the need to vary a valve from an open state to a closed state. During operation, the pad 320 continuously draws fluid from the reservoir 325 as fluid is deposited on the surface 15. The rate at which the fluid is deposited on the surface 15 substantially depends on the wetness or dryness of the surface 15, not on the speed at which the tool 310 is maneuvered over the surface 15. That is, the pad 320 applies a relatively high rate of fluid to the surface 15 when the surface 15 is substantially dry, and applies a relatively low rate of fluid (or no fluid) to the surface 15 when the surface 15 is substantially wet.

[0059] The capillary gradient of the pad 320 provides enough control of the fluid so that as long as the tool 310 is placed on a wetted surface 15, fluid flow through the pad 320 is halted. The air restriction device (e.g., the membrane 360), when used, provides smoother metering control for fluid flowing through the pad 320 by delivering air to the reservoir 325 during operation of the tool 310 to avoid a vacuum state that may otherwise occur in the tool 310. In this manner, the air restriction device 210 and the pad 320 cooperatively control delivery of fluid to the surface 15 via capillary action.

[0060] The tools 10, 310 described with regard to Figs. 1-18 embody devices that provide automatic fluid flow metering through the respective pads 265, 320 and a consistent fluid application to the surface 15 without user intervention or manipulation of a valve near the pads 265, 320 during use of the tools 10, 310. Generally, the tools 10, 310 are defined by an open fluid flow system in which the pads 265, 320 meter the fluid from the reservoir (e.g., the second

reservoir 190 or the reservoir 325). With regard to the tool 10 of Figs. 1-13, the amount of fluid in the second reservoir 190 is cooperatively maintained by the air restriction device 210, the inlet port 225, and the pad 265 so that the capillary gradient of the pad 265 is not overwhelmed by fluid pressure above the pad 265.

[0061] Various features and advantages of the invention are set forth in the following claims.

CLAIMS

1. A maintenance tool comprising:

an elongated handle having a proximal end and a distal end;

a first reservoir coupled to the handle and defining a first volume to support a first amount of fluid;

a head pivotably coupled to the proximal end of the handle and defining a second reservoir having a second volume to support a second amount of fluid, the head further defining a manifold communicating with the second reservoir;

an inlet port coupled to the head and fluidly connecting the first reservoir to the second reservoir such that fluid flows by gravity from the first reservoir to the second reservoir;

a pad coupled to the head and in communication with the manifold, the pad having a capillary gradient and positionable on a surface to draw fluid from the manifold and to control delivery of fluid to the surface via capillary action.

2. The maintenance tool of claim 1, further comprising a base coupled to the head, and wherein the pad is coupled to the base.

3. The maintenance tool of claim 2, wherein the base is detachably coupled to the head.

4. The maintenance tool of claim 2, wherein the base has an elongated cavity located on an underside of the base and a plurality of passages extending through the base, and wherein the pad is attached to the base within the cavity and is in communication with the manifold via the apertures.

5. The maintenance tool of claim 3, wherein the head has an elongated body with a longitudinal axis and a cross axis orthogonal to the longitudinal axis, and wherein the plurality of passages are partially defined by elongated channels along the underside of the base and extending substantially parallel to the cross axis.

6. The maintenance tool of claim 5, wherein the manifold extends a substantial length of the head parallel to the longitudinal axis and the passages define apertures in the top of the base and in fluid communication with the manifold.

7. The maintenance tool of claim 2, wherein the base has a first edge and a second edge opposite the first edge, and wherein the base is attached to the head such that the manifold is positioned closer to the first edge than the second edge.

8. The maintenance tool of claim 6, further comprising a handle attachment mechanism located between the manifold and the second edge.

9. The maintenance tool of claim 2, wherein the base has a circuitous recess, and wherein the head has a flange coupled to the base within the recess.

10. The maintenance tool of claim 2, wherein the base has a pocket, the maintenance tool further comprising a pad portion disposed in the pocket to balance the pad relative to the head.

11. The maintenance tool of claim 1, wherein the pad is constructed to limit fluid flow from the manifold in response to a predetermined amount of fluid disposed on the surface.

12. The maintenance tool of claim 1, further comprising a conduit fluidly connecting the second reservoir to the first reservoir and a valve coupled to the conduit to selectively control flow of fluid from the first reservoir to the second reservoir.

13. The maintenance tool of claim 1, wherein the first reservoir, the inlet port, and the pad cooperate with each other to maintain a substantially constant fluid level in the second reservoir and a predetermined static fluid head pressure above the pad.

14. The maintenance tool of claim 13, wherein the second reservoir defines a headspace above the fluid, the maintenance tool further comprising an air restriction device coupled to the head and fluidly communicating with the headspace to meter fluid through the pad.

15. The maintenance tool of claim 1, wherein the first reservoir is defined by a rigid body and has a restriction orifice located adjacent an outlet of the first reservoir to provide controlled fluid leakage from the first reservoir.

16. The maintenance tool of claim 1, wherein the inlet port extends into the head a distance, and wherein the distance is adjustable to vary the second amount of fluid in the second reservoir.

17. The maintenance tool of claim 1, wherein the head includes indicia for determining the fluid level in the second reservoir.

18. The maintenance tool of claim 1, wherein the head includes internal baffles disposed between the second reservoir and the manifold to meter fluid from the second reservoir to the manifold.

19. The maintenance tool of claim 1, wherein the head includes indicia for determining the fluid level in the second reservoir.

20. A maintenance tool comprising:

an elongated handle having a proximal end and a distal end;

a first reservoir coupled to the handle and defining a first volume to support a first amount of fluid;

a head pivotably coupled to the proximal end of the handle and defining a second reservoir having a second volume to support a second amount of fluid, the second reservoir defining a headspace above the fluid;

an inlet port coupled to the head and fluidly connecting the first reservoir to the second reservoir such that fluid flows from the first reservoir to the second reservoir;

an air restriction device coupled to the head and in fluid communication with the headspace;

a pad coupled to the head and in communication with the second reservoir, the pad having a capillary gradient and positionable on a surface to draw fluid from the second reservoir and cooperating with the air restrictor to control delivery of fluid to the surface via capillary action.

21. The maintenance tool of claim 20, wherein the head further defines a manifold positioned within the second reservoir and communicating with the pad to provide fluid to the pad.

22. The maintenance tool of claim 20, wherein the air restriction device includes a check valve.

23. The maintenance tool of claim 20, further comprising a base coupled to the head, and wherein the pad is detachably coupled to the base.

24. The maintenance tool of claim 23, wherein the base has an elongated cavity located on an underside of the base and a plurality of passages extending through the base, and wherein the pad is attached to the base within the cavity and is in communication with the manifold via the apertures.

25. The maintenance tool of claim 24, wherein the head has an elongated body with a longitudinal axis and a cross axis orthogonal to the longitudinal axis, and wherein the plurality of passages are partially defined by elongated channels along the underside of the base and extending substantially parallel to the cross axis.

26. The maintenance tool of claim 23, wherein the base has a first edge and a second edge opposite the first edge, and wherein the base is attached to the head such that the second reservoir is positioned closer to the first edge than the second edge.

27. The maintenance tool of claim 23, wherein the base has a pocket, the maintenance tool further comprising a pad portion disposed in the pocket to balance the pad relative to the head.

28. The maintenance tool of claim 20, wherein the pad is constructed to limit fluid flow from the manifold in response to a predetermined amount of fluid disposed on the surface.

29. The maintenance tool of claim 20, further comprising conduit fluidly connecting the second reservoir to the first reservoir and a valve coupled to the conduit to selectively control flow of fluid from the first reservoir to the second reservoir.

30. The maintenance tool of claim 20, wherein the first reservoir, the inlet port, and the pad cooperate with each other to maintain a substantially constant fluid level in the second reservoir and a predetermined static fluid head pressure above the pad.

31. The maintenance tool of claim 20, wherein the first reservoir is defined by a rigid body and has a restriction orifice located adjacent an outlet of the first reservoir to provide controlled fluid leakage to the second reservoir.

32. The maintenance tool of claim 20, wherein the inlet port extends into the head a distance, and wherein the distance is adjustable to vary the second amount of fluid in the second reservoir.

33. The maintenance tool of claim 32, wherein the head includes indicia for determining the fluid level in the second reservoir.

34. The maintenance tool of claim 20, wherein the head includes internal baffles to meter fluid to the pad.

35. The maintenance tool of claim 34, wherein at least two baffles at least partially define the second reservoir.

36. A maintenance tool comprising:

a hand-held housing having a reservoir defining a volume to support an amount of fluid;

a pad coupled to the housing and in communication with the reservoir, the pad having a capillary gradient and positionable on a surface to draw fluid from the reservoir and to control delivery of fluid to the surface via capillary action.

37. The maintenance tool of claim 36, wherein the housing has an inlet port, the maintenance tool further comprising a cap disposed in the inlet port to seal the inlet port.

38. The maintenance tool of claim 37, wherein the cap is defined by material permitting airflow into the reservoir and inhibiting fluid flow from the reservoir through the inlet port.

39. The maintenance tool of claim 36, wherein the housing has a concave portion on the underside of the housing to provide flexibility to the pad.

40. The maintenance tool of claim 36, wherein the housing has a plurality of protruding outlets through which fluid is drawn into the pad by capillary action.

41. The maintenance tool of claim 40, wherein the protruding orifices extend into and are engaged with the pad to avoid leakage.

42. The maintenance tool of claim 36, further comprising a skirt positioned over the pad and secured to the housing via an attachment mechanism.

43. The maintenance tool of claim 42, wherein the skirt is formed of a non-woven material.

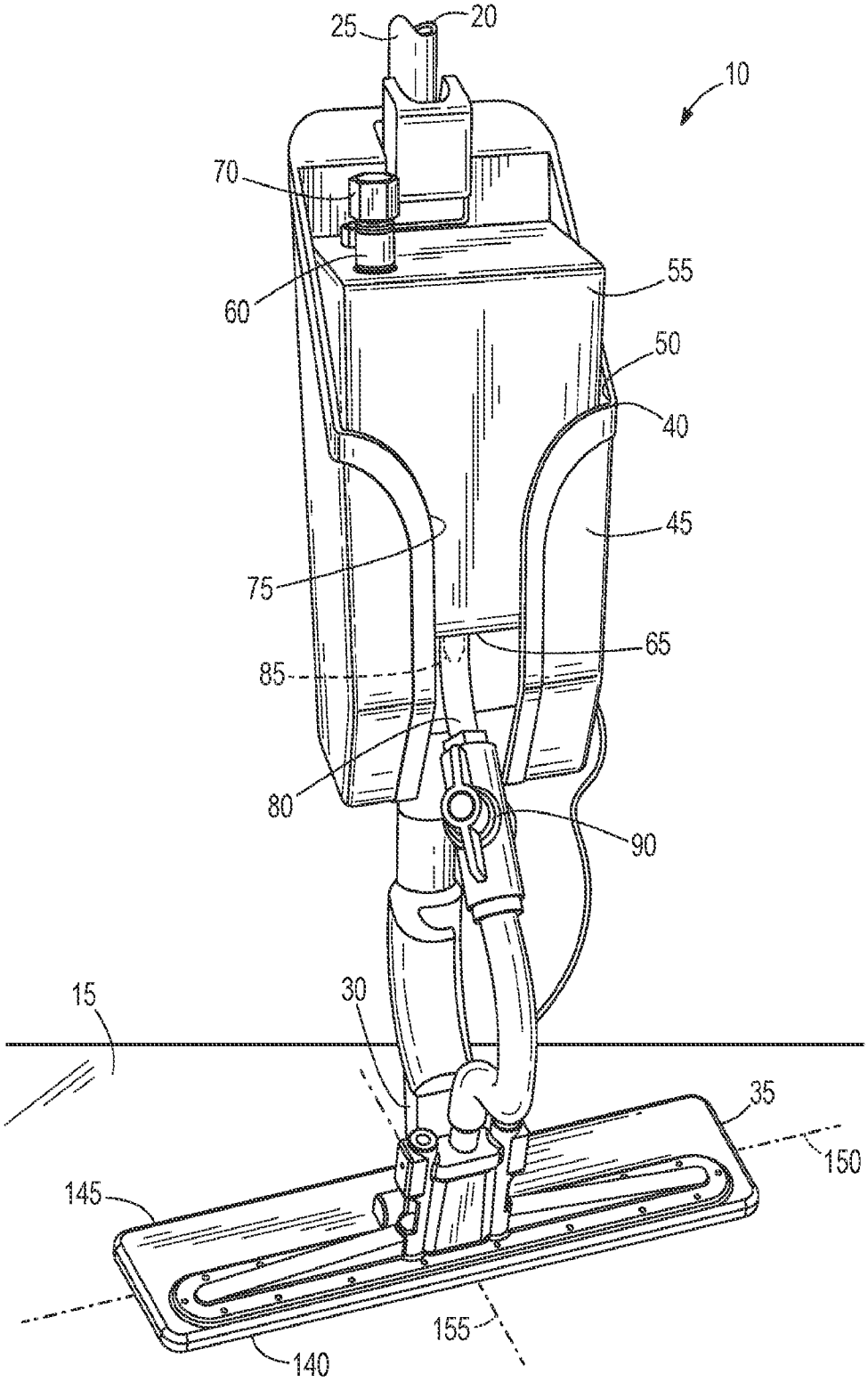


FIG. 1

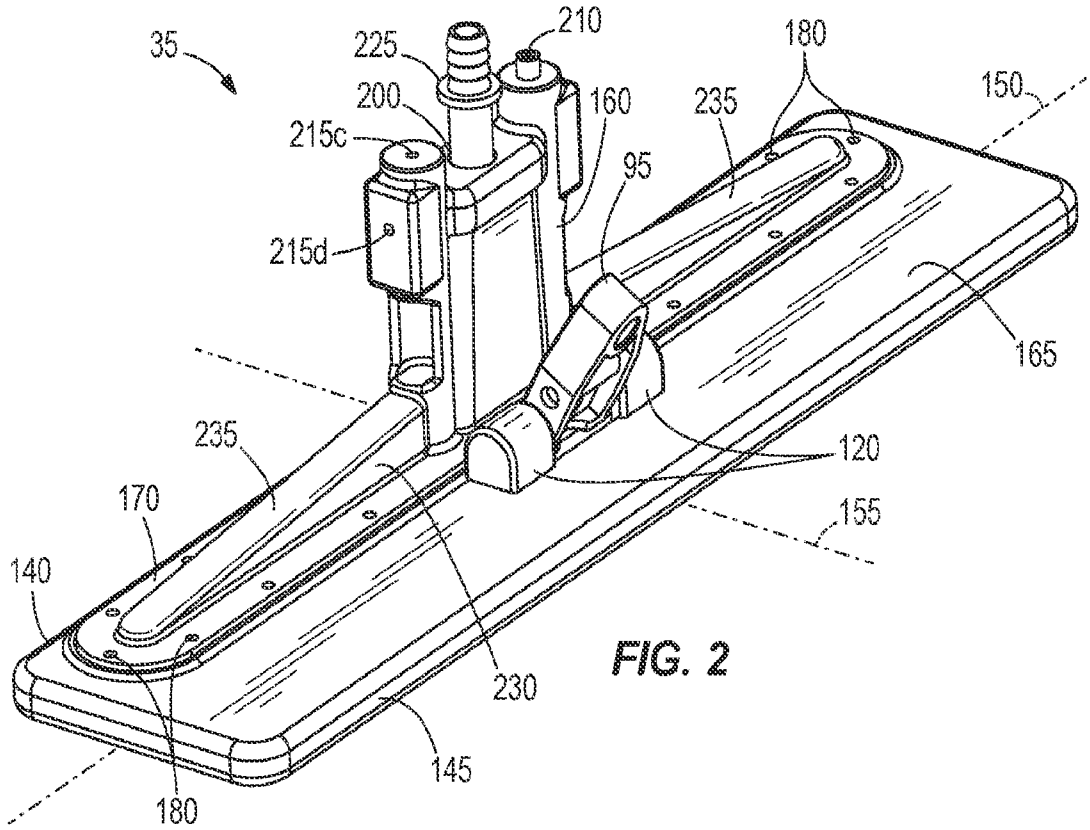

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FIG. 2

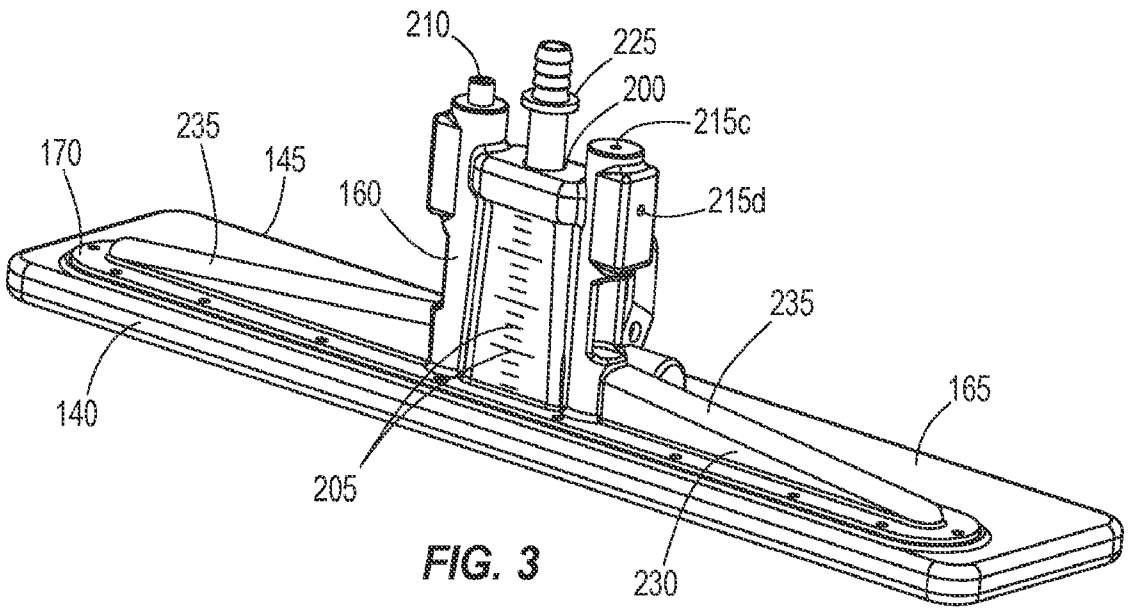

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FIG. 3

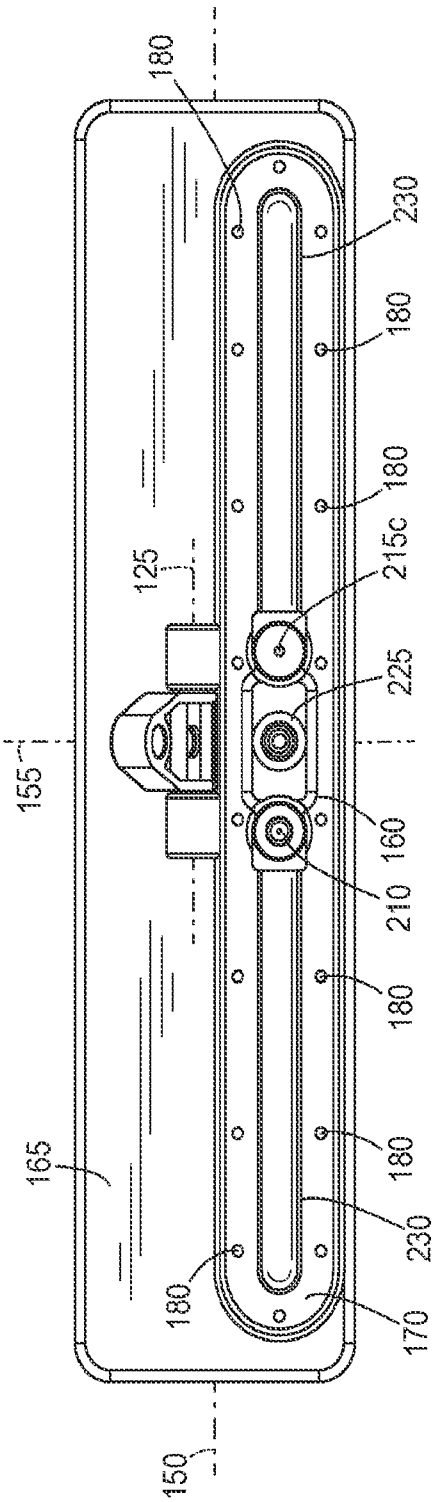

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FIG. 4

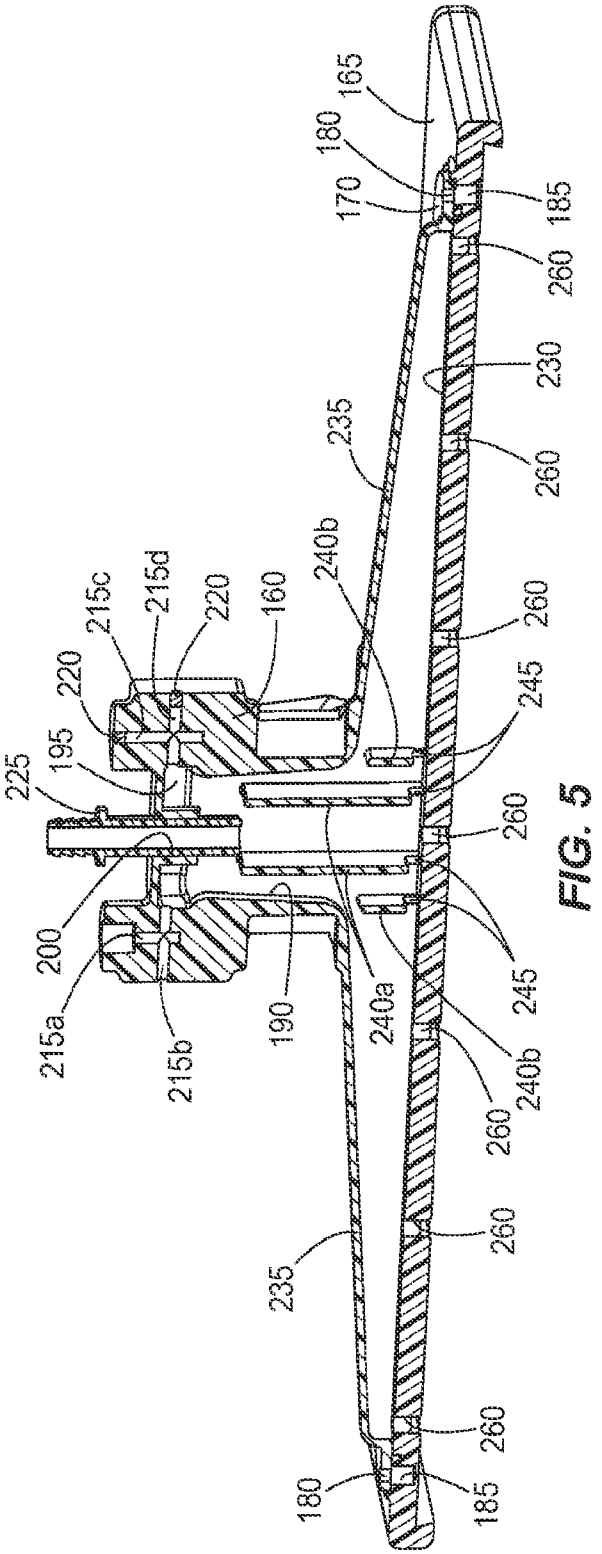

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FIG. 5

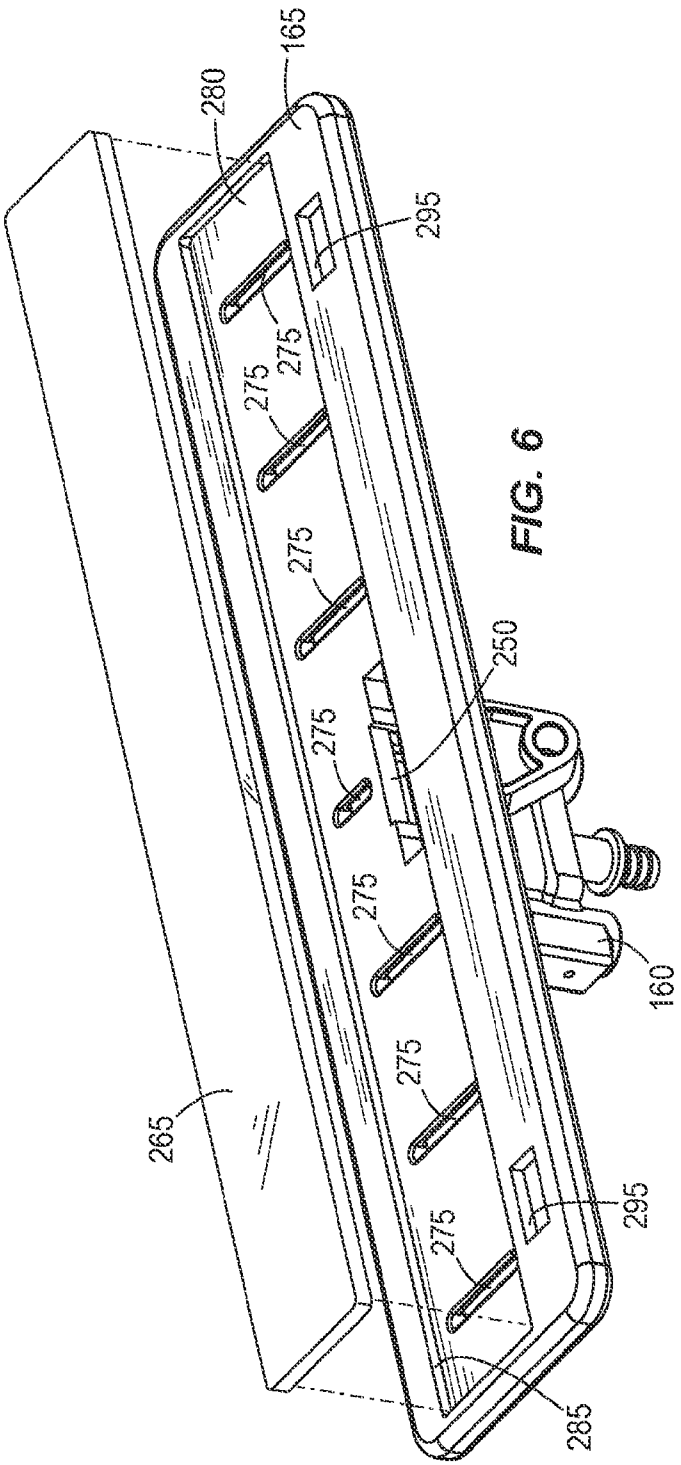


FIG. 6

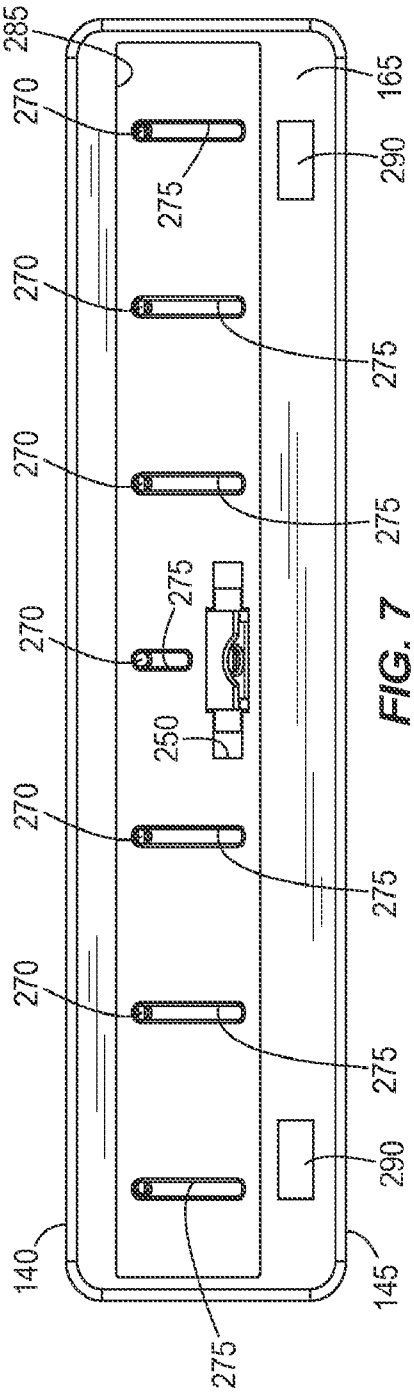


FIG. 7

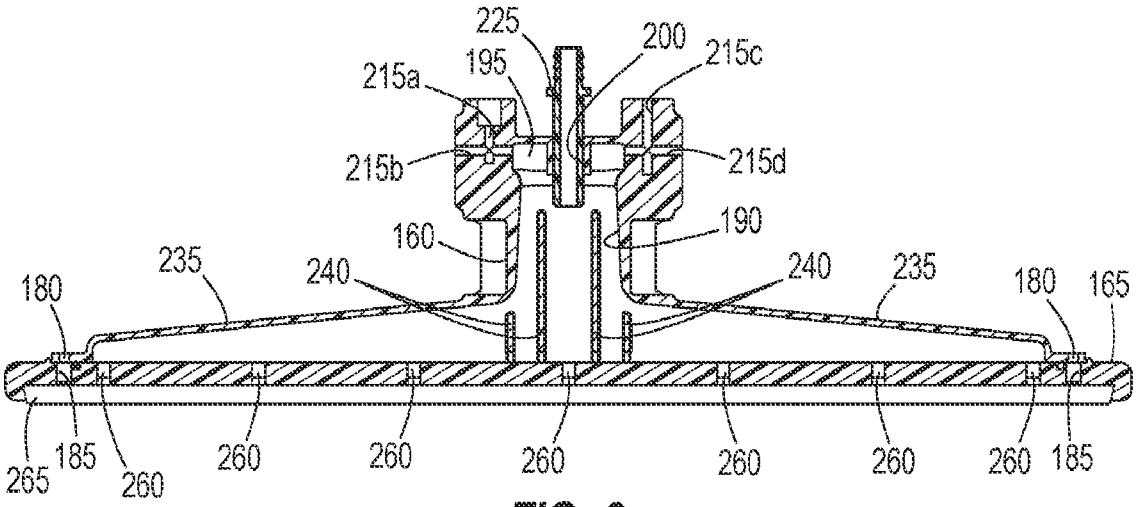

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FIG. 8

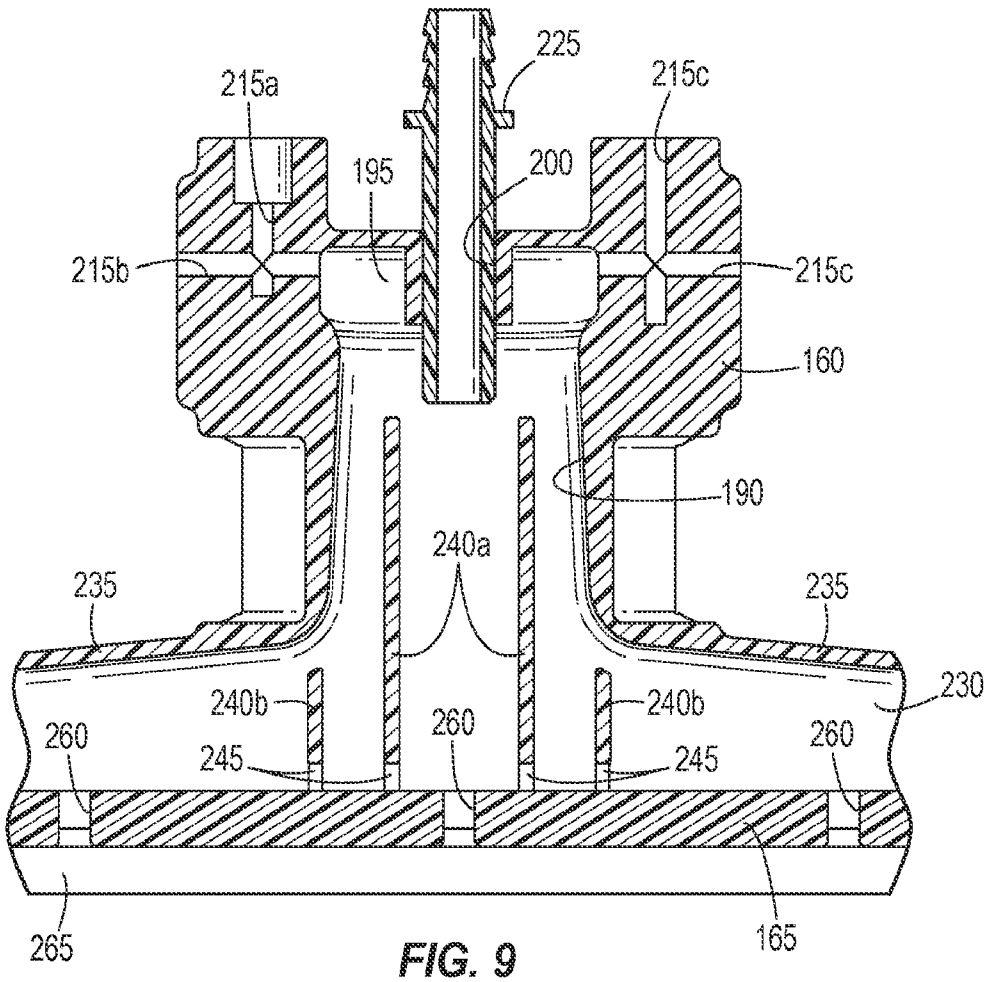

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FIG. 9

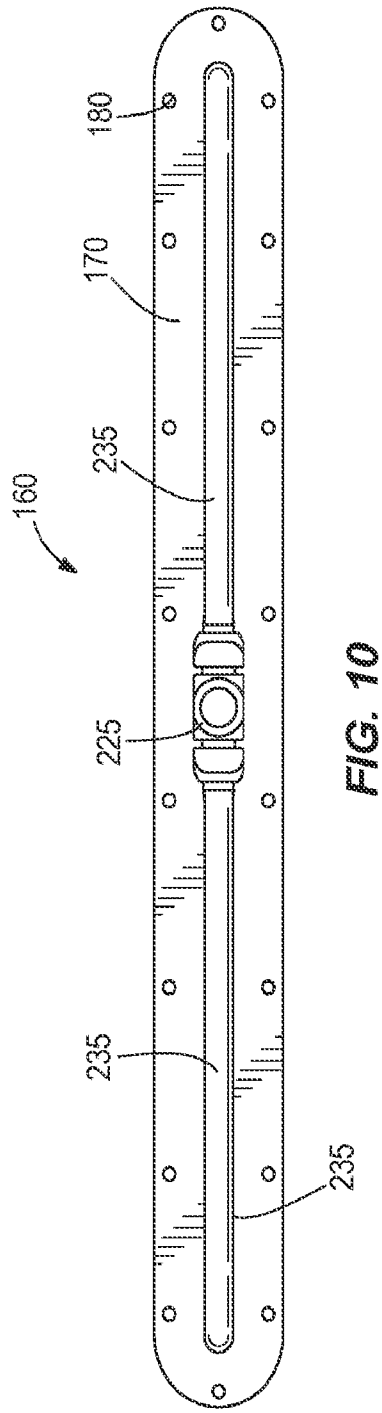

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FIG. 10

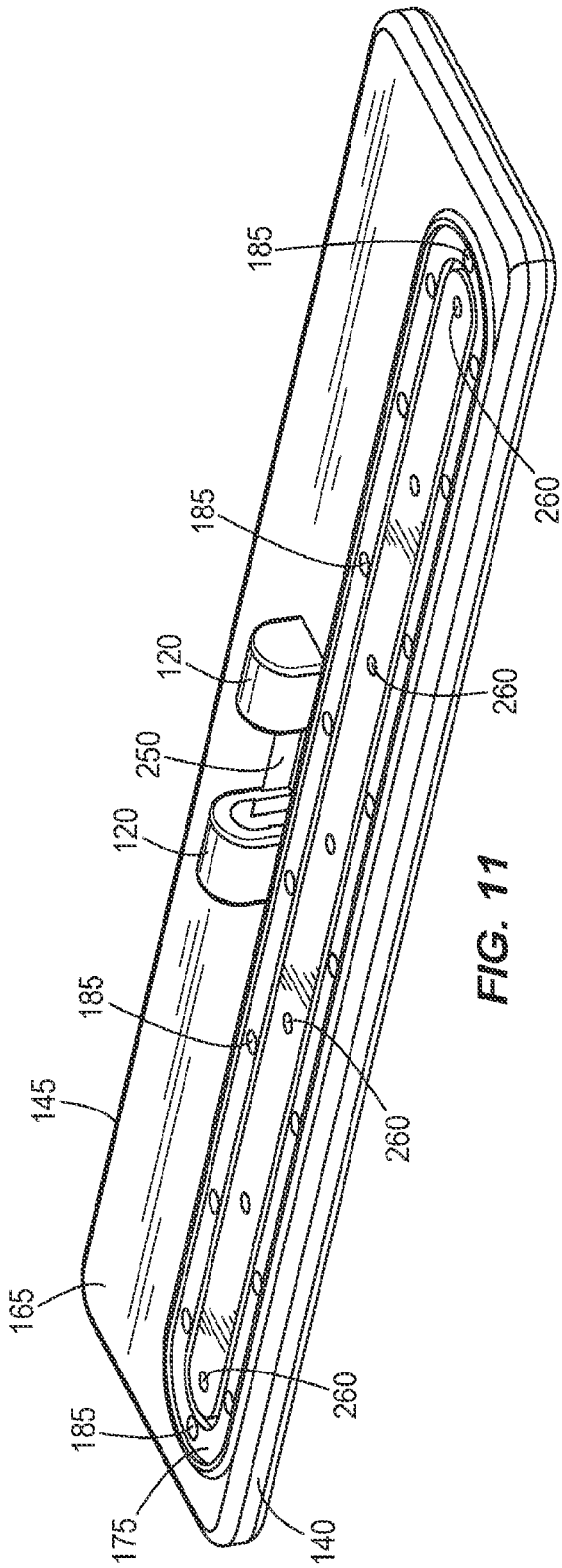

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FIG. 11

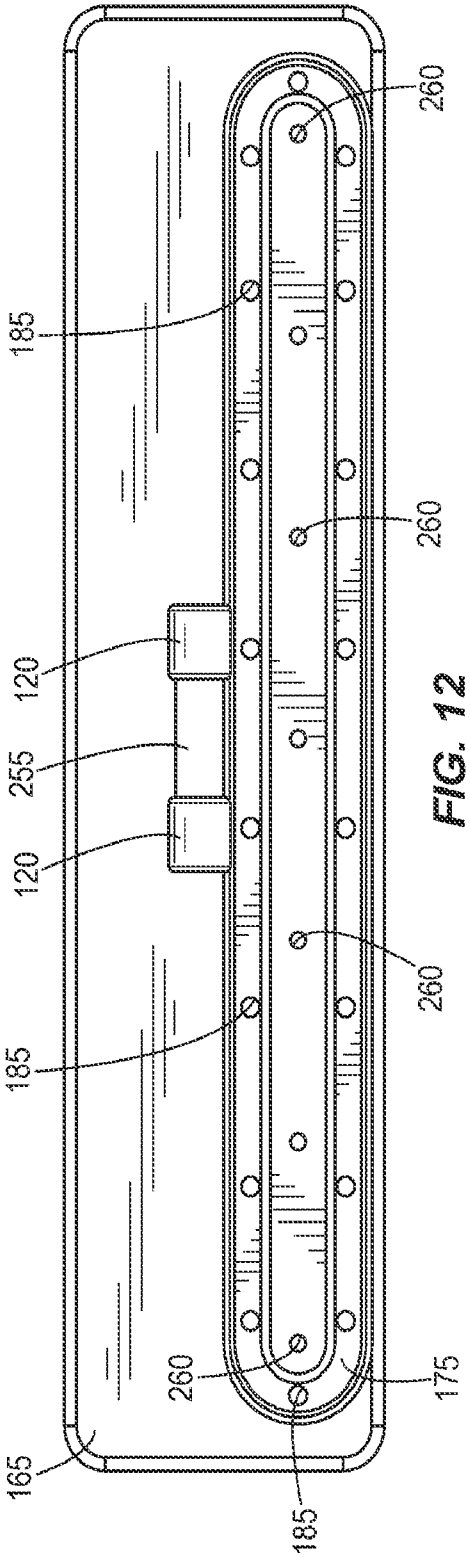

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FIG. 12

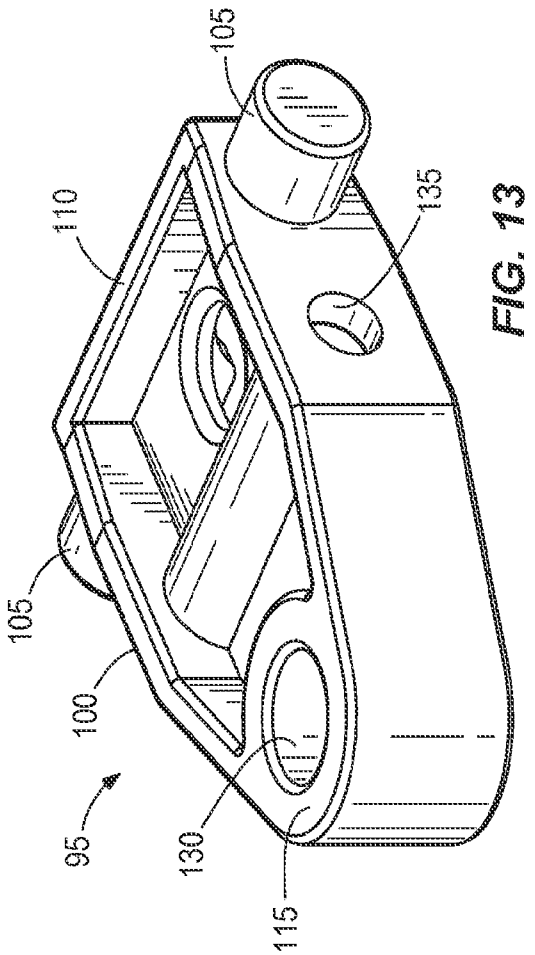

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FIG. 13

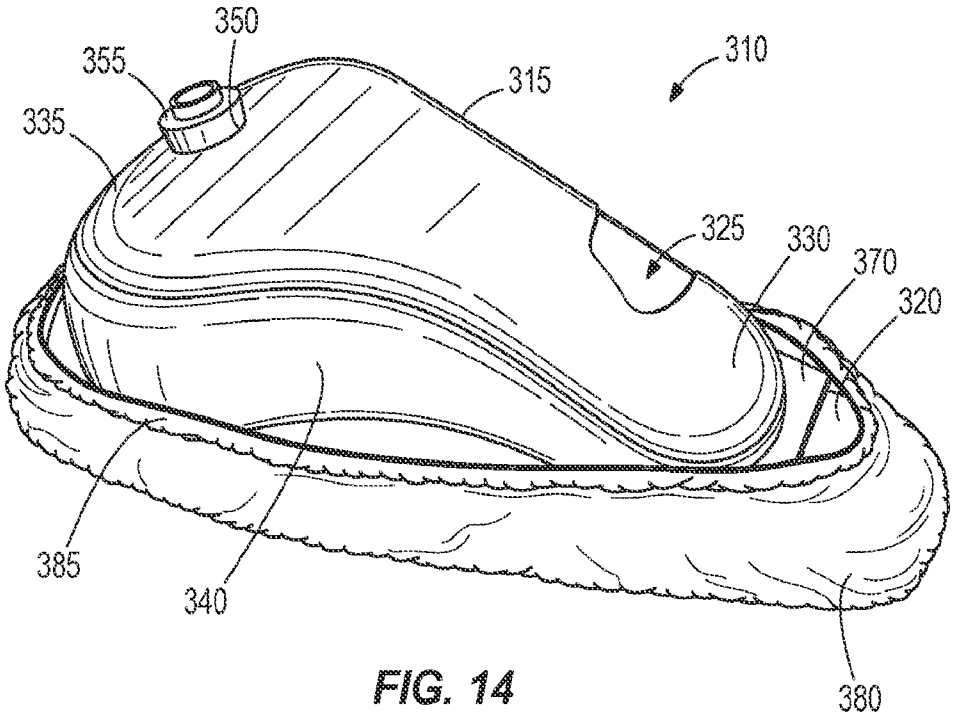

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FIG. 14

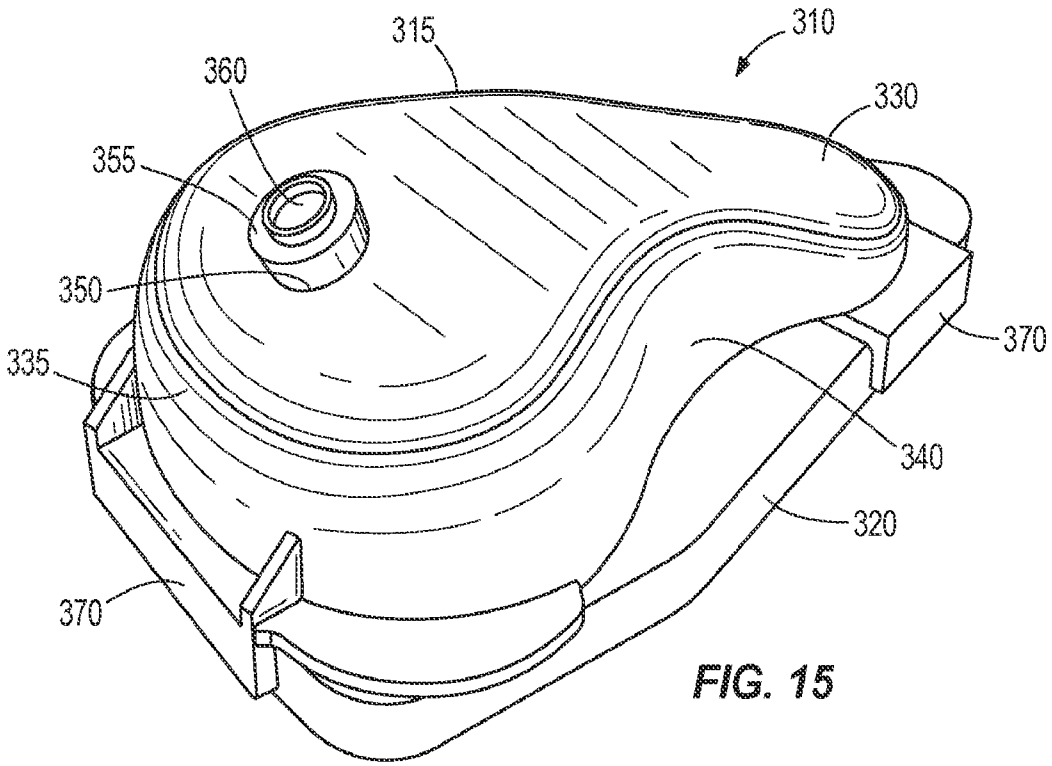

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FIG. 15

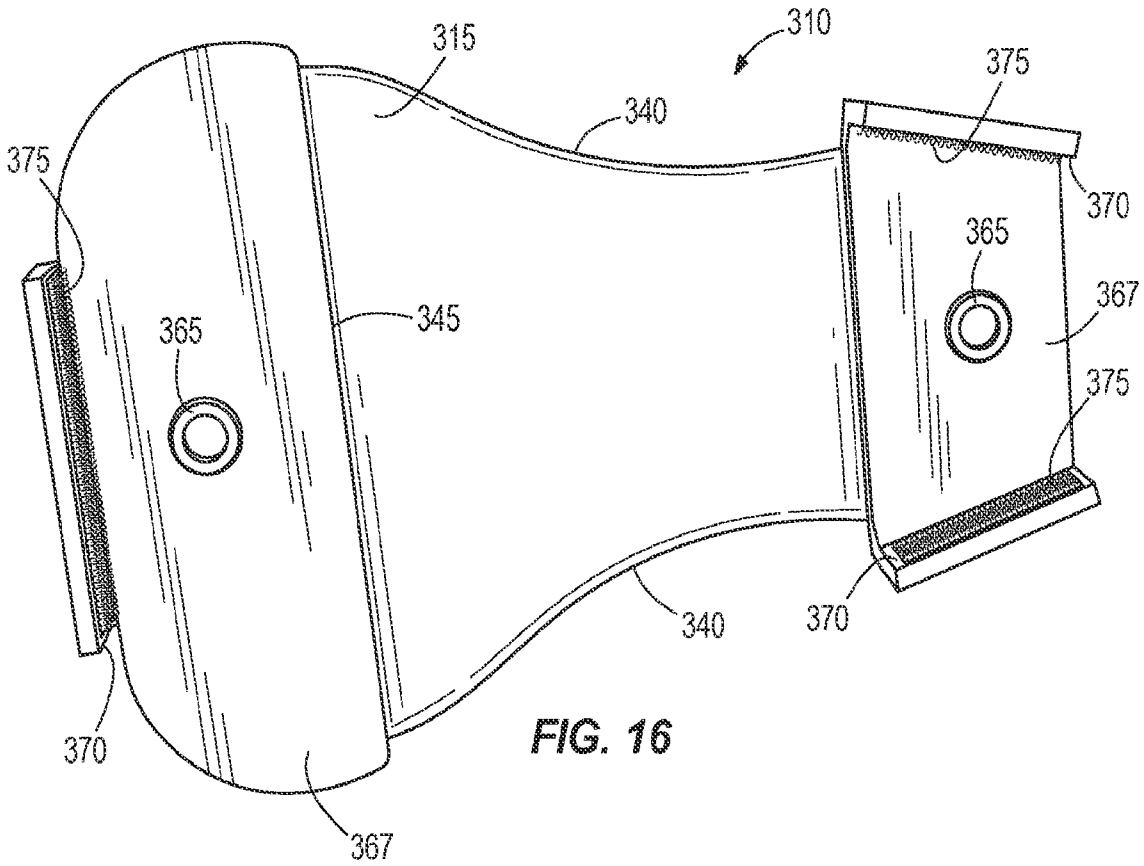


FIG. 16

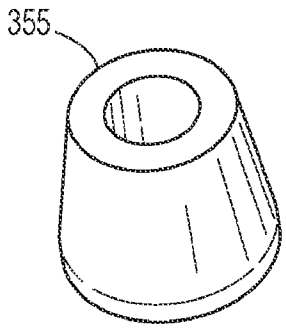


FIG. 17

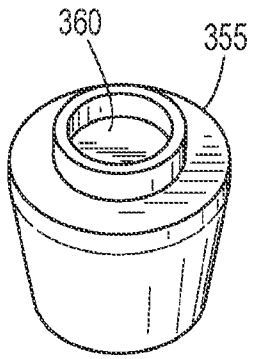


FIG. 18

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/068950

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - A47L 13/20 (2014.01)
USPC - 401/138
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)
IPC(8) - A46B 11/00, 11/04; A47L 1/08, 11/00, 11/34, 11/40, 13/10, 13/16, 13/20, 13/22, 13/24, 13/26, 13/30 (2014.01)
USPC - 15/4, 98, 115, 116.2, 147.1, 228, 244.2, 320, 321, 322; 401/27, 48, 137, 138, 139, 140, 263, 268, 270, 272, 282

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
CPC - A47L 11/34, 11/4088, 13/20, 13/22, 13/225 (2013.01)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PatBase, Google Patents, Google

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 2010/0316432 A1 (KIMURA) 16 December 2010 (16.12.2010) entire document	1-3,7,11-13,15,36,42 --- 4-6,8-10,14,17-31,34,35, 37-41,43
Y	US 2012/0222227 A1 (JOHNSON et al) 06 September 2012 (06.09.2012) entire document	4-6,8,24,25
Y	US 2004/0022575 A1 (HALL et al) 05 February 2004 (05.02.2004) entire document	9,14,20-31,34,35,43
Y	US 2011/0023251 A1 (BOBER et al) 03 February 2011 (03.02.2011) entire document	10,27
Y	US 2011/0158740 A1 (KANDASAMY et al) 30 June 2011 (30.06.2011) entire document	17,19
Y	US 2012/0204376 A1 (CHARLTON) 16 August 2012 (16.08.2012) entire document	18
Y	US 8,167,510 B2 (LAFLAMME et al) 01 May 2012 (01.05.2012) entire document	18,40,41
Y	US 2004/0228670 A1 (COLBURN et al) 18 November 2004 (18.11.2004) entire document	37-39

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"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
17 March 2014	14 APR 2014

Name and mailing address of the ISA/US	Authorized officer:
Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (July 2009)