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(54) **AUTOMATIC WATER AND SOAP DISPENSING FAUCET**

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(57) **ABSTRACT**

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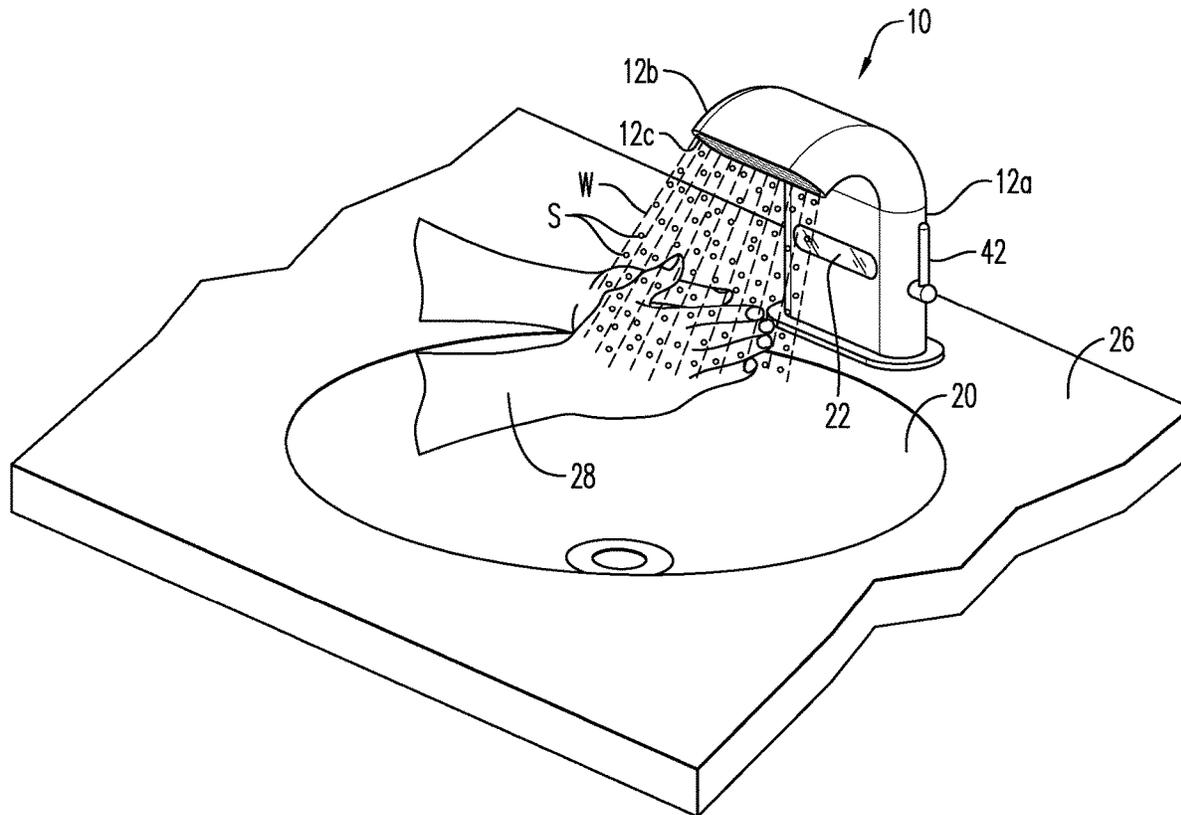
An automatic faucet assembly having a faucet spout for simultaneously dispensing water and soap; a touchless sensor on the automatic faucet assembly; a soap supply for a soap; a water flow control valve; and a controller. The touchless sensor is configured to signal the controller to activate a timed wash cycle including a start-up phase to initiate only water flow through the faucet spout for a first predetermined period of time, a scrubbing phase to dispense the soap from the soap supply and water flow simultaneously in a single stream through the faucet spout for a second predetermined period of time, and a rinsing phase to provide only water flow through the faucet spout for a third predetermined period of time.

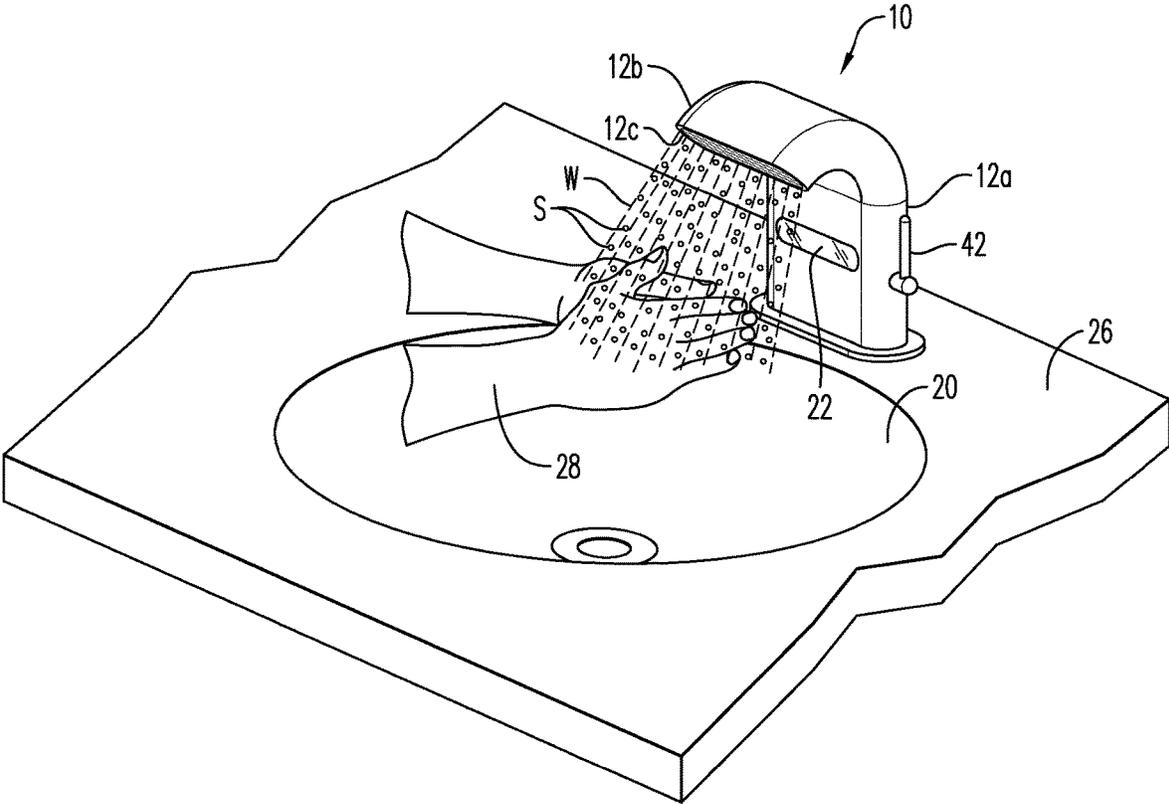
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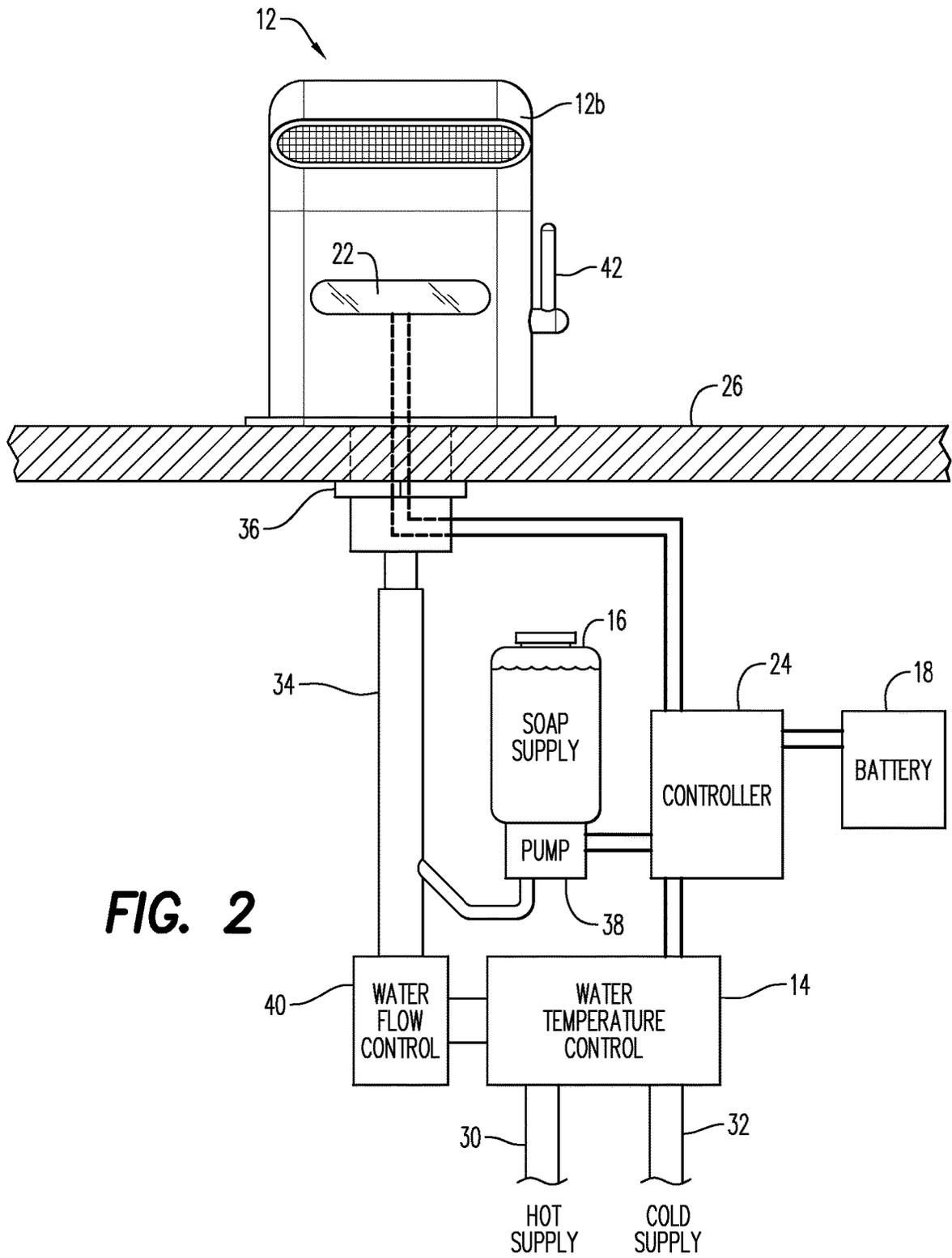
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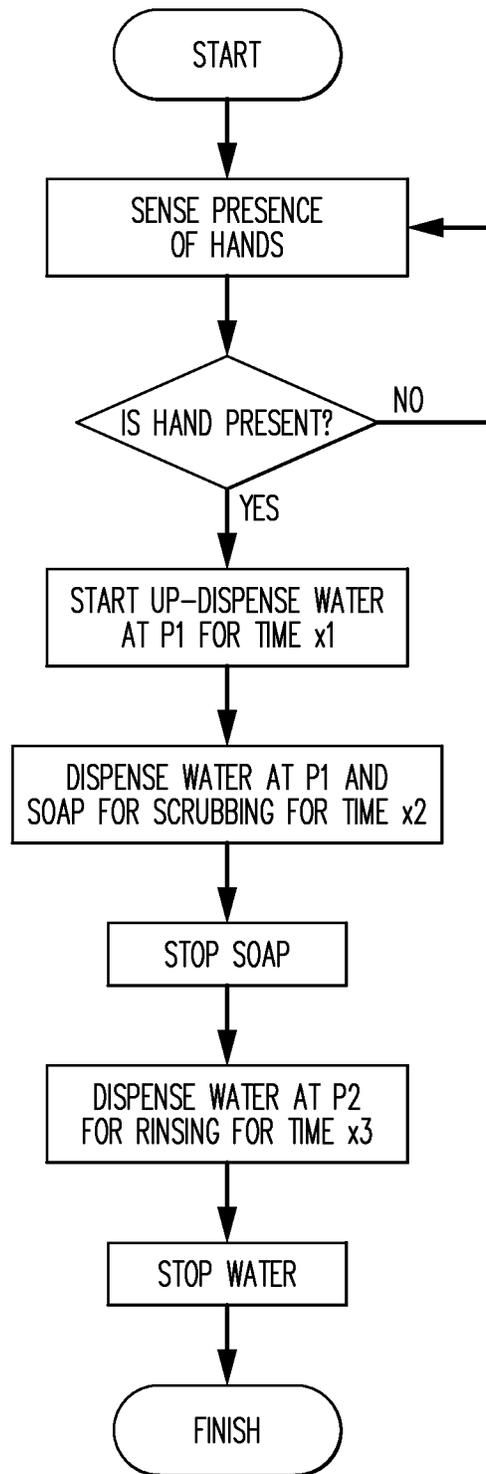
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**FIG. 1**





**FIG. 3**

## AUTOMATIC WATER AND SOAP DISPENSING FAUCET

### BACKGROUND

#### 1. Field of the Disclosure

**[0001]** The present disclosure relates to a faucet and, more particularly, to an automatic water and soap dispensing faucet for a sink.

#### 2. Description of Related Art

**[0002]** Hand washing hygiene is an important requirement for maintaining human health. Many infectious diseases may appear and be propagated if proper hand hygiene procedures are not implemented and followed. Infectious diseases may circulate due to poor hand hygiene via the spread of bacteria, parasites, and viruses. Furthermore, the impact of poor hand hygiene can increase pandemic public health concerns such as experienced with the H1N1 swine flu, avian influenza, and more recently, coronavirus or COVID-19.

**[0003]** Hand washing is a simple and cost-effective way to improve hand hygiene in a medical environment, in the food industry or after a visit to the bathroom. The World Health Organization has even set forth instructions for a hand washing protocol with soap and water. To further bathroom sanitation and hand hygiene, automatic faucets are widely known which automatically turn on water flow after sensing the presence of a user's hands under the faucet. In addition, automatic liquid soap dispensers are also well known in the art. In the prior art automatic liquid soap dispensers and automatic water faucets were available as separate and distinct units, each requiring its own power source as well as separate space. While functionally sufficient, such soap dispensers lead to a cluttered look next to an automatic faucet when mounted on a counter and may lead to soap discharge on the floor when mounted on a nearby wall.

**[0004]** Accordingly, there exists a need in the art for a system and method of using a combination automatic faucet that dispenses both soap and water to a user during a wash cycle.

### SUMMARY OF THE INVENTION

**[0005]** In one aspect, the disclosure provides an automatic faucet assembly comprising a faucet spout for simultaneously dispensing water and soap; at least one touchless sensor on the automatic faucet assembly; a soap supply for soap; a water flow control valve; and a controller. The touchless sensor is configured to signal the controller to activate a timed wash cycle including a start-up phase to initiate only water flow through the faucet spout for a first predetermined period of time; a scrubbing phase to dispense both the soap from the soap supply and water flow simultaneously in a single stream through the faucet spout for a second predetermined period of time; and a rinsing phase to provide only water flow through the faucet spout for a third predetermined period of time.

**[0006]** A further aspect of the disclosure provides a touchless water and soap dispensing faucet comprising a faucet body and a faucet spout for simultaneously dispensing water and soap in a single stream flow; at least one sensor mounted on the faucet body; a pump configured to deliver soap from a soap supply to the single stream flow; a water flow control

valve configured to deliver water to the single stream flow at a first predetermined pressure and at a second predetermined pressure, the second predetermined pressure being greater than the first predetermined pressure; and a controller; wherein said at least one touchless sensor is configured to signal the controller to activate a timed wash cycle.

**[0007]** Another aspect of the disclosure provides a system and method for washing hands to improve hand hygiene, the method comprising providing a touchless water and soap dispensing faucet having a faucet spout; sensing a user's hands under the touchless water and soap dispensing faucet; signaling a controller to begin a timed wash cycle including a start-up phase, a scrubbing phase and a rinsing phase; activating a start-up phase and initiating only a water flow through the faucet spout for a first predetermined period of time; activating a scrubbing phase and dispensing soap from a soap supply and water flow simultaneously in a single stream through the faucet spout for a second predetermined period of time; and activating a rinsing phase and providing only a water flow through the faucet spout for a third predetermined period of time.

**[0008]** Other systems, methods, features and advantages of the disclosure will be, or will become, apparent to one of ordinary skill in the art upon examination of the following figures and detailed description. It is intended that all such additional systems, methods, features and advantages be included within this description and this summary, be within the scope of the disclosure, and be protected by the following claims.

### BRIEF DESCRIPTION OF THE DRAWINGS

**[0009]** The disclosure can be better understood with reference to the following drawings and description. The components in the figures are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the disclosure. Moreover, in the figures, like reference numerals designate corresponding parts throughout the different views.

**[0010]** FIG. 1 is a perspective view of an automatic water and soap dispensing faucet according to an exemplary embodiment of the disclosure when installed on a sink base.

**[0011]** FIG. 2 is a schematic view of the automatic water and soap dispensing faucet.

**[0012]** FIG. 3 is a flow diagram for the use of the automatic water and soap dispensing faucet.

### DETAILED DESCRIPTION

**[0013]** According to the disclosure herein, an automatic water and soap dispensing faucet includes a sensor for detecting the presence of a user's hands to start a wash cycle and a soap dispenser that automatically dispenses a premeasured amount of soap at a predetermined time period in the wash cycle and in the same flow stream as the water. The faucet also provides water flow control to provide a higher flow rate of water during the rinse portion of the wash cycle in order to assist in thoroughly rinsing the soap from the user's hands. The automatic water and soap dispensing faucet delivers a complete and touchless wash cycle, thus providing improved hand hygiene for the prevention of disease transmission.

**[0014]** Referring to the drawings, and in particular FIGS. 1 and 2, an exemplary embodiment of the automatic water and soap dispensing faucet of the disclosure herein is

designated by reference numeral 10. The automatic water and soap dispensing faucet 10 generally includes a faucet body 12a and a faucet spout 12b, a water temperature control 14 to regulate the temperature of the water, a water flow control 40 to adjust the effective pressure of the water to be discharged, a soap supply 16, a power supply 18, at least one sensor 22, and a controller 24, as discussed in greater detail below.

[0015] The automatic water and soap dispensing faucet 10 is mounted for use with a sink or other wash basin 20. FIG. 1 illustrates a countertop 26 having a sink or other wash basin 20 mounted under the countertop 26. The sink 20 could of course also be a top mount whereby a rim of the sink 20 would be seated over the countertop 26. Still further, the sink and adjacent countertop area could be a combined unit, such as cultured marble vanity tops with integrated bowls as commonly used in bathrooms. In each case, the faucet body 12a is mounted rearward of the sink basin 20 either through the countertop 26 or the rear deck of the bowl if it an integral unit such that the faucet spout 12b projects over the sink 20. The faucet body 12a is fixedly secured by way of various fittings 36. The spout 12b for the automatic water and soap dispensing faucet 10 is configured to discharge both water W and soap S from the spout 12b. In an exemplary embodiment of the disclosure, the spout 12b has a wide body outlet 12c that provides a wide water flow sufficient to dispense water to substantially cover the width of the user's hands.

[0016] The sensor 22 is mounted through the front wall of the faucet body 12a in order to detect the presence or absence of a user's hands 28. In the exemplary embodiment, the sensor 22 is mounted to have a field of view into the sink 20 to detect a user's hands located in the sink at a position below the faucet spout 12b to facilitate wetting, scrubbing and rinsing of the hands 28. The field of view of the sensor 22 is configured to detect hands of all sizes, such as, for example, an average male glove size being 8 inches wide or an average female glove size being five inches wide. The sensor 22 may be an infrared sensor for detecting the user's hands. Other types of sensors may also be used however, such as, for example, heat sensors, capacitive sensor, optical or similar electronic devices, or acoustic sensors such as sonic or ultrasonic devices, and other similar sensors. In an exemplary embodiment of the disclosure, the faucet 10 also includes a manual override on/off button 42 configured to allow manual transmission of the signal to the controller 24 in order to begin the wash cycle. That is, if for some reason the sensor 22 fails to alert the controller 24 to the presence of a user's hands within the sink basin 20, the manual button 42 may be actuated to begin the wash cycle. Because of this possibility, it is also possible that an additional sensor may be integrated for redundancy or for actuating the another element of the system, such as a soap pump for example.

[0017] The water temperature control 14 is connected to a hot water supply line 30 and a cold water supply line 32. In an exemplary embodiment of the disclosure, the water temperature control 14 includes a thermostatic valve that is adjustable and set to a predetermined temperature such that the thermostatic valve controls the ratio of hot and cold water from the supplies 30, 32 to achieve the predetermined temperature. Alternatively, the water temperature control 14 could be a manual blending valve that requires the user to manually turn a knob, i.e., left or right, to adjust the temperature manually.

[0018] The water flow control or water flow valve 40 determines the flow rate at which the water will be discharged from the spout 12b. In an exemplary embodiment of the disclosure, the water flow control 40 delivers two water flow rates, referred to herein as a low pressure flow P1 and a high pressure flow P2, as discussed in greater detail below. Merely by way of example, and not limiting the disclosure herein, the low pressure flow P1 may be on the order of 0.2 GPM-0.6 GPM, and more particularly, 0.35-0.5 GPM, and the high pressure flow P2 may be on the order of 1.5 GPM-2.5 GPM, and more particularly 1.8-2.0 GPM, although other pressures which are lower or higher may of course also be used depending upon the specific installation environment.

[0019] The water flow control 40 may achieve the lower and higher flow rates in any number of ways. For example, one embodiment of the disclosure utilizes a water saver feature such as known in the art to obtain the lower pressure flow P1. When the higher pressure flow P2 is then required, the effect of the water saver would be removed or reconfigured to allow increased flow through the water supply 34, such as, for example, by rotation of a valve or by-passing the water saver feature. Alternatively, in a further embodiment of the disclosure, an increased pressure for the higher pressure P2 can be obtained by reducing the effective diameter of the water pipe and thereby creating a "nozzle effect" in which the pressure of the water will increase due to a reduction or other constriction/abutment in the water pipe, such as in a pressure reducing valve. Still further, in another exemplary embodiment of the disclosure a booster or supplemental pump could be provided and activated by the controller to increase the water pressure when the higher pressure P2 is required during the wash cycle, as discussed below.

[0020] When activated by the controller, the soap pump 38 will dispense a premeasured application of soap S from the soap supply 16 so as to reduce soap waste while also giving the user the convenience of touchless operation. In the exemplary embodiment, the soap contained in the soap supply 16 is a liquid soap capable of being pumped by the soap pump 38. As schematically illustrated in FIG. 1, the soap S and the water W are both discharged from the faucet spout 12b simultaneously in a single stream.

[0021] A power source 18, such as a battery in the exemplary, is provided for the faucet 10. Other sources of power could of course also be used such as an existing electrical connection. Also an option would be a hydro-generator which uses the movement of running water to generate energy, thus allowing a sensor faucet to work without an external power source. This solution may be most useful for installing a sink and sensor faucet in an area where wiring for power is not convenient. The power supply 18 is utilized to power the controller 24 which in turn activates the soap pump 38 and water flow control valve 40 for touchless operation.

[0022] Referring also to the flow diagram of FIG. 3, the sensor 22 provides a signal to the controller 24 indicating the presence or absence of hands 28 within its field of view. Once the hands 28 are detected, the sensor 22 sends the signal to the controller 24 to begin the wash cycle. The controller 24 begins the wash cycle with a start-up mode for an elapsed time T1 in which the water flow control 14 opens the water supply 34 so that the faucet discharges only water for an initial wetting of the hands 28. In the exemplary

embodiment, the time T1 for the start-up mode is approximately 1-4 seconds, and more preferably about 2 second, or however long is needed in a particular faucet application to provide a sufficient duration of water discharge to wet the hands prior to dispensing of any soap. In addition, during the start-up mode of operation, the water is dispensed at the lower pressure flow P1 obtained by activating the water control value 14 in a first mode of operation that provides for the discharge rate of water through the water supply 34 at the lower pressure flow P1.

[0023] After an elapsed start-up time of T1, the controller 24 then proceeds to a scrubbing phase. In the scrubbing phase, the controller 24 instructs the soap pump 38 to begin operation such that soap from the soap supply 16 is mixed with the water in the water supply 34 and discharged with the water through the faucet spout 12b. In an exemplary embodiment, the water discharged during the scrubbing phase is still at the lower pressure flow P1. The discharge of water and soap simultaneously is programmed for 20 seconds in the exemplary embodiment, but the exact duration can be increased (or decreased) as required to meet the hand-washing protocol being followed. An audible indicator or visual indicator can be activated during this process to make users aware of the start and/or end of the scrubbing phase, or music or other audible indication can be played for the entire duration of the scrubbing phase. The audible indicator, such as a beeping noise, or the visual indicator, such as a steady or flashing light, can also be programmed to beep or flash in faster intervals as the duration of the scrubbing phase is about to finish.

[0024] After the scrubbing phase, the automatic water and soap dispensing faucet 10 then proceeds to a rinsing phase for a period of time T3. In the rinsing phase, the controller 24 deactivates the soap pump 38 so that only water will be discharged from the faucet 12b. Further, in an exemplary embodiment of the disclosure, the controller 24 activates the water flow control 40 to dispense water at the higher pressure flow P2 during the rinsing phase. The rinsing phase is programmed to discharge water at the higher pressure flow P2 for approximately 15 to 30 seconds, and preferably about 20-25 seconds, or whatever time is determined to be a sufficient duration for thoroughly rinsing the soap from hands 28 of the user. Alternatively, in another embodiment of the disclosure, the rinsing phase will continue as long as the sensor continues to sense the presence of the hands in the sink. However, if hands are left underneath the spout for more than 60 seconds, or some other predetermined period of time, the water will automatically shut off.

[0025] The automatic, touchless wash cycle in accordance with an exemplary embodiment of the disclosure herein has been described above. However, further variations and modifications to such a wash cycle could also be implemented. For instance, in accordance with another embodiment of the disclosure, water could be dispensed at a constant flow pressure, such as the lower pressure flow P1 or the higher pressure flow P2 or a predetermined pressure therebetween, throughout the timed wash cycle and not just during the rinse phase of the wash cycle. In a further exemplary embodiment of the disclosure, the wash cycle begins at the lower pressure flow of only water during the startup phase to wet hands for a period of time T1, and is followed by a soap dispensing phase for a predetermined period of time T2a in which the water and soap are discharged simultaneously. Thereafter, the soap and water flow

will be stopped completely for a predetermined period of time to encourage a user to scrub their soapy hands. In this embodiment, the scrubbing phase of the wash cycle has no soap or water being discharged from the nozzle for the preferred scrubbing time T2. A sound indicator or light indicator can be used to alert the user to the time period T2 as it passes and thus guide the user to scrub their soapy hands as they await the return of the water flow. After the allotted period of time for the scrubbing phase, the rinsing phase then commences to dispense water at the higher pressure flow for a predetermined time T3 in order to thoroughly rinse the soap from the user's hands.

[0026] Still further, another variation of the automatic water and soap dispensing faucet may include a drying cycle immediately following the above-discussed wash cycle. That is, an automatic air dryer could be integrated with the faucet to also provide the user with a touchless drying experience without having to relocate to another location.

[0027] While various embodiments of the disclosure have been described, the description is intended to be exemplary, rather than limiting and it will be apparent to those of ordinary skill in the art that many more embodiments and implementations are possible that are within the scope of the disclosure. Accordingly, the disclosure is not to be restricted except in light of the attached claims and their equivalents. Also, various modifications and changes may be made within the scope of the attached claims.

I claim:

1. An automatic faucet assembly comprising:
  - a faucet spout for simultaneously dispensing water and soap;
  - at least one touchless sensor on the automatic faucet assembly;
  - a soap supply for a soap;
  - a water flow control valve; and
  - a controller;wherein said at least one touchless sensor is configured to signal the controller to activate a timed wash cycle; wherein the timed wash cycle includes:
  - a start-up phase to initiate only water flow through the faucet spout for a first predetermined period of time;
  - a scrubbing phase to dispense the soap from the soap supply and water flow simultaneously in a single stream through the faucet spout for a second predetermined period of time; and
  - a rinsing phase to provide only water flow through the faucet spout for a third predetermined period of time.
2. The automatic faucet assembly according to claim 1, wherein the at least one touchless sensor includes an infrared sensor configured to detect a user's hands.
3. The automatic faucet assembly according to claim 1, wherein the soap supply for includes a soap receptacle and a pump connected to for the soap receptacle.
4. The automatic faucet assembly according to claim 1, wherein the water flow control valve is configured to provide water flow through the faucet spout at a first predetermined pressure and at a second predetermined pressure, the second predetermined pressure being greater than the first predetermined pressure.
5. The automatic faucet assembly according to claim 4, wherein the water flow control valve is configured to provide water flow through the faucet spout at the first predetermined pressure during the start-up phase of the wash cycle.

6. The automatic faucet assembly according to claim 5, wherein the water flow control valve is configured to provide water flow through the faucet spout at the first predetermined pressure during the scrubbing phase of the wash cycle.

7. The automatic faucet assembly according to claim 6, wherein the water flow control valve is configured to provide water flow through the faucet spout at the second predetermined pressure during the rinsing phase of the wash cycle.

8. The automatic faucet assembly according to claim 1, further comprising an adjustable water temperature controller.

9. The automatic faucet assembly according to claim 1, further comprising a visual or audible indicator configured to be activated during the scrubbing phase of the wash cycle.

10. The automatic faucet assembly according to claim 1, further comprising a manual override button configured to signal the controller to activate the timed wash cycle.

11. A touchless water and soap dispensing faucet comprising:

- a faucet body and a faucet spout for simultaneously dispensing water and soap in a single stream flow;
  - at least one sensor mounted on the faucet body;
  - a pump configured to deliver soap from a soap supply to the single stream flow;
  - a water flow control valve configured to deliver water to the single stream flow at a first predetermined pressure and at a second predetermined pressure, the second predetermined pressure being greater than the first predetermined pressure; and
  - a controller;
- wherein said at least one touchless sensor is configured to signal the controller to activate a timed wash cycle.

12. The touchless water and soap dispensing faucet according to claim 11, wherein the at least one sensor includes an infrared sensor configured to detect a user's hands.

13. The touchless water and soap dispensing faucet according to claim 11, wherein the water flow control valve includes a water saver feature configured to provide water at the first predetermined pressure in a first mode of operation.

14. The touchless water and soap dispensing faucet according to claim 13, wherein the water saver feature in the

water flow control valve is configured to provide water at the second predetermined pressure in a second mode of operation.

15. The touchless water and soap dispensing faucet according to claim 11, wherein the water flow control valve includes a means for selectively reducing an effective diameter of an outlet from the water flow control valve, thereby increasing water flow pressure to provide water at the second predetermined pressure.

16. A method of washing hands to improve hand hygiene, comprising:

- providing a touchless water and soap dispensing faucet having a faucet spout;
- sensing a user's hands under the touchless water and soap dispensing faucet;
- signaling a controller to begin a timed wash cycle including a start-up phase, a scrubbing phase and a rinsing phase;
- activating a start-up phase and initiating only a water flow through the faucet spout for a first predetermined period of time;
- activating a scrubbing phase and dispensing soap from a soap supply and water flow simultaneously in a single stream through the faucet spout for a second predetermined period of time; and
- activating a rinsing phase and providing only a water flow through the faucet spout for a third predetermined period of time.

17. The method of washing hands according to claim 16, wherein initiating only the water flow in the start-up phase includes providing water flow through the faucet spout at a first predetermined pressure.

18. The method of washing hands according to claim 17, wherein activating the scrubbing phase includes providing soap and water flow through the faucet spout at the first predetermined pressure during the scrubbing phase of the wash cycle.

19. The method of washing hands according to claim 18, wherein activating the rinsing phase includes providing water flow through the faucet spout at a second predetermined pressure during the rinsing phase of the wash cycle.

20. The method of washing hands according to claim 16, further comprising actuating a visual or audible indicator during the scrubbing phase of the wash cycle.

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