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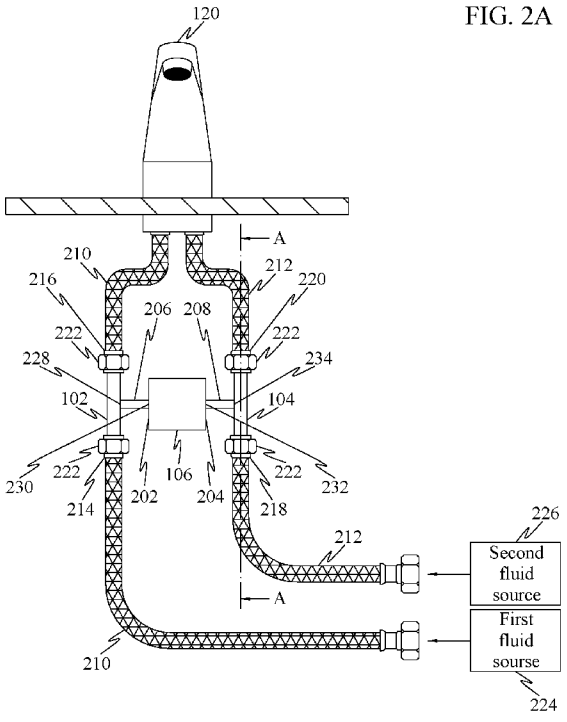
(54) Title: FLUID DISPENSING SYSTEM

FIG. 2A



(57) Abstract: A fluid dispensing system comprises a first pipe, a second pipe and a thermoelectric generator. The first pipe is configured to carry fluid to the fluid dispensing system. The second pipe is configured to carry fluid to the fluid dispensing system. Temperature of the fluid carried by the first pipe is higher than temperature of the fluid carried by the second pipe. The thermoelectric generator comprises a first side and a second side. The first side of the thermoelectric generator is in thermal contact with the first pipe. The second side of the thermoelectric generator is in thermal contact with the second pipe. Temperature gradient is established between the first side and the second side due to difference in temperature in the first pipe and the second pipe. Electric current is generated by the thermoelectric generator as a result of the temperature gradient.

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[Continued on next page]

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FLUID DISPENSING SYSTEM

BACKGROUND

[0001] Unless otherwise indicated herein, the materials described in this section are not prior art to the claims in this application and are not admitted to being prior art by inclusion in this section.

Field of the invention:

[0002] The subject matter in general relates to automatic water dispensers. More particularly, but not exclusively, the subject matter relates to supplying and managing electrical energy required for operating an automatic water dispenser, including, but not limited to, faucets and showers.

Background

[0003] Automatic water dispensers that control the flow of water by sensing the presence of an object, typically a hand, close to the water dispenser have been available in the market for many years. Such devices operate without the need to touch the device and provide a more hygienic means for washing hands. The flow of water stops automatically as soon as one removes one's hands away from the device; this feature reduces the amount of water used and is often mandated by local building codes for resource conservation.

[0004] Automatic water dispensers use electronic components and circuitry that consume electrical energy. The energy is normally supplied from the building's electrical system via wiring or from batteries. Installing electrical wiring adds complexity because of the presence of electricity and water, which require special considerations. Batteries are gradually drained and must be regularly replaced or recharged, adding cost and inconvenience, and are typically incompatible with high usage areas due to the added cost of replacement or recharging. Battery disposal is also environmentally undesirable.

[0005] Another significant disadvantage with depleted batteries is that the automatic water dispenser would stop operating until the batteries are replaced. A similar issue exists with wired water dispensers, namely, if the power is interrupted then the water dispenser is inoperable. Of course, a hybrid system with wiring and batteries can be deployed but the cost is significantly higher.

[0006] In view of the foregoing, there is a need for an improved technique for supplying electrical energy required for operating automatic water dispensers.

[0007] Apart from the challenges relating to the source of supply of electrical energy for operating automatic water dispensers, there are challenges relating to efficient use of energy while operating automatic water dispensers. Typically, sensing systems provided in automatic water dispensers consume considerable energy.

[0008] Faucets based on detecting reflected invisible light, such as infrared sensors, transmit a beam of light and measure the intensity of the reflected light in order to detect the presence of an object in the vicinity of the faucet. This approach required the control system to run a timer at all times and supply power to the infrared transmitter periodically. This process gradually drains the battery or batteries providing power to the control system.

[0009] Faucets may be equipped with capacitive sensor, instead of infrared sensor, to detect objects in the vicinity of the faucet. Physical objects including biological material such as humans can be modeled as passive electronic components. An object can be described with 3 distinct values R, L, and C. R being the resistance, L the inductance, and C the capacitance of the object. If two physical objects are placed in close vicinity, the said objects can be described as one capacitor. Changing the distance of the two objects would change the total capacitance of the said capacitor.

[0010] In case of an automatic faucet or similar washroom device, the faucet's body together with the built-in electronics and the sink can be modeled as a capacitor with specific capacitance. Once an object such as a human's hand is placed in the vicinity of the faucet, it can be considered as part of the said capacitor, and it changes the total capacitance of the system. If the controller is equipped with a capacitive sensor, the change in the capacitance of the system can be detected and used to trigger an event such as opening an electric valve.

[0011] Sanitary devices that utilize a capacitive sensor have a much lower power consumption and hence a longer battery life compared to devices utilizing an infrared sensor. The capacitive sensors are very sensitive to changes in the environment in which they are deployed. Such sensors may become instable through environment humidity, flow of water inside the faucet, electrical and chemical characteristics of water, sink material and other environmental parameters. Achieving a uniform predictable and stable behavior requires special measures during the installation of the device and is almost impossible.

[0012] In view of the foregoing, there is a need for improved management of electrical energy required for operating an automatic water dispenser, while ensuring acceptable reliability in detecting objects in the vicinity of the automatic water dispenser.

[0013] As discussed earlier, infrared sensors are typically more reliable than capacitive sensors. However, one of the challenges relating to infrared sensors is that the system needs to be calibrated to detect an object at a predefined distance from the infrared sensor. Special software for calibration needs to be developed and integrated in the computing device embedded in the system. At the time of manufacturing and installation, additional steps are required to calibrate the system.

[0014] Passive infrared sensors detect the infrared emitted by objects such as human hands and can be used to trigger an actuator such as a solenoid valve. Because an infrared emitting diode is not required as source of infrared light, systems utilizing passive infrared sensor have a much lower power consumption than those measuring the intensity of a reflected infrared beam. Currently available passive infrared sensors are used in motion detectors to detect moving objects at a distance of several meters. In applications such as automatic faucets, the sensor must detect objects in the vicinity of the sensor. The typical range is 5 to 30 centimeters.

[0015] In view of the short range, and relatively short desired tolerance, within which objects have to be sensed in the automatic faucets application, there is a need for improved calibration of passive infrared sensors.

SUMMARY

[0016] In one aspect, a fluid dispensing system is provided. The system comprises a first pipe and a second pipe. The first pipe and the second pipe are configured to carry fluid to the fluid dispensing system, such that temperature of the fluid carried by the first pipe is higher than temperature of the fluid carried by the second pipe. A thermoelectric generator comprising a first side and a second side is present in the system. The first side of the thermoelectric generator is in thermal contact with the first pipe, and the second side of the thermoelectric generator is in thermal contact with the second pipe. Temperature gradient is established between the first side and the second side due to difference in temperature in the first pipe and the second pipe, and electric current is generated by the thermoelectric generator as a result of the temperature gradient.

[0017] In another aspect, a controller of a fluid dispensing system is configured to receive input from a capacitive sensor to identify presence of an object. Upon identification of the presence of the object using the capacitive sensor, the controller turns on an infrared transmitter and monitors a corresponding infrared receiver to ascertain presence of the object within a predefined vicinity of the infrared transmitter. In the event of ascertaining the presence of the object within the predefined vicinity of the infrared transmitter, the controller turns on a valve to allow dispensing of fluid from the fluid dispensing system.

[0018] In yet another aspect, a passive infrared sensor is provided. The passive infrared sensor comprises a first polarizing filter and a second polarizing filter. The first polarizing filter and the second polarizing filter are positioned in front of the passive infrared sensor, such that light polarized by the first polarizing filter and the second polarizing filter reach the passive infrared sensor. At least one of the first polarizing filter and the second polarizing filter is configured to be rotated relative to the other to adjust the light reaching the passive infrared sensor, thereby adjusting sensitivity of the passive infrared sensor.

BRIEF DESCRIPTION OF DRAWINGS

[0019] Embodiments are illustrated by way of example and not limitation in the figures of the accompanying drawings, in which like references indicate similar elements and in which:

[0020] FIG. 1 is a schematic representation of a fluid dispensing system 100, in accordance with an embodiment;

[0021] FIG. 2A illustrates a thermoelectric generator 106 engaged to a flexible first hose 210 and a flexible second hose 212, in accordance with an embodiment;

[0022] FIG. 2B is a sectional view of a second pipe 104 along an axis A-A (shown in FIG. 2A), in accordance with an embodiment;

[0023] FIG. 3 illustrates the thermoelectric generator 106 with an insulated first pipe 102 and an insulated second pipe 104, in accordance with an embodiment;

[0024] FIG. 4 is an alternate embodiment of thermoelectric generator 106;

[0025] FIG. 5 is a schematic representation of a sensor system 114, in accordance with an embodiment;

[0026] FIG. 6 is a flowchart of an exemplary method 600 of working of the sensor system 114, in accordance with an embodiment; and

[0027] FIG. 7 is a schematic representation of an alternate embodiment of the sensor system 114.

DETAILED DESCRIPTION

[0028] The following detailed description includes references to the accompanying drawings, which form a part of the detailed description. The drawings show illustrations in accordance with example embodiments. These example embodiments, which may be herein also referred to as "examples" are described in enough detail to enable those skilled in the art to practice the present subject matter. However, it may be apparent to one with ordinary skill in the art, that the present invention may be practised without these specific details. In other instances, well-known methods, procedures and components have not been described in detail so as not to unnecessarily obscure aspects of the embodiments. The embodiments can be combined, other embodiments can be utilized, or structural, logical, and design changes can be made without departing from the scope of the claims. The following detailed description is, therefore, not to be taken in a limiting sense, and the scope is defined by the appended claims and their equivalents.

[0029] In this document, the terms "a" or "an" are used, as is common in patent documents, to include one or more than one. In this document, the term "or" is used to refer to a nonexclusive "or," such that "A or B" includes "A but not B," "B but not A," and "A and B," unless otherwise indicated.

[0030] Referring to FIG. 1, a fluid dispensing system 100 is provided for dispensing fluid from a faucet 120. The fluid dispensing system 100 may include a first pipe 102, a second pipe 104, a thermoelectric generator 106, a boost convertor 108, an energy storage unit 110, a controller 112, a sensor system 114, a mixing valve 116, an on-off valve and a faucet 120.

[0031] Referring now to FIG. 2A, the thermoelectric generator 106 is in contact with a flexible first hose 210 and a flexible second hose 212. The thermoelectric generator 106 may comprise a first side 202 and a second side 204. The first side 202 of the thermoelectric generator 106 may be in direct contact with the first pipe 102 carrying fluid that may be cold. The second side 204 of the thermoelectric generator 106 may be in direct contact with the

second pipe 104 carrying fluid that may be hot. In an embodiment, the fluid carried may be water.

[0032] In an embodiment, the first pipe 102 may carry fluid that may be hot. The second pipe 104 may carry fluid that may be cold.

[0033] In an embodiment, temperature gradient may be established between the first side 202 and the second side 204 of the thermoelectric module 106 due to difference in temperature of the fluids being carried in the first pipe 102 (hot fluid) and the second pipe 104 (cold fluid).

[0034] In an embodiment, electric current is generated due to the temperature gradient in the thermoelectric generator 106 (Peltier effect). The electric current thus generated may be transmitted to the boost converter 108 (refer FIG. 1). The boost converter 108 may be configured to modulate voltage of the electric current. In an embodiment, the boost converter 108 may increase the voltage of the electric current that is transmitted from the thermoelectric generator 106.

[0035] In an embodiment, the boost converter 108 may transmit the electric current to the energy storage unit 110 (refer FIG. 1) for storage of the electric current. The energy storage unit 110 may be configured to transmit electric current for the functioning of the controller (refer FIG. 1), the sensor system 114 (refer FIG. 1) and other components of the fluid dispensing system 100 that may require electric current to function.

[0036] Further, referring to FIG. 2A, the first side 202 of the thermoelectric generator 106 may be in contact with the first pipe 102 through a first thermal transfer component 206 and the second side 204 of the thermoelectric generator 106 may be in contact with the second pipe 104 through a second thermal transfer component 208. The first thermal transfer component 206 and the second thermal transfer component 208 may be extending laterally from the first side 202 and the second side 204 of the thermoelectric generator 106, respectively.

[0037] In an embodiment, the first thermal transfer component 206 may comprise a first end 228 and a second end 230. The first end 228 of the first thermal transfer component 206 may be thermally in contact with the first pipe 102 and the second end 230 of the first thermal transfer component 206 may be in thermal contact with the first side 202 of the thermoelectric generator 106.

[0038] Likewise, the second thermal transfer component 208 may comprise a first end 234 and a second end 232. The first end 234 of the second thermal transfer component 208 may be thermally in contact with the second pipe 104 and the second end 232 of the second thermal transfer component 208 may be in thermal contact with the second side 204 of the thermoelectric generator 106.

[0039] In an embodiment, the first pipe 102 and the second pipe 104 may be operably mechanically attached to the flexible first hose 210 and the flexible second hose 212, respectively. In an embodiment, the flexible first hose 210 and the flexible second hose 212 may be insulated. The flexible first hose 210 and the flexible second hose 212 may be insulated to avoid heat loss of the fluid being carried within the flexible hoses 210, 212. Also, the flexible hoses 210, 212 may be insulated to follow various safety regulations.

[0040] In an embodiment, the flexible first hose 210 may receive hot water from a first fluid source 224 and the flexible second hose 212 may receive cold water from a second fluid source 226.

[0041] In an embodiment, the mechanical attachment used to connect the first pipe 102 and the second pipe 104 to the flexible first hose 210 and the flexible second hose 212, respectively, may be pipe fittings, dielectric unions, or any other equivalent mechanical fittings 222.

[0042] In an embodiment, the first pipe 102 comprises an inlet 214 and an outlet 216. The inlet 214 of the first pipe 102 is connected to one end of the primary flexible first hose 210, wherein other end of the primary flexible first hose 210 is connected to the first fluid source 224. The outlet 216 of the first pipe 102 is connected to one end of the secondary flexible first hose 210, wherein other end of the secondary flexible first hose 210 is connected to the faucet 120 or mixing valve 116.

[0043] Likewise, the second pipe 104 comprises an inlet 218 and an outlet 220. The inlet 218 of the second pipe 104 is connected to one end of the primary flexible second hose 212, wherein other end of the primary flexible second hose 212 is connected to the second fluid source 226. The outlet 220 of the second pipe 104 is connected to one end of the secondary flexible second hose 212, wherein other end of the secondary flexible second hose 212 is connected to the faucet 120 or mixing valve 116. In the instant embodiment, the first pipe 102 and the second pipe 104 may not be insulated.

[0044] Referring to FIG. 2B, in an embodiment, the first thermal transfer component 206 and the second thermal transfer component 208 are solid cylinders. The first end 228 of the first thermal transfer component 206 may be directly physically exposed to the fluid in the first pipe 102. Similarly, the first end 234 of the second thermal transfer component 208 may be directly physically exposed to the fluid in the second pipe 104. The exposure may be such that, a surface 236 of the second thermal transfer component 208 may be in direct contact with the fluid flowing through the second pipe 104. Similarly, a surface (not shown) of the first thermal transfer component 206 may be in direct contact with the fluid flowing through the first pipe 102.

[0045] The advantage the instant embodiment has over an embodiment wherein the first thermal transfer component 206 and the second thermal transfer component 208 are merely in contact with the first pipe 102 and the second pipe 104, respectively, is that the thermal transfer components 206, 208 are in direct contact with the fluid flowing through the pipes 102, 104. This may result in the thermal transfer components 206, 208 conducting heat more efficiently and effectively to the thermoelectric generator 106.

[0046] Referring to FIG. 3, the thermoelectric generator 106 is provided with an insulated first pipe 102 and insulated second pipe 104. At least a part of the first pipe 102 and the second pipe 104 are insulated and another part is uninsulated. The uninsulated part of the first pipe 102 and the second pipe 104 are in contact with the first thermal transfer component 206 and second thermal transfer component 208, respectively. In an embodiment, the thermal transfer components 206, 208 too may be insulated (not shown) with the ends 228, 230, 232, 234 being left uninsulated where the thermal transfer components 206, 208 connect the sides 202, 204 of the thermoelectric generator 106 and the pipes 102, 104. The insulation of the pipes 102, 104 and the thermal transfer components 206, 208 may reduce radiation of the heat and improve heat conduction.

[0047] FIG. 4 is an alternate embodiment of thermoelectric generator 106, first pipe 102 and the second pipe 104. In the instant embodiment, the inlets 214, 218 of the pipes 102, 104 may be directly attached to the fluid sources 224, 226, respectively. The outlets 216, 220 of the pipes 102, 104 may be attached to the flexible hoses 210, 212, respectively. The advantage of the instant embodiment over the previous embodiments, is that the flexible hoses 210, 212 need not be cut into two to fix the pipes 102, 104. The instant embodiment is advantageous in attaching the system 100 to existing faucet arrangements by detaching the hoses 210, 212 from

the fluid sources 224, 226 and attaching the inlets 214, 218 of the pipes 102, 104 to the sources 224, 226 and attaching the outlets 216, 220 of the pipes 102, 104 to the hoses 210, 212.

[0048] FIG. 5 is a schematic representation of the sensor system 114, in accordance with an embodiment. The sensor system 114 may include a capacitive sensor 502, an infrared sensor 504, wherein the infrared sensor 504 may comprise an infrared transmitter 506 and an infrared receiver 508. The sensor system 114 may be in contact with the controller 112. The controller 112 may be connected to the on-off valve 118, which in turn may be in contact with the faucet 120.

[0049] FIG. 6 is a flowchart of an exemplary method 600 of working of the sensor system 114, in accordance with an embodiment. At step 602, referring to FIG. 5, when an object 510 is in the vicinity of the capacitive sensor 502 and thereby the faucet 120, there is change in capacitance. The controller 112 receives input corresponding to the change in capacitance from the capacitive sensor 502 (step 604, also refer FIG. 5).

[0050] At step 606, the controller 112 turns on the infrared sensor 504. At step 608, the infrared sensor 504 emits infrared light waves using the infrared transmitter 506. The controller 112 monitors the infrared receiver 508 to determine the presence of the object 510 within a predefined vicinity of the infrared transmitter 506. The same may be communicated to the controller 112.

[0051] At step 610, the controller 112 upon confirming the presence of the object 510 within the predefined vicinity of the infrared transmitter 506, turns on the on-off valve 118 to dispense fluid from the faucet 120.

[0052] At step 612, the controller 112 turns off the infrared sensor 504 after a predefined period if there is no detection of the object 510 within the predefined vicinity.

[0053] At step 614, the controller 112 turns on the capacitive sensor 502 to continue monitoring the presence of the object 510.

[0054] FIG. 7 is a schematic representation of an alternate embodiment of the sensor system 114. The sensor system 114 may include a passive infrared sensor 702, a first polarizing filter 704 and a second polarizing filter 706. The sensor system 114 may be in contact with the controller 112. The controller 112 may be connected to the on-off valve 118, which in turn may

be connected to the faucet 120.

[0055] The first polarizing filter 704 and the second polarizing filter 706 may be positioned in front of the passive infrared sensor 702. The polarizing filters 704, 706 lets light waves of a specific polarization pass and blocks light waves of other polarizations. Polarizing filters 704, 706 convert a beam of light of undefined or mixed polarization into a beam of well-defined polarization, that is polarized light.

[0056] In an embodiment, one of the two polarizing filters 704, 706 may be configured to be rotatably adjustable with respect to the other. This configuration of the polarizing filters 704, 706 helps in adjusting the light reaching the passive infrared sensor. This helps in adjusting the sensitivity of the passive infrared sensor 702.

[0057] In an embodiment, the passive infrared sensor 702 receives infrared waves from the object 510, when the object 510 is within a predefined distance from the passive infrared sensor 702. The infrared waves may pass through the polarizing filters 704, 706 and reach the passive infrared sensor 702.

[0058] The passive infrared sensor 702 may communicate the presence of the object 510 to the controller 112. The controller 112 may turn on the on-off valve 118 to dispense fluid from the faucet 120.

[0059] It shall be noted that the processes described above are described as sequence of steps; this was done solely for the sake of illustration. Accordingly, it is contemplated that some steps may be added, some steps may be omitted, the order of the steps may be re-arranged, or some steps may be performed simultaneously.

[0060] Although embodiments have been described with reference to specific example embodiments, it will be evident that various modifications and changes may be made to these embodiments without departing from the broader spirit and scope of the system and method described herein. Accordingly, the specification and drawings are to be regarded in an illustrative rather than a restrictive sense.

[0061] Many alterations and modifications of the present invention will no doubt become apparent to a person of ordinary skill in the art after having read the foregoing description. It is to be understood that the phraseology or terminology employed herein is for the purpose of

description and not of limitation. It is to be understood that the description above contains many specifications; these should not be construed as limiting the scope of the invention but as merely providing illustrations of some of the personally preferred embodiments of this invention. Thus, the scope of the invention should be determined by the appended claims and their legal equivalents rather than by the examples given.

CLAIMS

What is claimed is,

1. A fluid dispensing system comprising:

a first pipe configured to carry fluid to the fluid dispensing system;

a second pipe configured to carry fluid to the fluid dispensing system, wherein temperature of the fluid carried by the first pipe is higher than temperature of the fluid carried by the second pipe;

a thermoelectric generator comprising a first side and a second side, wherein,

the first side of the thermoelectric generator is in thermal contact with the first pipe;

the second side of the thermoelectric generator is in thermal contact with the second pipe;

temperature gradient is established between the first side and the second side due to difference in temperature in the first pipe and the second pipe; and

electric current is generated by the thermoelectric generator as a result of the temperature gradient.

2. The system of claim 1, wherein the thermoelectric generator comprises a first thermal transfer component and a second thermal transfer component, wherein,

the first thermal transfer component physically connects the first side of the thermoelectric generator to the first pipe; and

the second thermal transfer component physically connects the second side of the thermoelectric generator to the second pipe.

3. The system of claim 2, wherein the first thermal transfer component and the second thermal transfer component laterally extend from the thermoelectric generator.

4. The system of claim 2, wherein,

the first thermal transfer component comprises a first end and a second end;

the second thermal transfer component comprises a first end and a second end;

the first end of the first thermal transfer component is directly physically exposed to the fluid in the first pipe, wherein a surface of the first end of the first thermal transfer component is exposed to the fluid in the first pipe; and

the first end of the second thermal transfer component is directly physically exposed to the fluid in the first pipe, wherein a surface of the first end of the second thermal transfer component is exposed to the fluid in the second pipe.

5. The system of claim 4, wherein,

the second end of the first thermal transfer component is in contact with the first side of the thermoelectric generator; and

the second end of the second thermal transfer component is in contact with the second side of the thermoelectric generator.

6. The system of claim 1, wherein,

the first pipe is operably mechanically connected to a flexible first hose; and

the second pipe is operably mechanically connected to a flexible second hose.

7. The system of claim 6, wherein the first hose and the second hose are insulated.

8. The system of claim 6, wherein each of the first pipe and the second pipe comprises an inlet and an outlet, wherein,

the first hose is connected to the inlet and the outlet of the first pipe such that the fluid enters the first pipe from the first hose at the inlet of the first pipe and the fluid leaves the first pipe into the first hose through the outlet of the first pipe; and

the second hose is connected to the inlet and the outlet of the second pipe such that the fluid enters the second pipe from the second hose at the inlet of the second pipe and the fluid leaves the second pipe into the second hose through the outlet of the second pipe.

9. The system of claim 6, wherein each of the first pipe and the second pipe comprises an inlet and an outlet, wherein,

the inlet of the first pipe is operably mechanically connected to a first source from which the first pipe receives the fluid;

the outlet of the first pipe is operably mechanically connected to the first hose into which the fluid is passed from the first pipe;

the inlet of the second pipe is operably mechanically connected to a second source from which the second pipe receives the fluid; and

the outlet of the second pipe is operably mechanically connected to the second hose into which the fluid is passed from the second pipe.

10. The system of claim 1, further comprising a first thermal transfer component and a second thermal transfer component, wherein,

the first thermal transfer component physically connects the first side of the thermoelectric generator to the first pipe;

the second thermal transfer component physically connects the second side of the thermoelectric generator to the second pipe;

at least a part of the first pipe is insulated and at least another part of the first pipe is uninsulated;

the first thermal transfer component is physically connected to the another part of the first pipe, which is uninsulated;

at least a part of the second pipe is insulated and at least another part of the second pipe is uninsulated; and

the second thermal transfer component is physically connected to the another part of the second pipe, which is uninsulated.

11. The system of claim 1, further comprising a boost converter, wherein,

the electric current generated by the thermoelectric generator is transmitted to the boost converter; and

the boost converter modulates voltage of the electric current.

12. The system of claim 11, further comprising an energy storage unit, wherein, energy storage unit receives electric current from the boost converter and stores electric energy.

13. The system of claim 1, wherein the fluid dispensing system comprises a faucet for dispensing fluid.

14. The system of claim 1, further comprising a controller configured to,

receive input from a capacitive sensor to identify presence of an object;

turn on an infrared transmitter and monitor a corresponding infrared receiver to ascertain presence of at least a part of the object within a predefined vicinity of the infrared transmitter, only upon identification, using the capacitive sensor, of the presence of the object; and

turn on an on-off valve to allow dispensing of fluid from the fluid dispensing system.

15. The system of claim 14, wherein the controller is further configured to:

turn off the infrared transmitter and the infrared receiver after a predefine period in the absence of detection of any object within the predefined vicinity; and

allow capacitive sensor to continue monitoring to detect presence of any object, even when the infrared transmitter and the infrared receiver are turned off.

16. The system of claim 1, further comprising a passive infrared sensor, and at least a first polarizing filter and a second polarizing filter, wherein,

the first polarizing filter and the second polarizing filter are positioned in front of the passive infrared sensor, such that light polarized by the first polarizing filter and the second polarizing filter reach the passive infrared sensor;

at least one of the first polarizing filter and the second polarizing filter is configured to be rotatably adjustable relative to the other to adjust the light reaching the passive infrared sensor, thereby adjusting sensitivity of the passive infrared sensor.

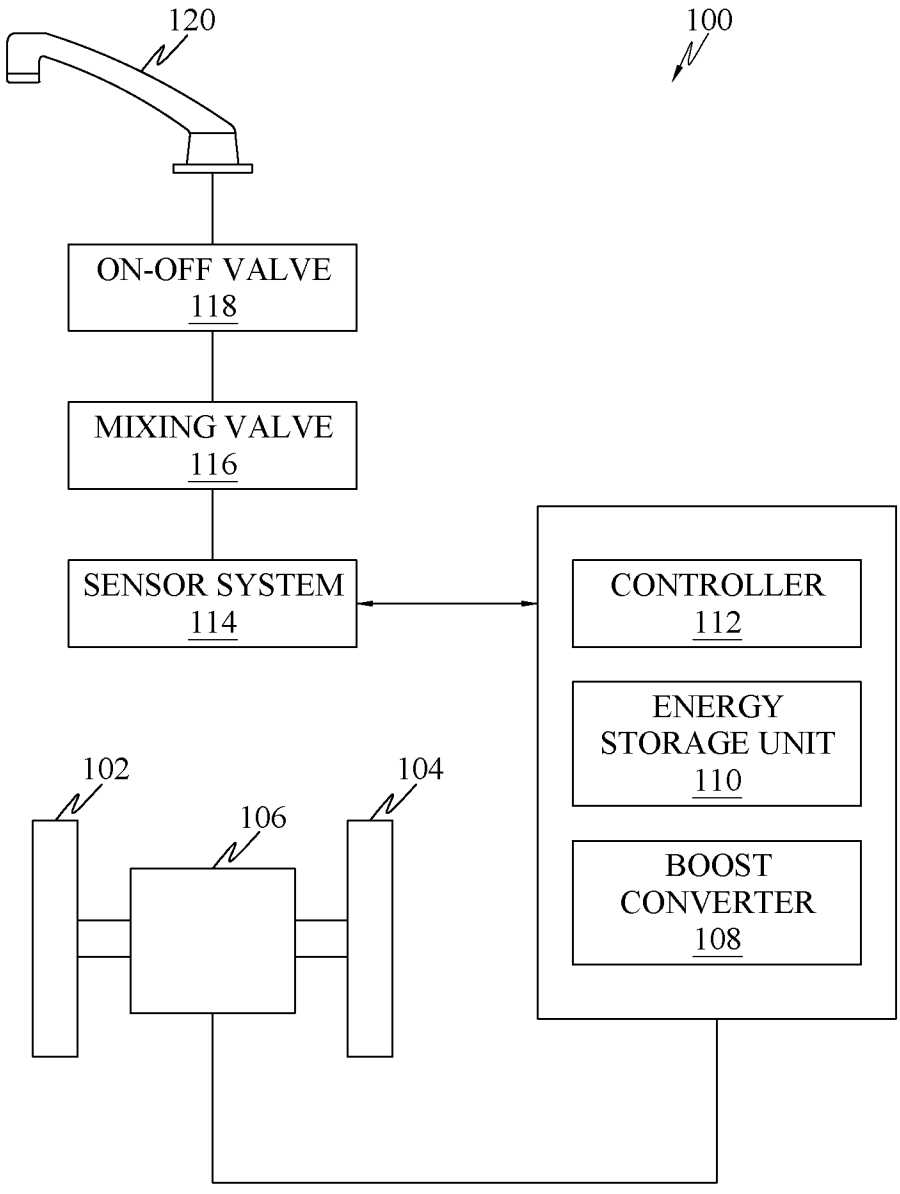
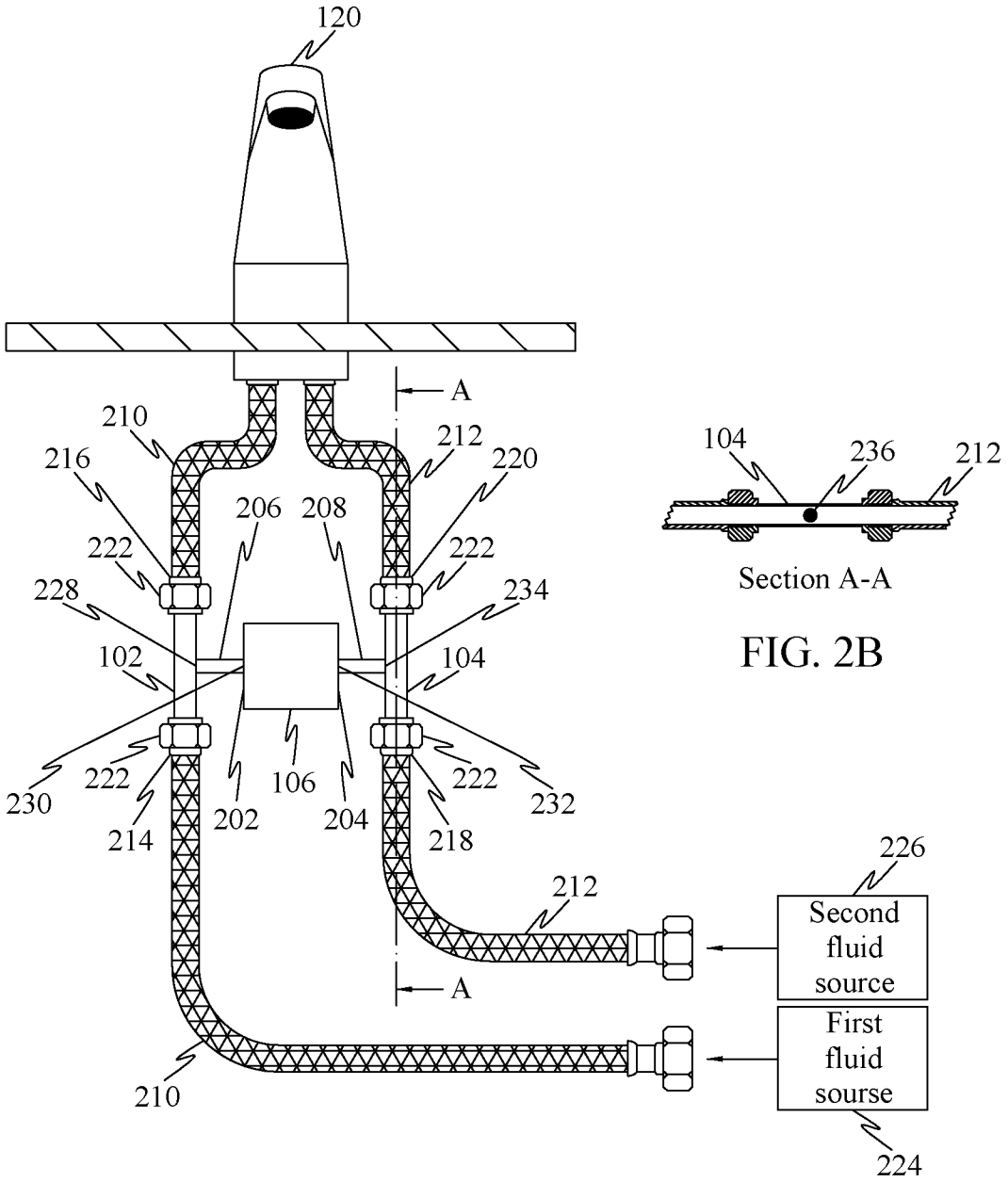

120
100
ON-OFF VALVE
118
MIXING VALVE
116
SENSOR SYSTEM
114
CONTROLLER
112
ENERGY
STORAGE UNIT
110
BOOST
CONVERTER
108
102
104
106

FIG. 1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A
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216
220
206
208
222
222
228
234
102
104
230
222
106
222
232
214
202
204
218
212
226
Second fluid source
A
First fluid sourse
210
224

FIG. 2A

104
236
212
Section A-A

FIG. 2B

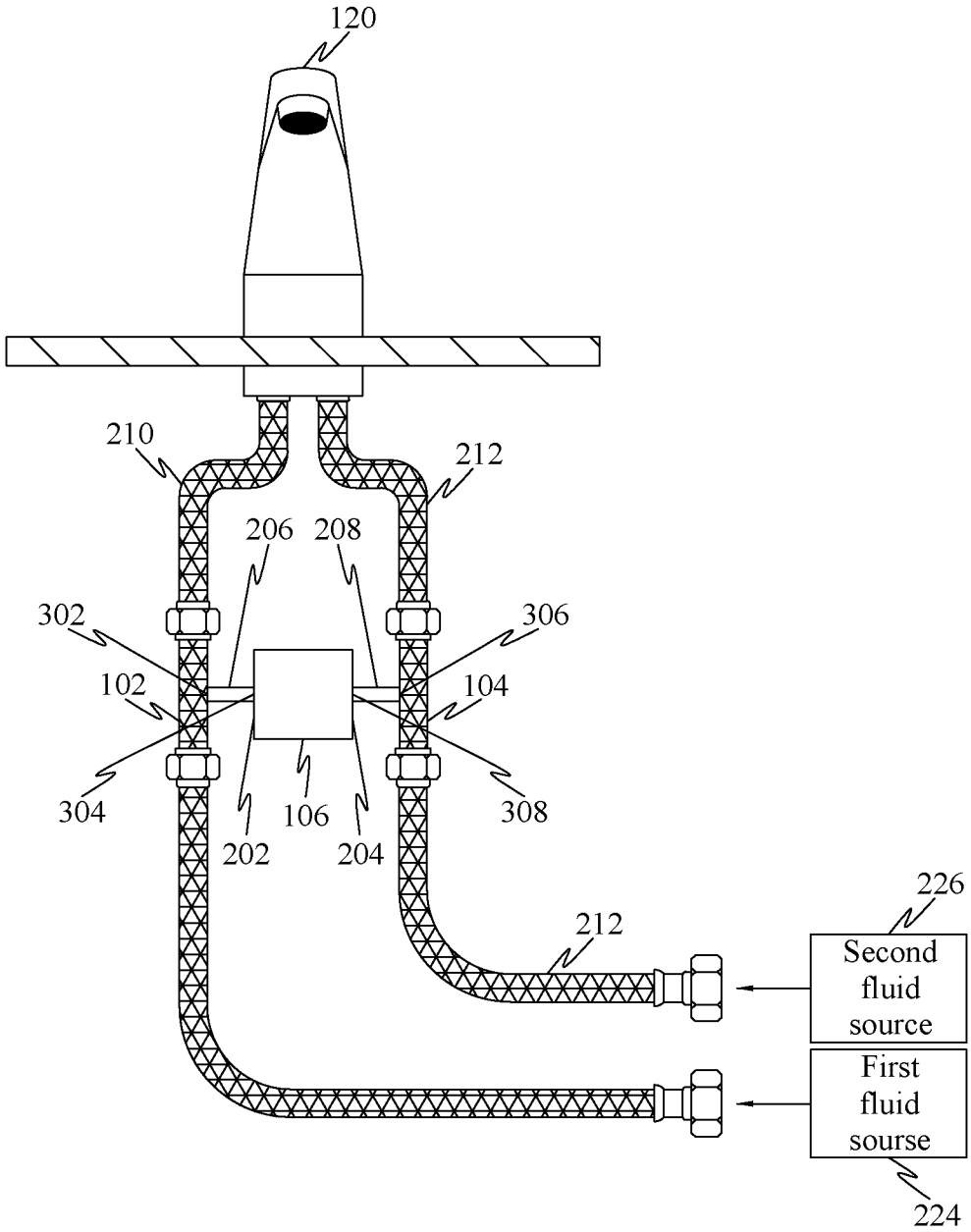
120
210
212
206
208
302
306
102
104
304
106
308
202
204
212
226
Second fluid source
First fluid sourse
224

FIG. 3

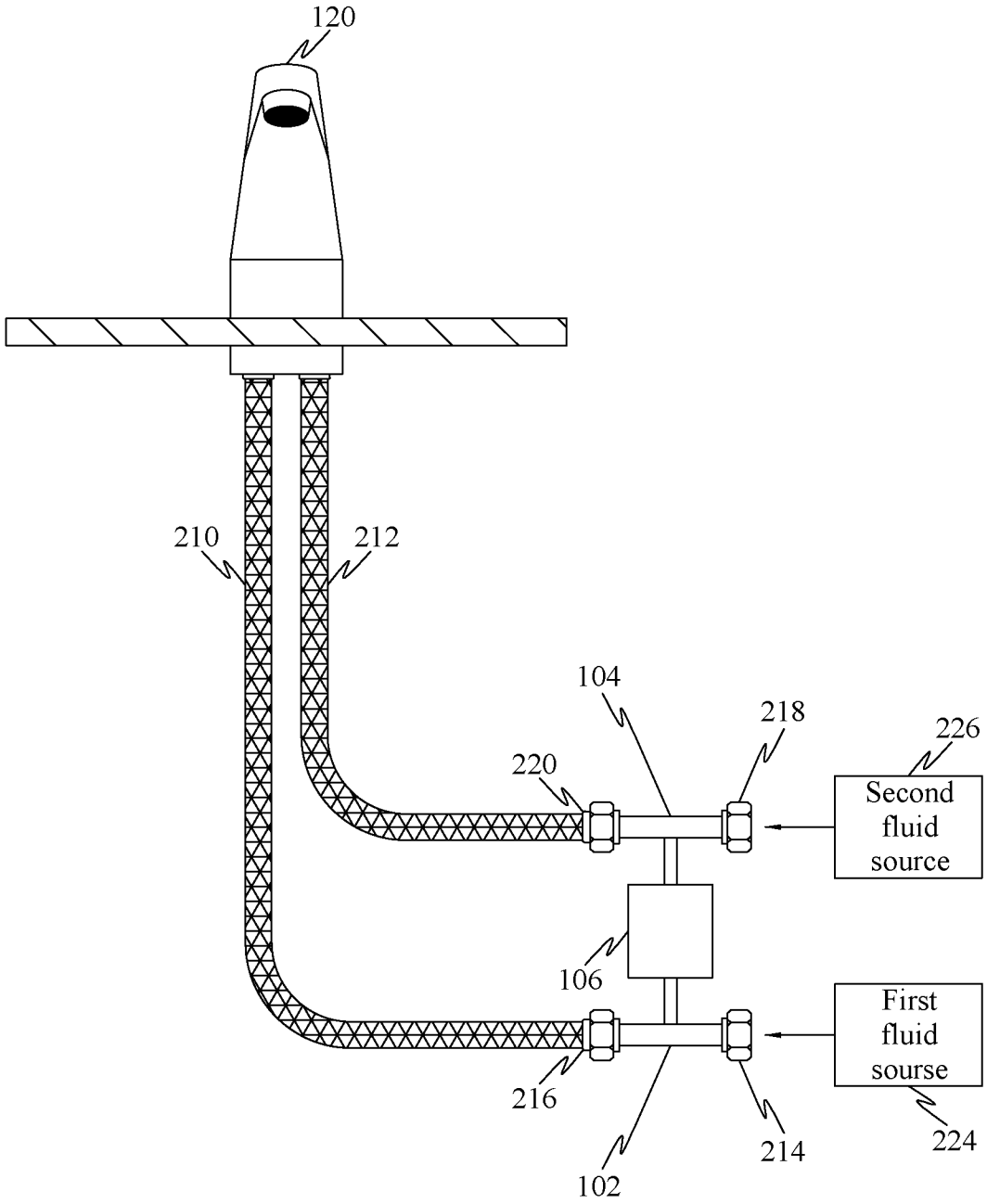
120
210
212
104
218
226
220
Second fluid source
106
First fluid sourse
216
214
224
102

FIG. 4

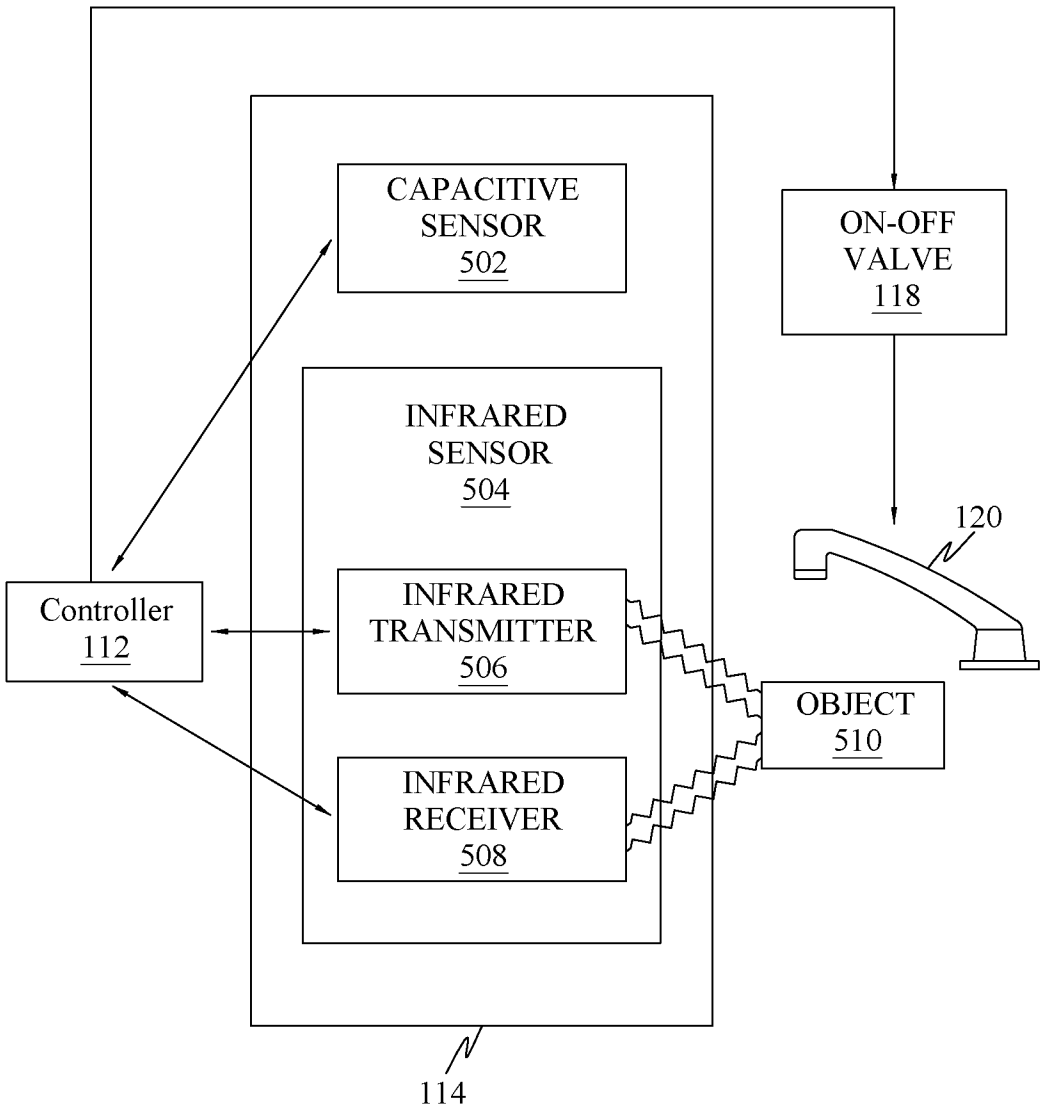
CAPACITIVE SENSOR 502
ON-OFF VALVE 118
INFRARED SENSOR 504
120
Controller 112
INFRARED TRANSMITTER 506
OBJECT 510
INFRARED RECEIVER 508
114

FIG. 5

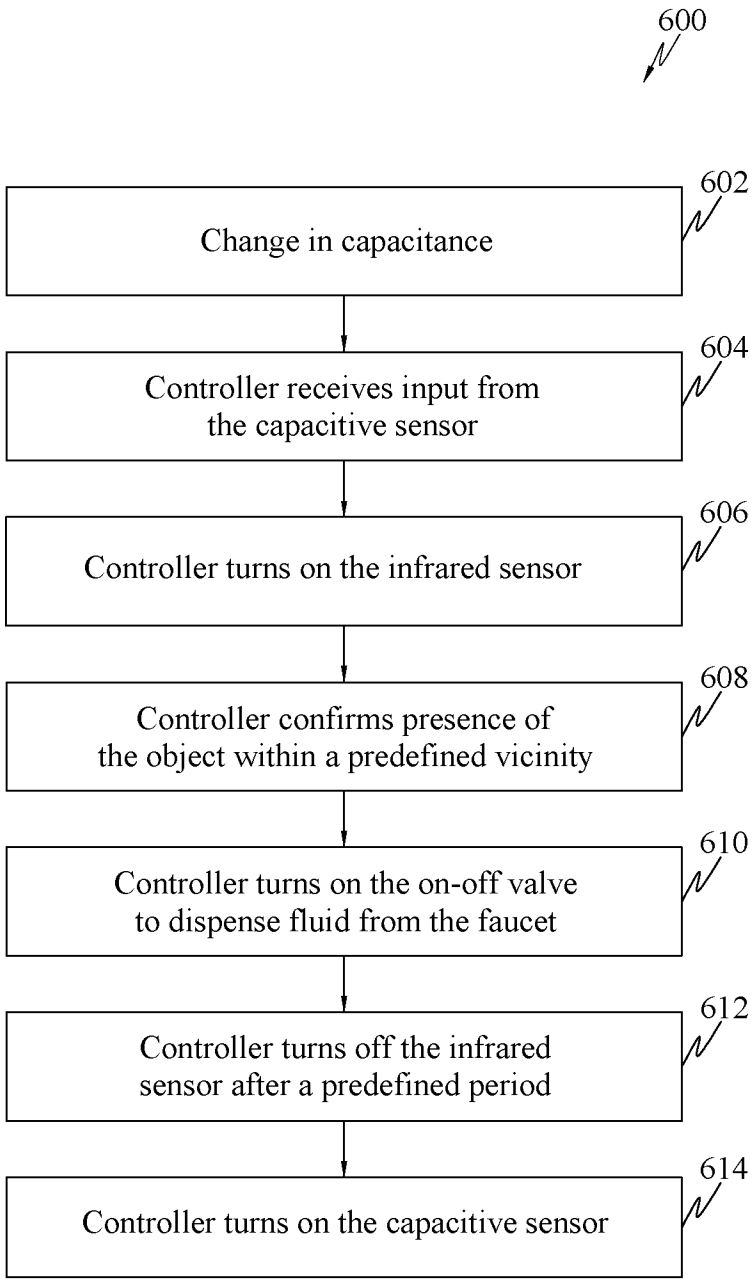
600
602
Change in capacitance
604
Controller receives input from the capacitive sensor
606
Controller turns on the infrared sensor
608
Controller confirms presence of the object within a predefined vicinity
610
Controller turns on the on-off valve to dispense fluid from the faucet
612
Controller turns off the infrared sensor after a predefined period
614
Controller turns on the capacitive sensor

FIG. 6

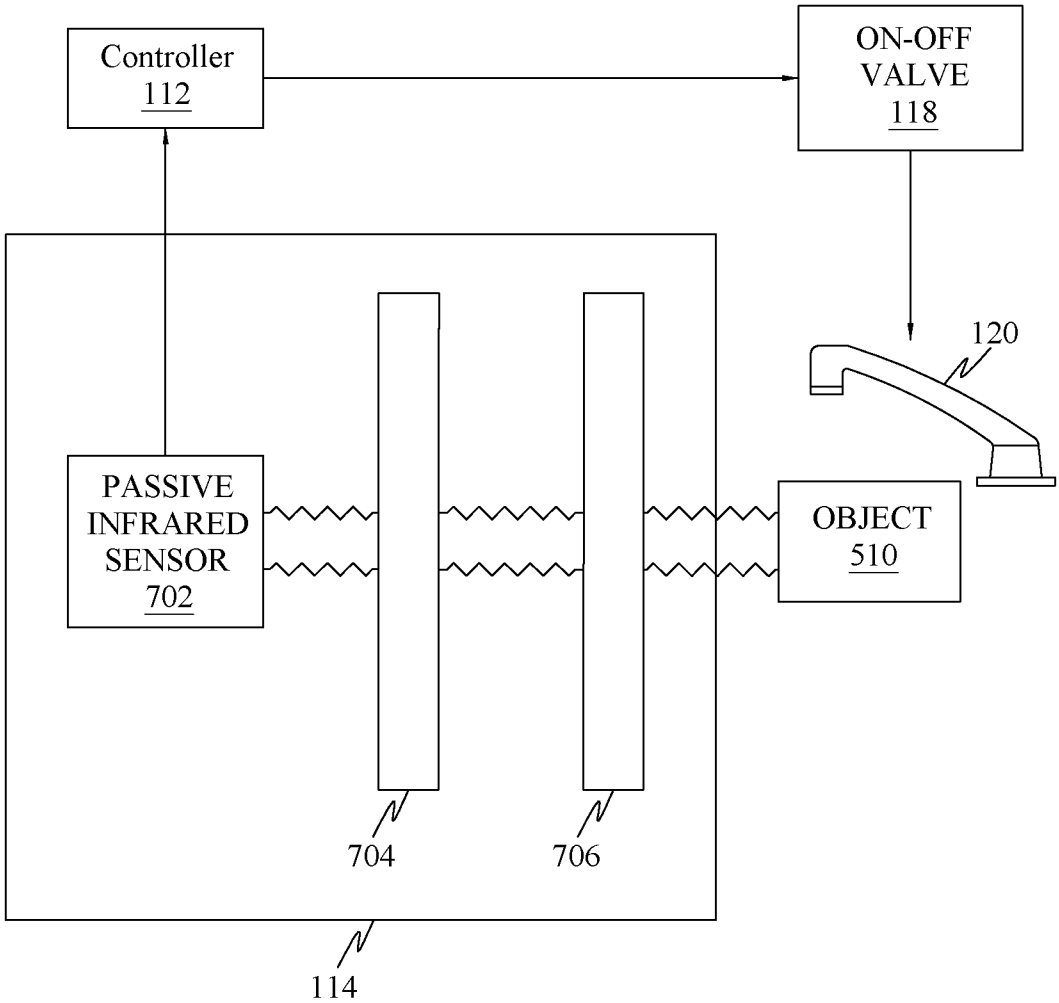
Controller
112
ON-OFF
VALVE
118
120
PASSIVE
INFRARED
SENSOR
702
OBJECT
510
704
706
114

FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2018/050659

A. CLASSIFICATION OF SUBJECT MATTER
IPC: ***H02N 11/00*** (2006.01) , ***B67D 7/06*** (2010.01) , ***E03C 1/05*** (2006.01) , ***F16K 31/02*** (2006.01)

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: ***H02N 11/00*** (2006.01) , ***B67D 7/06*** (2010.01) , ***E03C 1/05*** (2006.01) , ***F16K 31/02*** (2006.01)

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

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)
Canadian Patents Dtabase, Questel Orbit Keywords: faucet, thermoelectric, peltier, capacitive sensor

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US4873830, 17 October 1989 (17-10-1989), Blattler column 1, lines 21-26 column 3, lines 59-64 column 4, lines 24-29 column 5, lines 9-17	1
Y		2-16
Y	US2014-174556, 26 June 2014 (26-06-2014), Herbert et al. paragraph 0106, 0117	2-16
A	CN103904939A, 02 July 2014 (02-07-2014), Chen et al. Whole document	

☑ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

*	Special categories of cited documents:	"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
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier application or patent but published on or after the international filing date	"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
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 17 July 2018 (17-07-2018)	Date of mailing of the international search report 19 July 2018 (19-07-2018)
Name and mailing address of the ISA/CA Canadian Intellectual Property Office Place du Portage I, C114 - 1st Floor, Box PCT 50 Victoria Street Gatineau, Quebec K1A 0C9 Facsimile No.: 819-953-2476	Authorized officer Mark J. Stephens (819) 635-8754

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US2007-057215, 15 March 2007 (15-03-2007), Parsons et al. Whole document	
A	US2013-145535, 13 June 2013 (13-06-2013), Parsons et al. Whole document	
A	US2004-041110, 04 March 2004 (04-03-2004), Kaneko Whole document	

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
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		DE3872156D1	23 July 1992 (23-07-1992)
		EP0312737A1	26 April 1989 (26-04-1989)
		EP0312737B1	17 June 1992 (17-06-1992)
		JPH01102133A	19 April 1989 (19-04-1989)
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		US9695579B2	04 July 2017 (04-07-2017)
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		CA2843596A1	07 February 2013 (07-02-2013)
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		MX2013010365	24 October 2014 (24-10-2014)
		MX346610B	27 March 2017 (27-03-2017)
		MX2014001203	15 September 2014 (15-09-2014)
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		WO2013019272	23 May 2013 (23-05-2013)
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		US7437778B2	21 October 2008 (21-10-2008)
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		WO0242671A2	30 May 2002 (30-05-2002)
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		CA2386992A1	26 April 2001 (26-04-2001)
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		US2014182054A1	03 July 2014 (03-07-2014)
		US9598847B2	21 March 2017 (21-03-2017)
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