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Customer Calibration of a Plumbing Fixture

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Title:

Customer Calibration of a Plumbing Fixture

Abstract:

Disclosed is a method for calibrating a faucet which includes a metered plumbing fixture capable of dispensing a predetermined amount of fluid from the fixture and requesting a user to determine if the fixture dispensed the correct amount.

Invention:

A metered faucet is capable of delivering a prescribed volume of water. The customer can request 1 cup and receive 1 cup. This requires some metering technology such as a flow turbine or ultrasonic sensing in the product to control the amount of water. Whatever technology is used; it has intrinsic limitations in accuracy. Some of this error is due to initial error in calibration of the sensor. Other sources of error are time or environmentally dependent and may increase/decrease over time.

Analogous equipment manages this through calibration. Products must be periodically calibrated to eliminate time drift and other factors. In our products, this may be due to aging/deterioration of the sensor/turbine because of mechanical wear or the buildup of contaminants.

Calibration typically involves applying a known signal/quantity and then having the equipment measure it. For example, force 1 gallon of water through the faucet and let it measure it. Alternatively, the device can source a signal/quantity and that can be measured by precise equipment. This precise equipment then feeds back a quantitative number which is used to adjust the product. In this case, the faucet would dispense 1 cup into graduated cylinders or other equipment to measure the precise volume. The amount measured would be entered as a numeric correction factor (quantitative).

This invention attempts to further improve the calibration of a metered faucet. Because of time drift or other environmental conditions, the factory calibration may not be sufficient for some user's tastes.

One way to do this would be to ask the customer to precisely dispense 1 cup of water. The faucet would then measure the amount of water flowing. Based on these measurements, it would calibrate itself. This is only straightforward if the end user dispenses 1 cup of water at full flow to ensure that the flow turbine is spinning well. If they dial back the flow to ensure they hit the 1 cup limit exactly as they near this marker, then the flow meter becomes irrelevant (it won't spin for very small amounts of water flow) and we can't detect how much water is passing.

There are 2 ways to overcome this. The first is to leverage information about pressure/flow based upon the full flow case (which the customer is likely to utilize to fill the cup the majority of the way). Based on that, the handle position can be sensed and we can extrapolate the amount of flow at the lower flow rate and use this to make an educated calibration estimate.

The other primary alternative is to leverage a qualitative approach. Instead of asking the customer to dispense 1 cup and let the faucet measure it, we flip it around and ask the faucet to dispense 1 cup and let the customer measure it. The customer would dispense it into a measuring cup. They could then use the app associated with the faucet to specify how much error there is. Because most homes do not have precise measurement equipment, we could support a qualitative input. The customer could specify the error using qualitative photos, sliders, or other in app indicators which allow for a user to identify a discrepancy from the amount dispensed from the amount requested. This would allow the faucet to be dialed in during a calibration without requiring any equipment more precise than a measuring cup.

For example:

The customer could be shown multiple pictures depicting various amounts of error and asked to select which best matches their experience. They could then make the selection and repeat the test. The faucet should perform better next time and they could select among a pictures with progressively less error.