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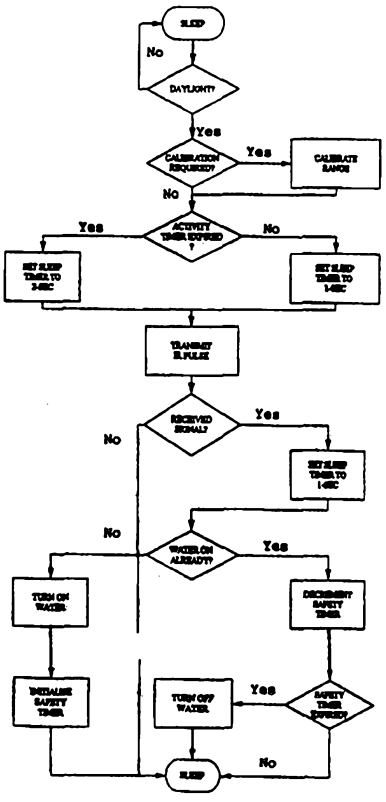
(57) Abstract

Accordingly to a first invention, there is provided a control device for an automated fluid flow system which includes an overriding device for enabling or disabling the automated fluid flow system in which a transmitter emits signals and reception of reflected signals by a receiver is used to initiate perdetermined actions which overriding device comprises: (a) light sensing means to measure the amount of light at or adjacent to the automated system; (b) comparison means to compare the amount of light measured by the light sensing means to at least one predetermined threshold amount of light and in response to such comparison initiate an enabling signal if the threshold amount has been exceeded or a disabling signal if the threshold amount has not been exceeded; and (c) overriding means to receive the enabling signal and cause the automated system to be enabled and to receive the disabling signal and cause the automated system to be disabled.



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Improvements in Automated Fluid Flow Systems

Field of the invention

The invention relates to improvements in automated fluid flow systems. In particular, improvements in control devices and fluid flow devices for such systems.

Background of the invention

Control devices for use with automated systems have applications in a number of fields. For example, water outlets that operate automatically when objects are placed in the pathway of an activation beam, garage doors that operate when a car is driven within a certain distance of the door and security systems which are operated if a beam across, for example, a door is broken by an object.

For some time now, water outlets that operate automatically when objects are placed in the pathway of an activation beam directed usually from the water outlet have been known. In the case of an infrared beam, pulsed IR is used to detect objects that are placed in their pathway and water commences to flow by operation of a solenoid valve. Water outlets of this nature have become popular and are frequently used in public rest rooms where the patrons of the rest room can wash their hands without the need to open and close the water outlet by physically touching a handle.

Most of these systems used today have more complex control, timing and measurement functions than earlier systems and require a very efficient micro processor with “Power Down” or "Sleep" capability in order to control the sophisticated operations of the systems.

As mentioned previously, while the use of such automatic systems provides considerable advantages, in order to be operational, the systems require a constant and reliable source of power.

The use of the AC mains supply to power such known electronic water outlet controllers in the past has resulted in inconvenience and high installation costs due to the need for an AC power point and secure location for the transformer/plug pack. Often, the only practicable installation means is to locate these external components in the ceiling or floor space requiring long extension leads and difficult access.

To overcome the difficulty with powering such electronic water outlet systems by using AC mains supply, it has become increasingly popular to implement a water outlet system which is battery operated and self contained, requiring no external power supply. However, the energy that can be stored, for example, in a dry battery (Eg. PP9 1.2 ampere hour) is very limited. The pulsed IR emitters and the water solenoid valve are major consumers of energy. Even the standby energy of the controller is significant, as this is present from the moment the battery is connected until its expiration. The control, timing and measurement functions of the common more complex systems also create a significant drain on the energy of batteries.

In the current systems there are a number of problems which result in a significant drain on the power resources, whether AC supply or battery. Various approaches to resolve these difficulties have been proposed and patents granted. The following are patents which disclose some of these approaches in automated water flow systems.

US patent no. 5142134 (Kunkel)

This patent discloses a system which differentiates between the reflection of stationary objects, eg the basin, from the user to avoid unnecessary activation of the water outlet and consumption of energy. It requires an initialisation process which is carried out upon installation and also after specific time intervals. It is capable of dealing with intermediate changes in the sensed area due to objects or the like being placed in the sensed area. This initialisation process of ranging commences by emitting a beam of increasing strength until there is sensing of reflections. The strength is then backed off to establish a threshold value of reflected signals which will be set not to activate the system.

US patent no. 4972070 (Laverty)

This patent discloses a control system for a water fountain. It is comprised of three circuits. The first defines a sensing zone which relies upon the predetermined synchronisation between the transmitter and the receiver. If an object is placed in the fountain then another circuit serves a time-out function after a predetermined period.

US patent no. 4941219 (Van Marcke); US patent no. 5086526 (Van Marcke)

These patents disclose a control system which has a detection field which is defined principally by temperature. The sensors are heat sensitive and therefore the presence of a human in the field will cause a rapid change in the temperature which is used to trigger water flow. It is termed a passive system as it does not rely upon reflection of pulses and is therefore said to have low power consumption.

US patent no. 5217035 (Van Marcke)

This patent discloses valve systems which integrate the use of various appliances eg washbasin and soap dispenser and hand drier. In each case before the valve is opened when activated by the presence of a user, a test of the battery which causes the operation of the appliance, is made.

US patent no. 5570869 (Diaz)

This patent discloses a control device and calibration device for an automated water flow system. These devices are designed to re-calibrate to compensate for a stationary object which may be placed in the sensing field. This approach is reliant upon a level of reflected signals always being present. Compensation is achieved by either increasing or decreasing the emitted signal to maintain a steady state signal. Once this reflected signal level is increased it causes the water to flow.

Australian patent application no.25361/92 (Mayer)

This patent also discloses a control device and calibration device for an automated water flow system which may also continuously compensate for any stationary object placed in the sensing field. It operates by initially providing a full strength signal from a transmitter and then reduces the strength of the signal until the reflected signal strength is small. The system is designed so that if this threshold signal strength is exceeded by an increase in the reflected signal then water is caused to flow. The re-calibration system is carried out periodically. If an object is placed in the sensing area and remains there for a predetermined period of time, re-calibrating will occur and transmitter signal strength will be adjusted either up or down so the threshold signal is maintained.

Accordingly, investigations were undertaken to develop a device to permit more efficient use of battery powered resources used in such systems.

Further, it is desirable to have as many of the components of the water flow system as possible located in an integral unit.

Basically, the conventional automatic water flow system comprises a spout, a water control valve arrangement connected at one end to sources of hot and cold water and to the spout at the other end, a mixing valve upstream of the water control valve to permit the amounts of hot and cold water fed to the water control valve arrangement to be varied, a sensing system (usually employing an infrared sensor) and a solenoid to open and close the valve arrangement to regulate the flow of water from the water source to the spout. A mounting is also provided to affix the spout to a predetermined surface such as a wall or sink.

It is common in such type of systems for the mixing valve to be located separately of the spout and water control valve arrangement eg under a bench. It is also common for the spout to be connected directly onto the outlet of the water valve arrangement whilst the mixing arrangement itself is located elsewhere eg under the sink.

One prior approach to this has been by IQUA which has produced a spout in which the water control valve arrangement with a solenoid and mounting means can be located in a lower portion of the spout. The solenoid has an arm which directly drives the valve to open or close the water flow in response to the sensing system. A separate water conduit is connected to the outlet of that arrangement and runs inside the spout to the water outlet. Further the solenoid which is used to permit direct operation of the valve has had to be specially designed for that application given the pressures which are involve to regulate the water flow.

Another known form of spout has a recess formed in its underneath surface to permit location of the sensing system in the spout. This spout has also has an integrally formed conduit to isolate the physical passage of water from the sensing system.

Object of the invention

It is an objective of the present invention to provide a device to permit more efficient use of battery powered resources used in automated systems, especially fluid flow systems.

It is another separate but related objective to provide a more compact design of spouts for use in fluid flow systems.

Summary of the invention

Accordingly to a first invention, there is provided a control device for an automated fluid flow system which includes an overriding device for enabling or disabling the automated fluid flow system in which a transmitter emits signals and reception of reflected signals by a receiver is used to initiate predetermined actions, which overriding device comprises:

(a) light sensing means to measure the amount of light at or adjacent to the automated system;

(b) comparison means to compare the amount of light measured by the light sensing means to at least one predetermined threshold amount of light and in response to such comparison initiate an enabling signal if the threshold amount has been exceeded or a disabling signal if the threshold amount has not been exceeded; and

(c) overriding means to receive the enabling signal and cause the automated system to be enabled and to receive the disabling signal and cause the automated system to be disenabled.

A method is also provided of enabling or disabling an automated fluid flow system in which a transmitter emits signals and reception of reflected signals by a receiver is used to initiate predetermined actions which method comprises the steps of:

(a) sensing and measuring the amount of light at or adjacent to the automated fluid flow system;

(b) comparing the amount of light measured by step (a) to at least one predetermined threshold amount of light and in response to such comparison initiate an enabling

signal if the threshold amount has been exceeded or a disabling signal if the threshold amount has not been exceeded; and

(c) receiving the enabling or disabling signal by an overriding means to enable the automated system in response to the enabling signal or disable the automated system in response to the disabling signal.

In the invention, typically the automated system will be deactivated when the light level at or adjacent to the automated fluid flow system falls below a predetermined minimum and then reactivated when the light level exceeds this or another predetermined amount. With this arrangement, it is possible for the amount of battery energy normally consumed by the device to be minimised in situations where the control device is not normally required to operate.

For example, if the control device is located in a wash room, when the light is switched off and there is no other source of light, the control device will be maintained in the deactivated phase. Upon a user entering the wash room and switching on the light, the control device would be reactivated when the light sensing means senses the increased light level exceeding the predetermined level.

Typically, the light sensitive means may be a cadmium sulphide cell or a phototransistor, though other alternatives will be readily apparent to those skilled in these devices. The light sensitive means may include different light threshold levels and means to periodically sample the light.

For example, a cadmium sulphide cell is incorporated into the circuitry to deactivate the infrared sensor which sensor is normally present in an automated fluid flow system to give a signal to initiate flow. When the surrounding light level falls below a set level which corresponds to a cadmium sulphide resistance of about 200 kilo ohms, the cell deactivates the sensor. However, a lower light level threshold may be easily set by changing the resistor in the bridge detector circuit.

The cadmium sulphide resistance is monitored immediately the microprocessor recovers from its "sleep mode". This test only takes a few microseconds of processor time and therefore negligible energy is consumed. If the cell resistance is above the 200 kilo ohms level then this denotes light which is darker than the threshold, and the

microprocessor will return to the "sleep mode" without attempting to sense the presence of the object.

The process is periodically repeated (eg every 2 seconds) until the cell resistance falls below a new threshold of 180 kilo ohms which indicates the presence of more light and the normal operation of the control device resumes. The differing thresholds are adopted so that aberrant changes in light levels do not prematurely cause erratic mode setting of the microprocessor.

Small time intervals of light sampling are preferred for venues such as wash rooms so the control system quickly activates once the lighting is turned on. Conversely, longer time intervals are preferred for venues such as public urinals which may not have lighting and are infrequently used at night.

This invention makes it possible to cause the control device to be in a shut down mode thus saving precious battery life when the water outlet is not in constant use but also being capable of rapid re-activation should the light conditions increase during these normally seldom used periods.

According to another aspect of the invention, a spout is provided which comprises

(a) a spout housing having a lower chamber, an upper chamber and an intermediate chamber, wherein (a) the upper chamber is integrally formed with the lower chamber and has a fluid inlet and a fluid outlet to permit fluid to pass through at least a portion of the spout housing and (b) the intermediate chamber is adjacent the upper chamber and extends from the lower chamber to receive sensing means and control means to regulate the flow of fluid from the spout housing.

(b) a body portion located in and attached to the lower chamber of the spout housing and having at least one fluid inlet to receive fluid from an external source of fluid and a fluid outlet which is aligned with and sealingly communicates with the fluid inlet of the upper chamber, the body portion including:

(i) a primary chamber having an inlet aperture to receive the fluid from the external source of fluid and an outlet aperture to pass the fluid to the fluid outlet of the body portion;

(ii) valve means movable within the primary chamber to regulate the flow of fluid from the inlet aperture to the outlet aperture; and

(iii) a servo chamber selectively communicating with the first chamber; and

(c) solenoid means to control the flow of fluid in the servo chamber and thereby the movement of the valve means in the primary chamber.

Preferably, the body portion has at least two fluid inlets and further includes a mixing valve arrangement to receive and mix fluid from the at least two fluid inlets.

Preferably, the mixing valve arrangement has means to vary the respective amounts of the fluids flowing into the mixing valve arrangement. Typically the fluid is water and two streams of water, one being hot water and the other cold water, flow into the mixing valve arrangement. The arrangement may also include an automatic self regulating fluid flow control to maintain a predetermined substantially constant flow rate of fluid through the spout. Further, the arrangement may also comprise a non return valve located in the fluid flow.

In one preferred arrangement the mixing valve arrangement has a cylinder or spool valve located in and axially rotatable within the chamber. The spool valve has a set of primary radial offset passageways for predetermined variable communication with the inlets for hot and cold water. Therefore by rotating the spool it is possible for the amount of hot and/or cold water passing into the primary chamber to be infinitely varied.

In another particularly preferred arrangement, the first chamber is divided into a first sub chamber and a second sub chamber by the valve means. The first sub chamber receives fluid from the inlet aperture of the primary chamber. The valve means has an opening of predetermined size to permit fluid to pass from the first sub chamber to the second sub chamber. The first sub chamber has the outlet aperture from the primary chamber which is opened and closed by movement of the valve means. The servo chamber communicates with the second sub chamber and has an opening to permit fluid passing from the second sub chamber into the opening to be expelled. The solenoid selectively closes that opening to build pressure in the second sub chamber thereby forcing the valve means to close against the outlet aperture.

Preferably, the regulating means further includes mounting means extending from the body portion to mount the body portion to a predetermined surface. Typically, the mounting means are at least two threaded fasteners, each with an associated locking member.

The various aspects of the invention when combined result in it being possible to locate in the lower chamber of a spout, the mixing and valve assemblies, as well as the mounting means. It also means the upper chamber can be formed as an integral part of the spout housing along with the lower chamber thereby avoiding additional assembly costs normally associated with fixing a separate conduit inside the spout housing.

Consequently, this is a more compact unit than hitherto known and substantially reduces the installation time which would be otherwise needed for installing a separate valve assembly and mixing assembly.

Description of the drawings

The invention will now be further explained and illustrated by reference to the accompanying drawings in which:

Figure 1 is a conceptual cross-sectional view of a spout incorporating the three inventions;

Figure 2 is a flow diagram of the valve system used in the spout of figure 1; and

Figure 3 is a flow chart of an electronic controller circuit according to the first aspect of the invention.

In the drawings like features are given the same numbers.

As shown in figure 1 a spout 10 is provided having a spout housing 11. Spout housing has a lower chamber 12, an upper chamber 13 defined by integral inner wall 14 and an intermediate chamber 15 defined by the integral wall 14 and a removable cover 16.

Valve assembly 17 is located and fixed into lower chamber 12. Assembly 17 is connected to hot and cold water sources via connector 18. Threaded holes 19 form part of the mounting means for spout 10. Bolts (not shown) pass through the surface (also not shown) to which the spout 10 is to be attached and into holes 19.

The fluid outlet 20 of assembly 17 abuts against and is sealed with fluid inlet 26 to the upper chamber 13. This seal is achieved by use of an O-ring and a pair of connecting bolts (not shown). At the upper end of upper chamber 13 is a fluid outlet 21 which is fitted with an aerator 22.

Intermediate chamber 15 houses the sensor assembly 23. This assembly includes a infrared transmitters 24 designed to emit infrared beams away from the spout towards an area where water will fall. A receiver 25 is designed to detect reflected infrared beams. The transmitters 24 and receiver 25 are mounted on circuit board 28 and are powered by a battery 27. Depending upon the particular circuit in use and the nature of the reflected beams, a signal is sent to the solenoid 29 of the valve assembly 17 to open or close the water flow to upper chamber 13 and hence fluid outlet 21. The solenoid 29 is also powered by the battery 27.

The cover 16 upon which the above components are mounted is releasably secured to the spout housing 11 via a tongue 30 and pin 31. As such the spout 10 may be easily serviced should there be a need to address issues in the electronics, battery or transmitters and receiver.

The valve assembly 17 will now be explained in detail with reference to figure 2.

Connector 18 has two openings 32 and 33 to receive respective hot and cold water. Hot and cold water passing through openings 32 and 33 enter a mixing valve arrangement 34. Mixing valve arrangement 34 includes a cylinder which is sealed in an opening with O-rings. That cylinder has a pair of offset transverse holes 35 and 36 so that rotation of the cylinder permits different relative amounts of hot and cold water to pass to the primary chamber 37. This primary chamber 37 has a flexible valve 39 which can move up and down under the influence of pressure to open or close off outlet 38. When the valve 39 is lifted water passes into outlet 38 into outlet passageway 40 which leads to fluid outlet 20. As indicated previously in figure 1, this outlet 20 sealingly engages fluid inlet 26 of upper chamber 13.

The primary chamber 39 also has an upper sub chamber 41. Flexible valve 39 has a hole 42 in its diaphragm. When the flexible valve 39 is in the closed position, water passes through hole 42 into upper sub chamber 41. A passageway 43 extends from this sub

chamber 41 into an chamber 44. A passageway 45 from chamber 44 connects with outlet passageway 40. Solenoid 29 is mounted so that in response to electrical signals, it will seal off or open passageway 45.

Accordingly, to open the valve 39, solenoid 29 is activated so as to open passageway 45. In doing so it permits the pressure of the water applied to the upper side of valve 39 to lessen and move upwardly. Water then flows from the mixing valve arrangement 34 into the primary chamber 37, outlet 38 and inturn to outlet passageway 40 and into the upper chamber 13.

To close the valve 39, the solenoid 29 is activated and causes the passageway 45 to close. Pressure builds up in the upper sub chamber 41 forcing the valve 39 to close outlet 38.

The use of this type of servo assisted system means that a smaller solenoid to that otherwise necessary by directly acting solenoids, may be employed. Likewise, the incorporation of a mixing valve assembly within the valve assembly is achieved which permits the integrated valve unit to be entirely located in the lower chamber. Separate mixing assemblies are therefore avoided. Further, the integration of the water flow conduit as part of the spout housing means that the chance of leakage of water into the sensor system is virtually eliminated.

The first aspect of the invention is illustrated in figure 3.

For example, the electronic controller circuit may be located in a wash room (not shown) which has both windows to allow naturally light to enter as well as an electric light operable by an on/off switch. The washroom may have a basin to which the automated water flow system is fitted. That system will typically be microprocessor based and is used in combination with a:

(a) a light sensing device;

(b) an infrared transmitter and receiver located adjacent the basin;

(c) calibration means to set the infrared transmission signal strength to define an area in the basin to be sensed for objects and movement; and

(d) a valve arrangement of the type illustrated in figures 1 and 2.

Referring specifically to figure 3, the microprocessor control device is initially in the SLEEP mode. Periodically, a light sensing device is interrogated in the DAYLIGHT? mode. If there is no light measured at all or the level of light sensed is below a predetermined threshold level, the microprocessor is returned to its SLEEP mode.

If the light measured is above the predetermined threshold level, the microprocessor then enters CALIBRATION REQUIRED mode and interrogates the calibration or sensitivity of the calibration means by comparing it to a preset calibration. If needed, re-calibration occurs in the CALIBRATION RANGE mode.

Once no further re-calibration is needed, then the microprocessor enters the ACTIVITY TIMER EXPIRED mode. In this mode, the timer which normally times out the maximum time the water is to run for, is interrogated. If it has expired then the SLEEP mode is set for 2 second intervals. If the activity has not expired then the SLEEP mode is set for 1 second intervals. In this way, power is saved by reducing the activity of the system.

At the end of each SLEEP mode interval, the microprocessor is reactivated and an infrared pulse is transmitted in the TRANSMIT PULSE mode into the basin.

In the RECEIVED SIGNAL mode, this pulse into the basin tests for any target now located in the basin (eg a user's hands). If no signal is received then the system returns to the SLEEP mode. If a signal is received, the SLEEP mode timer is set to 1 second and the system enters the WATER ON ALREADY mode. If the water is already flowing the DECREMENT SAFTEY TIMER interrogates the timer which controls the timed out function to cease water flow. If the timer has timed out then the water is turned off in the TURN OFF WATER mode. If the timer has not timed out, the system is returned to the SLEEP mode. The timer will time out in any event and the water flow will cease.

Accordingly, when the light is switched off and there is no other source of light, the control device will be maintained in the deactivated phase. Upon a user entering the wash room and switching on the light, the control device would be reactivated when the light sensing means senses the increased light level exceeding the predetermined level.

This invention makes it possible to cause the control device to be in a shut down mode thus saving precious battery life when the water outlet is not in constant use but also being capable of rapid re-activation should the light conditions increase during these normally seldom used periods.

The word 'comprising' as used in this description and in the claims does not limit the invention claimed to exclude any variants or additions which are obvious to the person skilled in the art and which do not have a material effect upon the invention.

It is to be understood by those skilled in the technology that many variations or modifications in details of design or construction may be made without departing from the essence of the present invention. Therefore, the invention should be understood to include all such variations and modifications within its scope.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A control device for an automated fluid flow system which includes an overriding device for enabling or disabling the automated fluid flow system in which a transmitter emits signals and reception of reflected signals by a receiver is used to initiate predetermined actions, which overriding device comprises:

   (a) light sensing means to measure the amount of light at or adjacent to the automated system;

   (b) comparison means to compare the amount of light measured by the light sensing means to at least one predetermined threshold amount of light and in response to such comparison initiate an enabling signal if the threshold amount has been exceeded or a disabling signal if the threshold amount has not been exceeded; and

   (c) overriding means to receive the enabling signal and cause the automated system to be enabled and to receive the disabling signal and cause the automated system to be disabled.

2. A control device according to claim 1 in which the threshold amount for initiation of the enabling signal is different than the threshold amount for initiation of the disabling signal.

3. A control device according to claim 1 in which the threshold amount for initiation of the enabling signal is higher than the threshold amount for initiation of the disabling signal.

4. The control device according to claim 1 in which the comparison means further includes a timer to cause the comparison means to carry out the comparison at predetermined times.

5. A control device according to claim 1 in which the light sensitive means is a cadmium sulphide cell or a phototransistor.

6. A method of enabling or disabling an automated fluid flow system in which a transmitter emits signals and reception of reflected signals by a receiver is used to initiate predetermined actions which method comprises the steps of:

(a) sensing and measuring the amount of light at or adjacent to the automated fluid flow system;

(b) comparing the amount of light measured by step (a) to at least one predetermined threshold amount of light and in response to such comparison initiate an enabling signal if the threshold amount has been exceeded or a disabling signal if the threshold amount has not been exceeded; and

(c) receiving the enabling or disabling signal by an overriding means to enable the automated system in response to the enabling signal or disable the automated system in response to the disabling signal.

7. A method according to claim 6 in which the threshold amount for initiation of the enabling signal is different than the threshold amount for initiation of the disabling signal.

8. A method according to claim 6 in which the threshold amount for initiation of the enabling signal is higher than the threshold amount for initiation of the disabling signal.

9. A method according to claim 6 in which step (b) is carried out at predetermined times.

10. A spout housing comprising:

(a) a lower chamber to receive (i) mounting means to mount the spout housing to a predetermined surface, (ii) fluid inlet means, and (iii) valve means to regulate the rate of flow of fluid through the fluid inlet means to a valve means fluid outlet;

(b) an upper chamber integrally formed with the lower chamber having a fluid inlet to communicate with the valve means fluid outlet, and a fluid outlet to permit the flow of fluid to pass from the spout housing; and

(c) an intermediate chamber adjacent the upper chamber and extending from the lower chamber to receive sensing means and control means to regulate the flow of water from the spout housing.

11. A spout according to claim 10 in which the intermediate chamber has an aperture and a cover to close the aperture.

12. A spout according to claim 11 in which the cover will be the base for mounting circuit boards, batteries and sensors.

13. A spout comprising:

(a) a spout housing having a lower chamber, an upper chamber and an intermediate chamber, wherein (i) the upper chamber is integrally formed with the lower chamber spout housing and has a fluid inlet and a fluid outlet to permit fluid to pass through at least a portion of the spout housing and (ii) the intermediate chamber is adjacent the upper chamber and extends from the lower chamber to receive sensing means and control means to regulate the flow of fluid from the spout housing;

(b) a body portion located in and attached to the lower chamber of the spout housing and having at least one fluid inlet to receive fluid from an external source of fluid and a fluid outlet which is aligned with and sealingly communicates with the fluid inlet of the upper chamber, the body portion including:

(i) a primary chamber having an inlet aperture to receive the fluid from the external source of fluid and an outlet aperture to pass the fluid to the fluid outlet of the body portion;

(ii) valve means movable within the primary chamber to regulate the flow of fluid from the inlet aperture to the outlet aperture;

(iii) a servo chamber selectively communicating with the first chamber; and

(c) solenoid means to control the flow of fluid in the servo chamber and thereby the movement of the valve means in the primary chamber.

14. A spout according to claim 13 wherein the body portion has at least two fluid inlets and the body portion further includes a mixing valve arrangement to receive and mix fluid from the at least two fluid inlets.

15. A spout according claim 14 in which the mixing valve arrangement has means to vary the respective amounts of the fluids flowing into the mixing valve arrangement.

16. A spout according to either claims 14 or 15 in which the mixing valve arrangement has a cylinder or spool valve located in and axially rotatable within the chamber.

17. A spout according to claim 16 in which the spool valve has a set of primary radial offset passageways for predetermined variable communication with the inlets for hot and cold water.

18. A spout according to claims 13 to 17 in which the first chamber is divided into a first sub chamber and a second sub chamber by the valve means; and

(a) the first sub chamber receives fluid from the inlet aperture of the primary chamber;

(b) the valve means has an opening of predetermined size to permit fluid to pass from the first sub chamber to the second sub chamber;

(c) the first sub chamber has the outlet aperture from the primary chamber which is opened and closed by movement of the valve means;

(d) the servo chamber communicates with the second sub chamber and has an opening to permit fluid passing from the second sub chamber into the opening to be expelled; and

(e) the solenoid selectively closes that opening to build pressure in the second sub chamber thereby forcing the valve means to close against the outlet aperture.

19. A spout according to claims 13 to 18 in which the regulating means further includes mounting means extending from the body portion to mount the body portion to a predetermined surface.

20. A spout according to claim 19 in which the mounting means are at least two threaded fasteners, each with an associated locking member.

21. A spout according to any one of claims 13 to 20 wherein the body portion further includes an automatic self regulating fluid flow control to maintain a predetermined substantially constant flow rate of fluid through the spout.

22. A spout according to any one of claims 13 to 21 further comprising a non return valve located in the fluid flow.

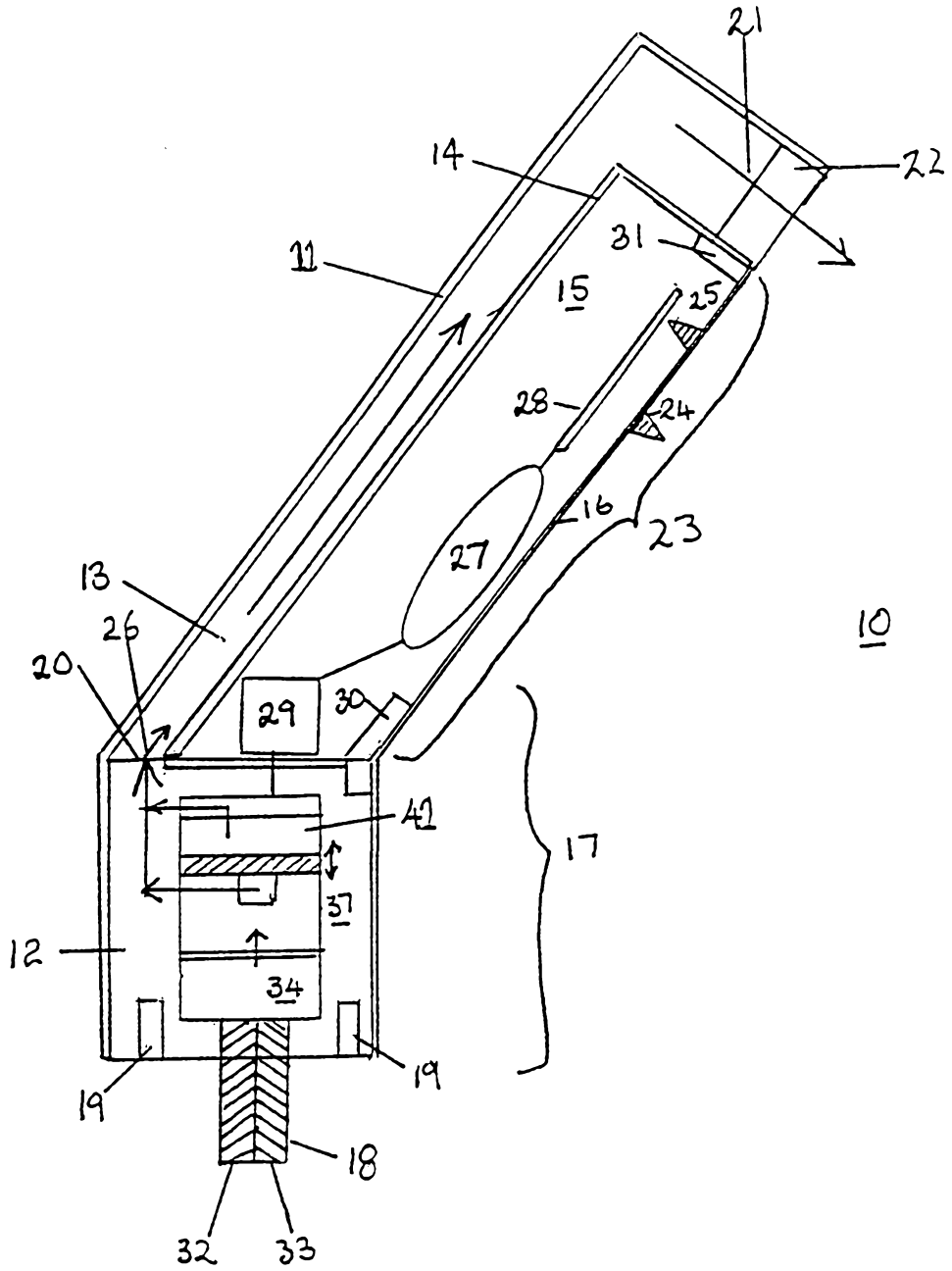
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FIGURE 1

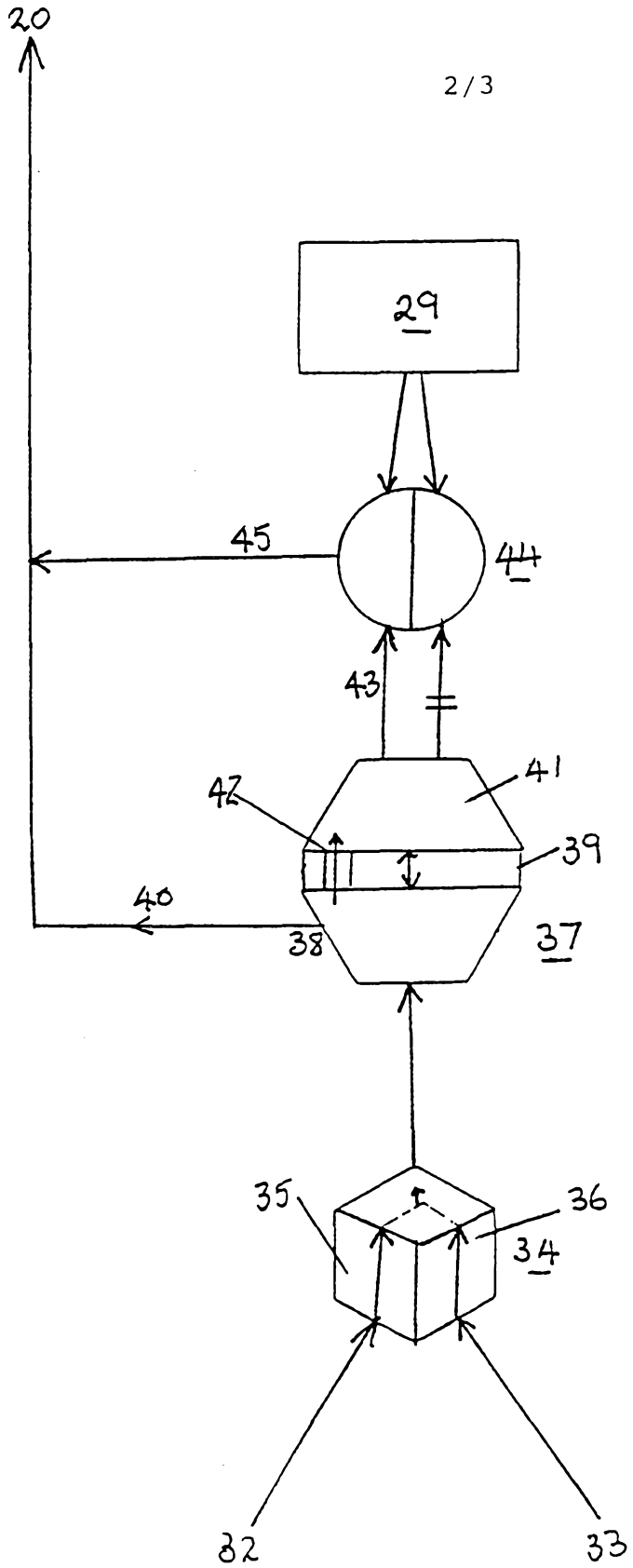

FIGURE 2

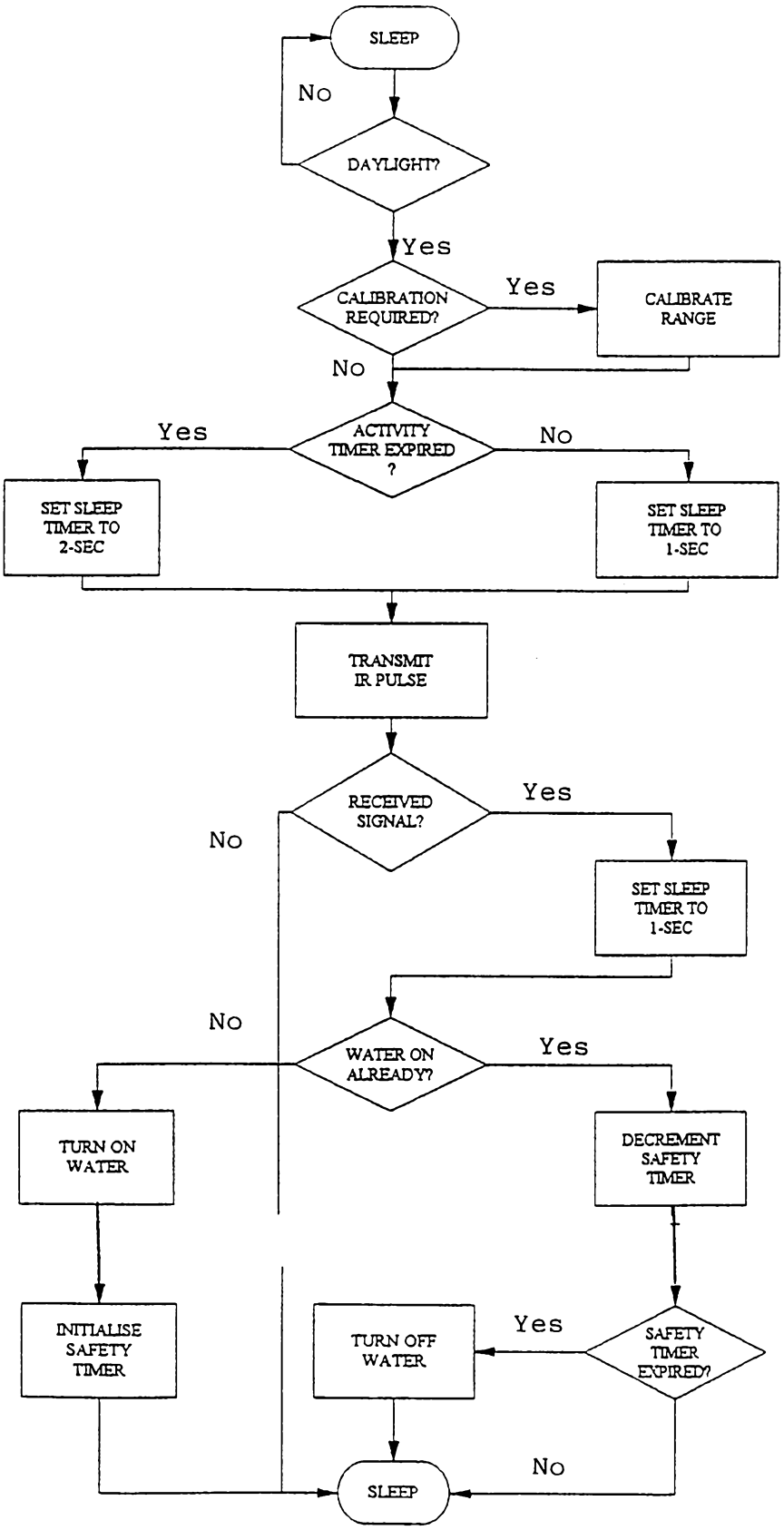
SLEEP
No
DAYLIGHT?
Yes
CALIBRATION REQUIRED?
Yes
CALIBRATE RANGE
No
ACTIVITY TIMER EXPIRED ?
Yes
No
SET SLEEP TIMER TO 2-SEC
SET SLEEP TIMER TO 1-SEC
TRANSMIT IR PULSE
RECEIVED SIGNAL?
Yes
No
SET SLEEP TIMER TO 1-SEC
WATER ON ALREADY?
No
Yes
TURN ON WATER
DECREMENT SAFETY TIMER
INITIALISE SAFETY TIMER
TURN OFF WATER
Yes
SAFETY TIMER EXPIRED?
SLEEP
No

FIGURE 3