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(54) SUBMERSIBLE PUMP AND AUTOMATIC LIQUID LEVEL CONTROL METHOD

TAUCHPUMPE UND VERFAHREN ZUR AUTOMATISCHEN FLÜSSIGKEITSSTANDSSTEUERUNG

POMPE SUBMERSIBLE ET PROCÉDÉ DE COMMANDE AUTOMATIQUE DE NIVEAU DE LIQUIDE

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Description

TECHNICAL FIELD

[0001] The present application relates to the field of automatic submersible pumps, and in particular to a submersible pump and an automatic liquid level control method.

BACKGROUND

[0002] Submersible pump is an important device for deep well water lifting. When in use, the whole submersible pump submerges into the water to extract the groundwater to the surface. Submersible pumps are widely used in domestic water, mine rescue, industrial cooling, farmland irrigation, seawater lifting, ship load regulation, fountain landscape and other fields.

[0003] Chinese patent application CN213331574 U discloses a water-shortage protection device for a submersible pump. The water-shortage protection device includes a barrel. A top of the barrel is provided with a second water outlet pipe and a second water inlet pipe. A top of the second water outlet pipe is communicated with a second soft long pipe, and the second water inlet pipe is provided with a stop valve. A bottom of an inner chamber of the barrel is provided with a submersible pump body. A top output end of the submersible pump body is provided with a first water outlet pipe. A first soft long pipe is communicated between the first water outlet pipe and the second water outlet pipe. A cable is provided on a right side of the submersible pump body. A second water level sensor is provided on a left wall of the inner chamber of the barrel, and the second water level sensor is located on a top of the submersible pump body. A right wall of the inner chamber of the barrel is provided with a first water level sensor, and the first water level sensor is located above the second water level sensor. A first water inlet pipe is provided at a bottom of a peripheral outer wall of the barrel, and the first water inlet pipe is provided with a solenoid valve. The utility model has reasonable structural design, which is convenient for protecting the submersible pump to avoid the idling of the submersible pump, thereby improving the service life of the submersible pump.

[0004] However, the positions of the first water level sensor and the second water level sensor of the submersible pump are fixed, which will lead to many problems. First of all, in actual use, the water level to be controlled is different according to the use environment and the shape of the water pool. However, the submersible pump cannot change the height of the water level sensor according to the actual demand. Secondly, the water level sensor has no indicator light, so its state cannot be directly displayed. When the submersible pump is not used for a long time, it is easy for the user to forget which water level sensor is started. Finally, the submersible pump only has a delayed turn-off function, and cannot automatically control the water level. EP 3 875 765 A1 discloses submersible pump with touch sensitive sensors. The submersible pump includes a pump body. The pump body forms a main compartment having an intake and an output for a liquid. The pump body is adapted for submersion in a body of liquid whose level is to be controlled. The submersible pump is provided with one or more sensors that enable the submersible pump to operate within a threshold operating level. The threshold operating level is between a lower liquid level and an upper liquid level set based on a user action associated with the one or more sensors. The one or more sensors of the pump are stationary touch sensitive sensors which are integrated in or attached to the pump body. The stationary touch sensitive sensors help in setting a desired liquid level (i.e. the threshold operating level) of the submersible pump based upon the user action (i.e. user touch). Being stationary sensors does not allow them to move along relative the pump housing substantially perpendicular to the liquid level, while on the other hand when being realized as switches at least part of them can be pressed substantially orthogonal in respect to the pumps main compartment.

SUMMARY

[0005] An objective of the present application is to provide a submersible pump and an automatic liquid level control method to solve the problems mentioned in the background.

[0006] To achieve the above objective, the present application provides the following technical solutions.

[0007] A first aspect of the present application provides a submersible pump, including:

a pump body provided thereon with a control panel;
a controller electrically connected to at least two sensing assemblies, wherein each of the liquid level sensors is configured to output a first signal and/or a second signal to the controller; and
the sensing assemblies, each including a liquid level sensor, an indicator light, and a switch;
where, the switch is provided on the control panel, and is configured to turn on or off the liquid level sensor;
the indicator light is configured to display an on/off state of the liquid level sensor; and
all the liquid level sensors are arranged at different heights on a side of the pump body. The switch is a push switch; the push switch is electrically connected to the controller and to the liquid level sensor, the indicator light is electrically connected to the controller, and the controller is configured to recognize different characteristic signals sent by different liquid level sensors; wherein the submersible pump is connected to a power supply and placed in a liquid pool; in response to the first signal, the controller is configured to execute a start program to start the

submersible pump, wherein a signal processing module of the controller is configured to receive and recognize the first signal, and output a first feedback signal to a control module of the controller; in response to the first feedback signal, the control module is configured to control a motor to rotate, so as to control the submersible pump to start; in response to the second signal, the controller is configured to execute a stop program to stop the submersible pump, wherein the signal processing module of the controller is configured to receive and recognize the second signal, and output a second feedback signal to the control module; in response to the second feedback signal, the control module is configured to control the motor to stop, so as to control the submersible pump to be turned off.

[0008] According to an implementation of the present application, the controller includes a signal processing module and a control module; and the signal processing module is electrically connected to the control module and the liquid level sensor.

[0009] According to an implementation of the present application, an inner chamber of the pump body is provided therein with a motor that is electrically connected to the control module; and the control module is configured to control the motor to start or stop.

[0010] According to an implementation of the present application, the controller further includes a timing module electrically connected to the signal processing module.

[0011] According to an implementation of the present application, only one of the liquid level sensors is configured to be activated to be in an on-state at the same time;

the first signal shows a change from absence to presence of a liquid detected by the activated liquid level sensor; and
the second signal shows a change from presence to absence of the liquid detected by the activated liquid level sensor.

[0012] According to an implementation of the present application, liquid level sensors include a first liquid level sensor and a second liquid level sensor; and the first liquid level sensor is provided at a position higher than the second liquid level sensor.

[0013] According to an implementation of the present application, both the first liquid level sensor and the second liquid level sensor are configured to be activated to be in an on-state at the same time;

the first signal shows a change from absence to presence of a liquid detected by the first liquid level sensor; and
the second signal shows a change from presence to absence of the liquid detected by the second liquid level sensor.

[0014] According to an implementation of the present application,

the timing module is configured to perform a countdown;
the signal processing module is configured to receive, process and output signals; and
the control module is configured to control the motor to start or stop, so as to control the submersible pump to start or stop.

[0015] According to an implementation of the present application, the start program includes:

outputting, by the signal processing module, a third signal to the control module after receiving the first signal, such that the control module starts the motor;
where, the third signal is a feedback signal output by the signal processing module after receiving the first signal, and is configured to control the control module to start the motor, so as to start the submersible pump.

[0016] According to an implementation of the present application, the stop program includes:

outputting, by the signal processing module, a fourth signal to the timing module after receiving the second signal, such that the timing module starts a countdown; outputting, by the timing module, a fifth signal to the signal processing module after finishing the countdown; receiving, by the signal processing module, the fifth signal, and outputting a sixth signal to the control module; and stopping, by the control module, the motor;
where, the fourth signal is a feedback signal output by the signal processing module after receiving the second signal, and is configured to control the timing module to start the countdown;
the fifth signal is a feedback signal output by the timing module after finishing the countdown; and
the sixth signal is a feedback signal output by the signal processing module after receiving the fifth signal, and is configured to control the control module to stop the motor, so as to stop the submersible pump.

[0017] According to an implementation of the present application,

the liquid level sensors that output the first signal or the second signal are changed by turning on the switches of the sensing assemblies at different heights;
the countdown is configured to remain the submersible pump on for a period of time after the signal

processing module receives the second signal; and the countdown has a duration of at least one second.

[0018] In conclusion, the present application has at least the following beneficial technical effects.

1. The submersible pump is provided with the sensing assemblies that can be turned on and off manually. When the operating environment and the size of the liquid pool change, the liquid level to be controlled changes. The submersible pump can be turned on and off at different liquid levels to meet different use needs.
2. The sensing assembly is provided with the indicator light to display the state of the liquid level sensor, such that the user can visually determine the on and off states of the liquid level sensor to reduce errors in use.
3. The controller is provided with the timing module to delay the turn-off of the submersible pump so as to prevent damage caused by motor idling, extend the service life, and prevent liquid waste caused by incomplete pumping.
4. The submersible pump capable of automatic liquid level control has various functions.

(1) The submersible pump can be automatically turned on and off.
(2) The liquid level can be automatically controlled. Pumping is performed when the liquid level is too high, and pumping is stopped when the liquid level is too low. The liquid level is manually switched by the switch.
(3) The automatically controlled liquid level can be a fixed liquid level or in a fixed range to adapt to different application scenarios.
(4) The automatic liquid level control method can provide a protection function. When the liquid level is higher or lower than a limit liquid level, the submersible pump can be forced to be turned on or off to prevent the submersible pump from making mistakes when the liquid level sensor fails.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] The present application will be further described in detail below with reference to the drawings and preferred embodiments. However, those skilled in the art should understand that these drawings are drawn only for the purpose of explaining the preferred embodiments, and therefore should not be construed as a limitation to the scope of the present application. In addition, unless otherwise specified, the drawings are only intended to conceptually represent the composition or configuration of the described objects and may include exaggerated displays, and the drawings are not necessarily drawn to scale.

FIG. 1 is an interior view of a submersible pump according to an embodiment of the present application;
FIG. 2 is an exterior view of the submersible pump according to an embodiment of the present application;
FIG. 3 is an enlarged view of A shown in FIG. 1;
FIG. 4 is a first schematic diagram of an automatic liquid level control method according to an embodiment of the present application;
FIG. 5 is a second schematic diagram of the automatic liquid level control method according to an embodiment of the present application; and
FIG. 6 is a flowchart of the automatic liquid level control method according to an embodiment of the present application.

[0020] Reference Numerals: 1. pump body; 2. control panel; 3. sensing assembly; 31. switch; 32. liquid level sensor; 321. first liquid level sensor; 322. second liquid level sensor; 33. indicator light; 4. motor; 5. motor shaft; 6. coupling; 7. impeller; 8. water inlet; 9. water outlet pipe; 10. diffusion chamber; 11. controller; and 12. foot.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0021] In order for those skilled in the art to better understand the technical solution of the present application, the present application is described in detail clearly and completely below in combination with the drawings and embodiments. It should be understood that the specific embodiments described herein are merely intended to explain the present application, rather than to limit the present application.

[0022] In the description of the present application, the terms such as "first" and "second" are merely intended to distinguish technical features, rather than to indicate or imply relative importance or implicitly indicate a number of the indicated technical features or implicitly indicate a sequence relationship of the indicated technical features.

[0023] It is understandable for those skilled in the art that in the description of the present application, terms such as "longitudinal", "transverse" "upper", "lower", "front", "rear", "left", "right" "vertical", "horizontal", "top", "bottom", "inside", and "outside" indicate the orientation or position relationships based on the drawings. They are merely intended to facilitate and simplify the description of the present application, rather than to indicate or imply that the mentioned system or components must have a specific orientation or must be constructed and operated in a specific orientation. Therefore, these terms should not be construed as a limitation to the present application.

Embodiment 1

[0024] Referring to FIGS. 1 and 2, this embodiment provides a submersible pump, including: pump body 1, control panel 2, sensing assemblies 3, and controller 11.

[0025] An inner chamber of the pump body 1 is provided therein with an upper chamber and a lower chamber from top to bottom, and a partition is provided between the upper chamber and the lower chamber.

[0026] The control panel 2 is provided on a side of the pump body 1. The control panel 2 is electrically connected to at least two sensing assemblies 3, which are arranged at different heights of the control panel 2.

[0027] The sensing assemblies 3 each include liquid level sensor 32, indicator light 33, and switch 31. The switch 31 is a push switch 31, which is provided on the control panel 2 and electrically connected to the liquid level sensor 32. The switch 31 is configured to turn the liquid level sensor 32 on and off. The indicator light 33 is configured to display the on and off states of the liquid level sensor, and at least includes working states such as normally on and flashing.

[0028] The liquid level sensor 32 is a non-contact liquid level sensor 32. The non-contact liquid level sensor 32 detects a change of a liquid level, and outputs a signal to the controller 11.

[0029] A top end of the upper chamber of the pump body 1 is provided with a controller 11. The controller 11 is electrically connected to the liquid level sensor 32, and the controller 11 includes a signal processing module, a control module, and a timing module. The timing module is electrically connected to the signal processing module. The control module is electrically connected to the signal processing module. The signal processing module is electrically connected to the liquid level sensor 32.

[0030] The controller 11 may also be provided inside the control panel 2, and the controller 11 is directly electrically connected to the liquid level sensor 32.

[0031] The timing module is configured to perform a countdown, such that when the liquid level drops below second liquid level sensor 322, the submersible pump continues to work for a period of time.

[0032] The signal processing module is configured to receive and output signals. The control module is configured to control motor 4 to rotate or stop, thereby controlling the start or stop of the submersible pump.

[0033] The upper chamber of the pump body 1 is further provided therein with the motor 4. The motor 4 is provided below the controller 11, and is electrically connected to the controller 11.

[0034] When the switch 31 is pressed to turn on the liquid level sensor 32, the indicator light 33 lights up. When the liquid level sensor 32 in the sensing assembly 3 senses the change of the liquid level, the liquid level sensor generates and transmits a change signal to the signal processing module of the controller 11. The signal processing module receives and outputs the signal to the control module or timing module to realize the automatic induction and control of the submersible pump.

Embodiment 2

[0035] Referring to FIGS. 1 and 2, the present application provides another embodiment based on Embodiment 1.

[0036] Motor shaft 5 extends from a bottom of the motor 4, and the motor shaft 5 extends into the lower chamber through the partition in the inner chamber of the pump body 1. Preferably, the motor shaft 5 is made of a metal material with high corrosion resistance and torsion resistance. A bottom end of the motor shaft 5 is sleeved with coupling 6, which is connected to the motor shaft 5 through a positioning screw.

[0037] The lower chamber of the pump body 1 is provided with impeller 7. The impeller 7 includes an axis center and multiple blades. The blades are arc-shaped and integrally formed with the axis center. The integrated forming design can enhance the strength of the impeller 7, which is safe when the impeller 7 rotates at a high speed and prevents the blades from falling off or flying out.

[0038] The impeller 7 is provided at the bottom of the motor 4. The impeller 7 is fixed at a bottom of the coupling 6 through a bolt, and the impeller 7 is connected to the motor 4 through the coupling 6. When motor 4 rotates, the motor drives motor shaft 5 to rotate, thereby driving coupling 6 and the impeller 7 to rotate together.

[0039] The pump body 1 further includes water inlet 8 and water outlet pipe 9. The water inlet 8 is provided on a bottom surface of the pump body 1, and communicates an external environment with the lower chamber of the pump body 1.

[0040] The water outlet pipe 9 is provided on the side of the pump body 1. A top end of the water outlet pipe 9 is provided with a water outlet. An inner chamber of the water outlet pipe 9 is communicated with the lower chamber. After entering the lower chamber from the water inlet 8, the liquid reaches the water outlet pipe 9, and finally sprays out from the water outlet.

[0041] Further, the water outlet pipe 9 has a three-stage ladder structure with a diameter decreasing from bottom to top. The water outlet pipe 9 with different diameters adapt to external water pipes with different diameters, thereby expanding the adaptability of the submersible pump.

[0042] The pump body 1 is further provided therein with a diffusion chamber 10. The diffusion chamber 10 is provided between the lower chamber and the water outlet pipe 9, and is connected to the lower chamber and the water outlet pipe 9. The diffusion chamber 10 is configured to slow down a speed of the liquid, thereby further increasing a pressure of the liquid and making it easier to be pumped out.

[0043] When the liquid enters the lower chamber, the impeller 7 rotates at high speed. The liquid rotates with the blades of the impeller 7. Under the action of a centrifugal force, the liquid flies away from the impeller 7 and shoots outward to enter the diffusion chamber 10 of the pump body 1. The speed of the liquid gradually slows down, and the pressure thereof gradually increases. Finally, the liquid flows out of the water outlet pipe 9.

[0044] Meanwhile, as the liquid is thrown around, a vacuum low-pressure region without air or liquid is formed at the axis center of the impeller 7. The liquid in the liquid pool flows into the pump through the water inlet 8 under the effect of atmospheric pressure on a pool surface, so as to realize circulation.

Embodiment 3

[0045] Referring to FIGS. 1 and 2, the present application provides another embodiment based on the above embodiment.

[0046] A bottom end of the pump body 1 is further provided with foot 12. The foot 12 is fixed at the bottom end of the pump body 1 through a bolt. The foot 12 includes a support frame and a bottom plate that are fixed by a bolt. The bottom plate is configured to fit a bottom of the liquid pool when the submersible pump is placed, so as to make the submersible pump stable and not easy to fall. A side peripheral surface of the support frame is provided with a hollow at a symmetrical position, through which the liquid enters the foot 12 from the liquid pool, thereby entering the pump body 1 from the water inlet 8. The foot 12 raises a height of the pump body 1 from the bottom of the liquid pool, so as to prevent the pump body 1 from sinking to the bottom to block the water inlet 8, thereby preventing the motor 4 from idling.

[0047] The top end of the pump body 1 is fixedly connected to a handle, which makes the use and handling of the submersible pump convenient.

[0048] The top end of the pump body 1 is further provided with a power line. The power line passes through the pump body 1 and is electrically connected to the controller 11. A connection between the power line and the pump body 1 is sealed to prevent liquid from entering the upper chamber of the pump body 1.

Embodiment 4

[0049] Referring to FIG. 3, the present application provides another embodiment based on the above embodiment.

[0050] Touch switch 31 with indicator light 33 in the prior art is selected to form the switch 31 and the indicator light 33. The switch 31 includes a conductive terminal, an elastic contact piece, a waterproof piece, and a movable button piece. The indicator light 33 includes a base and a light-emitting diode (LED) lamp. The elastic contact piece is located above the conductive terminal, and is spaced apart from the conductive terminal. The conductive terminal extends from below the base to connect the liquid level sensor 32. The LED lamp is located above the elastic contact piece. A circuit board of the LED lamp is electrically connected to the conductive terminal, such that the LED lamp is electrically connected to the liquid level sensor 32. The button piece is connected to the waterproof piece. The waterproof piece is located above the LED lamp and connected to the elastic contact piece through the LED lamp. The button piece is pressed to move the waterproof piece downward and press the elastic contact piece. The elastic contact piece contacts the conductive terminal to make a circuit on. The LED lamp lights up, and the liquid level sensor is powered on.

Embodiment 5

[0051] Referring to FIG. 3, the present application provides another embodiment based on the above embodiment.

[0052] The switch 31 is electrically connected to the controller 11. The indicator light 33 is electrically connected to the controller 11. The switch 31 is electrically connected to the liquid level sensor 32. The control principle of the sensing assembly is as follows:

When any switch 31 is pressed, the liquid level sensor 32 electrically connected to the switch 31 forms a path and is turned on. When the liquid level sensor 32 is turned on, a characteristic signal is output to the controller 11. The controller 11 receives, processes and recognizes the characteristic signal. The controller 11 can recognize different characteristic signals sent by different liquid level sensors 32. After recognition, the controller outputs a feedback signal to the indicator light 33 corresponding to the on-state liquid level sensor 32. The indicator light 33 lights up.

[0053] When any switch 31 is exited, the liquid level sensor 32 corresponding to the switch 31 sends a characteristic signal to the controller 11. The controller 11 recognizes the characteristic signal and outputs a feedback signal to the corresponding indicator light 33. The indicator light 33 lights off.

Embodiment 6

[0054] Referring to FIGS. 4-6, this embodiment provides an automatic liquid level control method, which is applied to the submersible pump provided by the above embodiment. The submersible pump includes two liquid level sensors 32 in an on state. The liquid level sensors 32 include first liquid level sensor 321 and second liquid level sensor 322. The first liquid level sensor 321 is provided at a position higher than the second liquid level sensor 322. The first liquid level sensor 321 and the second liquid level sensor 322 are arranged from top to bottom on the control panel 2 of the pump body 1. When the submersible pump is used, the bottom surface of the foot fits the bottom of the liquid pool.

[0055] The method includes:

The submersible pump is connected to a power supply and placed in the liquid pool.

[0056] S1. When the liquid level in the liquid pool rises above the first liquid level sensor 321, the first liquid level sensor 321 detects a change from absence to presence of a liquid, and outputs a first signal to the signal processing module of the controller 11. The signal processing module receives and recognizes the first signal, and

outputs a third signal to the control module. The control module controls the motor 4 to rotate, so as to control the submersible pump to start.

[0057] The first signal shows the change from absence to presence of a liquid detected by the first liquid level sensor 321 when the liquid level rises above the first liquid level sensor 321. The third signal is an electrical signal for controlling the control module to start the motor 4.

[0058] S2. When the liquid level drops below the second liquid level sensor 322, the second liquid level sensor 322 detects the change from presence to absence of a liquid, and outputs a second signal to the signal processing module of the controller 11. The signal processing module receives and recognizes the second signal, and outputs a fourth signal to the timing module. The timing module receives the fourth signal and starts a countdown. The submersible pump remains on.

[0059] The countdown has a fixed duration that is at least one second.

[0060] The second signal shows the change from presence to absence of a liquid detected by the second liquid level sensor 322 when the liquid level drops below the second liquid level sensor 322. The fourth signal is an electrical signal for controlling the timing module to start the countdown.

[0061] S3. The timing module finishes the countdown and outputs a fifth signal to the signal processing module. The signal processing module receives the fifth signal and outputs a sixth signal to the control module. The control module receives the sixth signal and controls the submersible pump to turn off.

[0062] After the submersible pump is turned off, when the liquid level rises above the first liquid level sensor 321, steps S1 to S3 are repeated.

[0063] The fifth signal is an electrical signal, which is a feedback signal showing that the timing module finishes the countdown, and enables the signal processing module to output the sixth signal to the control module.

[0064] The sixth signal is an electrical signal for controlling the control module to turn off the motor 4, thereby turning off the submersible pump.

[0065] The heights of the first liquid level sensor 321 and the second liquid level sensor 322 are adjustable. By turning on and off the sensing assemblies 3 at different heights, different liquid levels are controlled to adapt to different application scenarios.

Embodiment 7

[0066] Referring to FIGS. 4 and 6, the present application provides another embodiment based on the above embodiment.

[0067] The submersible pump includes a single liquid level sensor 32 in an on state.

[0068] The method includes:

The submersible pump is connected to a power supply and placed in the liquid pool.

[0069] S1. When the liquid level in the liquid pool rises above the liquid level sensor 32, the liquid level sensor 32 detects a change from absence to presence of a liquid, and outputs a first signal to the signal processing module of the controller 11. The signal processing module receives and recognizes the first signal, and outputs a third signal to the control module. The control module controls the motor 4 to rotate, so as to control the submersible pump to start.

[0070] The first signal shows the change from absence to presence of a liquid detected by the liquid level sensor 32 when the liquid level rises above the liquid level sensor 32. The third signal is an electrical signal for controlling the control module to start the motor 4.

[0071] S2. When the liquid level drops below the liquid level sensor 32, the liquid level sensor 32 detects the change from presence to absence of a liquid, and outputs a second signal to the signal processing module of the controller 11. The signal processing module receives and recognizes the second signal, and outputs a fourth signal to the timing module. The timing module receives the fourth signal and starts a countdown. The submersible pump remains on.

[0072] The countdown has a fixed duration that is at least two seconds.

[0073] The second signal shows the change from presence to absence of a liquid detected by the liquid level sensor 32 when the liquid level drops below the liquid level sensor 32. The fourth signal is an electrical signal for controlling the timing module to start the countdown.

[0074] S3. The timing module finishes the countdown and outputs a fifth signal to the signal processing module. The signal processing module receives the fifth signal and outputs a sixth signal to the control module. The control module receives the sixth signal and controls the submersible pump to turn off.

[0075] After the submersible pump is turned off, when the liquid level rises above the liquid level sensor 32, steps S1 to S3 are repeated.

[0076] The fifth signal is an electrical signal, which is a feedback signal showing that the timing module finishes the countdown, and enables the signal processing module to output the sixth signal to the control module.

[0077] The sixth signal is an electrical signal for controlling the control module to turn off the motor 4, thereby turning off the submersible pump.

[0078] The heights of the liquid level sensor 32 are adjustable. By turning on and off the sensing assemblies 3 at different heights, different liquid levels are controlled to adapt to different application scenarios.

Embodiment 8

[0079] Referring to FIG. 4, the present application provides another embodiment based on the above embodiment.

[0080] The controller 11 includes a signal processing module and a control module. The submersible pump

does not have a delayed turn-off function. After the controller receives the second signal, the controller immediately controls the motor to stop.

[0081] The method includes:

The submersible pump is connected to a power supply and placed in the liquid pool.

[0082] S1. The signal processing module of the controller 11 receives and recognizes a first signal, and outputs a feedback signal to the control module. The control module controls the motor 4 to rotate, so as to control the submersible pump to start.

[0083] S2. The signal processing module of the controller 11 receives and recognizes the second signal, and outputs a feedback signal to the control module. The control module controls the motor 4 to stop, so as to control the submersible pump to be turned off.

[0084] After the submersible pump is turned off, when the liquid level rises above the liquid level sensor 32, steps S1 and S2 are repeated.

Embodiment 9

[0085] Referring to FIGS. 1 and 6, the present application provides another embodiment based on the above embodiment.

[0086] The submersible pump can simultaneously turn on at most two liquid level sensors 32 through the switch 31 on the sensing assembly 3.

[0087] When the submersible pump is powered on for the first time, the two liquid level sensors 32 are turned on by default and the indicator lights 33 on the liquid level sensors 32 are always on. The switch 31 on any liquid level sensor 32 is pressed to turn on and off the liquid level sensor 32, so as to realize the automatic control of different user-defined liquid levels. At this time, for the first level sensor 321 and the second level sensor 322, the position of the first level sensor 321 is higher than that of the second level sensor 322.

[0088] When only one liquid level sensor 32 on the submersible pump is turned on, the switch 31 on the sensing assembly 3 is pressed separately, and the indicator light 33 flashes. When only a single liquid level sensor 32 is turned on, pressing the switch 31 on other sensing assembly 3 can restore the submersible pump to a state of turning on two liquid level sensors 32 under any working condition.

[0089] By turning on the liquid level sensors 32 at different heights or having different numbers, the automatic control of different liquid levels is realized, such that the submersible pump can adapt to many application scenarios.

[0090] When the use environment is different, the liquid level to be automatically controlled is different. The submersible pump using the automatic liquid level control method can control the liquid level in different ranges to adapt to different use needs.

Embodiment 10

[0091] Referring to FIGS. 1 to 6, the present application provides another embodiment based on the above embodiment.

[0092] The submersible pump further includes manual on and off and delayed turn-off functions.

[0093] The submersible pump can be forced to be turned on and off manually when no liquid level sensor 32 is turned on.

[0094] Countdowns with different durations are preset in the timing module. When no liquid level sensor 32 is turned on, the submersible pump outputs different signals through a program preset on the signal processing module after being manually turned on to apply countdowns of different durations. After the countdown, the control module controls the submersible pump to turn off, so as to realize the delayed turn-off function.

Claims

1. A submersible pump, comprising:

a pump body (1) provided thereon with a control panel (2); and

at least two sensing assemblies (3), wherein the sensing assemblies (3) each comprises a liquid level sensor (32), an indicator light (33), and a switch (31);

the switch (31) is provided on the control panel (2) and is configured to turn on or off the liquid level sensor (32);

the indicator light (33) is configured to display an on/off state of the liquid level sensor (32); and

all the liquid level sensors (32) are arranged at different heights on a side of the pump body (1);

characterized in that the submersible pump comprises a controller (11) that is electrically connected to the at least two sensing assemblies (3), wherein each of the liquid level sensors (32) is configured to output a first signal and/or a second signal to the controller (11); the switch (31) is a push switch; the push switch (31) is electrically connected to the controller (11) and to the liquid level sensor (32), the indicator light (33) is electrically connected to the controller (11), and the controller (11) is configured to recognize different characteristic signals sent by different liquid level sensors (32);

wherein the submersible pump is connected to a power supply and placed in a liquid pool;

in response to the first signal, the controller (11) is configured to execute a start program to start the submersible pump, wherein a signal processing module of the controller (11) is configured to receive and recognize the first signal, and output a first feedback signal to a control module of the

controller (11); in response to the first feedback signal, the control module is configured to control a motor (4) to rotate, so as to control the submersible pump to start;
in response to the second signal, the controller (11) is configured to execute a stop program to stop the submersible pump, wherein the signal processing module of the controller (11) is configured to receive and recognize the second signal, and output a second feedback signal to the control module; in response to the second feedback signal, the control module is configured to control the motor (4) to stop, so as to control the submersible pump to be turned off.

2. The submersible pump according to claim 1, wherein the controller (11) comprises a signal processing module and a control module; and the signal processing module is electrically connected to the control module and the liquid level sensor (32).

3. The submersible pump according to claim 2, wherein an inner chamber of the pump body (1) is provided therein with a motor (4) that is electrically connected to the control module; and the control module is configured to control the motor (4) to start or stop.

4. The submersible pump according to claim 3, wherein the controller (11) further comprises a timing module electrically connected to the signal processing module.

5. An automatic liquid level control method, used for the submersible pump according to claim 1, wherein only one of the liquid level sensors (32) is configured to be activated to be in an on-state at the same time;

the first signal shows a change from absence to presence of a liquid detected by the activated liquid level sensor (32); and
the second signal shows a change from presence to absence of the liquid detected by the activated liquid level sensor (32).

6. An automatic liquid level control method, used for the submersible pump according to claim 1, wherein liquid level sensors (32) comprise a first liquid level sensor (321) and a second liquid level sensor (322); and the first liquid level sensor (321) is provided at a position higher than the second liquid level sensor (322).

7. The automatic liquid level control method according to claim 6, wherein both the first liquid level sensor (321) and the second liquid level sensor (322) are configured to be activated to be in an on-state at the same time;

the first signal shows a change from absence to presence of a liquid detected by the first liquid level sensor (321); and
the second signal shows a change from presence to absence of the liquid detected by the second liquid level sensor (322).

8. The automatic liquid level control method according to claim 5 or 7, wherein

the timing module is configured to perform a countdown;
the signal processing module is configured to receive, process and output signals; and
the control module is configured to control the motor (4) to start or stop, so as to control the submersible pump to start or stop.

9. The automatic liquid level control method according to claim 8, wherein the start program comprises:

outputting, by the signal processing module, a third signal to the control module after receiving the first signal, such that the control module starts the motor (4);
wherein, the third signal is a feedback signal output by the signal processing module after receiving the first signal, and is configured to control the control module to start the motor (4).

10. The automatic liquid level control method according to claim 9, wherein the stop program comprises:

outputting, by the signal processing module, a fourth signal to the timing module after receiving the second signal, such that the timing module starts a countdown; outputting, by the timing module, a fifth signal to the signal processing module after finishing the countdown; receiving, by the signal processing module, the fifth signal, and outputting a sixth signal to the control module; and stopping, by the control module, the motor (4);
wherein, the fourth signal is a feedback signal output by the signal processing module after receiving the second signal and is configured to control the timing module to start the countdown;
the fifth signal is a feedback signal output by the timing module after finishing the countdown; and
the sixth signal is a feedback signal output by the signal processing module after receiving the fifth signal and is configured to control the control module to stop the motor (4).

11. The automatic liquid level control method according to claim 10, wherein

the liquid level sensors (32) that output the first signal or the second signal are changed by turning on the switches of the sensing assemblies at different heights;
the countdown is configured to remain the submersible pump on for a period of time after the signal processing module receives the second signal; and
the countdown has a duration of at least one second.

Patentansprüche

1. Tauchpumpe, umfassend:

einen Pumpenkörper (1), auf dem ein Bedienfeld (2) bereitgestellt ist, und
mindestens zwei Abtastanordnungen (3), wobei die Abtastanordnungen (3) jeweils einen Füllstandssensor (32), eine Kontrollleuchte (33) und einen Schalter (31) umfassen,
der Schalter (31) auf dem Bedienfeld (2) bereitgestellt und dazu ausgelegt ist, den Füllstandssensor (32) ein- oder auszuschalten,
die Kontrollleuchte (33) dazu ausgelegt ist, einen Ein-/Aus-Zustand des Füllstandssensors (32) anzuzeigen, und
alle Füllstandssensoren (32) in unterschiedlichen Höhen auf einer Seite des Pumpenkörpers (1) angeordnet sind,
dadurch gekennzeichnet, dass die Tauchpumpe eine Steuerung (11) umfasst, die mit den mindestens zwei Abtastanordnungen (3) elektrisch verbunden ist, wobei ein jeder der Füllstandssensoren (32) dazu ausgelegt ist, ein erstes Signal und/oder ein zweites Signal an die Steuerung (11) auszugeben, der Schalter (31) ein Druckschalter ist, der Druckschalter (31) elektrisch mit der Steuerung (11) und dem Füllstandssensor (32) verbunden ist, die Kontrollleuchte (33) elektrisch mit der Steuerung (11) verbunden ist und die Steuerung (11) dazu ausgelegt ist, verschiedene charakteristische Signale zu erkennen, die von verschiedenen Füllstandssensoren (32) gesendet werden,
wobei die Tauchpumpe an eine Stromversorgung angeschlossen und in einem Flüssigkeitsbecken platziert ist,
die Steuerung (11) dazu ausgelegt ist, als Reaktion auf das erste Signal ein Startprogramm auszuführen, um die Tauchpumpe zu starten, wobei ein Signalverarbeitungsmodul der Steuerung (11) dazu ausgelegt ist, das erste Signal zu empfangen und zu erkennen und ein erstes Rückkopplungssignal an ein Steuermodul der Steuerung (11) auszugeben, und das Steuermodul dazu ausgelegt ist, als Reaktion auf das erste Rückkopplungssignal einen Motor (4) so zu steuern, dass er sich dreht, sodass die Tauchpumpe so gesteuert wird, dass sie startet;
die Steuerung (11) dazu ausgelegt ist, als Reaktion auf das zweite Signal ein Stoppprogramm auszuführen, um die Tauchpumpe zu stoppen, wobei das Signalverarbeitungsmodul der Steuerung (11) dazu ausgelegt ist, das zweite Signal zu empfangen und zu erkennen und ein zweites Rückkopplungssignal an das Steuermodul auszugeben, und das Steuermodul dazu ausgelegt ist, als Reaktion auf das zweite Rückkopplungssignal den Motor (4) so zu steuern, dass er stoppt, sodass die Tauchpumpe so gesteuert wird, dass sie ausgeschaltet wird.

2. Tauchpumpe nach Anspruch 1, wobei die Steuerung (11) ein Signalverarbeitungsmodul und ein Steuermodul umfasst und das Signalverarbeitungsmodul elektrisch mit dem Steuermodul und dem Füllstandssensor (32) verbunden ist.

3. Tauchpumpe nach Anspruch 2, wobei eine Innenkammer des Pumpenkörpers (1) darin mit einem Motor (4) versehen ist, der elektrisch mit dem Steuermodul verbunden ist, und das Steuermodul dazu ausgelegt ist, den Motor (4) so zu steuern, dass er startet oder stoppt.

4. Tauchpumpe nach Anspruch 3, wobei die Steuerung (11) zudem ein Zeitsteuerungsmodul umfasst, das elektrisch mit dem Signalverarbeitungsmodul verbunden ist.

5. Verfahren zur automatischen Füllstandsregelung, das für die Tauchpumpe nach Anspruch 1 verwendet wird, wobei nur

einer der Füllstandssensoren (32) dazu ausgelegt ist, gleichzeitig in einem Ein-Zustand aktiviert zu werden,
wobei das erste Signal einen Wechsel vom Fehlen zum Vorhandensein einer durch den aktivierten Füllstandssensor (32) erfassten Flüssigkeit zeigt und
das zweite Signal einen Wechsel vom Vorhandensein zum Fehlen der durch den aktivierten Füllstandssensor (32) erfassten Flüssigkeit zeigt.

6. Verfahren zur automatischen Füllstandsregelung, das für die Tauchpumpe nach Anspruch 1 verwendet wird, wobei Füllstandssensoren (32) einen ersten Füllstandssensor (321) und einen zweiten Füllstandssensor (322) umfassen und der erste Füllstandssensor (321) an einer höheren Position als der zweite Füllstandssensor (322) bereitgestellt ist.

7. Verfahren zur automatischen Füllstandsregelung nach Anspruch 6, wobei sowohl der erste Füllstandssensor (321) als auch der zweite Füllstandssensor (322) dazu ausgelegt sind, so aktiviert zu werden, dass sie sich gleichzeitig in einem Ein-Zustand befinden,

das erste Signal einen Wechsel vom Fehlen zum Vorhandensein einer durch den ersten Füllstandssensor (321) erfassten Flüssigkeit zeigt und
das zweite Signal einen Wechsel vom Vorhandensein zum Fehlen der durch den zweiten Füllstandssensor (322) erfassten Flüssigkeit zeigt.

8. Verfahren zur automatischen Füllstandsregelung nach Anspruch 5 oder 7, wobei

das Zeitsteuerungsmodul dazu ausgelegt ist, ein Rückwärtszahlen durchzuführen;
das Signalverarbeitungsmodul dazu ausgelegt ist, Signale zu empfangen, zu verarbeiten und auszugeben, und
das Steuermodul dazu ausgelegt ist, den Motor (4) so zu steuern, dass er startet oder stoppt, sodass die Tauchpumpe so gesteuert wird, dass sie startet oder stoppt.

9. Verfahren zur automatischen Füllstandsregelung nach Anspruch 8, wobei das Startprogramm Folgendes umfasst:

Ausgeben eines dritten Signals durch das Signalverarbeitungsmodul an das Steuermodul nach dem Empfang des ersten Signals, sodass das Steuermodul den Motor (4) startet,
wobei das dritte Signal ein Rückkopplungssignal ist, das vom Signalverarbeitungsmodul nach dem Empfang des ersten Signals ausgegeben wird und dazu ausgelegt ist, das Steuermodul so zu steuern, dass es den Motor (4) startet.

10. Verfahren zur automatischen Füllstandsregelung nach Anspruch 9, wobei das Stoppprogramm Folgendes umfasst:

Ausgeben eines vierten Signals durch das Signalverarbeitungsmodul an das Zeitsteuerungsmodul nach dem Empfang des zweiten Signals, sodass das Zeitsteuerungsmodul eine Rückwärtszahlung startet; Ausgeben eines fünften Signals durch das Zeitsteuerungsmodul an das Signalverarbeitungsmodul nach dem Abschluss der Rückwärtszählung; Empfangen des fünften Signals durch das Signalverarbeitungsmodul und Ausgeben eines sechsten Signals an das Steuermodul und Stoppen des Motors (4) durch das Steuermodul,
wobei das vierte Signal ein Rückkopplungssignal ist, das vom Signalverarbeitungsmodul nach dem Empfang des zweiten Signals ausgegeben wird und dazu ausgelegt ist, das Zeitsteuerungsmodul so zu steuern, dass es die Rückwärtszahlung startet,
das fünfte Signal ein Rückkopplungssignal ist, das vom Zeitsteuerungsmodul nach dem Abschluss der Rückwärtszählung ausgegeben wird, und
das sechste Signal ein Rückkopplungssignal ist, das vom Signalverarbeitungsmodul nach dem Empfang des fünften Signals ausgegeben wird und dazu ausgelegt ist, das Steuermodul so zu steuern, dass es den Motor (4) stoppt.

11. Verfahren zur automatischen Füllstandsregelung nach Anspruch 10, wobei

die Füllstandssensoren (32), die das erste Signal oder das zweite Signal ausgeben, geändert werden, indem die Schalter der Abtastanordnungen in unterschiedlichen Höhen eingeschaltet werden;
die Rückwärtszählung so ausgelegt ist, dass die Tauchpumpe eine Zeit lang eingeschaltet bleibt, nachdem das Signalverarbeitungsmodul das zweite Signal empfangen hat, und
die Rückwärtszählung eine Dauer von mindestens einer Sekunde aufweist.

Revendications

1. Pompe submersible, comprenant :

un corps de pompe (1) pourvu sur celui-ci d'un panneau de contrôle (2) ; et
au moins deux ensembles de détection (3), les ensembles de détection (3) comprenant chacun un capteur de niveau de liquide (32), un voyant lumineux (33) et un interrupteur (31) ;
l'interrupteur (31) est pourvu sur le panneau de contrôle (2) et est conçu pour mettre en marche ou arrêter le capteur de niveau de liquide (32) ;
le voyant lumineux (33) est conçu pour afficher un état activé/désactivé du capteur de niveau de liquide (32) :

tous les capteurs de niveau de liquide (32) sont disposés à différentes hauteurs sur un côté du corps de pompe (1) ;
caractérisée en ce que la pompe submersible comprend un contrôleur (11) qui est connecté électriquement aux au moins deux ensembles de détection (3), chacun des capteurs de niveau de liquide (32) étant conçu pour émettre un premier signal et/ou

un deuxième signal vers le contrôleur (11) ; l'interrupteur (31) est un interrupteur à bouton-poussoir ; l'interrupteur (31) à bouton-poussoir est connecté électriquement au contrôleur (11) et au capteur de niveau de liquide (32), le voyant lumineux (33) est connecté électriquement au contrôleur (11), et le contrôleur (11) est conçu pour reconnaître différents signaux caractéristiques envoyés par différents capteurs de niveau de liquide (32) ;
la pompe submersible étant connectée à une alimentation électrique et placée dans un bassin de liquide ;
en réponse au premier signal, le contrôleur (11) est conçu pour exécuter un programme de mise en marche pour mettre en marche la pompe submersible, un module de traitement de signaux du contrôleur (11) étant conçu pour recevoir et reconnaître le premier signal, et émettre un premier signal de rétroaction vers un module de commande du contrôleur (11) ; en réponse au premier signal, le module de commande est conçu pour commander un moteur (4) pour qu'il tourne, de façon à commander la pompe submersible pour qu'elle se mette en marche ;
en réponse au deuxième signal, le contrôleur (11) est conçu pour exécuter un programme d'arrêt pour arrêter la pompe submersible, le module de traitement de signaux du contrôleur (11) étant conçu pour recevoir et reconnaître le deuxième signal, et émettre un deuxième signal de rétroaction vers le module de commande ; en réponse au deuxième signal de rétroaction, le module de commande est conçu pour commander le moteur (4) pour qu'il s'arrête, de façon à commander la pompe submersible pour qu'elle soit arrêtée.

2. Pompe submersible selon la revendication 1, dans laquelle le contrôleur (11) comprend un module de traitement de signaux et un module de commande ; et le module de traitement de signaux est connecté électriquement au module de commande et au capteur de niveau de liquide (32).

3. Pompe submersible selon la revendication 2, dans laquelle une chambre interne du corps de pompe (1) est pourvue dans celle-ci d'un moteur (4) qui est connecté électriquement au module de commande ; et le module de commande est conçu pour commander le moteur (4) pour qu'il démarre ou s'arrête.

4. Pompe submersible selon la revendication 3, dans laquelle le contrôleur (11) comprend en outre un module de temporisation connecté électriquement au module de traitement de signaux.

5. Procédé automatique de contrôle de niveau de liquide, utilisé pour la pompe submersible selon la revendication 1, dans lequel seulement

un des capteurs de niveau de liquide (32) est conçu pour être activé pour être dans un état de marche dans un même temps ;
le premier signal montre un changement d'absence à présence d'un liquide détecté par le capteur de niveau de liquide (32) activé ; et
le deuxième signal montre un changement de présence à absence du liquide détecté par le capteur de niveau de liquide (32) activé.

6. Procédé automatique de contrôle de niveau de liquide, utilisé pour la pompe submersible selon la revendication 1, dans lequel les capteurs de niveau de liquide (32) comprennent un premier capteur de niveau de liquide (321) et un deuxième capteur de niveau de liquide (322) ; et le premier capteur de niveau de liquide (321) est fourni à une position plus haute que le deuxième capteur de niveau de liquide (322).

7. Procédé automatique de contrôle de niveau de liquide selon la revendication 6, dans lequel le premier capteur de niveau de liquide (321) et le deuxième capteur de niveau de liquide (322) sont tous deux conçus pour être activés pour être dans un état de marche dans un même temps ;

le premier signal montre un changement d'absence à présence d'un liquide détecté par le premier capteur de niveau de liquide (321) ; et
le deuxième signal montre un changement de présence à absence du liquide détecté par le deuxième capteur de niveau de liquide (322).

8. Procédé automatique de contrôle de niveau de liquide selon la revendication 5 ou 7, dans lequel

le module de temporisation est conçu pour exécuter un compte à rebours;
le module de traitement de signaux est conçu pour recevoir, traiter et émettre des signaux ; et
le module de commande est conçu pour commander le moteur (4) pour qu'il se mette en marche ou s'arrête, de façon à commande la pompe submersible pour qu'elle se mette en marche ou s'arrête.

9. Procédé automatique de contrôle de niveau de liquide selon la revendication 8, dans lequel le programme de mise en marche comprend :

l'émission, par le module de traitement de signaux, d'un troisième signal vers le module de commande après la réception du premier signal, de telle sorte que le module de commande mette en marche le moteur (4) ;
le troisième signal étant un signal de rétroaction émis par le module de traitement de signaux après la réception du premier signal, et étant conçu pour commander le module de commande pour qu'il mette en marche le moteur (4).

10. Procédé automatique de contrôle de niveau de liquide selon la revendication 9, dans lequel le programme d'arrêt comprend :

l'émission, par le module de traitement de signaux, d'un quatrième signal ver le module de temporisation après la réception du deuxième signal, de telle sorte que le module de temporisation commence un compte à rebours ; l'émission, par le module de temporisation, d'un cinquième signal vers le module de traitement de signaux après la finalisation du compte à rebours ; la réception, par le module de traitement de signaux, du cinquième signal, et l'émission d'un sixième signal vers le module de commande ; et l'arrêt, par le module de commande, du moteur (4) ;
le quatrième signal étant un signal de rétroaction émis par le module de traitement de signaux après la réception du deuxième signal et étant conçu pour commander le module de temporisation pour qu'il mette en marche le compte à rebours ;
le cinquième signal étant un signal de rétroaction émis par le module de temporisation après la finalisation du compte à rebours ; et
le sixième signal étant un signal de rétroaction émis par le module de traitement de signaux après la réception du cinquième signal et étant conçu pour commander le module de commande pour qu'il arrête le moteur (4).

11. Procédé automatique de contrôle de niveau de liquide selon la revendication 10, dans lequel

les capteurs de niveau de liquide (32) qui émettent le premier signal et le deuxième signal sont changé en mettant en marche les interrupteurs des ensembles de détection à différentes hauteurs ;
le compte à rebours est conçu pour maintenir la pompe submersible en marche pendant une période de temps après que le module de traitement de signaux reçoive le deuxième signal ; et
le compte à rebours a une durée d'au moins une seconde.

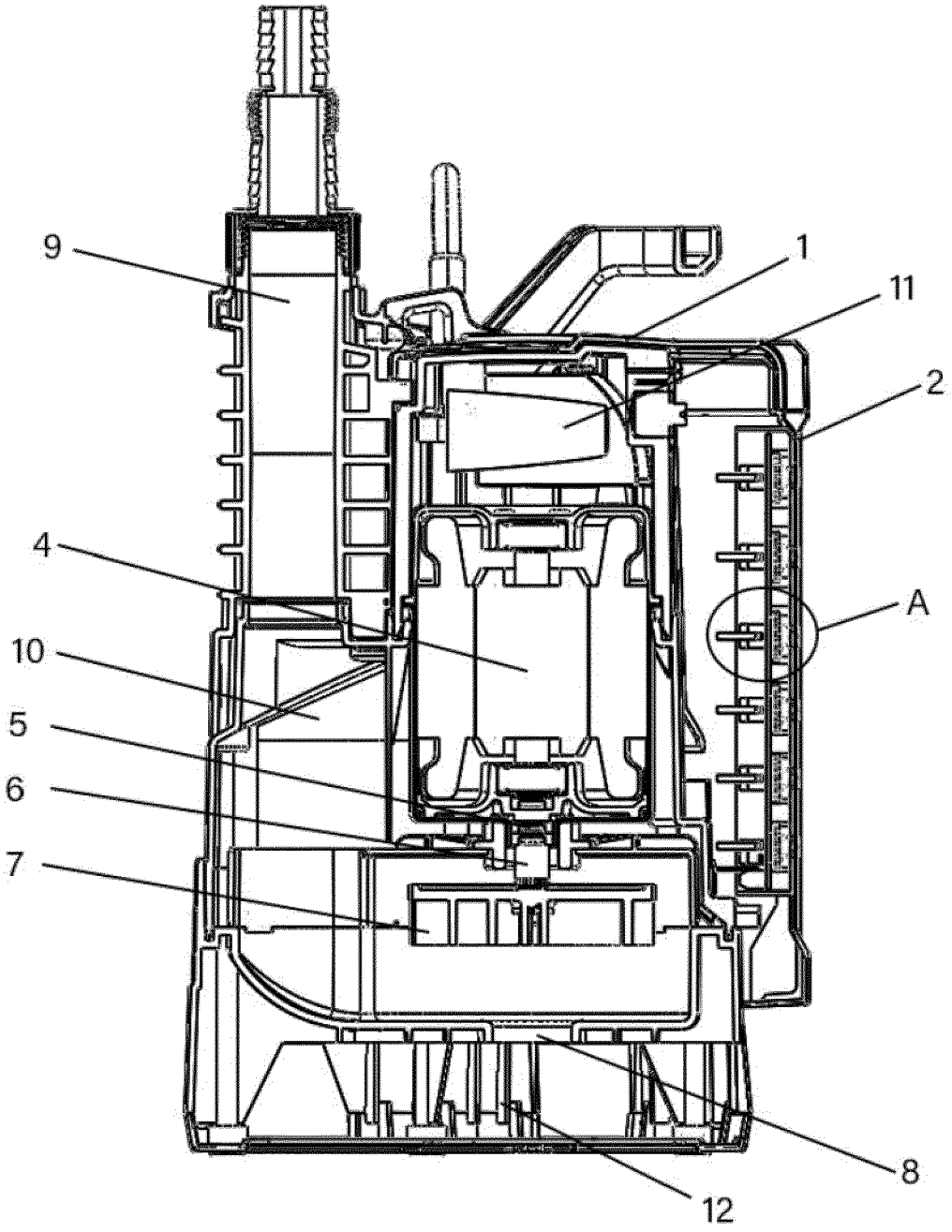

FIG. 1

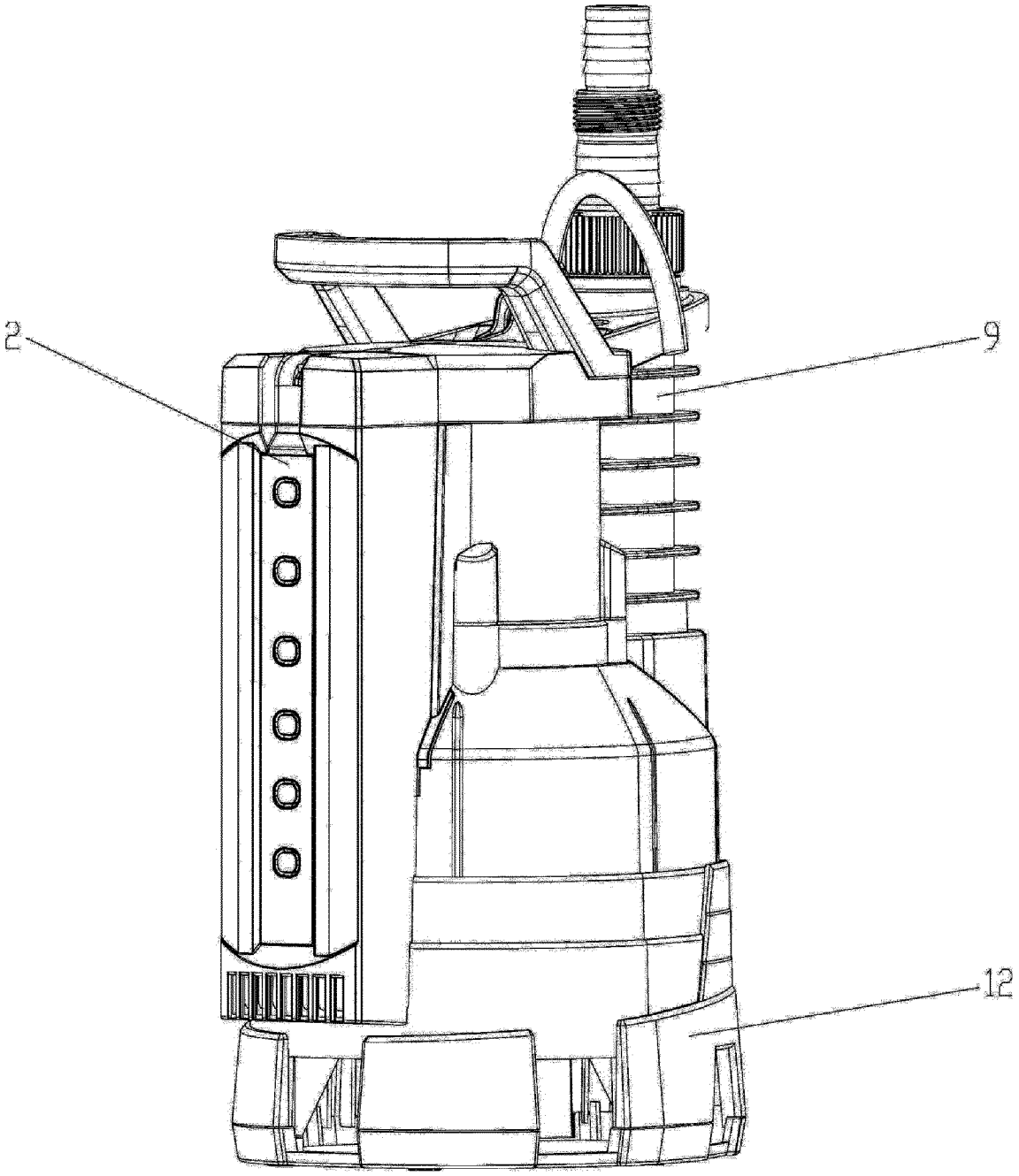

FIG. 2

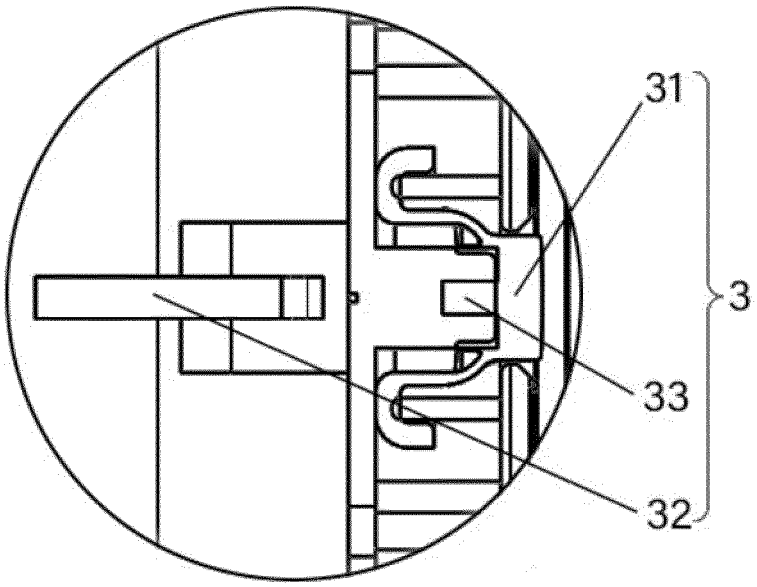

FIG. 3

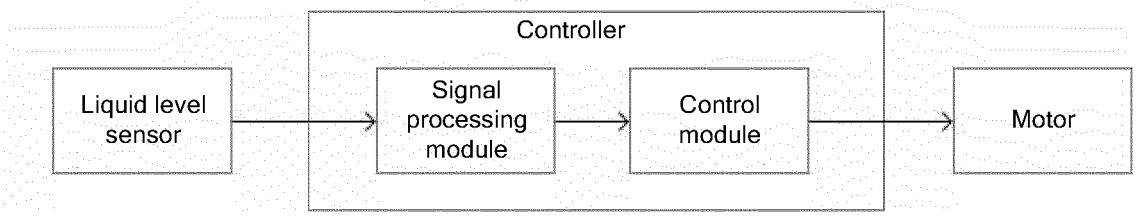

FIG. 4

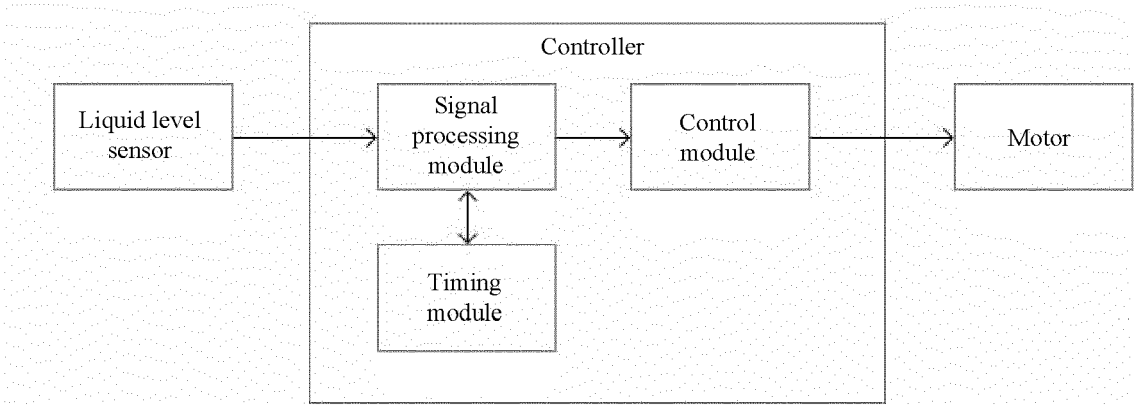

FIG. 5

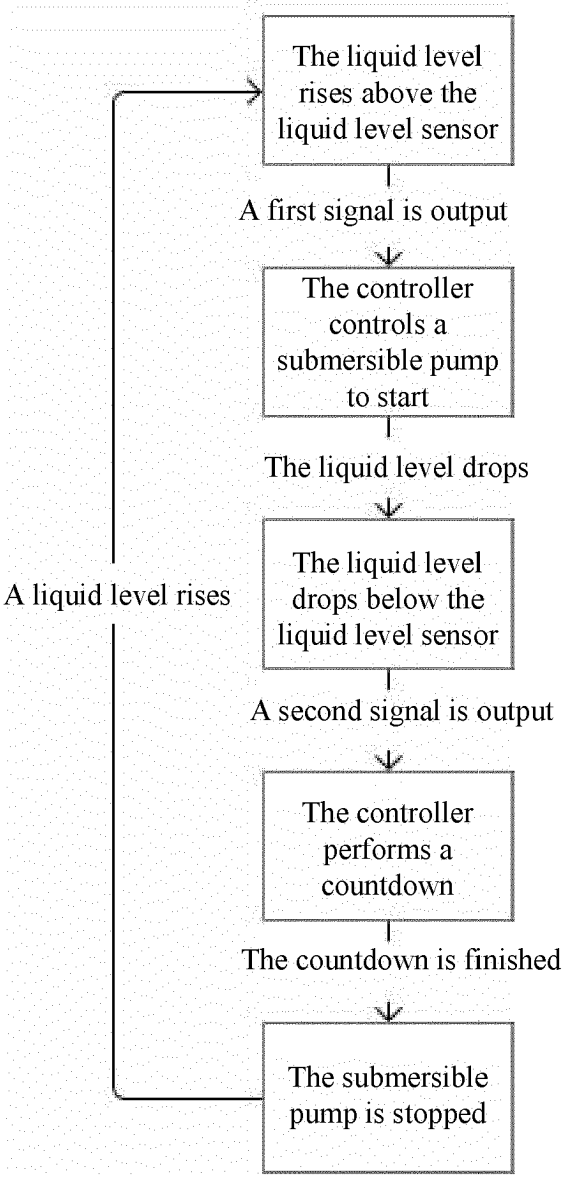
The liquid level rises above the liquid level sensor
A first signal is output
The controller controls a submersible pump to start
The liquid level drops
The liquid level drops below the liquid level sensor
A second signal is output
The controller performs a countdown
The countdown is finished
The submersible pump is stopped
A liquid level rises

FIG. 6

REFERENCES CITED IN THE DESCRIPTION

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- EP 3875765 A1 **[0004]**