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Plumbing Fixture Safety Modes

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Title:

Plumbing Fixture Safety Modes

Abstract:

Disclosed is a plumbing fixture capable of changing states depending on an input from a user. The fixture is capable of setting a first state of use and a second state of use being different from the first state and when a user requests the state to change, the fixture limits the maximum temperature output of a fluid. Additional, a purging system is described where when the system is used above a threshold, the system purges with cold water when deactivation is requested to ensure extremely hot water is not present in the fixture body.

Invention:

Some people prefer to have very hot water available at their faucet. This poses safety concerns though which are particularly pronounced with young children and the elderly. Water at 140 degrees can scald in under 5 seconds. Households without small children may be less concerned with this, but it can become a safety concern if small children are visiting. Relatives may be visiting or grandchildren may come over. It's possible to turn down the hot water tank, but that takes time to take effect. It must cool down and heat up which makes increasing/decreasing it difficult since it requires advanced planning.

APPROXIMATE TIME/TEMPERATURE RELATIONSHIPS IN SCALDS	
120°F *(49°C)*	More than 5 minutes
125°F *(52°C)*	1½ to 2 minutes
130°F *(54°C)*	About 30 seconds
135°F *(57°C)*	About 10 seconds
140°F *(60°C)*	Less than 5 seconds
145°F *(63°C)*	Less than 3 seconds
150°F *(66°C)*	About 1½ seconds
155°F *(68°C)*	About 1 second

Figure 1 – Reference information about scalding risks.

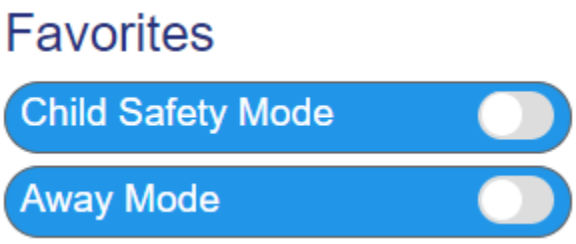

Figure 2 – App UI construct to toggle Child Safety mode.

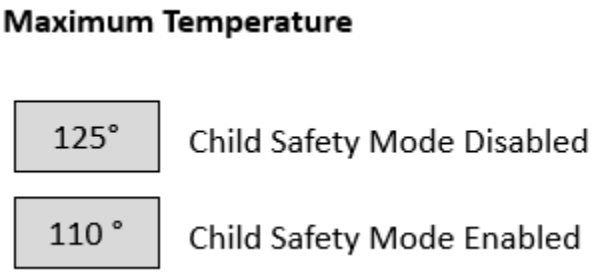

Figure 3 – Temperature settings associated with Child Safety mode.

- One or more connected fixtures (shower, faucet, etc)
- A means such as a remote app or touch screen to specify two max temperatures which applies to the whole house (see Figure 3):
    - Normal temp when child safety mode is disabled
    - More conservative temp when child safety mode is enabled
- One remote interface (app, voice, cloud service such as IFTTT) for the user to enable or disable child safety mode.
- A connected network (wifi, Bluetooth, etc) to allow the connected fixtures to communicate with the remote interface.
- When the user dispenses water from a fixture, it is restricted not to produce water above the set max temperature for the house. Additional max restrictions may be applied for that fixture. The lowest temperature will prevail.
    - Example: Assume a faucet that has its max temperature set to 120 degrees. The whole house temperature has a 105 degree max. The faucet would then be capped at 105. The lowest temp setting always prevails.

- The max temperature enforced toggles based on the child safety mode setting. This applies to all connected fixtures in the house.

A related invention could consist of the following:

- A faucet or shower head with sensors (e.g. IR, visual camera, time of flight, etc) to determine the size of the person present.
    - Example 1: Sensors pointed downward into the sink to observe the size of the user's hand. If a small hand is detected, it automatically limits the temperature to prevent scalding.
    - Example 2: Sensors in the shower to detect the size of the person. If a small child is detected, more conservative temperature limits are enforced.
    - Example 3: A sensor at a facet shooting outward towards the person standing in front of it. If that person is sensed to be a child, then conservative temperature limits are enforced.

Additionally,

- A plumbing fixture with electronic control and ability to regulate temperature
- A means to activate the faucet (a handle or sensor)
- A processor connected to the activation method and capable of controlling the water.
- The processor having an estimate of the amount of water in the line between the control valve and the point of dispense (representing residual water in the line)
    - This may be a hard coded value based on the standard geometry of the product (e.g. for a traditionally plumbed faucet).
    - This could be automatically detected based upon pressure/flow changes during faucet activation to estimate the length
- A processor executing a shutdown sequence when the water is shut off:
    - If the water temperature is above a safety threshold (e.g. 120 degrees), a small amount of cold water is mixed with the hot water to briefly lower the temperature so that it is approximately 120 degrees. This is intended to be a very small amount to replace the residual water in the hose. Very little water actually is dispensed at this lower temperature and the end user does not notice it.
    - Once the water in the hose has been purged with the lower temp water, the water is then shutoff.
    - If the faucet is immediately activated by another person, the water will start off no hotter than 120 degrees and mitigate the risk of scalding.

Furthermore,

- A faucet or shower head with sensors (e.g. IR, visual camera, time of flight, etc) to determine the size of the person present.
    - Example 1: Sensors pointed downward into the sink to observe the size of the user's hand. If a small hand is detected, it automatically limits the temperature to prevent scalding.
    - Example 2: Sensors in the shower to detect the size of the person. If a small child is detected, more conservative temperature limits are enforced.
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