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(71) Applicant: **KOHLER MIRA LIMITED** [GB/GB]; Cromwell Road, Cheltenham Gloucestershire GL52 5EP (GB).

(72) Inventors: **JONES, Oliver Philip**; c/o Kohler Mira Limited, Cromwell Road, Cheltenham Gloucestershire GL52 5EP (GB). **IDDON, Leyton**; c/o Kohler Mira Limited, Cromwell Road, Cheltenham Gloucestershire GL52 5EP (GB).

(74) Agent: **BARKER BRETTELL LLP**; 100 Hagley Road, Edgbaston, Birmingham West Midlands B16 8QQ (GB).

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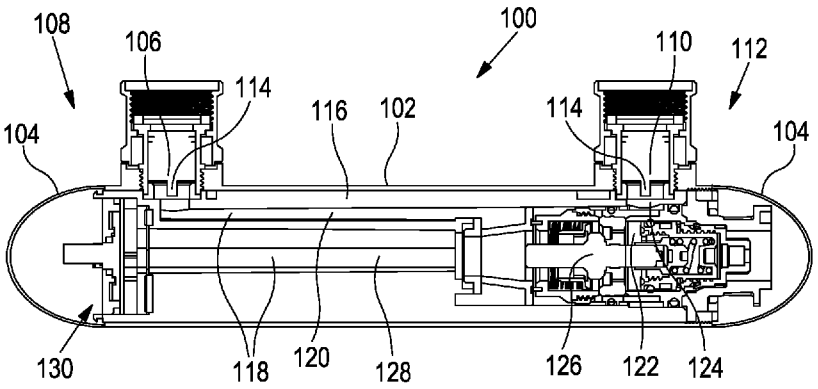


Figure 1

(57) Abstract: A valve for an ablutionary system, the valve comprising: a waterway body; and a diverter; wherein the waterway body includes: a first waterway portion configured to direct fluid flow from an inlet to the diverter; a second waterway portion configured to direct fluid flow from the diverter to a first outlet; and a third waterway portion configured to direct fluid flow from the diverter to a second outlet; wherein the diverter is configured to selectively direct fluid flow from the first waterway portion to at least one of the first waterway portion and the second waterway portion; wherein one or more of the first waterway portion, the second waterway portion, and the third waterway portion i s/are formed integrally with and defined by the waterway body.

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VALVE

The present disclosure relates to valves, particularly but not exclusively to user-controllable valves operable to provide selectively a flow of fluid such as water to one or more outlets. Such valves may include mixer valves, e.g. for use in mixer taps. The disclosure relates to ablutionary fittings and ablutionary systems, e.g. bath and/or shower systems, comprising such valves.

Valves are known in the art for selectively providing a desired flow of water to one or multiple water outlets. Mixer valves further allow the mixing of two input flows of water into a single output flow. Commonly, a hot input flow and a cold input flow are combined together in order to provide an output flow at a third temperature between the temperatures of the hot and cold input flows. A single output flow or multiple output flows may be provided. Where multiple output flows are provided, these may be activated together or separately, dependent on the needs of the user.

It is known to provide a mixer valve in the form of a bar valve. A bar valve typically comprises an elongate housing with an input flow provided towards each end of the housing. The input flows are then combined in a mixing chamber before forming an outlet flow and exiting the bar valve, for example towards the centre of the housing. In general, a flow control and a temperature control may be located at opposing ends of the housing and controllable by a user.

It is desired to provide a valve for use in an ablutionary system with improved characteristics, such as in flow and manufacturability.

A first aspect provides a valve for an ablutionary system, the valve comprising:

a waterway body; and

a diverter;

wherein the waterway body includes:

a first waterway portion configured to direct fluid flow from an inlet to the diverter;

a second waterway portion configured to direct fluid flow from the diverter to a first outlet; and

a third waterway portion configured to direct fluid flow from the diverter to a second outlet;

wherein the diverter is configured to selectively direct fluid flow from the first waterway portion to at least one of the first waterway portion and the second waterway portion;

wherein one or more of the first waterway portion, the second waterway portion, and the third waterway portion is/are formed integrally with and defined at least partially by the waterway body.

The first waterway portion, the second waterway portion and the third waterway portion may each be formed integrally with and defined at least partially by the waterway body.

The waterway body may be formed as a single part. The waterway body may be unitarily formed as one piece, for example as a moulding, or may be formed as multiple pieces and then fixed or bonded together, for example be adhesive, welding, mechanical fixture, or equivalent.

One or more of the first waterway portion, the second waterway portion and the third waterway portion may be straight at least in part. One or more of the fist waterway portion, the second waterway portion and the third waterway portion may comprise at least one bend.

The first waterway portion and the second waterway portion may be parallel along at least a portion of their respective lengths within the waterway body. The first waterway portion and the third waterway portion may be parallel along at least a portion of their respective lengths within the waterway body. The second waterway portion and the third waterway portion may be parallel along at least a portion of their respective lengths within the waterway body. The first waterway portion, the second waterway portion, and the third waterway portion may be parallel along at least a portion of their respective lengths within the waterway body.

The first waterway portion may extend a distance along a central axis of the waterway body.

The second waterway portion and the third waterway portion may be radially-offset from the first waterway portion. The second waterway portion and/or the third waterway portion may be disposed radially outwards of the first waterway portion.

The first waterway portion may be disposed between the second waterway portion and the third waterway portion.

The waterway body may be elongate and may have a longitudinal axis.

The longitudinal axis of the waterway body may be coincident with the central axis.

The first waterway portion, the second waterway portion, and the third waterway portion may each have an opening that exits the waterway body at a first end of the waterway body, the diverter forming an end to each of the first waterway portion, the second waterway portion, and the third waterway portion.

The diverter may include at least one moving part, the movement of which may selectively determine to which of the second waterway portion and the third waterway portion the fluid flow is provided.

The diverter may be a rotary diverter. The rotary diverter may be arranged such that rotation of the moving part may be around the or a central axis of the waterway body.

The second waterway portion and the third waterway portion may have an opening that exits the waterway body at the first outlet and second outlet, respectively.

The inlet may be in fluid communication with a source of fluid, e.g. a source of water operable to provide water at a desired temperature. Upstream of the inlet, fluid from the source of fluid may pass along a fourth waterway portion, which may be formed integrally with and defined at least partially by the waterway body.

The source of fluid may comprise an instantaneous water heater operable to provide water at a desired temperature.

The inlet may be in fluid communication with a mixing chamber that receives fluid flow from the or a fourth and a fifth waterway portions. The mixing chamber may be operable to provide a mixed flow to the inlet.

The mixing chamber may include a thermostatic mixer valve. The thermostatic mixer valve may allow the temperature of the mixed flow to be set to a desired temperature by a user.

The fourth and/or fifth waterway portions may be formed integrally with and defined at least partially by the waterway body.

The fourth and fifth waterway portions may each run from a respective external inlet to the mixing chamber. One of the external inlets may be in fluid communication with a source of hot fluid, e.g. hot water, and the other of the external inlets may be in fluid communication with a source of cold fluid, e.g. cold water.

One or more of the waterway portions (e.g. one of more of the first waterway portion, the second waterway portion, the third waterway portion, the fourth waterway portion and the fifth waterway portion) may comprise an open channel formed in the waterway body. One or more of the waterway portions (e.g. one of more of the first waterway portion, the second waterway portion, the third waterway portion, the fourth waterway portion and the fifth waterway portion) may comprise a bore extending a distance through the waterway body.

The valve may include a housing that surrounds or substantially surrounds the waterway body. The housing may provide protection to the waterway body or and/or may act as a frame to which the waterway body and other components may be attached.

The body may be configured to provide connections for connecting ablutionary fittings to the first outlet and/or the second outlet.

The diverter may include a fixed part and a moving part, the fixed part being in a fixed alignment relative to the waterway and the moving part being rotationally-

movable relative to the fixed part, movement of the moving part relative to the fixed part controlling the selective allowance or disallowance of flow to the first outlet and second outlet.

The fixed part may include an inlet aperture at least partially aligned with the first portion and two outlet apertures, each outlet aperture being at least partially aligned with one of the first outlet and second outlet.

The moving part may include an aperture that is at least partially aligned with the inlet aperture of the fixed part, the aperture being movable to a position such that provides a fluid flow path between the inlet aperture and one or both of the outlet apertures of the fixed part.

The fixed part and moving part therefore provide a simple control of the water flow through the valve, allowing water flow to either or both of the outlets by movement of the diverter.

The outlet apertures of the fixed part may be located within a 180 degree sector of the fixed part. Each outlet aperture may be located within its own 90 degree sector of the fixed part.

The aperture of the moving part may extend around an approximately 180 degree sector of the moving part. When combined with the outlet apertures being located within a 180 degree sector of the fixed part, this arrangement allows the moving part to direct flow from the first portion of the waterway to neither, either, or both of the outlet waterways, in use.

The aperture may be shaped so that, at all orientations, the moving part does not obstruct the inlet aperture.

By varying the alignment of the moving part, the level of flow through each outlet can also be controlled. For example, aligning the moving part such that the first outlet aperture is fully uncovered allows full flow through the first outlet whilst aligning the moving part such that the first aperture is only partially uncovered allows only partial flow through the first outlet.

The diverter may further comprise a diverter control for enabling a user to adjust the position of the moving part, in use. The diverter control may be rotationally-fixed relative to the moving part.

The diverter may be further configured to selectively allow or disallow flow from the first waterway portion to the second waterway portion and third waterway portion together. This will allow both the first outlet and second outlet to receive fluid, e.g. water, flow concurrently.

The valve may be a mixer valve and/or a bar valve.

By "formed integrally" it is meant that the waterway and body are formed as a single piece. By providing a waterway integrated into the body of the valve, along with a diverter that controls flow to both of the outlets, a simple and compact valve can be provided whilst allowing complex control of water flow. This aids manufacturability as well as being advantageous in terms of assembly, a lowered part-count, and flexibility of design, amongst other things. The simple design of waterway also enables enhanced flow through the valve.

A second aspect provides a valve for an ablutionary system, the valve comprising:

a body having a first inlet and a second inlet, a first outlet, and a second outlet;

a waterway formed integrally with and defined at least partially by the body, the waterway being configured to direct fluid flow directly or indirectly from the first inlet and the second inlet to the first outlet and the second outlet; and

a diverter that divides the waterway into a first portion configured to receive, directly or indirectly, a mixed flow from the first inlet and the second inlet, a second portion in communication with the first outlet and a third portion in communication with the second outlet, the diverter being configured to selectively allow or disallow flow from the first portion to the second portion and the third portion.

The body may further comprise a mixing chamber configured to receive inlet flows from the first inlet and the second inlet, forming the mixed flow, and may further be

configured to output the mixed flow to the first portion. Forming the mixed flow in a mixing chamber may enhance the mixing of the water within the valve.

The body may be formed as a single part. The body may be unitarily formed as one piece, for example as a moulding, or may be formed as multiple pieces and then fixed or bonded together, for example be adhesive, welding, mechanical fixture, or equivalent.

The mixing chamber may include a thermostatic mixer valve. The thermostatic mixer valve may allow the temperature of the mixed flow to be set to a desired temperature by a user.

The waterway may further comprise a fourth portion in communication with first inlet and second inlet. Alternatively, the waterway may further comprise a fourth portion in communication with the first inlet and a fifth portion in communication with the second inlet. Having a fourth portion, and optionally a fifth portion, of the waterway that transfers water from the at least one inlet, for example from the first inlet to the mixing chamber, and/or from the second inlet to the mixing chamber, further enhances the compactness of the valve.

The fourth portion and/or fifth portion may be configured to transfer water from the first inlet and/or second inlet to the mixing chamber.

The first inlet and second inlet may be positioned towards opposing ends of the body. Such an arrangement is advantageous for connection to standard sources of water for the first and second inlets.

The first outlet and second outlet may be positioned between the first inlet and second inlet, the first outlet and second outlet preferably being aligned with each other.

The valve may include a housing that surrounds or substantially surrounds the body, the housing preferably being configured to provide connections for connecting water supplies to the at least one inlet. The housing may also act to provide protection to the body or act as a frame to which the body and other components may be attached.

The body may be configured to provide connections for connecting ablutionary fittings to the first outlet and/or second outlet.

The body may be elongate with a longitudinal axis, the first portion being parallel or substantially parallel with the longitudinal axis. The first portion may be centrally disposed within the body.

The second portion and third portion may be parallel with or substantially parallel with the longitudinal axis and may be radially spaced from the first portion, relative to the longitudinal axis.

The diverter may include a fixed part and a moving part, the fixed part being in a fixed alignment relative to the waterway and the moving part being rotationally-movable relative to the fixed part, movement of the moving part relative to the fixed part controlling the selective allowance or disallowance of flow to the first outlet and second outlet.

The fixed part may include an inlet aperture at least partially aligned with the first portion and two outlet apertures, each outlet aperture being at least partially aligned with one of the first outlet and second outlet.

The moving part may include an aperture that is at least partially aligned with the inlet aperture of the fixed part, the aperture being movable to a position such that provides a fluid flow path between the inlet aperture and one or both of the outlet apertures of the fixed part.

The fixed part and moving part therefore provide a simple control of the water flow through the valve, allowing water flow to either or both of the outlets by movement of the diverter.

The outlet apertures of the fixed part may be located within a 180 degree sector of the fixed part. Each outlet aperture may be located within its own 90 degree sector of the fixed part.

The aperture of the moving part may extend around an approximately 180 degree sector of the moving part. When combined with the outlet apertures being located within a 180 degree sector of the fixed part, this arrangement allows the moving part to direct flow from the first portion of the waterway to neither, either, or both of the outlet waterways, in use.

The aperture may be shaped so that, at all orientations, the moving part does not obstruct the inlet aperture.

By varying the alignment of the moving part, the level of flow through each outlet can also be controlled. For example, aligning the moving part such that the first outlet aperture is fully uncovered allows full flow through the first outlet whilst aligning the moving part such that the first aperture is only partially uncovered allows only partial flow through the first outlet.

The diverter may further comprise a diverter control for enabling a user to adjust the position of the moving part, in use. The diverter control may be rotationally-fixed relative to the moving part.

The diverter may be further configured to selectively allow or disallow flow from the first portion to the second portion and third portion together. This will allow both the first outlet and second outlet to receive water flow concurrently.

The valve may be a mixer valve and/or a bar valve.

Though described as a first portion, second portion, third portion, fourth portion, and fifth portion, the portions of the waterway may be labelled differently depending on their position within the waterway. The second portion and third portion may be termed outlet portions, where provide flow from the diverter to the outlets. They may be termed a first outlet portion and a second outlet portion, respectively. The fourth portion and fifth portion may be termed inlet portions, where they receive flow from the at least one inlet. They may be termed a first inlet portion and second inlet portion, respectively. The first portion may be termed an intermediate portion, where it is interposed between the inlet portions and outlet portions in the direction of flow.

The skilled person will understand where labels such as these are used, no specific structure is implied by the labels and they are used only to aid the skilled person's understanding; the structure is limited by the description of the features themselves. Moreover, where allowed by the invention, any combination of portions may be provided, omitting other portions – e.g. the inclusion of a fifth portion does not depend upon the inclusion of a fourth portion.

A third aspect provides an ablutionary fitting comprising a valve according to the first aspect or the second aspect.

The ablutionary fitting may comprise a mixer valve. The ablutionary fitting may comprise a fluid, e.g. water, delivery device such as a tap, a faucet, a spray head, a sprinkler or a shower head.

A fourth aspect provides an ablutionary system comprising a valve according to the first aspect or a valve according to the second aspect and an ablutionary fitting in communication with an outlet of the valve.

Ablutionary fittings may be provided in communication with both the first outlet and the second outlet.

The or each ablutionary fitting may comprise a fluid, e.g. water, delivery device such as a tap, a faucet, a spray head, a sprinkler or a shower head.

The ablutionary system may comprise a shower system and/or a bath system.

A fifth aspect provide a kit of parts arranged to be assembled into a valve according to the first aspect, a valve according to the second aspect, an ablutionary fitting according to the third aspect or an ablutionary system according to the fourth aspect.

The skilled person will appreciate that except where mutually exclusive, a feature or parameter described in relation to any one of the above aspects may be applied to any other aspect. Furthermore, except where mutually exclusive, any feature or parameter described herein may be applied to any aspect and/or combined with any other feature or parameter described herein.

Non-limiting embodiments will now be described with reference to the accompanying drawings, in which:

Figure 1 is a first sectional view of a first embodiment of a valve;

Figure 2 is a second sectional view of the valve of Figure 1, at 90 degrees to the first sectional view;

Figure 3 is a third sectional view of the valve of Figure 1, showing the outlet waterways;

Figure 4 is an exploded perspective view of one end of the valve of Figure 1, showing the body and diverter;

Figures 5a to 5f show six views of the diverter of the first embodiment, with the moving part in six different orientations, highlighting the outlet flow associated with each orientation;

Figure 6 is a schematic diagram of an ablutionary system;

Figure 7 is a first sectional view of a second embodiment of a valve;

Figure 8 is a second sectional view of the valve of Figure 7, at 90 degrees to the first sectional view;

Figure 9 is an exploded perspective view of one end of the valve of Figure 7, showing the body and diverter; and

Figures 10a to 10e show five views of the diverter of the second embodiment, with the moving part in five different orientations, highlighting the outlet flow associated with each orientation.

Referring to Figures 1 to 3, there is shown a first embodiment of a valve, more specifically a mixer valve 100. The mixer valve 100 takes the form of a bar valve. The

mixer valve 100 is formed of a tubular outer housing 102 having a cap 104 at either end. The caps 104 are shown only in Figure 1. The caps 104 are rotatable relative to the outer housing 102 in order to provide user control of the mixer valve 100. A first inlet 106 is provided towards a first end 108 of the mixer valve 100 and a second inlet 110 is provided towards a second end 112 of the mixer valve. The first inlet 106 and the second inlet 110 allow hot and cold water to be provided to the mixer valve 100, respectively, through openings 114 in the outer housing 102. Although in the present embodiment hot water is supplied through the first inlet 106 and cold water is supplied through the second inlet 110, the water inputs could be reversed, if desired. Moreover, although described as hot and cold water, water of any temperature could be provided through either of the first inlet 106 and the second inlet 110.

Within the outer housing 102 is a body 116 which further defines the first inlet 106 and second inlet 110 and defines a waterway 118 through which water from the inlets 106, 110 can flow. The body 116 defines a first inlet portion 120 of the waterway 118, running from the first inlet 106 to a mixing chamber 122 located towards the second end 112, and a second inlet portion 124 of the waterway 118 that enables flow from the second inlet 110 to the mixing chamber 122. Due to the position of the mixing chamber 122, the first inlet portion 120 is significantly longer than the second inlet portion 124, as it must travel a majority of the length of the mixer valve 100 in order to reach the mixing chamber 122, whereas the second inlet 110 is located adjacent to the mixing chamber 122. Of course, this arrangement could be altered such that the first and second inlet portions 120, 124 are of equal length or of other, different, lengths.

The mixing chamber 122 may be positioned in any place within the mixer valve 100, but in the present embodiment is located towards the second end 112 for ease of manufacture, access, and control. In the illustrated example, the mixing chamber 122 includes a thermostatic control valve 126 that controls the proportions of the water mixing in the mixing chamber 122, from the first and second inlets 106, 110, based on a temperature setting controlled by the user. This setting is controlled by the rotation of the cap 104 at the second end 112 of the housing 102. Thus, the temperature of water output from the mixing chamber 122 may be automatically controlled by the thermostatic control valve 126.

From the mixing chamber 122, a mixed flow of water can flow through an intermediate portion 128 of the waterway 118 towards the first end 108 of the mixer valve 100 and through a diverter 130. The diverter 130 controls flow between the intermediate portion 128 of the waterway 118 and two outlet portions 132 of the waterway, each outlet portion 132 being associated with a respective one of a first and second outlet 134, 136, and providing a path for water flow to either the first outlet 134 or second outlet 136, respectively.

The body 116 can be considered to be elongate, having the inlets 106, 110 at opposed ends, and thus has a longitudinal axis. The first inlet portion 120, intermediate portion 128, and outlet portions 132 of the waterway 118 therefore can each be considered to extend in parallel with the said longitudinal axis, at least along a substantial extent of their respective lengths. The intermediate portion 128 is central within the body, effectively being coincident with the longitudinal axis, whilst the inlet portion 120 and outlet portions 132 are radially spaced relative to the longitudinal axis, about the intermediate portion 128.

The diverter 130 allows control of the flow of water from the intermediate portion 128 to either, neither, or both of the first outlet 134 and second outlet 136, by user control of the diverter 130. A diverter control 138 is provided that is rotated by rotation of the cap 104 at the first end 108 of the housing 102. Rotation of the cap 104 causes rotation of the diverter control 138 through a shaft 140, this rotation controlling the diverter 130 as described below. In the illustrated example, the diverter control 138, end cap 142, and washer 144, act together to seal the end of the body 116, thereby preventing water leakage from the waterway 118. The body 116 is unitarily-formed as a single part, for ease and/or simplification of construction. The inlet portions 120, 124, intermediate portion 128, and outlet portions 132 are all integrally formed within the body 116.

The diverter 130 of the present embodiment can be seen in Figure 4 and is formed of two main components: a fixed part 146 and a moving part 148. In addition, the washer 144, diverter control 138, and end cap 142 secure the diverter 130 in place and prevent leakage of water out of the end of the body 116. An elastomeric seal 150 is provided between the body 116 and the fixed part 146 of the diverter 130. In the illustrated example, the fixed part 146 and the moving part 148 are each formed of a ceramic

material, to enhance sealing. The fixed part 146 and the moving part 148 are each circular and fit within the body 116 and housing 102. In other embodiments, different shapes may be employed and the diverter 130 may be attached on the end of, rather than within, the body 116. The fixed part 146 and the moving part 148 share a central shared axis with the thermostatic control valve 126, the body 116, and the housing 102, the moving part 148 rotating around this shared axis. Other materials and constructions of the diverter 130 may also be used. Adaptations and different embodiments will be apparent to the skilled person when considering the present disclosure.

In the depicted embodiment, the fixed part 146 is located adjacent to the body 116 and includes an inlet aperture 152 that is aligned with the intermediate portion 128 of the waterway 118 and two outlet apertures 154 that are aligned with the outlet portions 132 of the waterway 118. If more than two outlets 134, 136 were to be provided, the fixed part 146 would include a corresponding number of outlet apertures 154. The inlet aperture 152 is located substantially centrally in the fixed part 146 whilst the outlet apertures 154 are formed as substantially-arc-shaped slots that extend around approximately 90 degrees of the fixed part 146, about the shared axis. The two outlet apertures 154 are contained within a 180 degree sector of the fixed part 146. A slight separation is provided between the outlet apertures 154.

The moving part 148 comprises an aperture 156 that, in the present embodiment extends over the centre of the moving part 148 and around substantially a 180 degree sector of the moving part 148. The central portion 158 of the aperture 156 therefore aligns with the inlet aperture 152 of the fixed part 146, no matter in what position the moving part 148 is placed. Depending on its rotational alignment, the remainder of the aperture 156 can be lined up with either or both of the outlet apertures 154. The aperture 156 of the moving part 148 therefore enables flow from the inlet aperture 152, through the aperture 156 of the moving part 148, and then through the outlet apertures 154 to one or both of the outlet waterways. The flow therefore rotates 180 degrees whilst passing through the diverter. By rotating the moving part 148 such that the aperture 156 does not align with either of the outlet apertures 154 – i.e. the moving part 148 is 180 degrees out of alignment with the fixed part 146 – flow can be prevented from exiting through either of the outlet apertures 154, and the diverter 130 can be considered to be in a closed configuration. Partial alignment of the aperture

156 with either of the outlet apertures 154 can be used in order to limit the rate of flow through either outlet 134, 136, by throttling.

Although the diverter 130 of the illustrated example is provided in the form described above, it will be apparent to the skilled person that the diverter 130 may take other forms including differently-shaped inlet ports, outlet ports, or additional parts which control either the inflow of water to the mixing chamber 122 or the outflow of water from the mixing chamber 122. For example, the angular extent of each of the inlet ports and outlet ports may be varied and may not necessarily be equal with any other inlet port or outlet port. This will vary the possible inlet flows and outlet flows enabled by the diverter 130 and may not be detrimental to its operation.

The moving part 148 also includes two control apertures 160 that engage with corresponding protrusions 162 on the diverter control 138. These protrusions 162 pass through similar apertures 164 in the washer 144 and allow the diverter control 138 to alter the rotational position of the moving part 148. The end cap 142 has a snap-fit engagement with the end of the body 116 using snap-fit connectors 166, and ensures that the diverter 130 is held in position whilst still allowing the rotation of the diverter control 138, washer 144, and moving part 148.

Figures 5a to 5f show how the change in orientation of the moving part 148 alters the water flow through the diverter 130 from the intermediate portion 128 of the waterway 118 and thus the mixing chamber 122 to the outlets 134, 136, via the outlet portions 132. The diverter 130 is shown end on, with the cap 104, end cap 142, diverter control 138, and washer 144 not shown, for clarity.

In Figure 5a, the aperture 156 of the moving part 148 is 180° out of alignment with the fixed part 146 and therefore no pathway is provided for water flow from the inlet aperture 152 to the either of the outlet apertures 154. Thus, no flow is enabled through the diverter 130. However, it can be seen that the inlet aperture 152 remains completely uncovered.

A rotation of approximately 30° clockwise – or 330° anticlockwise – of the moving part 148 leads to a partial alignment of the aperture 156 with the outlet aperture 154 associated with the first outlet 134, as shown in Figure 5b. A throttled flow is

therefore enabled between the inlet aperture 152 and the partially uncovered outlet aperture 154, allowing a throttled flow through the first outlet 134. Alteration of the degree of alignment of the moving part with the fixed part will vary the level of flow to the second outlet. Further rotation of the moving part 148 leads to the outlet aperture 154 being fully uncovered by the moving part 148 of the diverter 130, allowing full flow through the outlet aperture 154 to the first outlet 134. This is shown in Figure 5c.

Rotating the moving part 148 approximately 45° anticlockwise – or 315° clockwise – from the position of Figure 5a leads to the position of Figure 5d where a throttled flow is enabled through the second outlet 136, by partially uncovering the other of the outlet apertures 154. Figure 5e shows how further rotation uncovers the remainder of the outlet aperture 154 to allow full flow through the second outlet 136.

Figure 5f shows how a rotation of 180° from the position of Figure 5a leads to both of the outlet apertures 154 being uncovered, enabling flow from the intermediate portion 128 to both outlet portions 132 and thus both outlets 134, 136.

The design of the diverter 130 in the depicted embodiment is clearly very useful for control of the flow through both of the outlets 134, 136, providing precise control and also a large amount of flexibility. However, it will be clear to the skilled person that the diverter 130 used in the present invention need not be identical to that of the depicted embodiment nor necessarily be of a similar design. What is required is a diverter 130 that can control flow to both outlets 134, 136, and different ways of achieving this technical effect will be clear to the skilled person. Thus, the invention should not be thought to be limited to this particular arrangement of diverter 130. For example, multiple moving parts may be provided, apertures may be of different sizes or be in different positions, and the diverter 130 need not have any rotational or plane symmetry.

Figure 6 is a simple schematic diagram of an ablutionary system 168. The ablutionary system 168 includes the mixer valve 100 described above, the mixer valve 100 being connected directly or indirectly to an ablutionary fitting 170, which may comprise a water delivery device or fitting such as a tap, a faucet, a spray head, a shower head, or any other form of ablutionary fitting 170. Connected to the inlets 108, 110 of the

mixer valve 100 are two water supplies 172, 174. Although these water supplies may be any two water supplies, those depicted are a hot water supply 172, for example from a boiler, water heater, or hot water storage tank, and a cold water supply 174, for example from a mains water supply or a cold water storage tank. By providing a hot water supply 172 and a cold water supply 174, the mixer valve 100 may act to produce a mixed flow at its outlet – and therefore delivered to the ablutionary fitting 170 – that is at an intermediate temperature between the temperatures of the hot water supply 172 and cold water supply 174.

Although the depicted embodiment is in the form of a bar valve having an elongate body 116 and having inlets 106, 110 towards each end 108, 112, the present invention is equally suitable for use in any other type or form of valve, e.g. mixer valve.

Now referring to Figures 7 to 9, a second embodiment of a valve is shown. The second embodiment is also a mixer valve 200 in the form of a bar valve. The mixer valve 200 is of the same general arrangement as the mixer valve 100 of the first embodiment and includes a tubular outer housing 202 with first and second inlets 206, 210 provided towards first and second ends 208, 212 of the mixer valve 200, respectively. As in the first embodiment, the first inlet 206 and the second inlet 210 allow hot and cold water to be delivered to the mixer valve 200 through openings in the outer housing 202.

A body 216 further defines the first inlet 206 and second inlet 210 as well as defining a waterway 218 through which water from the first inlet 206 and second inlet 210 can flow, in use. The body 216 defines a first inlet portion 220 of the waterway 218, running from the first inlet 206 to the mixing chamber 222 located towards the second end 212, and a second inlet portion 224 of the waterway 218 that enables flow from the second inlet 210 to the mixing chamber 222. The relative locations and proportions of the inlet portions 220, 224 is similar to that of the first embodiment and will therefore not be described in detail.

As in the first embodiment, the mixing chamber 222 includes a thermostatic control valve 226 that controls the temperature of the water in response to a user input. This input is provided by a cap, which is not shown.

From the mixing chamber 222, a mixed flow of water can flow through an intermediate portion 228 of the waterway 218 towards the first end 208 of the mixer valve 200 and through a diverter 230. The diverter 230 controls flow between the intermediate portion 228 of the waterway 218 and two outlet portions 232 of the waterway 218, each outlet portion 232 being associated with a respective one of a first and second outlet 234, 236 and providing a channel for water flow to either the first outlet 234 or second outlet 236, respectively.

In contrast to the mixer valve 100 of the first embodiment, the mixer valve 200 of the second embodiment is limited to controlling flow of water from the intermediate portion 228 only to either the first outlet 234, the second outlet 236, or neither outlet, in response to user control of the diverter 230.

A diverter control 238 is provided that is rotated by rotation of a cap (not shown) at the first end 208 of the housing 202. Rotation of the diverter control 238 controls the diverter 230 as described below. In the illustrated example, the diverter control 238, a fixed part 246, and a moving part 248, act together to seal the end of the body 216, preventing water leakage from the waterway 218. An end cap 242 acts as a retainer to keep the other parts of the diverter 230 in position within the body 216. The body 216 is unitarily-formed as a single part, for ease of construction and simplification of construction. The inlet portions 220, 224, intermediate portion 228, and outlet portions 232 are all integrally formed within the body 216.

The diverter 230 is shown in detail in Figure 9. As mentioned above, the diverter 230 includes the fixed part 246 and the moving part 248, which act to control the flow of water through the diverter 230. Rotation of the diverter control 238 by a user causes rotation of the moving part 248 of the diverter 230. The diverter control 238 is helped to rotate freely relative to the end cap by a ceramic bearing 276 that is interposed between the two parts. Sealing of the diverter 230 is assisted by the use of two seals 250 that are provided between the diverter control 238 and the moving part 248 and the fixed part 246 and the body 216, respectively. Each seal 250 is elastomeric but may be provided as any other suitable type of seal, these being known to the skilled person.

In the second embodiment, the fixed part 246 is located adjacent to the body 216 and includes a substantially central inlet aperture 252 that is aligned with the intermediate portion 228 of the waterway 218 and two outlet apertures 254 that are aligned with the outlet portions 232 of the waterway 218. The outlet apertures 254 are positioned opposite one another with the inlet aperture 252 in-between. Each outlet aperture 254 is substantially arcuate and extends around approximately 90 degrees of the fixed part 246. The outlet apertures 254 are separated on either side by approximately 90 degrees.

The moving part 248 comprises an aperture 256 with a central portion 258 that extends over the centre of the moving part 248, in order to line up with the inlet aperture 252 of the fixed part 246, with the remainder of the aperture 256 occupying substantially a 90 degree sector of the moving part 248. Rotation of the moving part 248 therefore selectively aligns the aperture 256 with both the inlet aperture 252 of the fixed part 246 and one or neither of the outlet apertures 254 of the fixed part 246. As in the first embodiment, the water flow therefore reverses direction whilst passing through the diverter 230. By changing the orientation of the moving part 248 to align partially or completely with either of the outlet apertures 254 of the fixed part 246, the flow rate to either of the outlets 234, 236 can be controlled.

The moving part 248 includes three notches 278 that engage with corresponding protrusions 262 on the diverter control 238, allowing engagement of the diverter control 238 that can therefore cause rotation of the moving part 248. The end cap 242 has two connectors 280 that fit over protrusions 282 on the body 216 to hold the end cap 242 and the remainder of the diverter 230 in position relative to the body 216.

Figures 10a to 10e show how the change in orientation of the moving part 248 alters the water flow through the diverter 230 and thus to the outlets 234, 236 of the mixer valve 200. The diverter 230 is shown end on, with the end cap 242, bearing 276, diverter control 238, and seal 250, not shown, for clarity.

In Figure 10a, the aperture 256 of the moving part 248 is out of alignment with both outlet apertures 254 of the fixed part 246 by 90 degrees and therefore no pathway is provided for water flow from the inlet aperture 252 to the either of the outlet apertures

254. Thus, no flow is enabled through the diverter 230. However, it can be seen that the inlet aperture 252 remains completely uncovered.

A 45 degree rotation clockwise – or 315 degrees anticlockwise – of the moving part 248 leads to a partial alignment of the aperture 256 with the outlet aperture 254 associated with the second outlet 236, as shown in Figure 10b. A throttled flow is therefore enabled to the second outlet 236. Alteration of the degree of alignment of the moving part 248 with the fixed part 246 will vary the level of flow to the second outlet 236. Further rotation of the moving part 248 to a total of 90 degrees clockwise from the position of Figure 10a leads to the position of Figure 10c, where the aperture 256 is fully aligned with the outlet aperture 254 associated with the second outlet 236. Maximum flow is therefore delivered to the second outlet 236.

Rotating the moving part 248 approximately 45 degrees anticlockwise – or 315 degrees clockwise – from the position of Figure 10a leads to the position of Figure 10d where a throttled flow is enabled through the first outlet 234, by partially uncovering the other of the outlet apertures 254. Figure 10e shows how further rotation uncovers the remainder of the outlet aperture 254 to allow full flow through the first outlet 234.

It will be appreciated that the mixer valve 200 may be employed in an ablutionary system. For example, the ablutionary system may be generally as described above in relation to Figure 6.

It will be understood that the invention is not limited to the embodiments described above. Various modifications and improvements can be made without departing from the concepts disclosed herein. Except where mutually exclusive, any of the features may be employed separately or in combination with any other features and the disclosure extends to all combinations and sub-combinations of one or more features disclosed herein.

CLAIMS

1. A valve for an ablutionary system, the valve comprising:

a waterway body; and

a diverter;

wherein the waterway body includes:

a first waterway portion configured to direct fluid flow from an inlet to the diverter;

a second waterway portion configured to direct fluid flow from the diverter to a first outlet; and

a third waterway portion configured to direct fluid flow from the diverter to a second outlet;

wherein the diverter is configured to selectively direct fluid flow from the first waterway portion to at least one of the first waterway portion and the second waterway portion;

wherein one or more of the first waterway portion, the second waterway portion, and the third waterway portion is/are formed integrally with and defined at least partially by the waterway body.

2. A valve according to claim 1, wherein the first waterway portion, the second waterway portion and the third waterway portion are each formed integrally and defined at least partially by the waterway body.

3. A valve according to claim 1 or claim 2, wherein any two or more of the first waterway portion, the second waterway portion and the third waterway portion are parallel along at least a portion of their respective lengths within the waterway body.

4. A valve according to claim 1, claim 2 or claim 3, wherein the first waterway portion extends a distance along a central axis of the waterway body.

5. A valve according to claim 4, wherein the second waterway portion and the third waterway portion are radially-offset from the first waterway portion.

6. A valve according to any one of the preceding claims, wherein the first waterway portion, the second waterway portion, and the third waterway portion each have an opening that exits the waterway body at a first end of the waterway body, the diverter forming an end to each of the first waterway portion, the second waterway portion, and the third waterway portion.

7. A valve according to any one of the preceding claims, wherein the diverter includes at least one moving part, the movement of which selectively determines to which of the second waterway portion and third waterway portion the fluid flow is provided.

8. A valve according to claim 7, wherein the diverter is a rotary diverter.

9. A valve according to any one of the preceding claims, wherein the inlet is in fluid communication with a mixing chamber.

10. A valve according to claim 9, wherein the mixing chamber receives fluid flow from a fourth waterway portion and a fifth waterway portion, wherein the fourth waterway portion and/or the fifth waterway are formed integrally with and are defined at least partially by the waterway body.

11. A valve for an ablutionary system, the valve comprising:

a body having a first inlet, a second inlet, a first outlet, and a second outlet;

a waterway formed integrally with and defined at least partially by the body, the waterway being configured to direct fluid flow directly or indirectly from the first inlet and second inlet to the first outlet and second outlet; and

a diverter that divides the waterway into a first portion configured to receive, directly or indirectly, a mixed flow from the first inlet and the second inlet, a second portion in communication with the first outlet and a third portion in communication with the second outlet, the diverter being configured to selectively allow or disallow flow from the first portion to the second portion and the third portion.

12. A valve according to any one of the preceding claims 12 to 15, wherein the first inlet and second inlet are positioned towards opposing ends of the body.

13. A valve according to any one of the preceding claims, wherein the valve includes a housing that surrounds or substantially surrounds the waterway body, the housing preferably being configured to provide connections for connecting water supplies to the at least one inlet.

14. A valve according to any one of the preceding claims, wherein the diverter is further configured to selectively allow or disallow flow from the first portion to the second portion and the third portion together.

15. An ablutionary fitting comprising a valve according to any one of the preceding claims.

16. An ablutionary system comprising a valve according to any one of claims 1 to 14 and an ablutionary fitting in fluid communication with an outlet of the valve.

17. A kit of parts arranged to be assembled into a valve according to any of claims 1 to 14, an ablutionary fitting according to claim 15 or an ablutionary system according to claim 16.

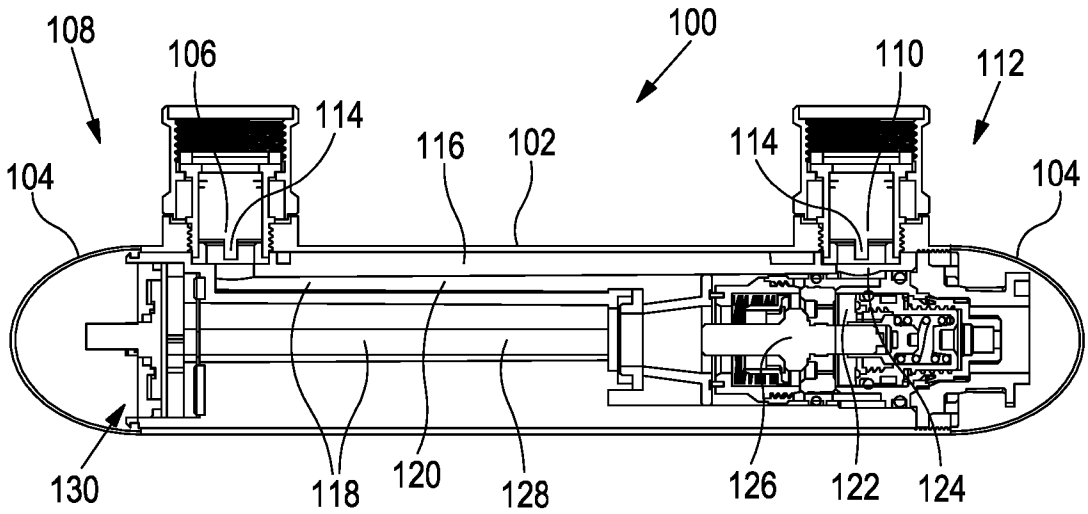


Figure 1

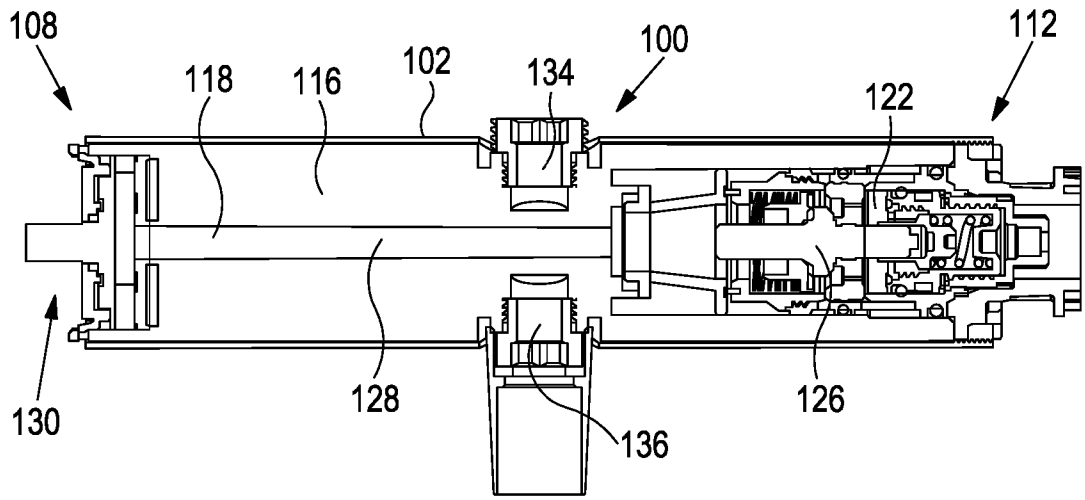


Figure 2

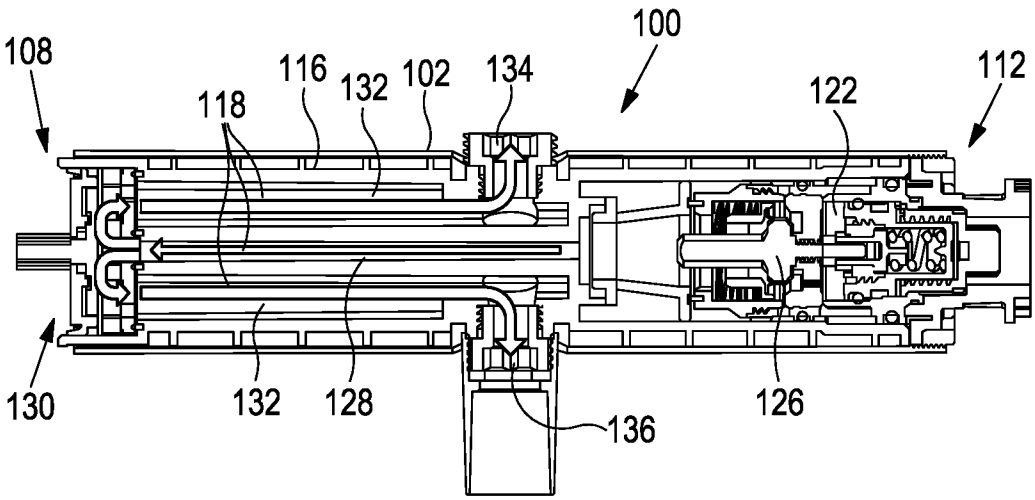


Figure 3

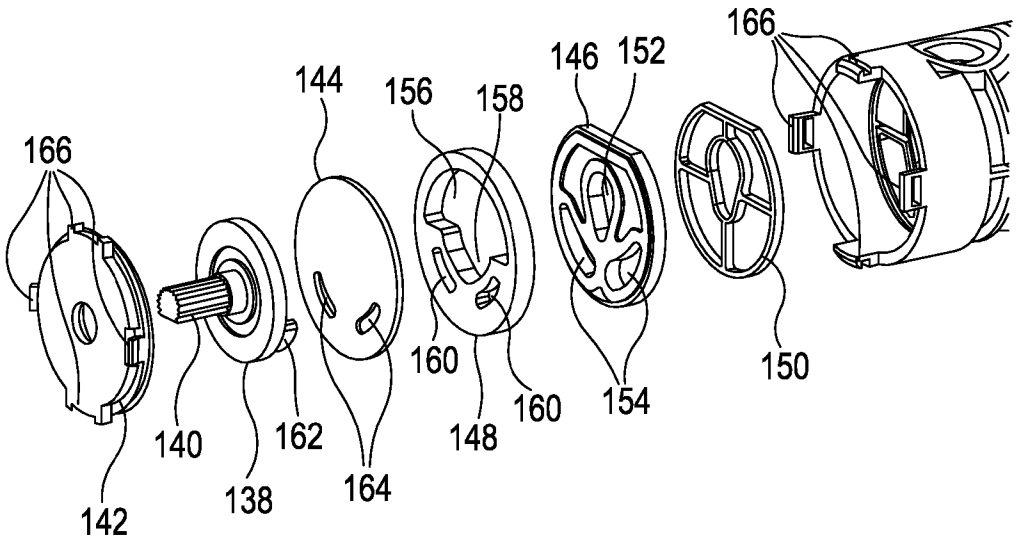


Figure 4

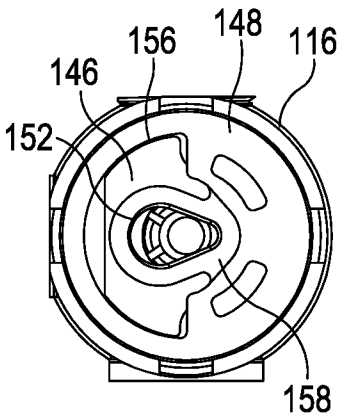


Figure 5a

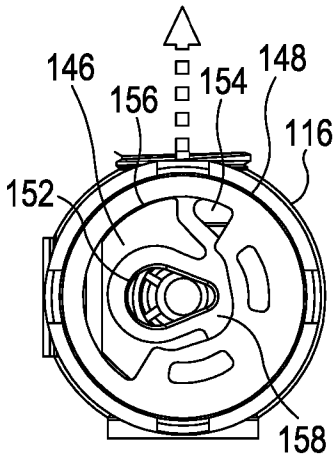


Figure 5b

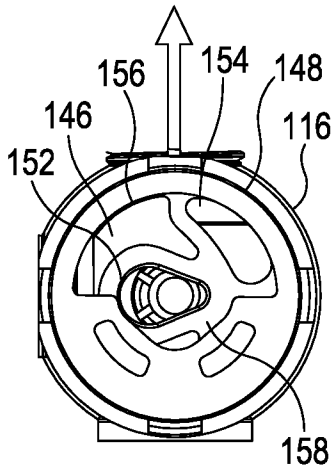


Figure 5c

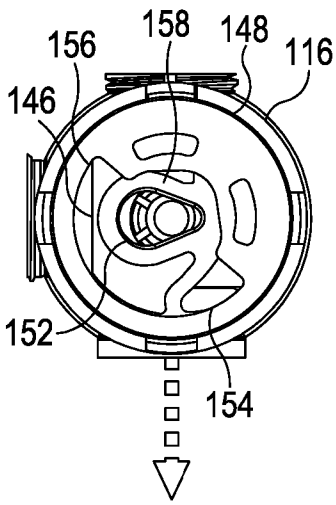


Figure 5d

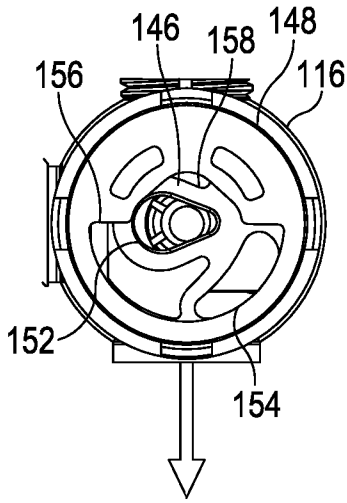


Figure 5e

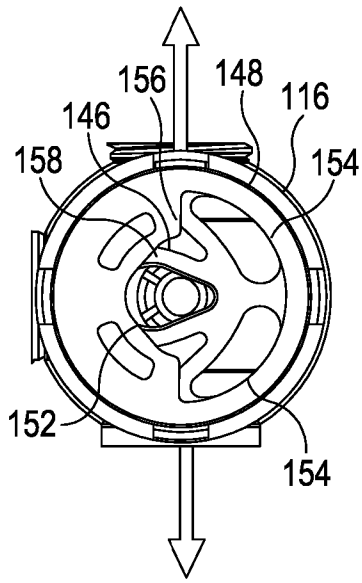


Figure 5f

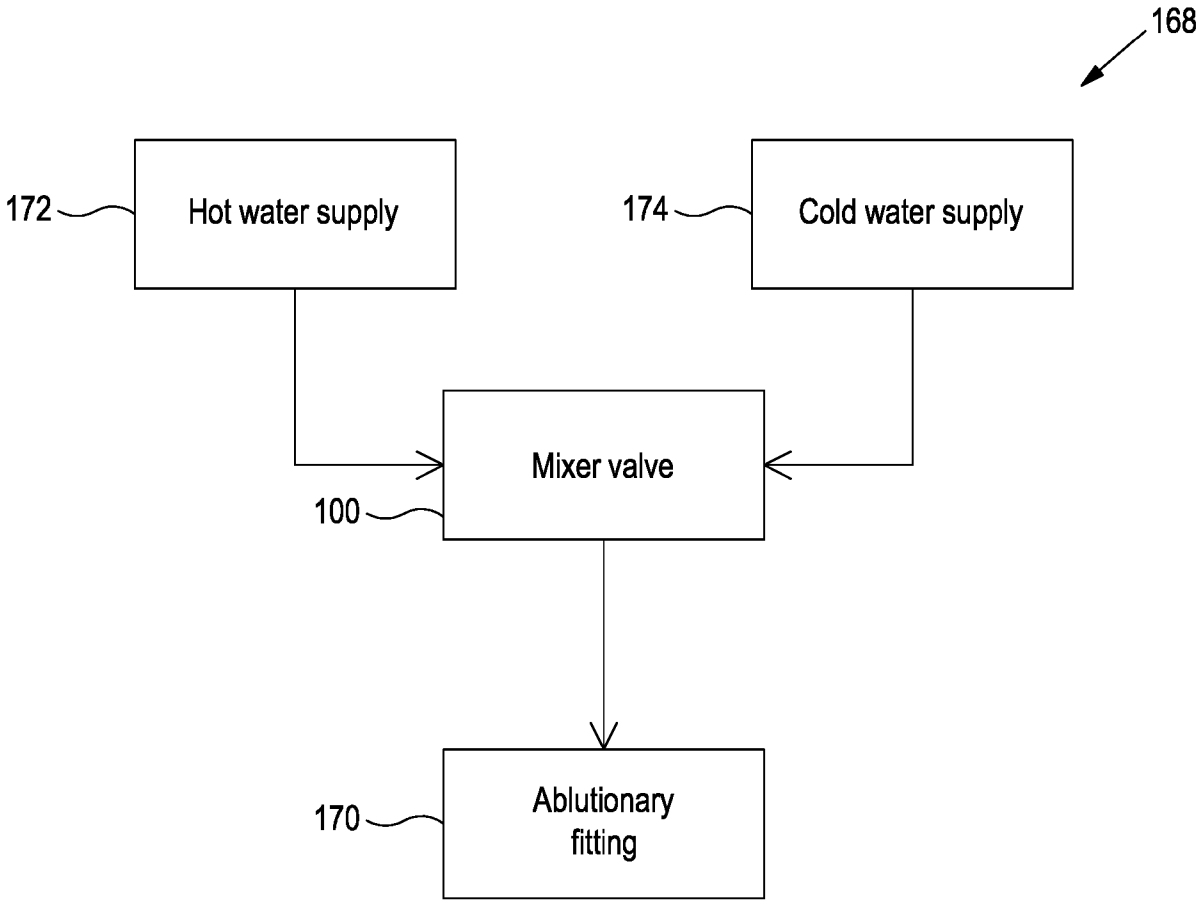

168
172
Hot water supply
174
Cold water supply
Mixer valve
100
170
Ablutionary fitting

Figure 6

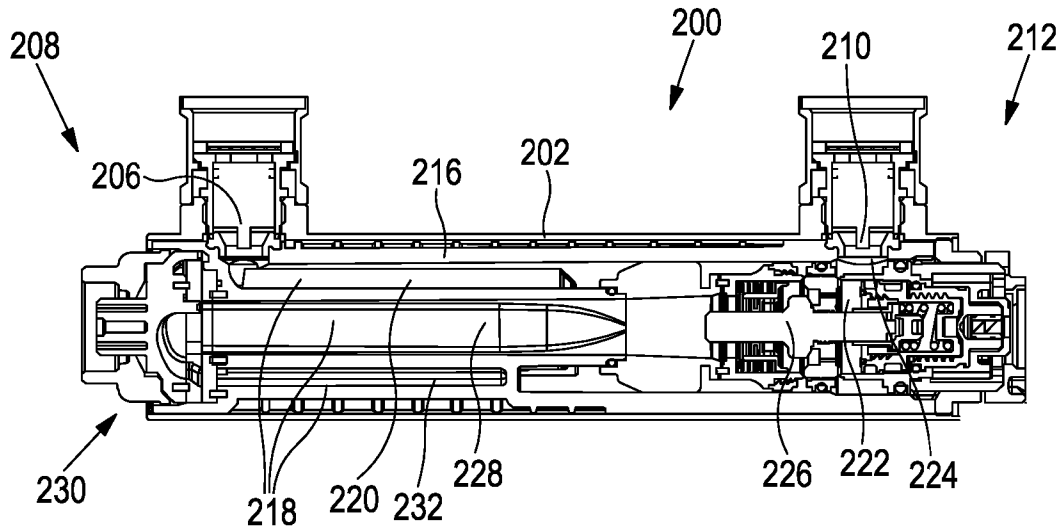


Figure 7

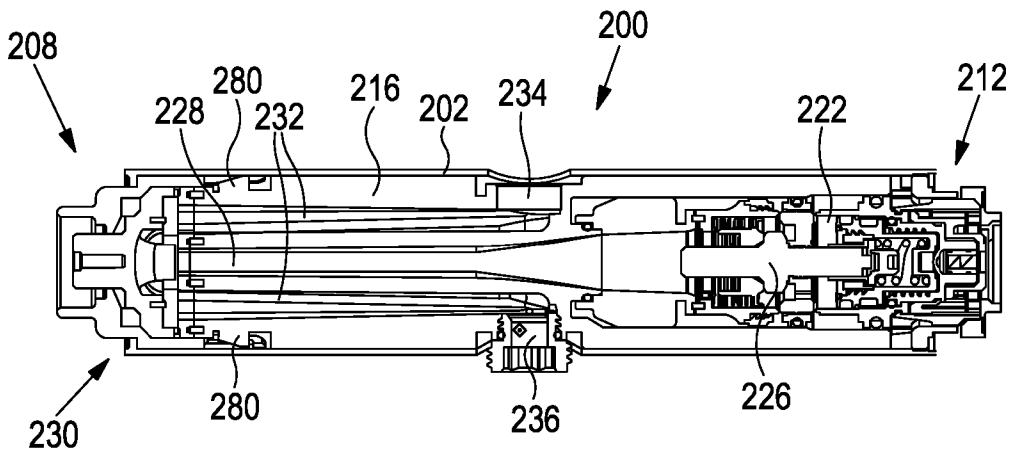


Figure 8

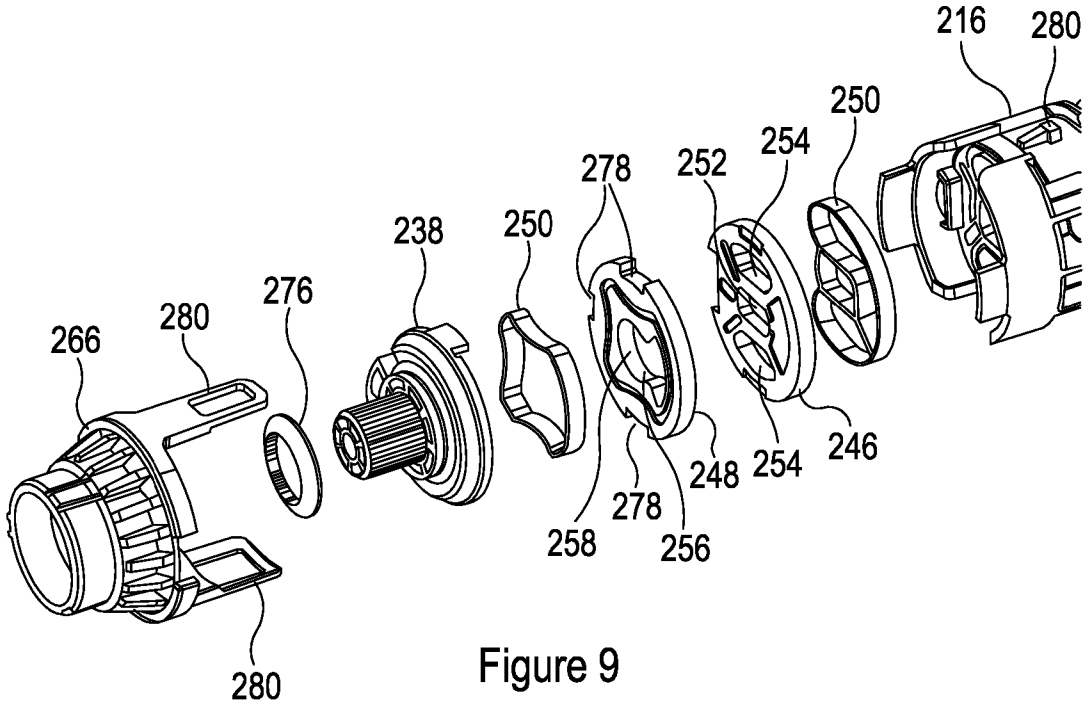

216
280
250
254
252
278
238
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276
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266
278
248
254
246
258
278
256
280

Figure 9

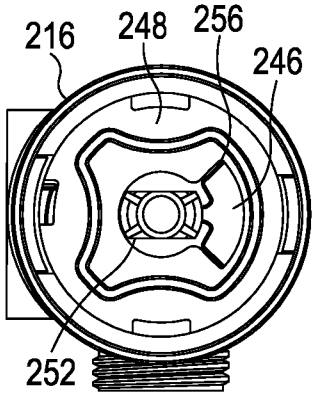


Figure 10a

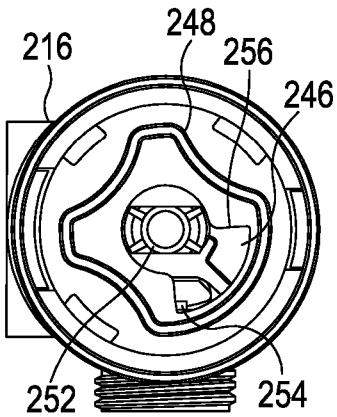


Figure 10b

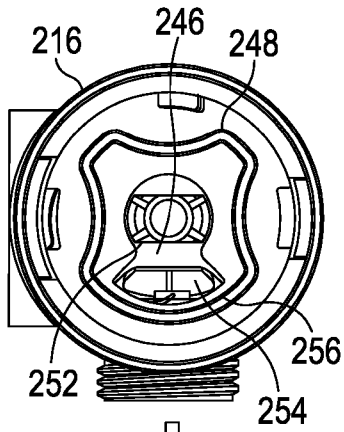


Figure 10c

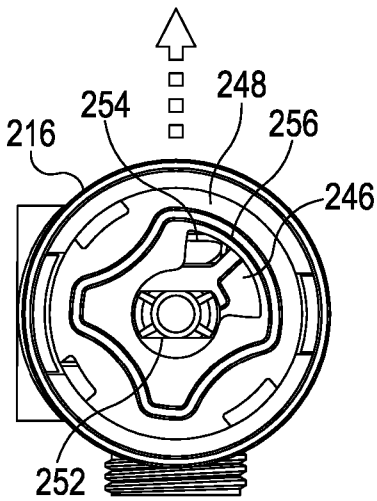


Figure 10d

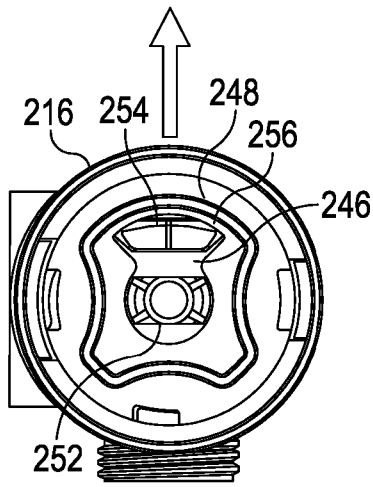


Figure 10e

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2020/050129

A. CLASSIFICATION OF SUBJECT MATTER
INV. F16K11/00 F16K11/074 F16K27/04 G05D23/00
ADD.

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)
F16K G05D

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2017/190406 A1 (XIAMEN RUNNER IND CORPORATION [CN]) 9 November 2017 (2017-11-09) detailed description of the (machine) translation; figures 1-6	1-17
X	EP 2 789 885 A1 (CARLO NOBILI S P A RUBINETTERIE [IT]) 15 October 2014 (2014-10-15) paragraph [0032] - paragraph [0037]; figures 5-9	1-17
A	EP 2 940 220 A1 (IDEAL STANDARD INT BVBA [BE]) 4 November 2015 (2015-11-04) paragraph [0013] - paragraph [0019]; figures 1-5	1-17

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"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
26 March 2020	09/04/2020

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Müller, Bernhard

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2020/050129

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 10 2010 018671 A1 (GROHE AG [DE]) 3 November 2011 (2011-11-03) paragraph [0030] - paragraph [0038]; figures 1-9	1-17
A	WO 2014/089946 A1 (NINGBO JIEYI SANITARY WARE CO LTD [CN]) 19 June 2014 (2014-06-19) abstract; figures 1-16	1-17
A	EP 3 373 100 A1 (ORAS OY [FI]) 12 September 2018 (2018-09-12) paragraph [0020] - paragraph [0026]; figures 1-3B	1-17
A	US 2016/376774 A1 (CHAN SAI FAI [HK]) 29 December 2016 (2016-12-29) paragraph [0066] - paragraph [0093]; figures 1-25	1-17

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/GB2020/050129

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2017190406 A1	09-11-2017	CN 105782510 A	20-07-2016
		WO 2017190406 A1	09-11-2017
EP 2789885 A1	15-10-2014	EP 2789885 A1	15-10-2014
		ES 2744594 T3	25-02-2020
EP 2940220 A1	04-11-2015	DE 202014101920 U1	08-05-2014
		EP 2940220 A1	04-11-2015
		ES 2678001 T3	08-08-2018
		RU 2014136185 A	10-04-2016
DE 102010018671 A1	03-11-2011	DE 102010018671 A1	03-11-2011
		EP 2564283 A1	06-03-2013
		WO 2011134628 A1	03-11-2011
WO 2014089946 A1	19-06-2014	CN 102996857 A	27-03-2013
		WO 2014089946 A1	19-06-2014
EP 3373100 A1	12-09-2018	DE 102017105051 A1	13-09-2018
		EP 3373100 A1	12-09-2018
US 2016376774 A1	29-12-2016	CN 104864164 A	26-08-2015
		CN 204756117 U	11-11-2015
		GB 2537789 A	26-10-2016
		HK 1194605 A2	17-10-2014
		TW M513291 U	01-12-2015
		US 2016376774 A1	29-12-2016
		WO 2015127895 A1	03-09-2015