(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
12 December 2024 (12.12.2024)

WIPO | PCT

(10) International Publication Number
WO 2024/254026 A2

(51) International Patent Classification:
Not classified

(21) International Application Number:
PCT/US2024/032341

(22) International Filing Date:
04 June 2024 (04.06.2024)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
63/471,339 06 June 2023 (06.06.2023) US

(71) Applicant: **AS AMERICA, INC.** [US/US]; 865 Centennial Ave, Piscataway, New Jersey 08854 (US).

(72) Inventors: **SANTO, David**; 35 Berdine Court, Colonia, New Jersey 07067 (US). **YE, Xiaojing**; 26 Mount Pleasant Avenue, Edison, New Jersey 08820 (US).

(74) Agent: **STEVENSON, Tyler A.** et al.; AS AMERICA, INC., 865 Centennial Ave, Piscataway, New Jersey 08854 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CV, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, MG, MK, MN, MU, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, CV, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SC, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, ME, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:
— *without international search report and to be republished upon receipt of that report (Rule 48.2(g))*

(54) Title: WATER DELIVERY ASSEMBLY WITH MAGNETIC SENSOR

(57) Abstract: A water delivery assembly comprising a water dispensing device; an actuation assembly; and a mixing assembly, wherein the actuation assembly is configured to be operated to control a volume and a temperature of water delivered from the water dispensing device, the actuation assembly comprises a magnetic sensor assembly, and the mixing assembly is configured to be positioned exterior to or removed from the water dispensing device, and to deliver mixed hot/cold water to the water dispensing device.

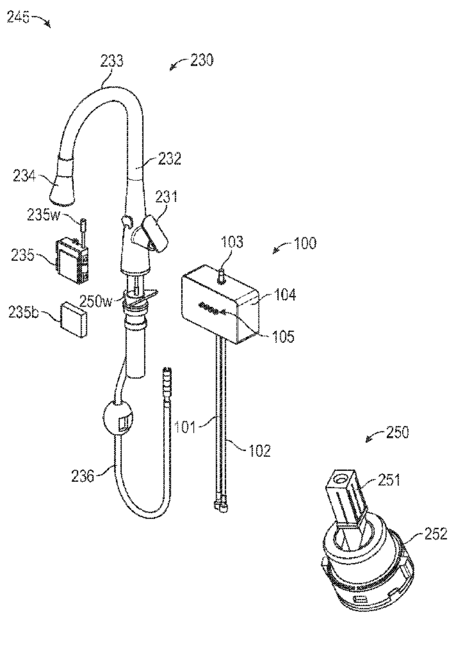

FIG. 2A

WO 2024/254026 A2

Water Delivery Assembly with Magnetic Sensor

The application is directed to a water delivery assembly, for example a faucet assembly, comprising a magnetic sensor assembly.

Background

Conventional faucet assemblies, for instance kitchen faucets, typically have a single handle configured to adjust both water volume (water flow rate) and water temperature. A kitchen faucet handle is typically coupled to a mixing valve, through which hot and cold source water are mixed and then delivered to a faucet spray head. Faucet design is limited as a faucet body houses a handle actuator associated with a mixing valve, among other components. Further, such manual handles are limited towards setting a desired water volume and temperature. Desired are faucet assemblies where for example a mixing valve and/or a handle may be positioned exterior to a faucet body, thereby providing a much greater freedom towards a faucet design. Also desired are handle actuators capable of providing a greater precision towards delivering a desired water volume and water temperature.

Summary

Accordingly, disclosed is a water delivery assembly comprising a water dispensing device; an actuation assembly; and a mixing assembly, wherein the actuation assembly is configured to be operated to control a volume and a temperature of water delivered from the water dispensing device, the actuation assembly comprises a magnetic sensor assembly, and the mixing assembly is configured to be positioned exterior to or removed from the water dispensing device, and to deliver mixed hot/cold water to the water dispensing device.

In some embodiments, a water delivery assembly may comprise a kitchen faucet, a bath faucet, a shower head, a tub spout, and the like. A mixing assembly may be configured to be positioned exterior to, or remote from, a water delivery assembly, for instance under a countertop, in a cabinet, behind a wall, etc. An actuation assembly may be positioned at or near a water delivery assembly, for instance coupled to a kitchen faucet body as in a conventional kitchen faucet, or in a shower stall. An actuation assembly may also be positioned exterior to or remote from a water delivery assembly, for instance on a countertop nearby a faucet, on a backsplash, or outside a shower stall on a bathroom wall.

A present mixing assembly and magnetic sensing assembly provides a high degree of freedom in design of water delivery assemblies, and also provides a high degree of precision towards providing a desired water temperature and flow rate.

Brief Description of the Drawings

The disclosure described herein is illustrated by way of example and not by way of limitation in the accompanying figures. For simplicity and clarity of illustration, features illustrated in the figures are not necessarily drawn to scale. For example, the dimensions of some features may be exaggerated relative to other features for clarity. Further, where considered appropriate, reference labels have been repeated among the figures to indicate corresponding or analogous elements.

Fig. 1A and **Fig. 1B** show views of a mixing assembly, according to some embodiments.

Fig. 1C provides a cross-section view of a mixing assembly, according to an embodiment.

Fig. 1D provides an exploded view of a mixing assembly, according to an embodiment.

Fig. 2A shows a faucet assembly, according to an embodiment.

Fig. 2B provides an exploded view of a magnetic sensor assembly, according to an embodiment.

Fig. 2C and **Fig. 2D** provide cross-section views of a magnetic sensor assembly, according to some embodiments.

Detailed Description

Fig. 1A and **Fig. 1B** provide views of mixing assemblies **100** and **125**, respectively, according to some embodiments. Mixing assemblies **100** and **125** are configured to be positioned at an exterior of a faucet body, for example below/under a deck surface onto which a faucet is to be installed, or another “remote” location. Mixing assemblies **100** and **125** comprise housing **104**, configured to house a water mixing valve or mixing valves. Assemblies **100** and **125** as shown also comprise first inlet water conduit **101** and second inlet water conduit **102**, configured to couple to a hot source water line and a cold source water line, respectively (or vice-versa), and configured to deliver hot source water and cold source water to a mixing valve or valves. A mixing valve or mixing valves positioned at a housing interior space are configured to provide a mixture of hot and cold water, and to direct the hot/cold water mixture through mixing assembly outlet **103** to a faucet. Extending through housing **104** are electrical ports **105**, configured to couple to electric wires coupled to one or more of a power source, a presence sensor, or an actuation assembly. Electrical ports **105** may be coupled to a controller or printed circuit board positioned at an interior of housing **104**. Mixing assembly **125** further comprises knob **106** (temperature knob), which may be employed to pre-set a temperature of water to be delivered to a faucet in an automatic mode.

Fig. 1C provides a cross-section view of mixing assembly **100** or **125**, according to an embodiment. First electric motor **107** is coupled to first valve **109**, and second electric motor **108** is coupled to second valve **110**, all positioned at an interior of housing **104**. First motor **107** is coupled to first valve **109** by pinion gear **111p** meshed with spur gear **113s**, and second motor **108** is coupled to second valve **110** by pinion gear **112p** meshed with spur gear **114s**. Gears **111p**, **112p**, **113s**, and **114s** are bevel gears, wherein gears **111p** and **112p** have a largest diameter of about 20 mm, and gears **113s** and **114s** have a largest diameter of about 40 mm. First motor **107** and second motor **108** are configured to receive instructions from a controller (not shown) and to rotate first valve spindle **109s** and second valve spindle **110s** to open or close first valve **109** and second valve **110** to provide a desired mix of hot and cold source water from first inlet conduit **101** and second inlet conduit **102** to mixing chamber **116** of manifold **115**. The hot/cold water mixture is directed from manifold **115** to mixing assembly outlet **103** and to a faucet.

Fig. 1D provides an exploded view of mixing assembly **100**, according to an embodiment. Shown are housing front part **104f** and housing rear part **104r**, configured to couple together and to house controller **117**. Controller **117** is coupled to electrical ports **105**, which are configured to extend through housing apertures **104a**. First inlet water conduit **101** and second inlet water conduit **102** are configured to pass through housing lower opening **104l** into an interior of housing **104** and to couple to manifold base **115b** of manifold **115**. Manifold top **115t** comprises mixing chamber **116** and is configured to couple to manifold base **115b** and to outlet adapter **118** via flow sensor **119**. Turning first motor **107** results in turning of gears **111p** and **113s**, and first valve spindle **109s**. Rotation of first valve spindle **109s** results in rotating moveable ceramic disc **109md** relative to stationary ceramic disc **109sd**, to open or close valve **109** to allow/disallow water (e.g. hot source water) flow through manifold **115** to mixing chamber **116**. Likewise, turning second motor **108** results in turning of gears **112p** and **114s**, and second valve spindle **110s**. Rotation of second valve spindle **110s** results in rotating moveable ceramic disc **110md** relative to stationary ceramic disc **110sd**, to open or close valve **110** to allow/disallow water (e.g. cold source water) flow through manifold **115** to mixing chamber **116**. A desired mixture of hot/cold water is configured to be directed from manifold **115**, through mixing assembly outlet **103**, and to a faucet.

Fig. 2A depicts faucet assembly **245**, according to some embodiments. Faucet assembly **245** comprises faucet **230**, mixing assembly **100**, and magnetic sensor assembly **250**. Magnetic sensor assembly **250** is positioned inside faucet body **232** at faucet handle **231**. Magnetic sensor assembly stem **251** is configured to couple to faucet handle **231** and is positioned in magnetic sensor assembly housing **252**. Faucet water conduit **236** is configured to couple to mixing assembly outlet **103**, and runs through faucet body **232** and faucet spout **233**, and is coupled to spray head **234**. Spray head **234** may be configured to dispense mixed hot/cold water received from mixing assembly **100** in a variety of spray patterns. Spray head **234** may be a “pull-down” spray head, where it may be pulled out and away from spout **233** and returned to a docked position at spout **233** (removably docked). Assembly **245** comprises battery pack **235b** to be positioned in battery case **235**. Battery pack **235b** is configured to be in wired electronic communication with controller **117** via wire **235w** plugged into an electronic port **105** of mixing assembly **100**. Likewise, magnetic sensor assembly **250** is configured to be in wired electronic communication with controller **117** via wire **250w** plugged into an electronic port **105** of mixing assembly **100**.

Fig. 2B provides an exploded view of magnetic sensor assembly **250**, according to an embodiment. Sensor assembly comprises sensor assembly housing **252**, upper spacer **250su**, sensor assembly stem, or joystick, **251**, neodymium magnet **253**, rotation/angle stop guide **254**, lower spacer **250sl**, joystick stem socket **255**, sensor holder **256**, magnetic (Hall effect) sensor **257**, and base cover **258**.

Fig. 2C and **Fig.** 2D show cross-section views of magnetic sensor assembly **250**, according to some embodiments. Visible are magnetic sensor assembly stem, or joystick, **251**, sensor assembly housing **252**, magnet **253**, rotation/angle stop guide **254**, stem socket **255**, sensor holder **256**, magnetic sensor **257**, and base cover **258**. Joystick **251** is positioned a distance above magnetic sensor **257**, for instance a distance of about 4 mm from a magnet lower surface to sensor **257**. Joystick **251** is configured to be moved about to control a temperature and flow rate (volume) of water dispensed from a faucet.

Disclosed is a water delivery assembly comprising a mixing assembly and an actuation assembly comprising a magnetic sensor assembly, wherein the mixing assembly is configured to positioned exterior to a water delivery device. In some embodiments, a water delivery assembly may comprise a kitchen faucet, a bath faucet, a shower, a bathtub, a walk-in tub, etc. As described herein, a term “faucet assembly” and “water delivery assembly” or “water delivery device” or “water dispensing device” may be used interchangeably. In some aspects, a water dispensing or delivery device may comprise any feature configured to dispense water, for example any of a spout, a spray head, a spigot, a nozzle, etc. In some embodiments, a mixing assembly may be positioned exterior to or, remote from a water dispensing device. For instance, a mixing assembly may be positioned under a deck or countertop onto which a faucet is to be installed, may be positioned exterior of a shower stall, may be positioned exterior to a walk-in tub or bathtub, etc. In other embodiments, an actuation assembly may also be positioned exterior to a faucet body, for example on a countertop or deck, on a backsplash, on a wall, etc. An actuation assembly may be positioned exterior to a shower stall, exterior to a bathtub, exterior to a walk-in tub, etc., so that one may not have to reach into a shower stall or bend down to a tub to operate it. Terms such as “exterior to”, “remote from”, or “removed from” may each have a similar meaning, for example “not directly coupled to”.

A mixing assembly positioned exterior to a water delivery assembly provides a greater degree of freedom towards design of the assembly. For example, a typical single handle kitchen faucet contains a mixing valve positioned in a faucet body and coupled to the handle. The valve is configured to mix hot and cold source water, and to deliver the mixed water to a faucet spout. Removing a mixing valve from within a faucet body provides a greater freedom in design of the faucet. A present mixing assembly may be positioned below a deck onto which a faucet is to be installed. In other embodiments, a mixing assembly may be positioned in a cabinet, in a wall, in a basement, or other location.

A “handle” of an actuation assembly coupled to the magnetic sensor assembly may also be positioned exterior of or remote to a water delivery assembly. For example, a present faucet actuation assembly may be positioned on a countertop, on a backsplash, or other location away from the faucet. In other embodiments, an actuation assembly may be positioned on or at a faucet body as is shown in the figures.

A present mixing assembly is configured to receive hot source water and cold source water from for example residential water lines, to mix the hot and cold source water to provide a hot/cold water mixture of a desired temperature, and to deliver the hot/cold water mixture at the desired temperature and a desired volume to a faucet. A present mixing assembly is configured to receive instructions from a controller to deliver the hot/cold water mixture at the desired temperature/volume. The controller is configured to receive signals from an actuation assembly indicative of a person's desired water temperature/volume. An actuation assembly comprises a present magnetic sensor assembly. A mixed water volume may bean a mixed water flow rate.

A controller, a magnetic sensor assembly, and one or more electromechanical valves are configured to be in electronic communication. These components are also configured to be in electronic communication with a power source, for example a battery or a residential power source. Electronic communication may be "wired" communication, as depicted in the figures, or may be wireless or partly wireless communication. In some embodiments, wireless communication may allow for an actuation assembly to be positioned remote to a water dispensing device.

A mixing assembly may comprise an electromechanical valve, which electromechanical valve is configured to receive instructions from a controller to provide a hot/cold water mixture. In some embodiments, an electromechanical valve may comprise a solenoid. In some embodiments, an electromechanical valve may comprise an electric motor coupled to a valve. An electric motor may be coupled to a valve by a gear assembly. An electric motor may be coupled directly to a valve. In some embodiments, a valve may comprise a valve spindle configured to be rotated by an electric motor. A valve spindle may be configured to rotate a ceramic disc to open, close, partially open, or partially close a valve. A gear assembly may comprise a bevel pinion gear meshed with a bevel spur gear, wherein a bevel pinion gear is coupled to an electric motor, and a bevel spur gear is coupled to a valve spindle. In some implementations, a bevel spur gear may have a larger diameter than a bevel pinion gear. For instance, a ratio of a bevel spur gear diameter to a bevel pinion gear diameter may be from about 1.5/1, about 1.7/1, about 1.8/1 or about 2.0/1, to any of about 2.2/1, about 2.4/1, about 2.6/1, about 2.8/1, about 3.0/1, or more.

A present magnetic sensor assembly may comprise a magnet configured to be re-positioned or moved above a magnetic sensor, for example a Hall effect sensor. A magnetic sensor may be in a fixed position. A position of a magnet is configured to be detected by a magnetic sensor, and a magnetic sensor is configured to send a signal to a controller regarding a magnet position. A controller is configured to convert this signal to a water temperature and water volume, and to send instructions to one or more electromechanical valves to operate and to deliver water at the indicated temperature and volume to a water dispensing device.

An actuation assembly may comprise a handle, knob, lever, or the like, coupled to a magnetic assembly stem, not unlike a joystick. An actuation assembly stem may have a first end coupled to a magnet. A stem first end may have rounded, sphere-shaped end having an aperture configured to receive a magnet, as depicted in the figures. A stem second end may be configured to couple to the above-mentioned handle, knob, lever, etc. Terms such as handle, knob, lever, and the like may be used interchangeably herein.

In some embodiments, a mixing assembly may comprise a first electromechanical valve configured to receive hot water from a hot source water line, and a second electromechanical valve configured to receive cold water from a cold source water line. A controller is configured to receive a magnet position signal from a magnetic sensor indicative of a user's desired water temperature and water volume, and to send instructions to a first electromechanical valve and second electromechanical valve to open or close to adjust a mixed hot/cold water temperature and volume to be provided to a water dispensing device. As described herein, terms "open" and "close" in reference to a valve may mean fully open, fully close, partially open, or partially close.

A mixing assembly may comprise a manifold having one more ports configured to receive and/or couple to one or more electromechanical valves. A manifold may also have a port configured to receive and/or to couple to a first water inlet conduit configured to couple to a first water source and a port configured to receive and/or couple to a second water inlet conduit configured to a second water source. One of the first water inlet conduit and second water inlet conduit is configured to provide hot water to the manifold, and the other is configured to provide cold water. A manifold may also have a port configured to receive and/or couple to an outlet adapter, which adapter is configured to couple to a water conduit configured to deliver mixed hot/cold water to a water dispensing device. In another embodiment, a manifold may have a port configured to receive and/or directly couple to a water conduit configured to deliver mixed hot/cold water to a water dispensing device.

In some embodiments, a mixing assembly may comprise a mixing chamber, configured to receive hot water and cold water from one or more electromechanical valves, to allow hot and cold water to mix, and to deliver mixed hot/cold water to a mixing assembly outlet and onto a water dispensing device. In some embodiments a manifold may comprise a mixing chamber. In some embodiments, a manifold may comprise a single unitary molded part. In other embodiments, a manifold may comprise two or more parts joined together. For instance, a manifold may comprise a lower part configured to receive water inlet conduits and electromechanical valves, and an upper part comprising a mixing chamber and configured to couple to an outlet conduit or outlet adapter.

In some embodiments, a mixing assembly may be positioned within a housing, for instance as depicted in the figures. A housing may comprise one or more openings to receive a first inlet conduit, a second inlet conduit, and an outlet conduit. In some aspects, a controller may be positioned at a housing interior. A controller may have one or more electronic ports, which for instance may extend through openings of a housing and configured to receive and/or couple to (e.g. plug to) one or more electric wires connected to a magnetic sensor, a power source, or one or more other components, for instance a presence sensor. A controller may also have one or more electronic ports configured to electronically couple to one or more electromechanical valves at a housing interior. In other implementations, a controller may be positioned at or near a magnetic sensor assembly, for example adjacent a magnetic sensor.

A housing and/or a manifold may comprise a thermoplastic, for instance an engineering thermoplastic. Thermoplastics may include a polypropylene, a polyethylene, a polyester, a polyamide, a polystyrene, mixtures thereof, or copolymers thereof. Engineering thermoplastics include for example polyamides, polyesters, polycarbonates, acrylonitrile-butadiene-styrene, polysulfones (PSU), polyethersulfones (PESU), cyclic olefin copolymer (COC), acrylonitrile-styrene-acrylate (ASA), polyphenylene oxides (PPO), polyphenylene sulfides (PPS), polyphenylenesulfones (PPSU), polyether ether ketones (PEEK), polyethylenimine (PEI), polyphthalamides (PPA), polyacetals, copolymers thereof, and blends thereof. Polyamides include nylon and polyphthalamide (PPA). Polyacetals include polyoxymethylene (POM). In some embodiments, a thermoplastic polymer may comprise a glass-filled thermoplastic, for example a glass-filled polyamide. Parts comprising a thermoplastic may be prepared via a molding process, for example injection molding.

Water lines or conduits may comprise a thermoplastic, a metal, a rubber, etc. In some embodiments, a water conduit may comprise PEX (cross-linked polyethylene). Water conduits may be rigid, flexible, or partly flexible.

In some implementations, a joystick may be configured to move a magnet in a first direction, for instance to adjust a mixed water volume or temperature, and to move a magnet in a second direction, for instance to adjust the other of the mixed water volume or temperature. In some aspects, a joystick may be configured to move a magnet along a 360° region, wherein for instance a top/left quadrant position may be configured to send a signal to a controller to request hot/high volume mixed water, a top/right quadrant – cold/high volume, a bottom/right – cold/low volume, and a bottom/left – hot/low volume. A bottom area position may be configured to turn water off. A top area positon may be configured to turn water at a highest volume. A top center may be configured to provide a 50/50 mix of hot/cold water.

In some embodiments, movement of a magnet along a first axis may be configured to adjust a mixed water volume or a mixed water temperature, and movement of a magnet along a second axis may be configured to adjust the other of a mixed water volume and a mixed water temperature. A first axis and a second axis may intersect, for instance may be substantially perpendicular.

In some embodiments, a movement of a handle/joystick, and thereby a magnet, may be configured to mimic a typical single handle kitchen faucet. For instance, a handle may be configured to move in a front/back direction to adjust a mixed water temperature, for instance over a range of from about 50°, about 60°, about 70°, or about 80°, to any of about 90°, about 100°, about 110°, about 120°, about 130°, about 140°, about 150°, about 160°, or more. For instance, a handle may be configured to move in an up/down direction, opposite a front/back direction to adjust a mixed water volume, for instance over a range of from about 14°, about 16°, about 18°, or about 20°, to any of about 22°, about 24°, about 26°, about 28°, about 30°, about 32°, about 34°, about 36°, or more. A magnetic sensor assembly rotation/angle stop guide may be configured to provide for an allowed movement of a joystick to adjust a mixed water volume and temperature.

In some embodiments, a water dispensing device, for example a faucet, may be configured to be operated in both an automatic mode and/or a manual mode. A manual mode may comprise operation of an actuation assembly comprising a magnetic sensor assembly as described herein. In some embodiments, a water dispensing device, for example a faucet, may comprise a presence sensor positioned for example on or in a faucet body or faucet spout, for instance an infrared (IR) sensor, optical sensor, or capacitive sensor. Upon a person approaching, being present at, or placing one's hand or hands at or near a faucet, a faucet may be configured to dispense mixed hot/cold water in an automatic mode, and to cease dispensing water when a person removes one's hand or hands or retreats from the faucet. In another embodiment, a faucet or water dispensing device may be configured to cease dispensing water after a defined period of time in an automatic mode.

A presence sensor may also be configured to send a signal to a controller to indicate a person's presence or absence to initiate or cease water flow. A person's presence or absence at or near a water dispensing device may comprise a person approaching or retreating from the device, may comprise a person being at or near (or not) the device, or may comprise a presence or absence of a person's hand or hands at or near the device. The controller may be configured to operate one or more valves of a mixing assembly as outlined herein to deliver or to stop delivering water to a water dispensing device. A mixing assembly may be associated with a manual knob, lever, dial, etc., to set (pre-set) a desired temperature of mixed hot/cold water to be delivered in an automatic mode. A manual temperature knob, lever, dial, etc. may be in electronic communication with a controller and to indicate the pre-set temperature to the controller. Likewise a mixing assembly may be associated with a manual knob, lever, dial, etc. configured to pre-set a mixed water volume to be delivered in an automatic mode. A manual knob, lever, dial, etc. configured to pre-set a mixed water temperature and volume to be delivered in an automatic mode may be positioned at a mixing assembly housing. In some implementations, operation of a manual mode may be configured to disable operation of an automatic mode. For example, a controller may be configured to not receive signals from a presence sensor during operation of a manual mode. A presence sensor may be configured to be in electronic communication with a controller via wired or wireless connection.

In some implementations, an actuation assembly and mixing assembly may be associated with an array of water dispensing devices, for instance an array of automatic faucets positioned in a commercial bathroom. In such embodiments, a single actuation assembly and mixing assembly may be employed to pre-set a mixed water temperature and volume to be delivered to each faucet in an automatic mode. Each faucet of an array of faucets may be associated with an electromechanical valve in electronic communication with a controller.

A mixing assembly, water source inlet conduits, a water outlet conduit, one or more electromechanical valves, and a water dispensing device are in flow communication.

In some embodiments, a water dispensing assembly may comprise a flow sensor, for example a flow sensor positioned downstream of a mixing assembly and upstream of a device outlet configured to dispense water. A flow sensor may be in electronic communication with a controller, and configured to indicate an actual water flow rate/volume to a controller. A controller may comprise software configured to determine if an actual water flow rate matches that of a flow rate indicated by a magnet position, and to adjust a flow rate if necessary.

Following are some embodiments of the disclosure.

In a first embodiment, disclosed is a water delivery assembly comprising a water delivery device; an actuation assembly; and a mixing assembly, wherein the actuation assembly is configured to be operated to control a volume and a temperature of water delivered from the water dispensing device, the actuation assembly comprises a magnetic sensor assembly, and the mixing assembly is configured to be positioned exterior to, or removed from (remote to) the water dispensing device, and to deliver mixed hot/cold water to the water dispensing device.

In a second embodiment, disclosed is a water delivery assembly according to the first embodiment comprising a faucet, wherein the mixing assembly is configured to be positioned below a deck surface onto which the faucet is configured to be installed. In a third embodiment, disclosed is a water delivery assembly according to embodiment 2, wherein the magnetic sensor assembly is coupled to the faucet body.

In a fourth embodiment, disclosed is a water delivery assembly according to embodiment 2, wherein the magnetic sensor assembly is configured to be positioned exterior to the faucet. In a fifth embodiment, disclosed is a water delivery assembly according to embodiment 4, wherein the magnetic sensor assembly is configured to be positioned at a deck surface onto which the faucet is configured to be installed, or at a backsplash adjacent the deck surface.

In a sixth embodiment, disclosed is a water delivery assembly according to any of the preceding embodiments, wherein the magnetic sensor assembly comprises a magnet and a magnetic sensor. In a seventh embodiment, disclosed is a water delivery assembly according to any of the preceding embodiments, wherein the actuation assembly comprises a controller, a stem having a first end coupled to a magnet, and a magnetic sensor, the magnetic sensor is in a fixed position, the stem and magnet are configured to move relative to the magnetic sensor, the magnetic sensor is configured to detect a position of the magnet, the controller is in electronic communication with the magnetic sensor and is configured to receive an electronic signal from the magnetic sensor indicating the magnet position, and the controller is configured to instruct the mixing assembly to deliver the mixed water to the water dispensing device at a water volume and a water temperature corresponding to the magnet position.

In an eighth embodiment, disclosed is a water delivery assembly according to embodiment 7, wherein a stem second end is coupled to a handle, the handle configured to be actuated to move the stem and magnet. In a ninth embodiment, disclosed is a water delivery assembly according to embodiments 7 or 8, wherein movement of the magnet along a first axis is configured to adjust the mixed water volume, and movement of the magnet along a second axis is configured to adjust the mixed water temperature. In a tenth embodiment, disclosed is a water delivery assembly according to embodiment 9, wherein the first axis and the second axis intersect. In an eleventh embodiment, disclosed is a water delivery assembly according to embodiments 9 or 10, wherein the first axis and the second axis are perpendicular.

In a twelfth embodiment, disclosed is a water delivery assembly according to any of embodiments 7 to 11, wherein the mixing assembly comprises a first electromechanical valve configured to receive hot water from a hot water source, and a second electromechanical valve configured to receive cold water from a cold water source, the controller is in electronic communication with the first electromechanical valve and configured to instruct the first electromechanical valve to open or close to adjust a volume of hot water delivered to the water dispensing device, the controller is in electronic communication with the second electromechanical valve and configured to instruct the second electromechanical valve to open or close to adjust a volume of cold water delivered to the water dispensing device.

In a thirteenth embodiment, disclosed is a water delivery assembly according to embodiment 12, wherein the controller, the first electromechanical valve, the second electromechanical valve, and the magnetic sensor are each in electronic communication with a power source. In a fourteenth embodiment, disclosed is a water delivery assembly according to embodiments 12 or 13, wherein the controller is in wired electronic communication with the magnetic sensor, and/or is in wired electronic communication with the first electromechanical valve and the second electromechanical valve. In a fifteenth embodiment, disclosed is a water delivery assembly according to embodiments 12 or 13, wherein the controller is in wireless electronic communication with the magnetic sensor, and/or is in wireless electronic communication with the first electromechanical valve and the second electromechanical valve.

In a sixteenth embodiment, disclosed is a water delivery assembly according to any of embodiments 12 to 15, wherein the mixing assembly comprises a mixing chamber, the first electromechanical valve is configured to deliver hot water to the mixing chamber, the second electromechanical valve is configured to deliver cold water to the mixing chamber, and the mixing chamber is configured to deliver mixed hot/cold water to the water dispensing device. In a seventeenth embodiment, disclosed is a water delivery assembly according to any of embodiments 12 to 16, wherein the mixing assembly comprises a manifold, the first electromechanical valve and the second electromechanical valve are coupled to the manifold, the manifold is configured to couple to a hot source water line and to a cold source water line, and the manifold is configured to couple to an outlet line configured to deliver mixed hot/cold water to the water dispensing device.

In an eighteenth embodiment, disclosed is a water delivery assembly according to embodiment 17, wherein the first electromechanical valve and the second electromechanical valve are at least partially positioned in the manifold. In a nineteenth embodiment, disclosed is a water delivery assembly according to any of embodiments 12 to 18, wherein the first electromechanical valve comprises a first solenoid and the second electromechanical valve comprises a second solenoid. In a twentieth embodiment, disclosed is a water delivery assembly according to any of embodiments 12 to 18, wherein the first electromechanical valve comprises a first electric motor coupled to a first valve, and the second electromechanical valve comprises a second electric motor coupled to a second valve.

In a twenty-first embodiment, disclosed is a water delivery assembly according to embodiment 20, wherein the controller is in electronic communication with the first electric motor and configured to instruct the first electric motor to operate the first valve to open or close to adjust a volume of hot water delivered to the water dispensing device, and the controller is in electronic communication with the second electric motor and configured to instruct the second electric motor to operate the second valve to open or close to adjust a volume of cold water delivered to the water dispensing device. In a twenty-second embodiment, disclosed is a water delivery assembly according to embodiments 20 or 21, wherein the first electric motor is coupled to the first valve through a first gear assembly, and the second electric motor is coupled to the second valve through a second gear assembly. In a twenty-third embodiment, disclosed is a water delivery assembly according to any of embodiments 20 to 22, wherein the first valve comprises a first spindle, the second valve comprises a second spindle, the first electric motor is configured to rotate the first spindle to open and closed the first valve, and the second electric motor is configured to rotate the second spindle to open and close the second valve.

In other embodiments, an electromechanical valve may comprise a needle valve, for example a first spindle and/or a second spindle may be configured to move a needle to open and close a valve.

In a twenty-fourth embodiment, disclosed is a water delivery assembly according to embodiment 23, wherein the first spindle and the second spindle are each configured to rotate a ceramic disc to open and close the first valve and the second valve, respectively. In a twenty-fifth embodiment, disclosed is a water delivery assembly according to embodiments 23 or 24, wherein the first electric motor is coupled to the first spindle through a first gear assembly, and the second electric motor is coupled to the second spindle through a second gear assembly. In a twenty-sixth embodiment, disclosed is a water delivery assembly according any of embodiments 22 to 25, wherein the first gear assembly comprises a pinion bevel gear coupled to the first electric motor, and a spur bevel gear meshed with the pinion bevel gear and coupled to the first spindle, and the second gear assembly comprises a pinion bevel gear coupled to the second electric motor, and a spur bevel gear meshed with the pinion bevel gear and coupled to the second spindle.

In a twenty-seventh embodiment, disclosed is a water delivery assembly according to any of the preceding embodiments, wherein the mixing assembly is positioned at a housing interior. In a twenty-eighth embodiment, disclosed is a water delivery assembly according to any of embodiments 7 to 27, wherein the controller is positioned at a housing interior. In a twenty-ninth embodiment, disclosed is a water delivery assembly according to any of embodiments 7 to 28, wherein the controller is associated with one or more electric ports, each port configured to receive and couple to an electric wire. In a thirtieth embodiment, disclosed is a water delivery assembly according to embodiment 29, wherein the housing comprises one or more openings to receive the one or more electric ports.

In a thirty-first embodiment, disclosed is a water delivery assembly according to any of embodiments 17 to 30, wherein the manifold comprises a first port configured to receive the first electromechanical valve, a second port configured to receive the second electromechanical valve, a hot water port configured to couple to the hot source water line, a cold water port configured to couple to the cold source water line, and an outlet port configured to couple to the mixed hot/cold water outlet line. In a thirty-second embodiment, disclosed is a water delivery assembly according to any of embodiments 17 to 20, wherein the manifold comprises the mixing chamber. In a thirty-third embodiment, disclosed is a water delivery assembly according to any of embodiments 17 to 32, wherein the manifold comprises an engineering thermoplastic.

In a thirty-fourth embodiment, disclosed is a water delivery assembly according to any of embodiments 7 to 33, comprising a flow sensor in electronic communication with the controller.

In a thirty-fifth embodiment, disclosed is a water delivery assembly according to any of the preceding embodiments, wherein the water dispensing device comprises a kitchen faucet, a bath faucet, a shower spray head, or a bath tub or walk-in bath spout.

In a thirty-sixth embodiment, disclosed is a water delivery assembly according to any of the preceding embodiments, wherein the actuation assembly comprises a presence sensor configured to detect a presence or absence of a person at or near the device, the water dispensing device is configured to operate in a manual mode by a person actuating the magnetic sensor assembly, and the water dispensing device is configured to operate in an automatic mode by the presence sensor detecting the person's presence or absence. In a thirty-seventh embodiment, disclosed is a water delivery assembly according to any of the preceding embodiments, wherein the actuation assembly is configured to be positioned exterior to or remote from the water dispensing device.

The term “flow communication” or “fluid communication” means for example configured for liquid or gas flow therethrough and may be synonymous with “fluidly coupled”. The terms “upstream” and “downstream” indicate a direction of gas or fluid flow, that is, gas or fluid will flow from upstream to downstream.

Likewise, “electrical communication” or “electronic communication” may mean “electrically coupled”. Electrical communication may be via wired connection or may be wireless.

The terms “coupled” or “connected” may mean that an element is “attached to” or “associated with” another element. Coupled or connected may mean directly coupled or coupled through one or more other elements. An element may be coupled to an element through two or more other elements in a sequential manner or a non-sequential manner. The term “via” in reference to “via an element” may mean “through” or “by” an element. Coupled or connected or “associated with” may also mean elements not directly or indirectly attached, but that they “go together” in that one may function together with the other.

The term “towards” in reference to a of point of attachment, may mean at exactly that location or point or, alternatively, may mean closer to that point than to another distinct point, for example “towards a center” means closer to a center than to an edge.

The term “like” means similar and not necessarily exactly like. For instance “ring-like” means generally shaped like a ring, but not necessarily perfectly circular.

The articles "a" and "an" herein refer to one or to more than one (e.g. at least one) of the grammatical object. Any ranges cited herein are inclusive. The term "about" used throughout is used to describe and account for small fluctuations. For instance, "about" may mean the numeric value may be modified by ±0.05%, ±0.1%, ±0.2%, ±0.3%, ±0.4%, ±0.5%, ±1%, ±2%, ±3%, ±4%, ±5%, ±6%, ±7%, ±8%, ±9%, or ±10%. All numeric values are modified by the term "about" whether or not explicitly indicated. Numeric values modified by the term "about" include the specific identified value. For example "about 5.0" includes 5.0.

The term “substantially” is similar to “about” in that the defined term may vary from for example by ±0.05%, ±0.1%, ±0.2%, ±0.3%, ±0.4%, ±0.5%, ±1%, ±2%, ±3%, ±4%, ±5%, ±6%, ±7%, ±8%, ±9%, or ±10% of the definition; for example the term “substantially perpendicular” may mean the 90° perpendicular angle may mean “about 90°”. The term “generally” may be equivalent to “substantially”.

Features described in connection with one embodiment of the disclosure may be used in conjunction with other embodiments, even if not explicitly stated.

Embodiments of the disclosure include any and all parts and/or portions of the embodiments, claims, description and figures. Embodiments of the disclosure also include any and all combinations and/or sub-combinations of embodiments.

Claims

1. A water delivery assembly comprising
a water dispensing device;
an actuation assembly; and
a mixing assembly,

wherein
the actuation assembly is configured to be operated to control a volume and a temperature of water delivered from the water dispensing device,
the actuation assembly comprises a magnetic sensor assembly comprising a magnet and a magnetic sensor, and
the mixing assembly is configured to be positioned exterior to or remote from the water dispensing device, and to deliver mixed hot/cold water to the water dispensing device.

2. The water delivery assembly according to claim **1**, wherein the actuation assembly is configured to be positioned exterior to or remote from the water dispensing device.

3. The water delivery assembly according to claim **1**, wherein
the actuation assembly comprises a controller,
the actuation assembly comprises a stem having a first end coupled to the magnet and a second end coupled to a handle,
the magnetic sensor is in a fixed position,
the handle is configured to be actuated to move the stem and magnet relative to the magnetic sensor,
the magnetic sensor is configured to detect a position of the magnet,
the controller is in electronic communication with the magnetic sensor and is configured to receive an electronic signal from the magnetic sensor indicating the magnet position, and
the controller is configured to instruct the mixing assembly to deliver the mixed water to the water dispensing device at a water volume and a water temperature corresponding to the magnet position.

4. The water delivery assembly according to claim **3**, wherein movement of the magnet along a first axis is configured to adjust the mixed water volume, and movement of the magnet along a second axis is configured to adjust the mixed water temperature.

5. The water delivery assembly according to claim **3**, wherein

the mixing assembly comprises a first electromechanical valve configured to receive hot water from a hot water source, and a second electromechanical valve configured to receive cold water from a cold water source,

the controller is in electronic communication with the first electromechanical valve and configured to instruct the first electromechanical valve to open or close to adjust a volume of hot water delivered to the water dispensing device, and

the controller is in electronic communication with the second electromechanical valve and configured to instruct the second electromechanical valve to open or close to adjust a volume of cold water delivered to the water dispensing device.

6. The water delivery assembly according to claim **5**, wherein

the mixing assembly comprises a mixing chamber,

the first electromechanical valve is configured to deliver hot water to the mixing chamber,

the second electromechanical valve is configured to deliver cold water to the mixing chamber, and

the mixing chamber is configured to deliver mixed hot/cold water to the water dispensing device.

7. The water delivery assembly according to claim **5**, wherein

the first electromechanical valve comprises a first electric motor coupled to a first valve,

the second electromechanical valve comprises a second electric motor coupled to a second valve,

the controller is in electronic communication with the first electric motor and configured to instruct the first electric motor to operate the first valve to open or close to adjust a volume of hot water delivered to the water dispensing device, and

the controller is in electronic communication with the second electric motor and configured to instruct the second electric motor to operate the second valve to open or close to adjust a volume of cold water delivered to the water dispensing device.

8. The water delivery assembly according to claim **5**, wherein
the mixing assembly comprises a manifold,
the first electromechanical valve and the second electromechanical valve are coupled to the manifold,
the manifold is configured to couple to a hot source water line and to a cold source water line, and
the manifold is configured to couple to an outlet line configured to deliver mixed hot/cold water to the water dispensing device.

9. The water delivery assembly according to claim **7**, wherein the first electric motor is coupled to the first valve through a first gear assembly, and the second electric motor is coupled to the second valve through a second gear assembly.

10. The water delivery assembly according to claim **7**, wherein
the first valve comprises a first spindle,
the second valve comprises a second spindle,
the first electric motor is configured to rotate the first spindle to open and closed the first valve, and
the second electric motor is configured to rotate the second spindle to open and close the second valve.

11. The water delivery assembly according to claim **10**, wherein the first spindle and the second spindle are each configured to rotate a ceramic disc to open and close the first valve and the second valve, respectively.

12. The water delivery assembly according to claim **3**, wherein the mixing assembly and the controller are positioned at a housing interior.

13. The water delivery assembly according to claim **3**, wherein the controller is associated with one or more electric ports, each port configured to receive and couple to an electric wire.

14. The water delivery assembly according to claim **8**, wherein the manifold comprises
a first port configured to receive the first electromechanical valve,
a second port configured to receive the second electromechanical valve,

a hot water port configured to couple to the hot source water line,
a cold water port configured to couple to the cold source water line, and
an outlet port configured to couple to the mixed hot/cold water outlet line.

15. The water delivery assembly according to claim **8**, wherein the manifold comprises the mixing chamber.

16. The water delivery assembly according to claim **8**, wherein the manifold comprises an engineering thermoplastic.

17. The water delivery assembly according to claim **3**, comprising a flow sensor in electronic communication with the controller.

18. The water delivery assembly according to claim **1**, wherein the water dispensing device comprises a kitchen faucet, a bath faucet, a shower spray head, a bath tub spout, or a walk-in bath spout.

19. The water delivery assembly according to claim **1**, wherein the magnetic sensor assembly is coupled to a faucet body.

20. The water delivery assembly according to claim **1**, wherein the magnetic sensor assembly is configured to be positioned exterior to the water dispensing device.

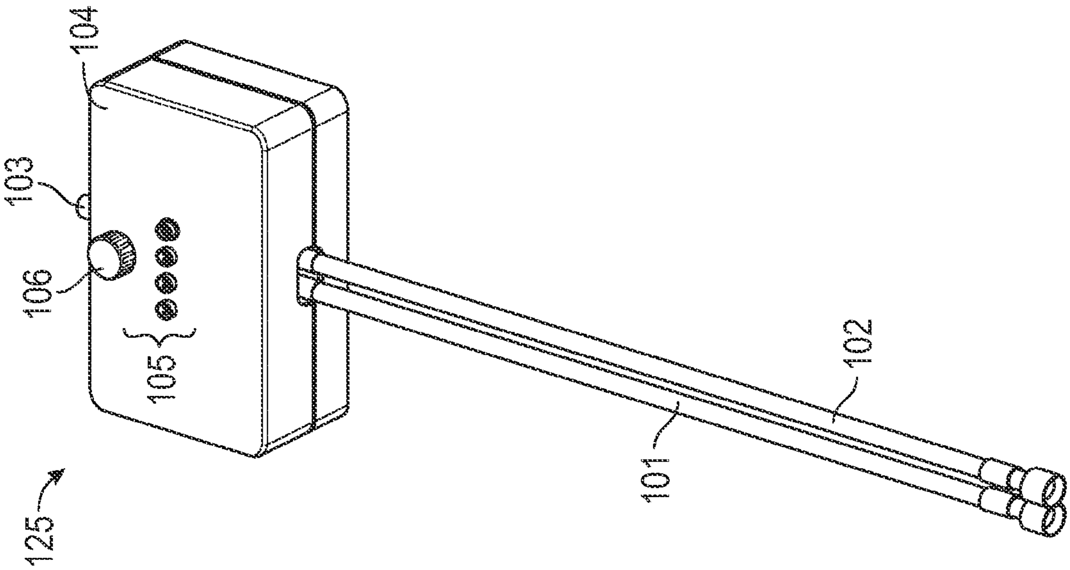

FIG. 1B

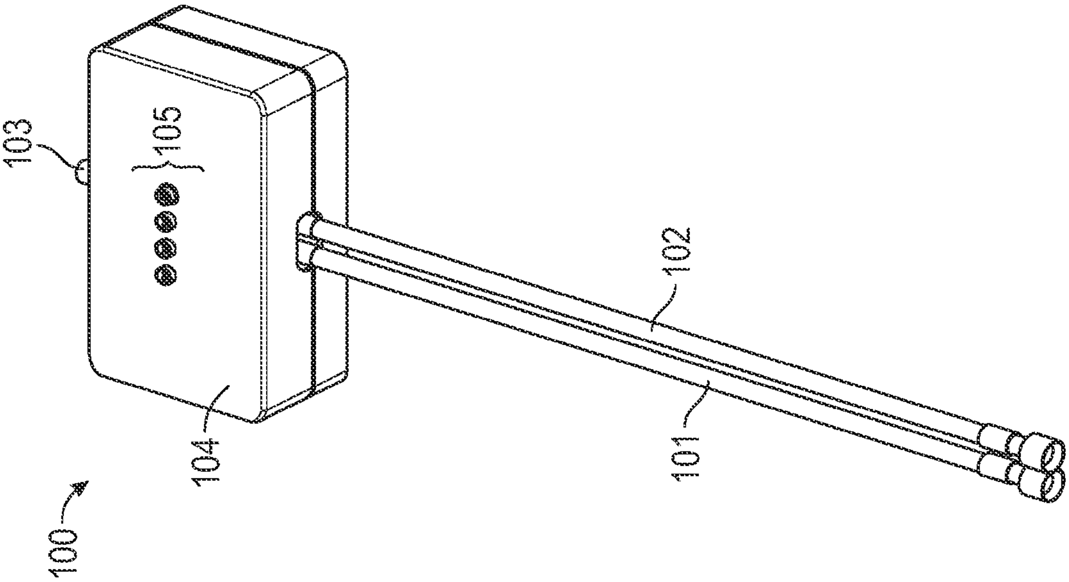

FIG. 1A

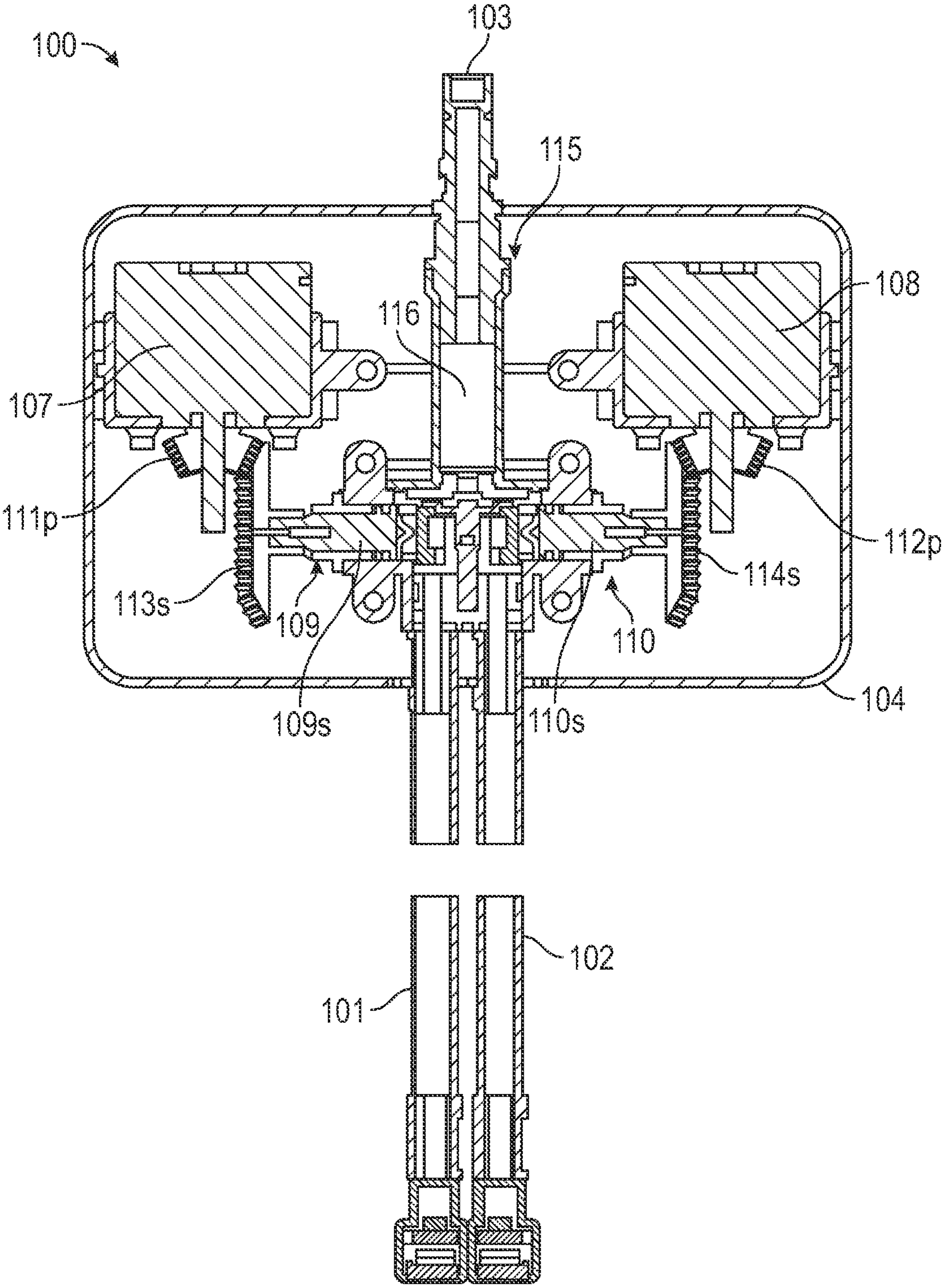
100
103
115
116
108
107
111p
112p
113s
114s
109
110
109s
110s
104
102
101

FIG. 1C

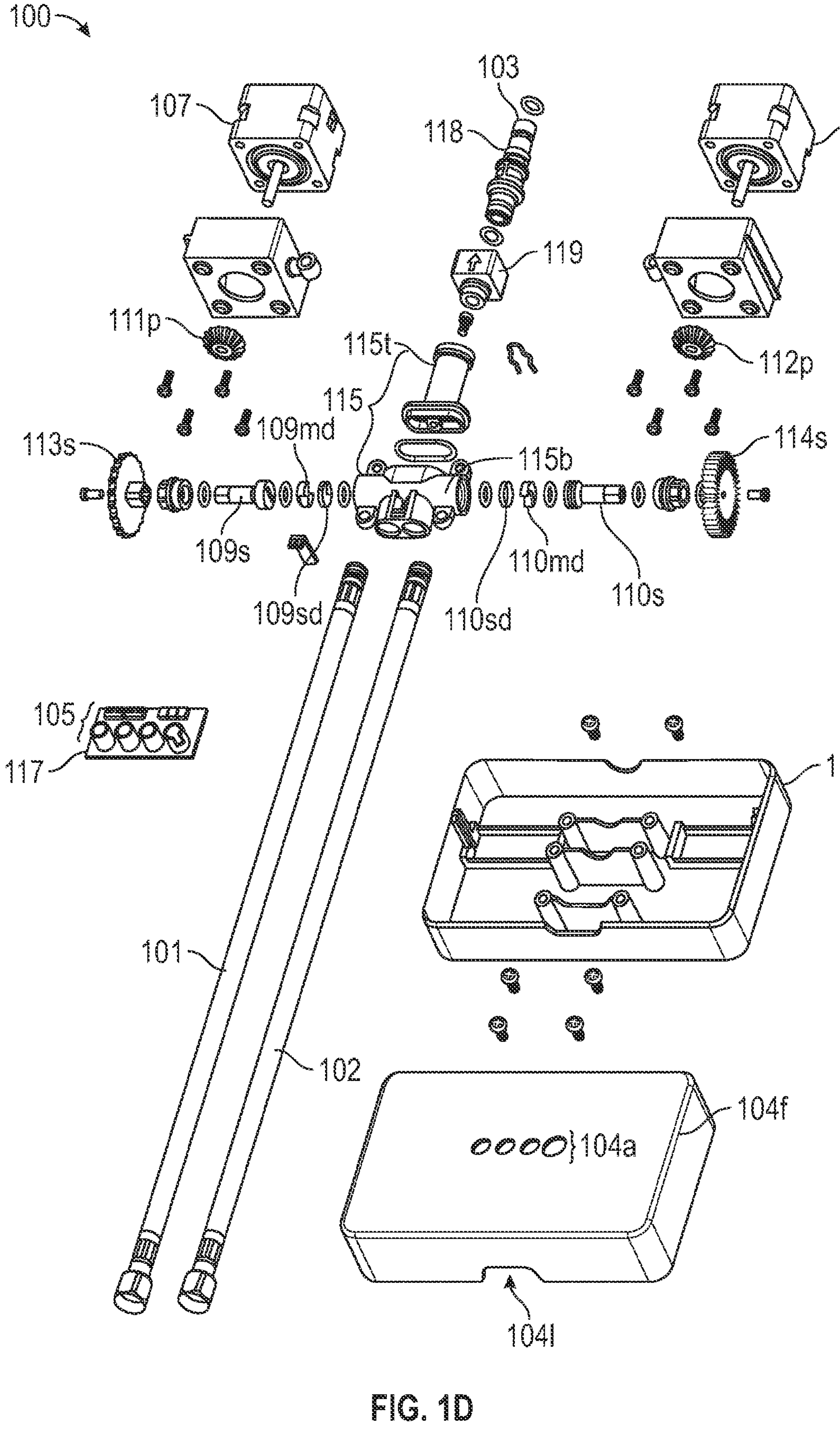
100
103
107
118
108
119
111p
115t
112p
115
109md
113s
115b
114s
109s
110md
110s
109sd
110sd
105
117
104r
101
102
104f
104a
104l

FIG. 1D

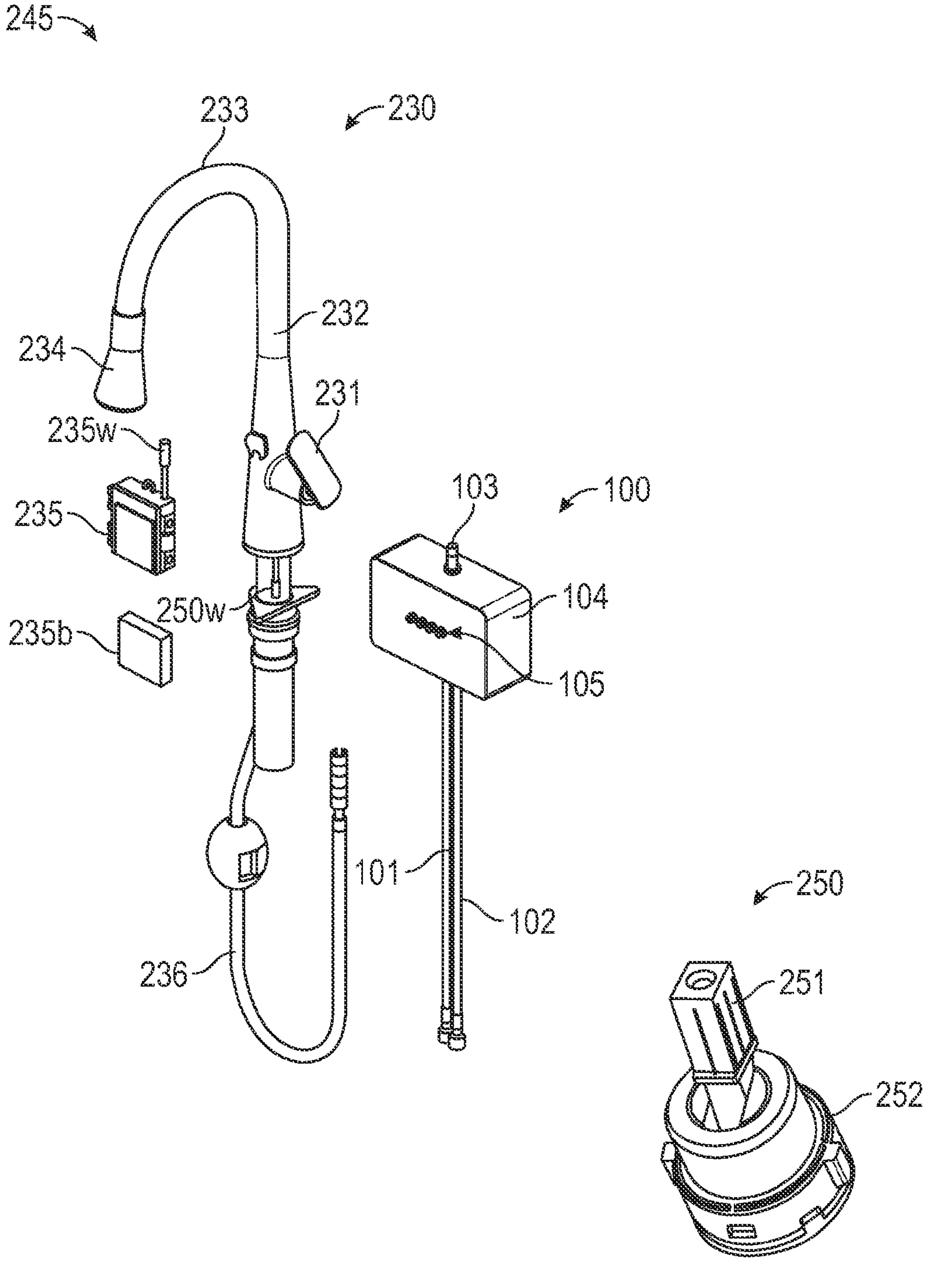
245
233
230
232
234
231
235w
103
100
235
104
250w
235b
105
101
102
250
236
251
252

FIG. 2A

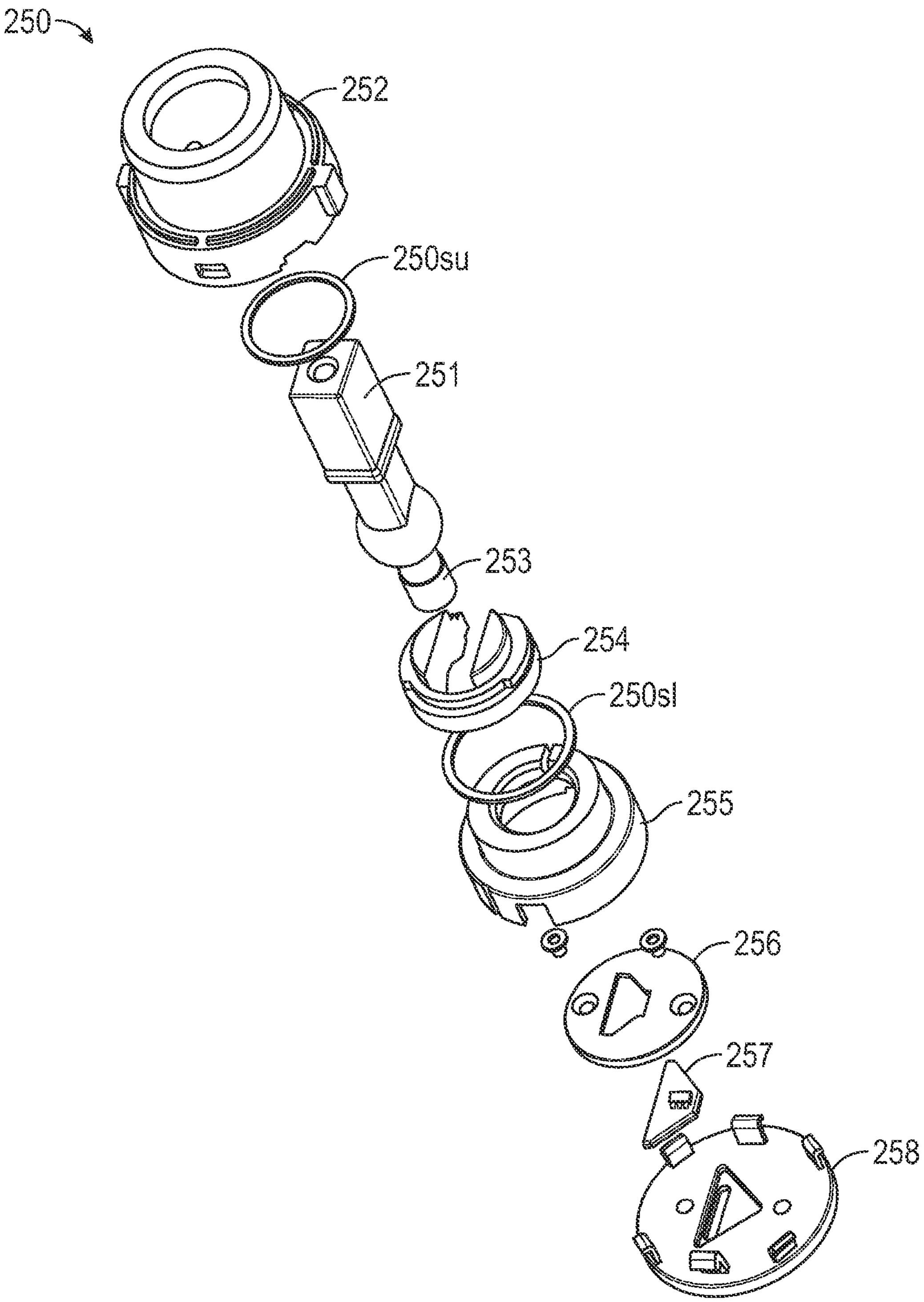

FIG. 2B

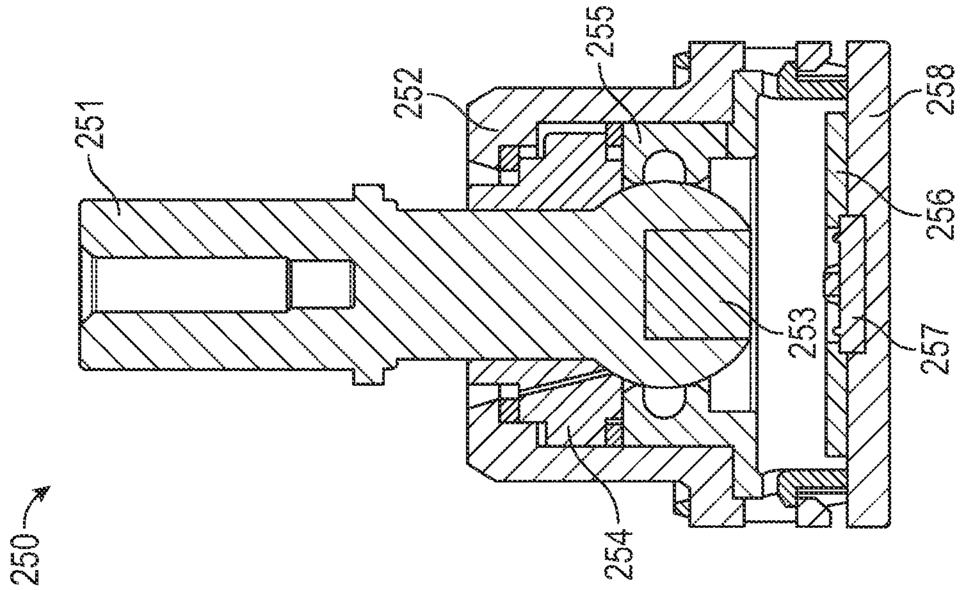
250
251
252
253
254
255
256
257
258

FIG. 2D

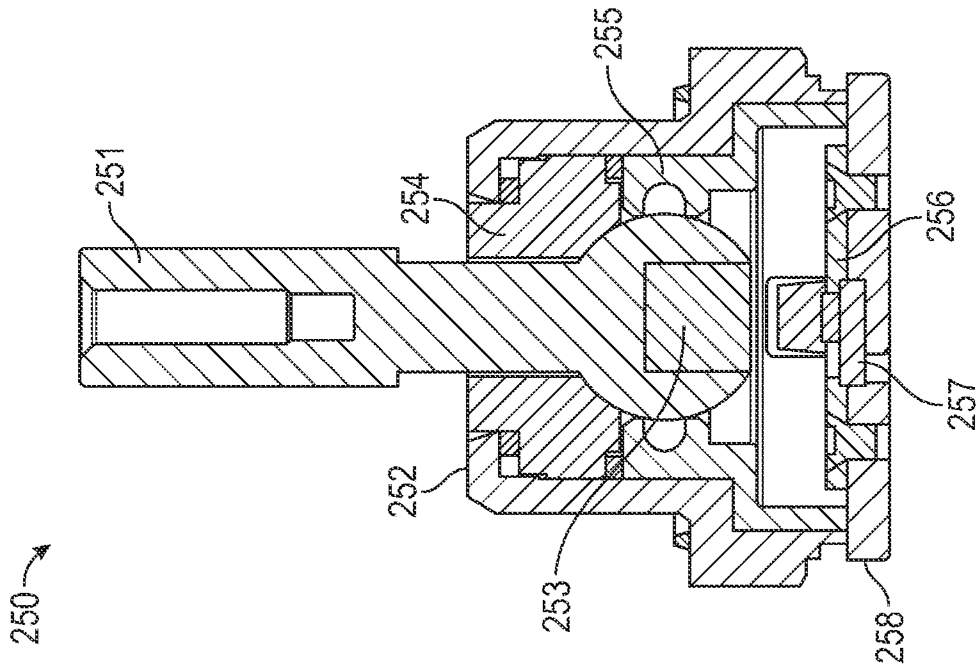
250
251
252
253
254
255
256
257
258

FIG. 2C