Title: IMPROVEMENTS IN BATH SHOWER MIXERS

Abstract: A bath shower mixer (1) has inlets (7, 8) for hot and cold water, a bath fill outlet (6), a shower outlet (4), a rotatable control knob (12) for manual selection of the output water temperature and a control lever (13) for controlling flow of the output water to a selected one of the bath fill outlet (6) and shower outlet (4). The control lever (13) sets the maximum output water temperature selectable by the control knob (12) on selection of the outlet to provide a maximum output water temperature that is lower for showering than for bath filling.
For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.
IMPROVEMENTS IN BATH SHOWER MIXERS

This invention concerns improvements in or relating to mixers for mixing hot and cold water to provide a source of temperature controlled water according to user selection of water temperature. The invention has particular, but not exclusive, application to thermostatic mixers for maintaining a selected water temperature substantially constant. More especially the invention concerns mixers provided with a diverter valve for diverting the temperature controlled water to a selected one of at least two outlets, for example to a shower or a bath or washbasin.

Bath shower mixers are known that allow the user to selectively divert water either through an outlet spout for filling a bath or through a shower outlet for showering. In this way, the functionaity of a separate bath fill device and a shower is combined in one product. Such mixers may either be mounted on the end of the bath, as with conventional bath taps or mounted on the wall at one end of the bath a small height above the bath lip.

Bath shower mixers are also known that use a thermostatic mixing valve to control the temperature of the output water. The thermostat compensates for variations in the temperature and/or pressure in the incoming hot and cold water supplies to maintain the user selected output water temperature substantially constant. In this way, fluctuations in output water temperature which could potentially scald the user can be avoided. The output water from the thermostatic mixing valve can be used to give thermostatically controlled water for either the bath or shower or both.
Thermostatic mixing valves for use in health care establishments such as hospitals, nursing homes etc where the users, by virtue of their mental or physical condition, are deemed to be at greater risk of injury in their use of domestic hot water than would be the case for normally able persons in their own dwelling, have to comply with safety standards that specify the performance, material requirements and test methods to be met. In the UK the standards are set down in the National Health Service Model Engineering Specification D08.

The D08 standard specifies different maximum temperatures for showering and bath fill and different temperatures for bath fill depending on whether or not the bather is under the constant supervision of a competent person. The maximum temperatures under these conditions are currently set out in Table 1.

<table>
<thead>
<tr>
<th>Application</th>
<th>Maximum mixed water temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shower</td>
<td>41</td>
</tr>
<tr>
<td>Bath (unassisted)</td>
<td>44</td>
</tr>
<tr>
<td>Bath (assisted)</td>
<td>46</td>
</tr>
</tbody>
</table>

Thermostatic mixers are known having a stop to limit the maximum water temperature the user can select. When such thermostatically controlled mixers are employed in a bath shower mixer, the maximum water temperature delivered to the selected outlet is the same. Consequently, if the maximum selectable temperature is set to that for safe showering, it is too low for bath filling while setting the maximum selectable temperature for bath filling gives a risk of scalding if the user inadvertently selected the maximum temperature while showering. As a result, the known
thermostatically controlled bath shower mixers with a maximum selectable water temperature do not meet the DO8 standard for use in health care establishments.

Health care establishments are precluded from installing a bath shower mixer that does not meet the DO8 standard in any area which is deemed to be high risk i.e. anywhere a patient or visitor can operate the device without the supervision of a competent person. Currently, the only way to achieve the different temperature requirements of the DO8 standard for bath filling and showering is to use two separate thermostatically controlled mixers, one controlling bath filling and the other controlling showering. This results in increased difficulty of installation and is, naturally, more expensive than using a single thermostatic mixer. It also leads to a significant increase in the time taken for regular maintenance and monitoring of performance which is required as part of the DO8 standard.

Another disadvantage of many existing designs of bath shower mixers is that the main body is usually made as a metal casting and readily conducts the temperature of the incoming flow of hot water to the outer surface giving rise to a risk of injury to the user if they inadvertently touch the outer surface of the body while the mixer is in use. It is a requirement that products used in healthcare establishments should have no exposed surfaces that can go above safe temperatures and designs of the main body to alleviate this problem involving complex waterways can add to manufacturing costs.

The present invention has been made from a consideration of the foregoing problems and disadvantages of existing mixers, especially
thermostatically controlled bath shower mixers for use in health care establishments.

An embodiment of the invention provides a mixer having at least two outlets for temperature controlled water wherein the maximum output water temperature from each outlet can be set independently of the other outlet(s).

A preferred embodiment of the invention provides such a mixer where the temperature of the output water is thermostatically controlled to maintain a selected output water temperature substantially constant.

A preferred embodiment of the invention also provides such a mixer where the maximum output water temperature is set in response to selection of the outlet through which the temperature controlled water is discharged.

A preferred embodiment of the invention further provides such a mixer wherein the maximum selectable output water temperature from each outlet is set by a stop operable to prevent selection of a higher output water temperature.

Other benefits and advantages of the invention will be apparent from the description hereinafter of exemplary embodiments.

According to one aspect of the present invention there is provided a mixer having inlets for hot and cold water, first and second water outlets, means for diverting output water to a selected one of the first and second water outlets, and means for setting a maximum output water temperature from the selected water outlet in response to actuation of the diverter means.
By this invention, the maximum output water temperature is set automatically in response to user selection of an outlet. In this way, the maximum output water temperature can be varied according to the intended use of the water. For example, where the outlets are used for showering and bath filling, the maximum output water temperature for showering may be set lower than the maximum output water temperature for bath filling. As a result, the maximum output water temperature is automatically reduced when changing over from bath filling to showering. In this way, the user is protected from output water temperatures exceeding the maximum for showering when switching flow from the bath fill outlet to the shower outlet if the selected output water temperature for bath filling exceeds the maximum output water temperature for showering.

Preferably, the mixer includes mixing valve means for mixing hot and cold water to provide temperature controlled output water in accordance with user selection and the setting means is operable to set the maximum output water temperature that can be selected for a given outlet.

Advantageously, the mixing valve means is thermostatically controlled to maintain the selected output water temperature substantially constant. In this way, the effect of changes in temperature and/or pressure of one or both incoming water supplies on the selected output water temperature are reduced or eliminated.

Preferably, the mixing valve means is manually operable by a rotatable control member to select the output water temperature and the setting means includes stop means to block rotation of the control member to
select output water temperatures higher than the maximum output water temperature.

Advantageously, the diverter means is manually operable by a rotatable control element to select the outlet and the stop means includes first and second stops rotatable with the control element and a rotatable stop sleeve for interacting with the stops and the control member to block rotation of the control member to select output water temperatures higher than the maximum output water temperature. At least one of the stops may be adjustable to vary the maximum permitted output water temperature from the outlet controlled by the stop.

Preferably, the stop means also blocks rotation of the control member to prevent selection of output water temperatures lower than a minimum output water temperature.

Advantageously, the diverter means comprises a diverter valve having relatively rotatable valve members for diverting the output water to the selected outlet. The valve members may be a pair of ceramic discs formed with ports co-operable to divert the output water to the selected outlet.

In a preferred arrangement, one of the ceramic discs is fixed and the other ceramic disc is rotatable to block output water flow to both outlets in an “off” position and to divert the output water flow to the selected outlet in each of two “on” positions.

In an especially preferred arrangement, the outlets are used for showering and bath filling and the shower outlet is connected to the bath fill outlet in the “off” position allowing the shower to drain down. In this way, the
shower does not retain a "dead leg" of water and there is a short delay when the shower mode is next selected as the delivery pipe fills up before water issues from the shower head. As a result, the user can get out of the way of the initial spray after selecting the shower mode if desired.

Preferably, the mixer is arranged to be fail-safe in the shower mode of operation by shutting-off the flow of water to the shower outlet if the user tries to force the control member to select an output water temperature for showering higher than the maximum. In this arrangement, any attempt by the user to rotate the control member in the shower mode of operation to exceed the maximum output water temperature set by the stop means causes the diverter valve to de-select the shower outlet and prevent discharge of water from the shower outlet.

Advantageously, the mixer comprises a main body housing the mixer valve means and the diverter means and the incoming flows of hot and cold water are connected to the mixer valve means via a manifold within the main body. As a result, the main body is not heated by the incoming hot water flow to temperatures exceeding the maximum safe temperatures for showering and bath filling and the risk of the user being scalded by contact with the outer surface of the main body is reduced or eliminated.

According to a second aspect of the present invention, there is provided a method of controlling the output water temperature from a mixing valve to a selected one of two outlets comprising the steps of providing a manually operable control member for user selection of the desired output water temperature, providing stop means for blocking rotation of the control member to select output water temperatures exceeding a maximum output water temperature, providing diverter means for diverting the
output to the selected outlet, and providing setting means operable in response to selection of the outlet to set the stop means.

Preferably, the setting means is operable to set the stop means such that the maximum output water temperature from one outlet is higher than the maximum output water temperature from the other outlet.

Advantageously, the temperature difference between the maximum output water temperatures of the outlets can be adjusted. For example, the stop means may be adjustable to set the maximum output water temperature from one or both outlets.

In a preferred embodiment, said one outlet is a bath fill outlet and said other outlet is a shower outlet whereby the maximum output water temperature for bath filling is higher than for showering and stop means is adjustable to set the maximum output water temperature for bath filling.

According to a third aspect of the present invention, there is provided a system of controlling the maximum output water temperature from a plurality of water outlets in response to selection of any one of the outlets.

According to a fourth aspect of the invention there is provided a thermostatically controlled bath shower mixer having water inlets for connection to supplies of hot and cold water, a bath water outlet, a shower water outlet, a diverter valve for diverting output water to one of the outlets in accordance with user selection, a thermostatic mixing valve for mixing hot and cold water to provide temperature controlled output water in accordance with user selection, stop means for blocking user
selection of an output water temperature higher than a pre-determined maximum output water temperature to the selected outlet, the stop means being operable to permit user selection of output water diverted to the bath water outlet having an output water temperature up to a first pre-determined maximum output water temperature and selection of output water diverted to the shower water outlet having an output water temperature up to a second pre-determined maximum output water temperature, the first and second pre-determined maximum output water temperatures being different.

Preferably, the mixing valve includes a rotatable control member for user selection of the output water temperature and the stop means is arranged to block rotation of the control member to select output water temperatures higher than the permitted maximum output water temperature to the selected outlet.

In a preferred embodiment, the first pre-determined maximum output water temperature is higher than the second pre-determined maximum output water temperature whereby output water for bath filling can be hotter than output water for showering.

The invention will now be described in more detail, by way of example only with reference to the accompanying drawings wherein:

**Figure 1** is an isometric view of a bath shower mixer embodying the invention;

**Figure 2** is an isometric view of the bath shower mixer shown in Figure 1 with parts of the body and cover removed to show internal parts of the mixer;
Figure 3 is a sectional view of the bath shower mixer shown in Figures 1 and 2 along a centre line through the shower outlet, body and spout;

Figure 4 is a sectional view through the bath shower mixer shown in Figures 1 and 2 along a centre line through the hot and cold water inlets;

Figure 5 is an exploded isometric view of the temperature control mechanism of the bath shower mixer shown in Figures 1 to 4;

Figure 6 is an exploded isometric view of the water diverter mechanism of the bath shower mixer shown in Figures 1 to 5;

Figure 7 is a diagrammatic plan view of the fixed ceramic of the water diverter mechanism shown in Figure 6;

Figure 8 is a diagrammatic plan view of the driven ceramic of the water diverter mechanism shown in Figure 6;

Figure 9 is a diagrammatic plan view of the fixed ceramic and the driven ceramic of Figures 7 and 8 in the off position;

Figure 10 is a diagrammatic representation of the fixed ceramic and the driven ceramic of Figures 7 and 8 in the shower on position;

Figure 11 is a diagrammatic representation of the fixed ceramic and the driven ceramic of Figures 7 and 8 in the bath on position;
Figure 12 is a diagrammatic representation of the temperature control mechanism viewed from above showing the interaction of the component parts in the shower on position set to a minimum showering temperature;

Figure 13 is a diagrammatic representation of the temperature control mechanism viewed from above showing the interaction of the component parts in the shower on position set to a maximum showering temperature;

Figure 14 is a diagrammatic representation of the temperature control mechanism viewed from above showing the interaction of the component parts in the off position after having last been used for showering;

Figure 15 is a diagrammatic representation of the temperature control mechanism viewed from above showing the interaction of the component parts on selection of the bath fill position after having last been used for showering;

Figure 16 is a diagrammatic representation of the temperature control mechanism viewed from above showing the interaction of the component parts in the bath on position set to a maximum bath fill temperature;

Figure 17 is a diagrammatic representation of the temperature control mechanism viewed from above showing the interaction of the component parts in the bath on position set to a minimum bath fill temperature;

Figure 18 is a diagrammatic representation of the temperature control mechanism viewed from above showing the interaction of the component parts in the off position after having last been used for bath filling;
Figure 19 is a diagrammatic representation of the diverter lever assembly showing the bath fill stop in the position for a maximum bath fill water temperature limit of 46°C;

Figure 20 is a diagrammatic representation of the diverter lever assembly showing the bath fill stop in the position for a maximum bath fill water temperature limit of 44°C;

Figure 21 is a plan view of the stop sleeve with the auxiliary stop fitted for a maximum bath fill water temperature limit of 44°C; and

Figure 22 is a diagrammatic representation of the temperature control mechanism viewed from above similar to Figure 16 and showing the interaction of the component parts in the bath on position set to a lower maximum bath fill temperature.

Referring first to Figures 1 to 6 of the accompanying drawings, a thermostatically controlled bath shower mixer 1 embodying the invention is shown comprising a body 2 of generally T-shape in plan view secured to a water inlet manifold assembly 3. The body 2 has a water outlet 4 for showering and a central spout 5 provided with a water outlet 6 for bath filling.

The inlet manifold assembly 3 has inlets 7, 8 for connection to incoming supplies of hot and cold water and includes serviceable items (not shown) including check valves, flow regulators and filters (not shown) for each supply.

In use, the manifold assembly is mounted on the bath (for the bath mounted version) or the wall (for the wall mounted version) and the water
supplies connected to the inlets 7,8. The main body 2 is then screwed on to the manifold assembly 3. In this way, the main body 2 can be detached for access to the manifold assembly 3 whereby maintenance of the serviceable items is facilitated.

Furthermore, the incoming hot and cold water flows are contained within the inlet manifold assembly and prevented from coming into direct contact with the main body 2. As a result, the main body 2 which is typically a metal casting is not heated by the incoming hot water flow to temperatures exceeding the maximum safe temperatures and the risk of the user being scalded by contact with the outer surface of the main body 2 is reduced or eliminated.

The outlet 6 in the spout 5 is arranged for discharging water into the bath and the outlet 4 is connected via a supply pipe (not shown) to a shower head (not shown) for showering. The supply pipe may be a flexible hose connected to a shower handset or a rigid pipe connected to a fixed shower rose.

The body 2 is a casting or metal or alloy and is provided with an opening of ovoid shape in plan view closed by a removable cover 9 providing access to a thermostatic cartridge unit 10 of a water temperature control mechanism (Figure 5) and a diverter valve 11 of a water diverter mechanism (Figure 6).

The water temperature control mechanism includes a manually operable control knob 12 rotatable by the user to select the desired output water temperature. The water diverter mechanism includes a manually operable control lever 13 rotatable by the user to control selectively discharge of
output water from either selected one of the water outlets 4 and 6 for showering or bath filling.

The control lever 13 is shown in an off position in Figure 1 aligned with the spout 5. In this position, the diverter valve 11 of the water diverter mechanism is closed and prevents water flow through the mixer 1 to both the water outlets 4 and 6.

The control lever 13 is rotatable through 90° in a clockwise direction from the off position to a first on position in which the diverter valve 11 opens to allow water flow to the water outlet 4 for showering and prevents water flow to the water outlet 6 for bath filling.

The control lever 13 is also rotatable through 90° in an anticlockwise direction from the off position to a second on position in which the diverter valve 11 opens to allow water flow to the water outlet 6 for bath filling and prevents water flow to the outlet 4 for showering.

The cartridge unit 10 houses a thermostatic mixing valve 14 and the control knob 12 is rotatable to adjust the setting of a mixing valve 14 to vary the relative proportions in which the incoming supplies of hot and cold water are mixed to provide temperature controlled output water according to user selection.

An actuator (not shown), for example a wax thermostat, responsive to the output water temperature is operable to adjust automatically the mixing valve 14 to alter the relative proportions of hot and cold water to maintain a selected output water temperature substantially constant.
As described in more detail later herein, rotation of the control lever 13 to the first on position adjusts the position of a stop 15 to set the maximum output water temperature that can be selected for showering. In this embodiment, the maximum shower temperature is set slightly below 41°C to comply with the current DO8 standard for health care establishments.

Rotation of the control lever 13 to the second on position adjusts the position of a stop 16 to set the maximum output water temperature that can be selected for bath filling. In this embodiment, the maximum bath temperature can be set at either 44°C or 46°C during installation to comply with the current DO8 standard for healthcare establishments according to the level of supervision given to the bather.

It will be understood that these temperature settings are exemplary only and that other temperature settings for the maximum shower and/or bath temperatures can be provided according to the intended application of the mixer 1.

As will be appreciated from the foregoing description of the general construction and principle of operation of the bath shower mixer 1, the present invention employs a single thermostatic mixing valve 14 to control the temperature of both the bath water and the shower water and permits different settings of the maximum water temperature for bathing and showering to be obtained in a simple manner that facilitates installation and can comply with current standards for use in healthcare establishments.

More especially, as described in more detail later herein, the mixer 1 automatically adjusts the maximum water temperature to that required for
either bath fill or showering as the user selects the desired output. As a result, only a single mixing valve 14 is required providing potential cost savings compared to existing arrangements that require two thermostatic mixing valves, one for bathing and one for showering, to comply with the current standards for use in healthcare establishments. Furthermore, only one thermostatic mixing valve 14 needs to be monitored and maintained providing further potential cost savings.

As best shown in Figure 2, 3, 4 and 5, the cartridge unit 10 is detachably mounted in the body 2 of the mixer 1 and retained by a plate 17. The cartridge unit 10 is provided with a pair of water inlets 18a, 18b on opposite sides for the incoming hot and cold supplies, and an outlet 19 in the bottom for temperature controlled output water. The inlets 18a, 18b open to inlet chambers 20a, 20b in the body 2 for the incoming hot and cold supplies from the inlet manifold assembly 3. The outlet 19 opens to a chamber 21 in the spout 3 that leads to the diverter valve 11.

The cartridge unit 10 is also provided with a temperature control spindle 22 for mounting the control knob 12. The spindle 22 has axial splines 23 engageable with mating axial splines (not shown) at the inner end of a tubular sleeve 24 depending from the underside of the control knob 12 to key the control knob 12 to the spindle 22. The control knob 12 is releasably secured to the spindle 22 by inserting a screw (not shown) in the outer end of the sleeve 24 to engage a threaded insert (not shown) located in a bore 25 in the spindle 22.

A drive ring 26 for the diverter valve 11 is located over a cylindrical portion of the cartridge unit 10 and sits on the plate 17. The plate 17 is provided with a rib 27 that extends for about 150° and provides a stop 28
(one only shown) at each end to limit rotation of the drive ring 26 as described later.

A temperature stop sleeve 29 is seated inside and is rotatable relative to the drive ring 26 and has an upstanding stop 30 on the upper surface co-operative with a radial web 31 on the underside of the control knob 12 as described later. The sleeve 29 also has a stop 32 (Figures 12 to 18) on the underside co-operative with a stop 33 on the cartridge unit 10 as described later herein.

The control lever 13 is connected to a coupling ring 34 that locates over a sleeve portion 35 of the drive ring 26 and has circumferentially spaced internal recesses 36 engaged by external lugs 37 on the sleeve portion 35 to key the control lever 13 to the drive ring 26.

As best shown in Figures 2 and 6, the drive ring 26 is connected to a drive ring 38 via a drive belt 39. The drive rings 26, 38 comprise timing pulleys 26a, 38a provided with teeth (not shown) and the drive belt 39 is a timing belt provided with teeth (not shown) engageable with the teeth of the timing pulleys whereby rotation of the drive rings 26, 38 is synchronised. The drive ring 38 is rotatably mounted above upper part 40a of a casing 40 of the water diverter mechanism housing the water diverter valve 11. The belt drive may be replaced by a chain drive or by a gear drive or by a cam mechanism or by a lever linkage or any other suitable drive transmission.

The water diverter valve 11 comprises a fixed annular ceramic plate 41 seated in a lower part 40b of the casing 40 and a rotatable annular ceramic plate 42 located over and in face to face contact with the fixed plate 41 to prevent leakage therebetween. A drive spindle 43 for the
rotatable ceramic plate 42 is operatively connected to the drive ring 38 via a connector 44 keyed to the drive ring 38 by engagement of pegs 45 in aligned holes 46 in the drive ring 38.

5 With reference now also to Figures 7 to 11, the fixed ceramic plate 41 is formed with four ports 41a,b,c,d (Figure 7). Ports 41a and 41b are water inlets and ports 41c,41d are water outlets. The rotatable ceramic plate 42 is formed with one port 42a (Figure 8).

10 In the off position of the control lever 13 shown in Figure 1, the port 42a in the rotatable ceramic plate 42 overlaps the water outlet ports 41c,41d and blanks off the water inlet ports 41a,41b of the fixed ceramic plate 41 (Figure 9). As a result, water flow from the mixing valve 14 to either the bath fill outlet 6 or the shower outlet 4 is prevented in the off position of the control lever 13 and any water remaining in the shower supply pipe connected to the shower outlet 4 can drain through the bath fill outlet 6.

In this way, the shower supply pipe drains down when the diverter valve 11 is closed to prevent a "dead leg" of water being retained that may produce an initial shot of cold water when the shower mode of operation is next selected. Furthermore, there is a short delay when the shower mode is next selected as the delivery pipe fills up before water issues from the shower head. As a result, the user can get out of the way of the initial spray after selecting the shower mode if desired.

25 On rotation of the control lever 13 in a clockwise direction from the position shown in Figure 1, the drive ring 26 is rotated and transmits the drive to the drive ring 38 via the timing pulleys 26a,38a and timing belt 39. The drive ring 38 in turn rotates the rotatable ceramic plate 42 relative to the fixed ceramic plate 41 so that the port 42a overlaps the
water inlet port 41a and water outlet port 41c in the fixed ceramic plate 41 to open the diverter valve 11 allowing water to flow to the shower outlet 4. In this position, the rotatable ceramic plate 42 blanks of the water inlet 41b and water outlet 41d to prevent water flow to the bath fill outlet 6.

As best shown in Figures 9 and 10, the spacing of the ports 41a, 41c is such that the port 42a in the rotatable ceramic plate 42 does not overlap the ports 41a, 41c to connect the shower outlet 4 to output water from the mixer valve 14 until the ceramic plate 42 has been rotated through approximately 70° in a clockwise direction. In this way, the water flow to the shower outlet 4 is connected during the final part of the rotation of the control lever 13 to the on position and is disconnected during the first part of the rotation of the control lever 13 to the off position.

On rotation of the control lever 13 in an anti-clockwise direction from the position shown in Figure 1, the drive ring 26 is rotated and transmits the drive to the drive ring 38 via the timing pulleys 26a, 38a and timing belt 39. The drive ring 38 in turn rotates the rotatable ceramic plate 42 relative to the fixed ceramic plate 41 so that the port 42a overlaps the water inlet port 41b and water outlet port 41d in the fixed ceramic plate 41 to open the diverter valve 11 allowing water to flow to the bath fill outlet 6. In this position, the rotatable ceramic plate 42 blanks of the water inlet 41a and water outlet 41c to prevent water flow to the shower outlet 4.

As best shown in Figures 9 and 11, the spacing of the ports 41b, 41d is such that the port 42a in the rotatable ceramic plate 42 overlaps the ports 41b, 41d to connect the bath fill outlet 6 to output water from the mixer valve 14 when the ceramic plate 42 has been rotated through
approximately 30° in an anticlockwise direction. In this way, the water flow to the bath fill outlet 6 is connected during a major part of the rotation of the control lever 13 to and from the on position.

In this embodiment, the cross-sectional area of the ports 41b, 41d for diverting the water flow to the bath fill outlet 6 is larger than the cross-sectional area of the ports 41a, 41c for diverting the water flow to the shower outlet 4. In this way, a higher flow rate is provided for bath filling. The flow rate for showering may be controlled by a flow regulator (not shown) in the shower outlet 4. A flow regulator (not shown) may also be provided in the bath fill outlet 6 or in the inlets 7, 8 to control the flow rate in high pressure installations.

Rotation of the control lever 13 from the central off position is limited to 90° in each direction by engagement of the drive spindle 26 with stops 28 at opposite ends of the rib 27 giving a total range of movement of the control lever of 180° between the on positions for showering and bath filling. It will be understood, however that this is not essential and that other ranges of angular movement can be employed.

Operation of the control lever 13 to set the maximum output water temperature that can be selected for bath filling and showering will now be described with reference to Figures 12 to 18 in which the direction of rotation of the control knob 12 to increase output water temperature is indicated by arrow A and to reduce output water temperature by arrow B.

Referring first to Figure 12, the control lever 13 is shown in the on position for showering and the control knob 12 is shown in the setting providing a minimum output water temperature. In this position clockwise rotation of the control lever 13 is blocked by the stop 28
(Figure 5) as described previously. Clockwise rotation of the control knob 12 to reduce the output water temperature is blocked by engagement of web 31 on the underside of the control knob 12 with the stop 30 on the stop sleeve 29 which in turn is prevented from rotating in a clockwise direction by engagement with stop 16 on the coupling ring 34 connected to the control lever 13.

On rotation of the control knob 12 in an anti-clockwise direction to increase the output water temperature, the web 31 is free to rotate through nearly 360° at which point it engages the opposite side of the stop 30 on the stop sleeve 29. On continued rotation in an anticlockwise direction, the stop sleeve 29 rotates with the control knob 12 until the stop 30 engages the stop 15 on the coupling ring 34 as shown in Figure 12. This corresponds to the maximum output water temperature that can be selected for showering and, in this embodiment, is set slightly below 41°C for use in health care establishments. The user can rotate the control knob 12 to select any desired output water temperature between the maximum and minimum temperatures in the normal manner.

At the maximum temperature setting, further rotation of the control knob 12 to increase the water temperature is blocked by the stop 15 and requires a significantly higher force to be applied to the control knob 12 to move the control lever 13. A child or an elderly person would normally be unable to apply sufficient force and, if an excessive force is applied, the diverter valve 11 is closed by anticlockwise rotation of the control lever 13 of approximately 20° from the on position. As a result, the shower outlet 4 is automatically de-selected and the risk of scalding from discharge of output water exceeding the maximum temperature for showering is reduced or eliminated.
The shower can be turned off at any temperature setting of the control knob 12 by rotating the lever 90° in an anticlockwise direction from the position shown in Figures 12 and 13 to close the diverter valve 11. Figure 14 shows the position when the control lever 13 is rotated to the off position with the control knob 12 set to provide the maximum output water temperature for showering.

The control lever 13 can be rotated through 90° in an anticlockwise direction from the off-position shown in Figure 14 to select the bath fill mode of operation. As the control lever 13 is rotated the stop 16 engages the stop 30 on the stop sleeve 29 and the stop sleeve 29 rotates with the control lever 13 until the position shown in Figure 15 is reached. In this position, the stop 32 on the underside of the stop sleeve 29 engages the stop 33 on the cartridge unit 10 and the stop 30 blocks further rotation of the stop 16 in an anticlockwise direction.

The control lever 13 is also prevented from rotating in an anticlockwise direction in this position by the stop at the other end of the rib 29 (Figure 5). In this way, the stops are protected from damage if an excessive force is applied to rotate the control lever 13 in the anticlockwise direction from the position shown in Figure 15.

As shown in Figure 15, the control knob 12 has not moved from the position shown in Figure 14 corresponding to the maximum output water temperature for showering. The control knob 12 can be rotated in an anticlockwise direction from the position shown in Figure 15 to increase the output water temperature until the web 31 on the underside of the control knob 12 engages the stop 30 on the stop sleeve 29 as shown in Figure 16. This corresponds to the maximum output water temperature that can be selected for bath filling and, in this embodiment, can be set
during installation to either 46°C (Figure 16) or 44°C (Figure 22) for use in health care establishments as described later.

On rotation of the control knob 12 in a clockwise direction to reduce the output water temperature, the web 31 is free to rotate through nearly 360° at which point it engages the opposite side of the stop 30 on the stop sleeve 29 as shown in Figure 17. This corresponds to the minimum output water temperature that can be selected for bath filling. Again, the user can rotate the control knob 12 to select any desired output water temperature between the maximum and minimum temperatures in the normal manner.

In this embodiment, the minimum output water temperature for bath filling is slightly warmer than the minimum output water temperature for showering due to the permitted rotational movement of the control knob 12 between the maximum and minimum temperature settings being less in the bath fill mode of operation than in the showering mode of operation.

At the minimum temperature setting, further rotation of the control knob 12 to reduce the water temperature is blocked by the stop 16 and requires a significantly higher force to be applied to the control knob 12 to move the control lever 13. A child or an elderly person would normally be unable to apply sufficient force and, if an excessive force is applied, clockwise rotation of the control lever 13 closes the diverter valve 11.

The bath fill can be turned off at any temperature setting of the control knob 12 by rotating the control lever 13 90° in an anticlockwise direction from the position shown in Figures 16 and 17 to close the diverter valve 13. Figure 18 shows the position when the control lever 13 is rotated to
the off position with the control knob 12 set to provide the maximum output water temperature for bath filling.

If the control lever 13 is rotated through 90° from the position shown in Figure 18 to select the shower mode of operation, the stop 15 will engage stop 30 of the stop sleeve 29 and rotate the stop sleeve 29 and control knob 12 to the position shown in Figure 13 corresponding to the maximum output water temperature setting for showering.

The ports 41a, 41c start to overlap after approximately 70° of this movement and fully overlap at the end of the movement. As a result, the temperature of the water initially discharged when the control lever has been rotated through about 70° can be slightly higher than the maximum output water temperature selectable by the user when the control lever has been rotated through 90° to the full on position for showering.

To prevent discharge of water exceeding 41°C, the maximum water temperature selectable by the user is set to be slightly below 41°C in this embodiment for installation of the mixer in healthcare establishments. As a result, the slightly higher water temperature that may be discharged during initial selection/de-selection of the shower mode of operation is prevented from exceeding 41°C in accordance with the current DO8 standard. It will be understood however that the maximum selectable shower temperature may be increased/decreased by appropriate positioning of the stops according to the requirements for any particular application.

The set-up of the temperature control mechanism to provide a maximum bath fill water temperature of either 46°C or 44°C will now be described
with particular reference to Figures 16 and Figures 19 to 22. As previously described, the maximum bath fill water temperature is set in response to rotation of the control lever 13 to contact stop 16 with stop sleeve 29 and rotate stop sleeve 29 to engage stop 33.

Stop 16 is detachable and the coupling ring 34 has two angularly spaced slots 47a, 47b by means of which the stop 16 can be secured in either one of two positions relative to the stop 15 (see Figures 19 and 20). In addition, stop 32 on the stop sleeve 29 can be extended in the circumferential direction by means of a removable auxiliary stop 32' (see Figure 21) to provide either one of two stop positions of the stop sleeve 29 relative to the stop 33. Slot 47a is used with stop 32 for a maximum bath fill temperature of 46°C (Figure 16) and slot 47b is used with stop 32' for a maximum bath fill temperature of 44°C (Figure 22).

By putting stop 16 in slot 47b and fitting auxiliary stop 32', stop 16 comes into contact with the temperature stop sleeve 29 later in the rotational travel as the diverter lever 13 is being rotated to the bath fill position. As a result, the temperature stop sleeve 29 is rotated less in the anti-clockwise direction to engage auxiliary stop 32' with stop 33 (Figure 22) and the maximum bath temperature is set lower than if stop 16 were in slot 47a and auxiliary stop 32' removed (Figure 16).

The position of the stop 16 is set on installation in combination with the auxiliary stop 32' to suit the conditions in which the mixer 1 will be used. Thus, the maximum bath fill temperature can be set to 46°C when the bather is always be accompanied by a competent person. If the bather is not accompanied, then the maximum bath fill temperature should be set to 44°C. It will be understood however that other temperature settings could be provided according to the requirements for any given installation.
As will now be appreciated, the maximum output water temperature that can be selected for showering and bath filling is set automatically in response to user selection of either the shower or bath fill modes of operation by rotating the control lever 13 from the “off” position to either the shower “on” position or the bath fill “on” position. Furthermore, the shower mode of operation is automatically de-selected if the user attempts to select an output water temperature for showering higher than the maximum output water temperature setting.

Moreover, the maximum output water temperature setting is effected automatically when rotating the control lever 13 from the “off” position to either the shower “on” position or the bath fill “on” position whether the control lever 13 was last set for showering or bath filling and whether the control knob 12 was set to the maximum or minimum temperature or an intermediate temperature when the control lever 13 was last returned to the “off” position.

Furthermore, the arrangement of the stops provides different settings for the maximum output water temperature in the shower and bath fill modes of operation that are achieved automatically in response to rotation of the control lever 13 in any position of the control knob 12.

Moreover, the temperature control mechanism can be set during installation of the bath shower mixer 1 to provide a maximum output water temperature for bath filling of either 44°C or 46°C to comply with the current DO8 standard for healthcare establishments according to whether the user is supervised.
As will now be apparent, the interaction of the stops ensures that the maximum output water temperature is set on selection of either the shower or bath fill modes of operation whatever the previous mode of operation. By providing an element of "automation" to the operation of the bath shower mixer, it is more user friendly.

In particular, the stop sleeve provides a lost motion connection between the control lever of the water diverter mechanism and the control knob of the temperature control mechanism according to the position of the control knob.

Thus, at output water temperature settings below 41°C in either the bath fill or shower modes of operation, the position of the control knob is unaffected by rotation of the control lever to and from the "off" position to select either mode of operation. At output water temperature settings above 41°C in the bath fill mode of operation, the control knob is unaffected by rotation of the control lever to and from the "off" position to select the bath fill mode of operation but, on rotation of the control lever to select the shower mode of operation, the control knob is rotated to reduce the output water temperature below 41°C. In this way, discharge of water at a temperature above 41°C in the shower mode of operation is prevented irrespective of the selected output water temperature in the last mode of operation.

Furthermore, the arrangement of the diverter valve is such that, on selection of the shower mode of operation, the water does not begin to flow from the outlet until the control lever is approaching the "on" position. In this way, the temperature stop is set to prevent the temperature of the output water exceeding 41°C before the water flows.
It will be understood that the invention is not limited to the embodiment above described and that the operation of the bath shower mixer to provide maximum output water temperature control for showering and bath filling using a single thermostatic mixing valve could be achieved in a number of ways.

For example, in the above described embodiment, the control lever 13 controls selection of the outlet and the on/off flow of water through the mixer 1 and the control knob 12 controls the selection of the output water temperature. It will be understood, however that these functions can be provided in a variety of different ways.

Thus the control lever 13 may control selection of the outlet only and the control knob 12 sequentially controls the on/off flow of water through the mixer 1 and selection of the output water temperature.

Alternatively, the control lever 13 may control selection of the outlet and control knob 12 control selection of the output water temperature with a separate control being provided for the on/off flow of water through the mixer 1.

In another arrangement, one control may be provided to switch the water flow on/off and control the flow of the water and another control to select the outlet and control the output water temperature. For example the control may be rotated to select bath or shower with further rotation increasing the temperature of the water discharged.

In a still further arrangement a single control may be provided for all three functions. For example, the user may rotate the control to select
the desired outlet and continue to rotate the control to increase the flow and temperature of the outlet water.

It will also be understood that the invention is not limited in its application to bath shower mixers for healthcare establishments. For example, the bath shower mixer could be used to control output water temperatures for showering and bath fill in hotels or similar institutions that may run the risk of legal action if customers were to scald themselves. Other applications that would be improved by the increased level of safety offered by the inclusion of different maximum output water temperatures for bathing and showering will be apparent to those skilled in the art and are within the scope of this invention.

Other modifications will be apparent to those skilled in the art. For example, the diverter lever needn’t be mounted concentric with the temperature control knob as described. Instead it could be mounted concentric to the water diverter mechanism and drive it directly, with the temperature control mechanism being driven by a gear train or belt drive or chain drive. The mixing valve may be of any suitable type and may be thermostatically controlled as described or non-thermostatically controlled.

Although the invention has been described for controlling the output water temperature from outlets for a bath and shower, it will be understood that the invention is not limited to such application and that the output water from the outlets could be used in a variety of ablutionary or other installations.
Thus, the temperature control mechanism could be incorporated in multiple outlet shower units to give the user control over the maximum temperatures of water jets from its various outlets as they select them.

The temperature control mechanism could be incorporated into any water delivery product e.g. shower, bath tap, basin tap, bidet etc. It could allow different users to set the maximum temperature allowable from the products outlets to their preferred level before use thus ensuring they never come into contact with water temperature higher than that which they set.

The temperature control mechanism could be used as a minimum temperature limiting device. In such circumstances it is less likely to be used as a safety device and more likely to offer an increased level of comfort for the user by ensuring they do not come into contact with water of a lower temp than they select.
CLAIMS

1. A mixer having inlets for hot and cold water and at least two outlets for temperature controlled water wherein the maximum output water temperature from each outlet can be set independently of the other outlet(s).

2. A mixer according to claim 1 wherein the temperature of the output water is thermostatically controlled to maintain a selected output water temperature substantially constant.

3. A mixer according to claim 1 or claim 2 wherein the maximum output water temperature is set in response to selection of the outlet through which the temperature controlled water is discharged.

4. A mixer according to any one of the preceding claims wherein the maximum selectable output water temperature from each outlet is set by a stop operable to prevent selection of a higher output water temperature.

5. A mixer according to any one of the preceding claims having means for diverting output water to a selected one of first and second water outlets, and means for setting a maximum output water temperature from the selected water outlet in response to actuation of the diverter means.

6. A mixer according to claim 5 wherein mixing valve means is provided for mixing hot and cold water to provide temperature controlled output water in accordance with user selection and the setting means is operable to set the maximum output water temperature that can be selected for a given outlet.
7. A mixer according to claim 6 wherein the mixing valve means is thermostatically controlled to maintain the selected output water temperature substantially constant.

8. A mixer according to claim 6 or claim 7 wherein the mixing valve means is manually operable by a rotatable control member to select the output water temperature, and the setting means includes stop means to block rotation of the control member to select output water temperatures higher than the maximum output water temperature.

9. A mixer according to claim 8 wherein the diverter means is manually operable by a rotatable control element to select the outlet, and the stop means includes first and second stops rotatable with the control element and a rotatable stop sleeve for interacting with the stops and the control member to block rotation of the control member to select output water temperatures higher than the maximum output water temperature.

10. A mixer according to claim 9 wherein at least one of the stops is adjustable to vary the maximum permitted output water temperature from the outlet controlled by the stop.

11. A mixer according to any one of claims 8 to 10 wherein, the stop means also blocks rotation of the control member to prevent selection of output water temperatures lower than a minimum output water temperature.

12. A mixer according to any one of claims 5 to 11 wherein the diverter means comprises a diverter valve having relatively rotatable valve members for diverting the output water to the selected outlet.
13. A mixer according to claim 12 wherein the valve members comprise a pair of ceramic discs formed with ports co-operable to divert the output water to the selected outlet.

14. A mixer according to claim 13 wherein one of the ceramic discs is fixed and the other ceramic disc is rotatable to block output water flow to both outlets in an "off" position and to divert the output water flow to the selected outlet in each of two "on" positions.

15. A mixer according to claim 14 wherein the outlets are used for showering and bath filling and the shower outlet is connected to the bath fill outlet in the "off" position allowing the shower to drain down.

16. A mixer according to claim 15 wherein the mixer is arranged to be fail-safe in the shower mode of operation by shutting-off the flow of water to the shower outlet if the user tries to force the control member to select an output water temperature for showering higher than the maximum.

17. A mixer according to any one of claims 5 to 16 wherein the mixer comprises a main body housing the mixer valve means and the diverter means and the incoming flows of hot and cold water are connected to the mixer valve means via a manifold within the main body.

18. A method of controlling the output water temperature from a mixing valve to a selected one of two outlets comprising the steps of providing a manually operable control member for user selection of the desired output water temperature, providing stop means for blocking rotation of the control member to select output water temperatures exceeding a maximum output water temperature, providing diverter means
for diverting the output to the selected outlet, and providing setting means operable in response to selection of the outlet to set the stop means.

19. A method according to claim 18 wherein the setting means is operable to set the stop means such that the maximum output water temperature from one outlet is higher than the maximum output water temperature from the other outlet.

20. A method according to claim 18 or claim 19 wherein the temperature difference between the maximum output water temperatures of the outlets can be adjusted.

21. A method according to claim 20 wherein the stop means is adjustable to set the maximum output water temperature from one or both outlets.

22. A method according to any one of claims 19 to 21 wherein said one outlet is a bath fill outlet and said other outlet is a shower outlet whereby the maximum output water temperature for bath filling is higher than for showering and stop means is adjustable to set the maximum output water temperature for bath filling.

23. A system of controlling the maximum output water temperature from a plurality of water outlets in response to selection of any one of the outlets.

24. A thermostatically controlled bath shower mixer having water inlets for connection to supplies of hot and cold water, a bath water outlet, a shower water outlet, a diverter valve for diverting output water to one of the outlets in accordance with user selection, a thermostatic
mixing valve for mixing hot and cold water to provide temperature
controlled output water in accordance with user selection, stop means for
blocking user selection of an output water temperature higher than a pre-
determined maximum output water temperature to the selected outlet, the
stop means being operable to permit user selection of output water
diverted to the bath water outlet having an output water temperature up to
a first pre-determined maximum output water temperature and selection of
output water diverted to the shower water outlet having an output water
temperature up to a second pre-determined maximum output water
temperatures being different.

25. A bath shower mixer according to claim 24 wherein the mixing
valve includes a rotatable control member for user selection of the output
water temperature and the stop means is arranged to block rotation of the
control member to select output water temperatures higher than the
permitted maximum output water temperature to the selected outlet.

26. A bath shower mixer according to claim 24 or claim 25 wherein
the first pre-determined maximum output water temperature is higher than
the second pre-determined maximum output water temperature whereby
output water for bath filling can be hotter than output water for
showering.

27. A mixer substantially as hereinbefore described with reference to
the accompanying drawings.

28. A method of controlling the output water temperature from a
mixing valve to a selected one of two outlets substantially as hereinbefore
described with reference to the accompanying drawings.
FIGURE 12
A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G05D23/13 F16K11/044 E03C1/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G05D F16K E03C

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 practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Further documents are listed in the continuation of box C.

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Date of mailing of the international search report: 12/10/2004

Name and mailing address of the ISA
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Authorized officer
Vano Gea, J
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