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[US/US]; Becker & Poliakoff, P.A., 8951 Center Street,
Manassas, Virginia 20110 (US).

(72) Inventor; and

(71) Applicant: ELKHATAT, Ahmed Mohamed Reda
[EG/QA]; Qatar University, College of Engineering, De-
partment of Chemical Engineering, P.O. Box 2713, Doha
(QA).

(74) Agent: FORDE, Remmon R. et al.; Nath, Goldberg &
Meyer, 112 S. West Street, Alexandria, VA 22314 (US).

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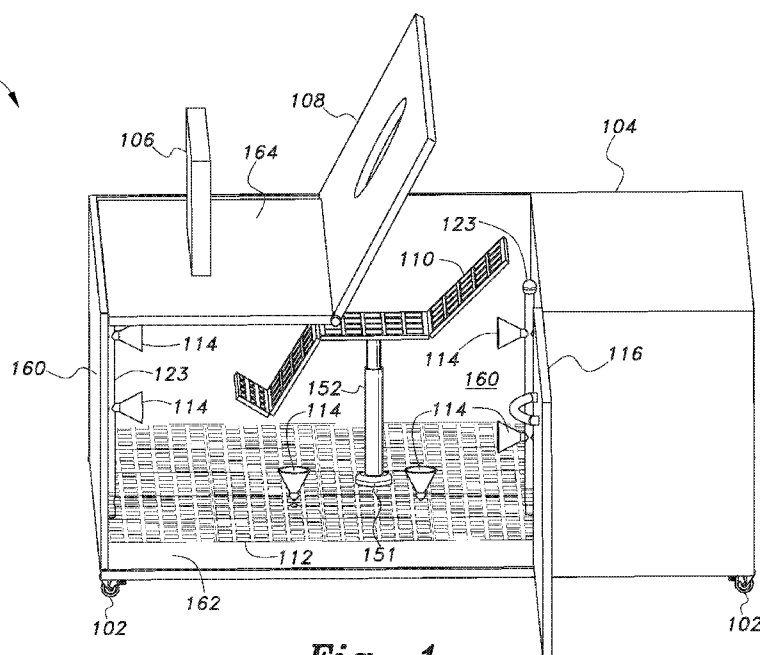


Fig. 1

(57) Abstract: The smart shower compartment (SSC) (100) is a closed compartment provided with a water-air nozzle system (WANS) that jets soapy water/air, pure water/air, or air alone for washing rinsing or drying purposes, respectively. The SSC (100) contains a water tank (104) with a heater and sensor, a water pump (218), an air compressor (220) to jet the water/air mixture, and pipe/hose systems having electronic valves for connecting the WANS. The SSC (100) is supported by electronic control systems that control the washing, rinsing, drying, water flow rate, air flow rate and pressure. The SSC (100) is provided with a Height Adjustable Net Chair (HANC) (110) that offers both safety and comfort, without obstruction of the washing, rinsing and drying cycles. The SSC (100) doesn't require connection to the water/drainage system, as it contains both water and drainage tanks. Thus, the SSC (100) is considered to be a portable system.

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SMART SHOWER COMPARTMENT**TECHNICAL FIELD**

The present invention relates generally to shower systems, and more particularly to a smart shower compartment that provides a closed compartment, portable, shower assembly
5 for the elderly and disabled persons.

BACKGROUND ART

For those with reduced mobility, including the elderly and disabled, moving into and exiting from a typical shower can be difficult. Most showers include a raised wall used to contain the water within the shower interior. This wall presents an obstacle for some users as
10 it requires the user to step over the wall to enter the bath. This can be difficult and even dangerous for those with reduced mobility from injury or impairment, as the user has to step over the shower wall one leg at a time while maintaining balance on a single foot. While this is readily accomplished by one of normal health and strength, physical impairments and age can quickly diminish one's capacity to engage in such routine activities.

15 Thus, a smart shower compartment solving the aforementioned problems is desired.

DISCLOSURE OF INVENTION

The smart shower compartment (SSC) is a closed compartment provided with a water-air nozzle system (WANS) that jets soapy water/air, pure water/air, or air alone for washing rinsing or drying purposes, respectively. The SSC contains a water tank with heater
20 and sensor, a water pump, an air compressor to jet the water/air mixture, and pipe/hose systems with electronic valves that the WANS is connected to. The SSC is supported by an electronic control system that controls the washing, rinsing, drying, water flow rate, air flow rate and pressure. The SSC is provided with a Height Adjustable Net Chair (HANC) that offers both safety and comfort, without obstruction of the washing, rinsing, and drying
25 cycles. The SSC doesn't require connection to a water/drainage system, as it contains both water and drainage tanks. Thus, the SSC is considered to be a portable system.

These and other features of the present invention will become readily apparent upon further review of the following specification and drawings.

BRIEF DESCRIPTION OF DRAWINGS

Fig. 1 is a perspective view of a smart shower compartment according to the present invention.

Fig. 2 is a schematic diagram illustrating system design of a smart shower compartment according to the present invention.

Fig. 3 is a schematic diagram illustrating the hot air system of a smart shower compartment according to the present invention.

Fig. 4 is a schematic diagram illustrating the hydraulic system of a smart shower compartment according to the present invention.

Similar reference characters denote corresponding features consistently throughout the attached drawings.

BEST MODE FOR CARRYING OUT THE INVENTION

The smart shower compartment (SSC) is a closed compartment including a water-air nozzle system (WANS) that jets soapy water/air, pure water/air, or air alone for washing rinsing or drying purposes, respectively. The SSC contains a water tank with heater and sensor, a water pump, and an air compressor to jet the water/air mixture. A pipe/hose system with electronic valves is connected to the WANS. The SSC is supported by an electronic control system that controls the washing, rinsing, drying, water flow rate, air flow rate, and pressure.

The SSC is provided with a Height Adjustable Net Chair (HANC) that offers both safety and comfort, without obstruction of the washing, rinsing, and drying cycles. The SSC doesn't require connection to an external water/drainage system, as it contains both water and drainage tanks. Thus, the SSC is considered to be a portable system.

The present smart shower compartment 100 provides elderly and handicapped persons with dignity, independence and privacy, and greatly reduces the risk of bathroom injury. The SSC can be used as a safe luxury tool for those who want to have a relaxing and rejuvenating bathing experience, while utilizing the power of compressed air with water to accomplish both maximum cleaning and minimum water consumption. The SSC provides hygiene, where warm compressed air is used for dryness in the last stage instead of towels. A heater system is used to adjust the water temperature.

The smart compartment is programmed to provide several programs, for example, a "Full Wash" program that includes a soaped water cycle, followed by water wash cycle, and

finally a warm air cycle for drying. Another program, "Refreshment Wash", involves a cold water cycle only, followed by a drying cycle.

Other different programs can be included besides the aforementioned cycles. A touch screen control panel 106 is used for programing, and can also be used as an entertainment tool. The touch screen control panel 106 can be a microprocessor-based system, such as an Arduino[®] microcontroller-based system, with complementary components that facilitate programming and incorporation into other circuits. The exemplary Arduino microcontroller circuit may communicate with a Sony Experia waterproof smartphone (or other smartphone) via Bluetooth[®] (Bluetooth is a registered trademark of Bluetooth SIG, Inc.) (BT module), and runs the cycle program. Since, the Arduino runs on 12V DC; it is connected to a 12V DC power supply (SMPS) in the system. The Arduino has a preprogrammed PID controller algorithm to achieve this. Since, the solenoid valves in the hydraulic system are rated 24V AC, a 24V transformer has been built in. This power is switched to the solenoid valves using mechanical relays. The relays are controlled by the microcontroller of the touch screen control panel 106.

The SSC utilizes a 25-gallon water tank. Heating elements and sensors/thermostat, plunger pump/Engine, air compressors, high pressure hoses, pipes, Air-Water Nozzles, Soap Nozzles, height adjustable net chair, tablet, piping accessories and spare parts are included. The components are electronically connected to provide programmability via the control panel 106.

Referring now to Fig. 1, the present smart shower compartment 100 has side 160, bottom 162, and top 164 enclosure walls defining an interior volume of the compartment 100. To facilitate entry into the shower compartment interior, an entry door 116 is provided along a cutout of one of side walls 160 to allow entry therethrough. The door 116 pivots outward from the side wall 160, the door 116 being in alignment with the cutout in the side wall 160 to seal the compartment from water leakage when the door 116 is closed. The SSC 100 is provided with a safety lock that stops the whole system in case of emergency, just by opening the door 116 from inside. The touch screen control panel 106 is disposed on the exterior of the top enclosure wall 164. A hinged access door 108 is disposed along a cutout of the top enclosure wall 164. This access door 108 may have an aperture allowing a user's extremities to be disposed therethrough for access to the touch screen control panel 106.

A net latticework 112 defines a floor portion of the shower compartment interior volume, the floor net latticework 112 being disposed above the bottom enclosure wall 162

and allowing water to drain through the floor and into the bottom enclosure wall 162. A water tank 104 is attached to an exterior portion of one of the side walls 160 of the smart shower compartment 100. One or more water delivery nozzles 114 are disposed inside the shower compartment and are operable with a manifold 240 (shown in Figs 2 and 3). A
5 plunger-style water pump 218 has an inlet connected to the water tank 104 via an inlet supply line 230. A connected inlet filter 232 may be disposed between the water pump 218 and the water tank 104. A by-pass hose 234 may shunt the connection of the inlet filter 232 to the water tank 104. A shower gel container 224 in-line with a controlling valve 222 is connected to the inlet portion of the water pump 218.

10 The plunger of the water pump 218 is connected to a motor 216, which actuates the plunger to pressurize the water flowing from the outlet of the water pump 218 to a high pressure line 228, which feeds the manifold 240 and a soap delivery manifold 214. The soap delivery manifold 214 feeds soap delivery nozzles 213. An air compressor 220 is also connected to the manifold 240 to allow an adjustable mixture of air and/or water through the
15 nozzles 114.

As shown in Fig. 4, a drain 406 is provided. The drain 406 may be disposed in the bottom enclosure wall 162 and, thus, would be adapted for draining water from the bottom enclosure wall 162. A drainage tank may be connected at the drain connection, the drainage tank receiving and storing effluent from the drain 406. The particular embodiment shown in
20 Fig. 4 illustrates a hydraulic system 400. This hydraulic system 400 is responsible for the washing and rinsing cycles and comprises a water inlet with a solenoid valve 408c disposed between the inlet and the water tank 104. Initially, the tank 104 is filled while monitoring the temperature. The solenoid valve 408c is used to fill the tank, while a built-in temperature sensor is used to monitor the temperature. A level/float switch 205 is disposed inside the
25 water tank 104 to regulate the level of water in the tank 104. A drain solenoid valve 408d is disposed between a drain outlet of the water tank 104 and the drain 406. As long as the temperature is not within the accepted limit, the water will be flushed through the drain solenoid valve 408d. When enough water is in the tank (as measured by the level/float switch 205), the shower cycle starts. A drain/flow pump 410 is disposed between the water
30 tank 104 and a pair of valves 408a and 408b. Valve 408a feeds a manifold 452a, which feeds mist nozzles 402. In one embodiment, there can be as many as fourteen mist nozzles responsible for a wetting cycle, and eighteen shower nozzles responsible for soaping and showering cycles. Valve 408b feeds a manifold 452b, which feeds the shower nozzles 404. Disposed between the connection of the drain/flow pump 410 to the valves 408a and 408b is

a feed comprising a liquid soap container 412 in line with a pressure pump 414 and a check valve 416. The washing cycle starts with activating the pump 410 and jetting of the water through the mist nozzles 402 using solenoid valve 408a. After “misting” for a predetermined number of seconds, the valve 408a is turned off, and the valve 408b is turned on to actuate flow through the shower nozzles. Soap can be added to the shower by activating the small pressure pump 414.

Again referring to Fig. 1, the height adjustable net chair (HANC) 110 has a base portion 151 attached to the floor 112 and a telescoping tube 152 extending upward therefrom, the net latticework (net chair 110) being attached to upper portion of the telescoping tube 152. As shown in Fig. 1, the net chair 110 has an angled foot support portion, an angled calf support portion, an angled thigh/buttocks support portion, and an angled back support portion.

Additionally, a vertically extending water delivery pipe 123 disposed along one of the side enclosure walls 160 connects a nozzle 114 to the manifold 240. The smart shower compartment 100 is portable and may be wheeled to its operable location due to wheels 102 disposed on the exterior of the bottom enclosure wall 162.

As shown in Fig. 3, a hot air delivery system 300 is responsible for the drying process (which starts after completing the showering cycles) and for adding warm air during the showering process, and includes a centrifugal ventilator 301 connected to a hot air hose 303, which feeds a hot air manifold 302, the manifold 302 feeding hot air hoses 340, the hot air hoses 340 being connected to hot air nozzles 314. Air can be provided also from an air compressor 220 instead of the centrifugal ventilator 301, so that the air compressor 220 may have a connection to a hot air hose 303. A heating element 326 is disposed inside the hot air hose 303, which may have a temperature sensor embedded in it to monitor the hot air temperature. In order to regulate the power of the heating element of the hot air delivery system 300, a Solid State Relay (SSR) has been used. The single-phase frequency converter 418 (shown in Fig. 4) powers the centrifugal ventilator 301. The single-phase frequency converter 418 controls the speed of the air pump (centrifugal ventilator 301). If an air compressor 220 is used to produce the air instead of the centrifugal ventilator 301, then a solenoid air control valve is used to control the air flow. Four different settings have been programmed, to be selected by the program in the microcontroller of the touch screen control panel 106.

It is to be understood that the present invention is not limited to the embodiments described above, but encompasses any and all embodiments within the scope of the following claims.

CLAIMS

I claim:

1. A smart shower compartment, comprising:

5 a shower compartment having a bottom enclosure wall, a top enclosure wall, and a plurality of side enclosure walls defining an interior volume, one of the side enclosure walls having a side cut-out defined therein configured to allow a user to step into the interior volume of the shower compartment;

10 an entry door attached to the side enclosure wall having the cut-out defined therein, the entry door being adapted to operably seal the side cutout and prevent leaks when the entry door is closed;

a net latticework defining a floor portion of the shower compartment interior volume, the floor net latticework being disposed above the bottom enclosure wall and allowing water to drain through the floor and into the bottom enclosure wall;

15 a water tank attached to an exterior portion of one of the sidewalls of the shower compartment;

a water pump connected to the water tank;

a manifold connected to the water pump;

20 at least one water delivery nozzle disposed inside the shower compartment and operable with the manifold;

a drain disposed in the bottom enclosure wall and adapted for draining water from the bottom enclosure wall;

a drainage tank connected to the drain, the drainage tank receiving and storing water drained from the bottom enclosure wall;

25 a height adjustable net chair (HANC) having a base portion attached to the floor portion and a telescoping tube extending upward therefrom, the telescoping tube having an upper portion, the chair having a net latticework support portion attached to the upper portion of the telescoping tube;

30 a top cut-out defined in the top enclosure wall, the top cut-out being adapted to allow a user access to an exterior portion of the shower compartment when the user is seated inside the shower compartment;

an access door attached to the top enclosure wall, the access door being adapted to operably seal the top cutout and prevent leaks when the access door is closed while still allowing the user access to the exterior portion of the shower compartment; and

a touch screen control panel operable with the at least one water delivery nozzle, the touch screen control panel being disposed on the top enclosure wall, the touch screen control panel having means for programming the shower compartment and for displaying entertainment programs to the user.

2. The smart shower compartment according to claim 1, wherein the net latticework support portion comprises:

an angled foot support portion;
an angled calf support portion;
an angled thigh/buttocks support portion; and
an angled back support portion.

3. The smart shower compartment according to claim 1, further comprising roller wheels, the bottom enclosure wall being mounted on the roller wheels.

4. The smart shower compartment according to claim 1, further comprising a water delivery pipe disposed along at least one of the enclosure walls, the water delivery pipe connecting the at least one water nozzle to the manifold.

5. The smart shower compartment according to claim 1, further comprising a heating element and a thermostat disposed inside the water tank.

6. The smart shower compartment according to claim 1, further comprising:
a shower gel container disposed inside the smart shower compartment;
a control valve connected to the shower gel container, the water pump having an inlet connected to the control valve and the water tank;

a soap delivery manifold, the water pump having an outlet connected to the soap delivery manifold; and

soap delivery nozzles disposed in the shower compartment and connected to the soap delivery manifold.

7. The smart shower compartment according to claim 6, further comprising an inlet filter disposed between the water pump inlet and the water tank.

5 8. The smart shower compartment according to claim 6, wherein the water pump is a plunger pump.

10 9. The smart shower compartment according to claim 8, further comprising a plunger pump motor connected to the plunger pump for high pressure delivery of soap and water to the nozzles.

10. The smart shower compartment according to claim 9, further comprising a single-phase frequency converter connected to and supplying power to the plunger pump.

15 11. The smart shower compartment according to claim 1, further comprising an air compressor connected to the manifold.

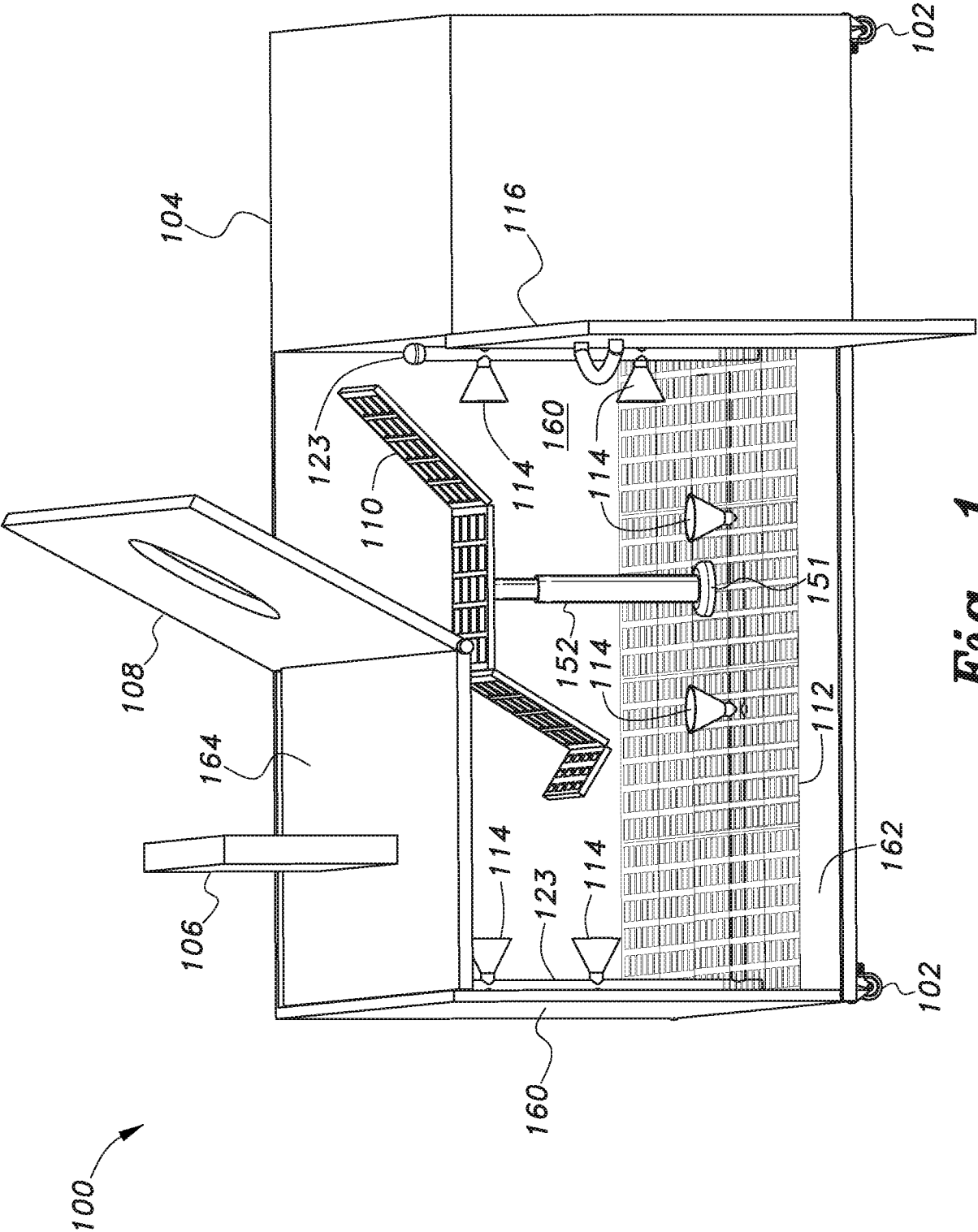
12. The smart shower compartment according to claim 11, further comprising an air heating element disposed between the air compressor and the manifold.

20 13. The smart shower compartment according to claim 12, further comprising a level/float switch disposed inside the water tank to regulate flow/level of water incoming to the water tank.

25 14. The smart shower compartment according to claim 1, further comprising a solenoid valve connected between the water tank and the drain, the solenoid valve being selectively energized to permit water to drain from the water tank directly to the drain.

30 15. The smart shower compartment according to claim 14, further comprising means for draining the water tank until a desired water temperature in the water tank is reached.

16. The smart shower compartment according to claim 15, wherein the touch screen control panel further comprises means for initiating showering, rinsing and drying sequences applied to a user inside the shower compartment.



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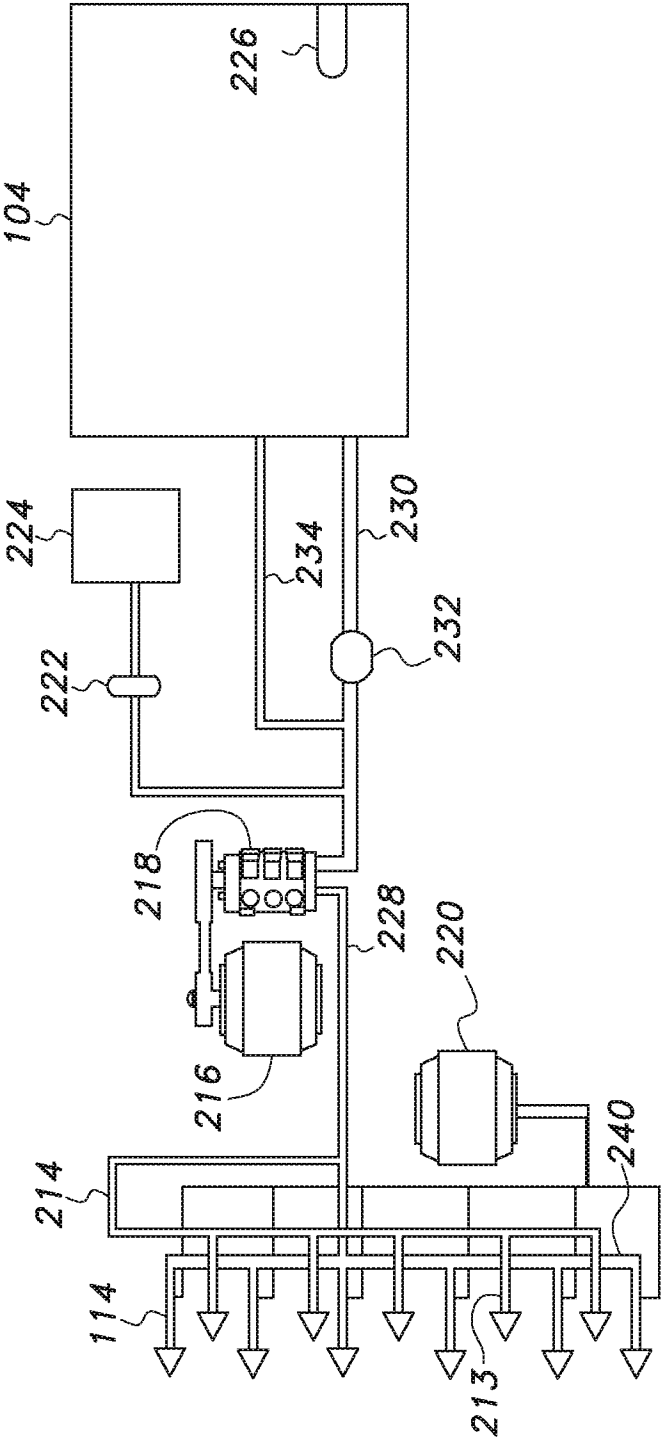


Fig. 2

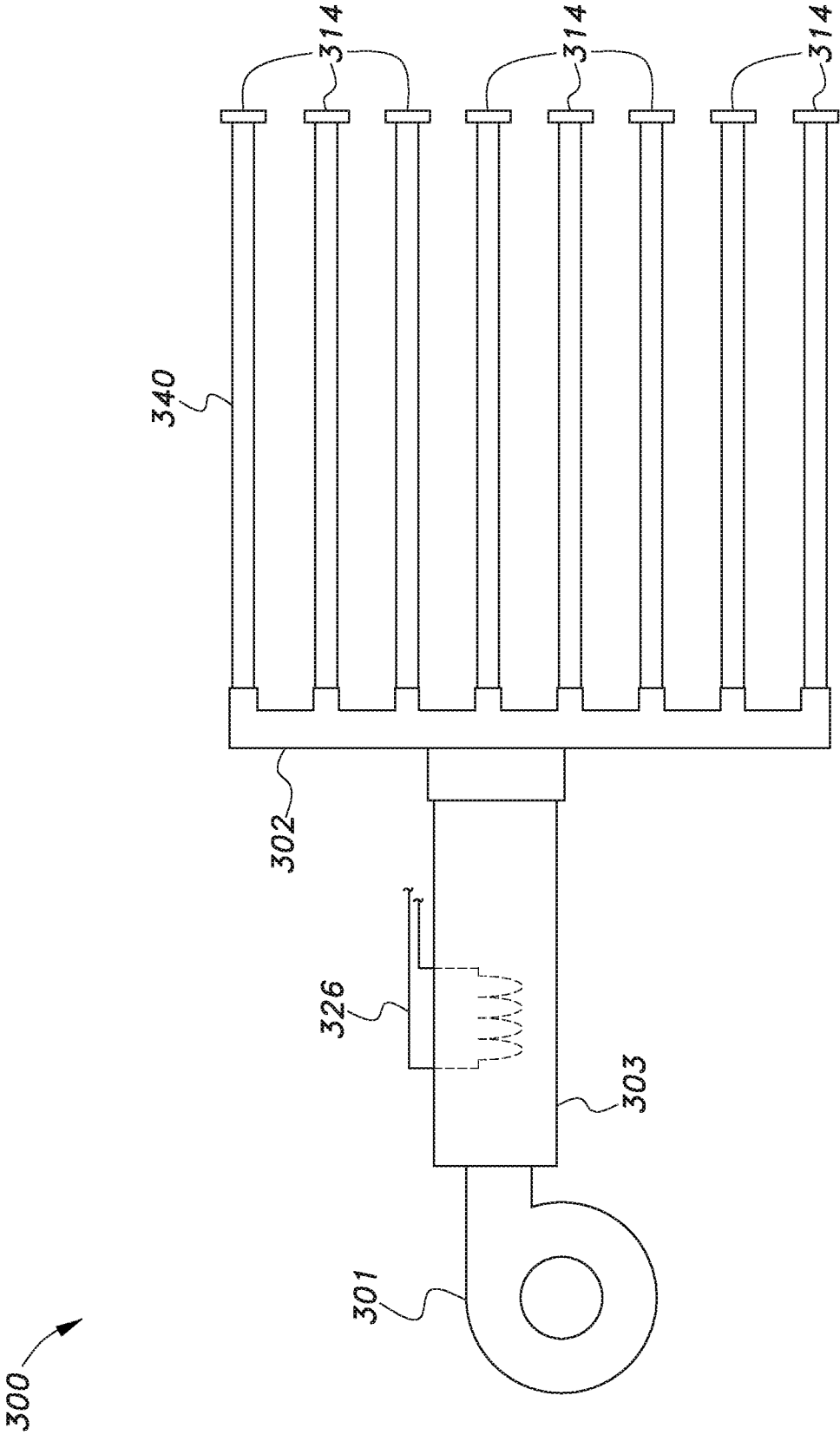
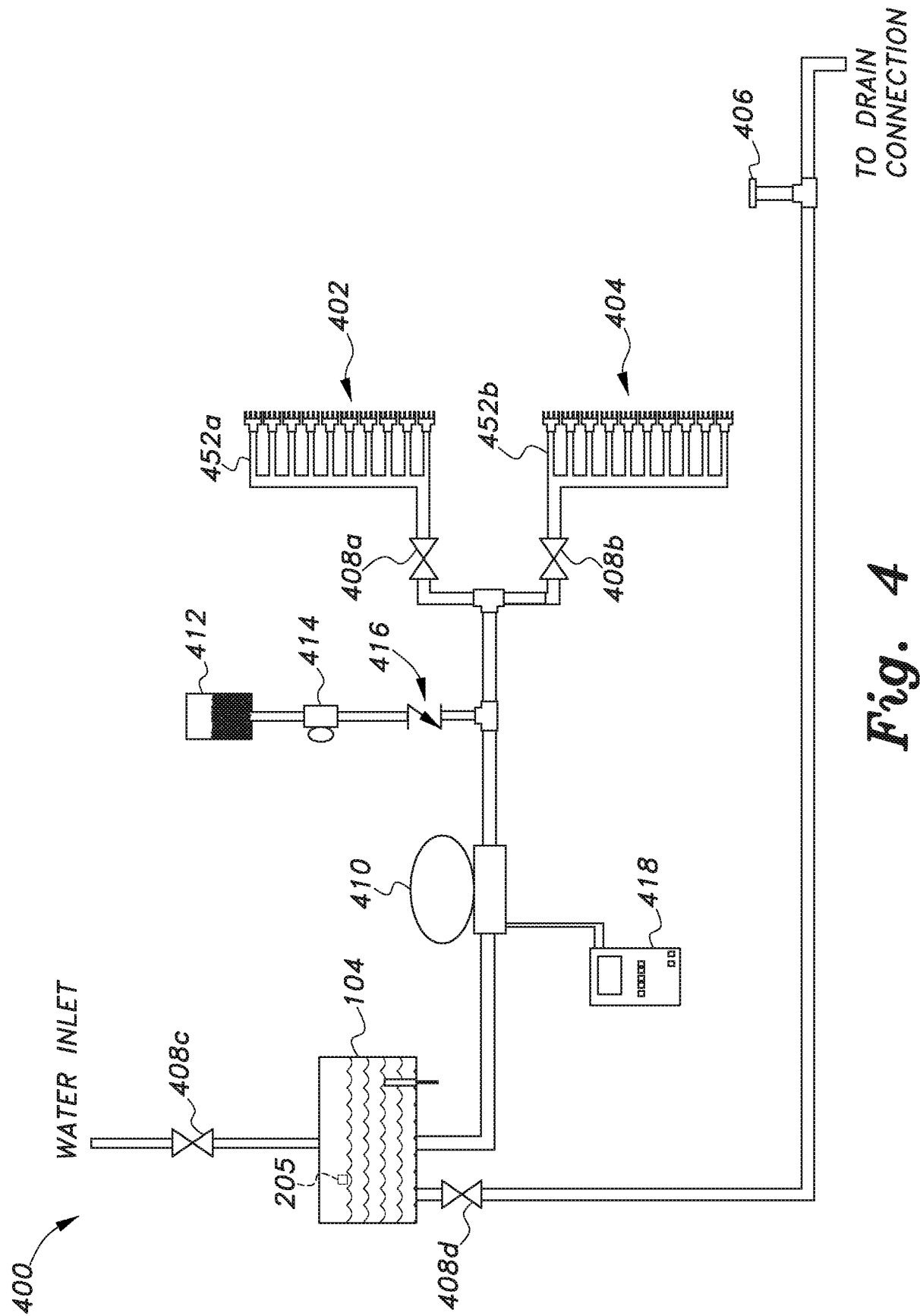


Fig. 3



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2016/044619**A. CLASSIFICATION OF SUBJECT MATTER****A47K 3/32(2006.01)i, E04H 1/12(2006.01)i, E03C 1/04(2006.01)i, E04F 15/02(2006.01)i, E03F 5/04(2006.01)i, E06B 7/16(2006.01)i, A47C 7/14(2006.01)i**

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)

A47K 3/32; A47K 3/28; G07F 17/18; A47K 3/00; A47K 4/00; E04H 1/12; E03C 1/04; E04F 15/02; E03F 5/04; E06B 7/16; A47C 7/14

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: smart shower compartment (SSC), shower, bath, sauna, door, nozzle, tank, drain, telescopic, chair, touch

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 10-2001-0027684 A (PARK, WEI SOOK) 06 April 2001 See page 2, line 27 - page 3, line 15 and figures 1, 2.	1-16
A	US 2015-0208873 A1 (TECHNOLOGY INNOVATORS INC.) 30 July 2015 See claims 1, 3 and figures 1A, 1B.	1-16
A	KR 20-0293576 Y1 (KANG, WON SEOK) 01 November 2002 See abstract and figures 1, 2.	1-16
A	KR 20-0172616 Y1 (OH, JEONG SU) 15 March 2000 See claims 1-3 and figures 1, 2.	1-16
A	KR 20-0433945 Y1 (HITRON INC.) 13 December 2006 See abstract, claims 1-6, and figures 1a-3.	1-16



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

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International Application Division

Korean Intellectual Property Office

189 Cheongsa-ro, Seo-gu, Daejeon, 35208, Republic of Korea

Facsimile No. +82-42-481-8578

Authorized officer

HWANG, Chan Yoon

Telephone No. +82-42-481-3347



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

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date

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06/04/2001

None

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01/11/2002

None

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None

KR 20-0433945 Y1

13/12/2006

None