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(54) **PUMP CONTROL SYSTEM**

PUMPSTEUERSYSTEM

SYSTÈME DE CONTRÔLE DE POMPE

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**EP 2 439 413 B1**

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## Description

### Field of the Invention

**[0001]** The present invention relates to pump systems and the control thereof.

### Background to the Invention

**[0002]** It is known to use pressure switches to control the pump of a liquid delivery system. Typically the pump is turned off and on depending on the liquid pressure detected by the pressure switch. By way of example, the plumbing system of a caravan can be connected to an external water supply by means of a hose connected to a submersible pump. The pump is submerged in the external water supply and is turned off and on by the pressure switch in response to the changes in water pressure in the plumbing system, for example when a tap is opened or closed.

**[0003]** EP 1 255 174 A1 and WO 2009/004277 A2 disclose pump systems in which an electric pump is started and stopped depending on the liquid demand downstream of the pump.

**[0004]** A problem with this arrangement is that, in some circumstances, the pressure switch can cause the pump to turn off and on unnecessarily causing a pulsing in the water delivery resulting in unwelcome noise and uneven water flow.

**[0005]** Another problem with such systems is that they are often run from batteries which, when in a relatively run down state, do not provide the pump with sufficient power to produce sufficient pressure in the plumbing system to cause the pressure switch to operate. This can lead to the pump running continuously, producing an unwelcome level of background noise as well as creating a constant current draw on the battery which may eventually result in the battery being over-discharged and damaged.

**[0006]** A third problem arises if the water supply runs dry and the pump continues to run. This can cause the pump to overheat and permanent damage to occur.

**[0007]** It would be desirable to provide a pump control system that mitigates the problems outlined above.

### Summary of the Invention

**[0008]** Accordingly, a first aspect of the invention provides a pump system according to claim 1.

**[0009]** In preferred embodiments, the pump system is co-operable with a plumbing system arranged to deliver fluid (typically liquid, usually water) to users via one or more outlets (e.g. a tap for a sink or bath, or a shower head), each outlet being controlled by a tap or similar dispensing device. When one or more of said taps are open (i.e. there is a demand for fluid via one or more of said outlets), the pump system, under the control of the control apparatus, is arranged to cause fluid to be

pumped through the plumbing system to deliver fluid to the or each respective outlet. When the tap(s) are closed (i.e. when there is no demand for fluid to be delivered via an outlet), the pump system, under the control of the control apparatus, ceases to cause fluid to be pumped through the plumbing system. Typically, the plumbing system includes, or is connected to, a fluid reservoir, e.g. a water tank, from which said fluid is pumped to the plumbing system. The pump system may be located in the fluid reservoir, in which case it may comprise a submersible pump.

**[0010]** Advantageously, the control apparatus is configured to deactivate the pump in response to determining that there is no demand for fluid, e.g. by determining that the or each (and typically all where there is more than one) of said taps, or other outlet control devices, is closed. This corresponds with a decrease in the output fluid flow, especially fluid flow rate, from the pump, which in turn corresponds with a decrease in pump operating current. Hence, a first current threshold value may be set that is deemed to correspond to a cessation of demand for fluid, e.g. the or each tap or other outlet control device being closed, and the control apparatus monitors the pump operating current and when the current reaches or is below the first threshold value, the control apparatus causes the pump to be deactivated.

**[0011]** According to the invention, the control apparatus comprises, or is co-operable with, a pressure sensor that is responsive to the pressure of fluid in the plumbing system, the control apparatus being arranged to activate the pump when pressure sensor indicates that said fluid pressure has decreased to the extent that it may be deemed to correspond to a demand for fluid at one or more outlets. Conveniently, the control apparatus is arranged to activate the pump when pressure sensor indicates that said fluid pressure meets or drops below a first pressure threshold value.

**[0012]** Preferably, said at least one current threshold includes a second current threshold value corresponding to said pump running dry.

**[0013]** According to the invention, said controller is arranged to adjust said first current threshold value depending on the voltage level provided to the pump by said power supply. Advantageously, the controller is arranged to adjust said first current threshold value depending on said voltage level to maintain said first threshold value at a level that corresponds to substantially the same fluid flow rate from the pump. The controller may therefore include or be co-operable with means for measuring the voltage level of the power supply. This advantageous aspect of the invention is particularly applicable in cases where the power supply comprises one or more batteries.

**[0014]** Preferably, the control apparatus includes, or is co-operable with a pulse width modulation (PWM) system for supplying said pump with a pulse width modulated voltage supply.

**[0015]** A second aspect of the invention provides a

plumbing system, especially for a caravan, mobile home or RV, incorporating the pump system of the first aspect of the invention.

**[0016]** A third aspect of the invention provides a method of controlling a pump system, the method being according to claim 10.

**[0017]** It will be understood that current monitoring can be performed indirectly by monitoring one or more corresponding voltages and so references herein to current monitors and the like are intended to embrace corresponding voltage monitoring arrangements.

**[0018]** Further advantageous aspects of the invention will be apparent to those ordinarily skilled in the art upon review of the following description of a specific embodiment and with reference to the accompanying drawings.

#### Brief Description of the Drawings

**[0019]** An embodiment of the invention is now described by way of example and with reference to the accompanying drawings in which:

Figure 1 is a schematic diagram of a plumbing system suitable for use with the present invention; and

Figure 2 is a schematic diagram of a pump control system including a pump control apparatus embodying one aspect of the present invention;

Figure 3 is a flow chart illustrating the operation of the pump system of Figure 2.

#### Detailed Description of the Drawings

**[0020]** Referring now to figure 1 of the drawings there is shown generally indicated as 10, a plumbing system which, in the present example, is intended for the delivery of water, although the invention is not limited to water delivery systems. The system 10 comprises at least one, but typically a plurality of, outlets (e.g. the tap(s) of a sink or bath, or a shower head, or a domestic appliance) through which the water, or other liquid, can be dispensed during use. In Figure 1, only one outlet is shown, namely a tap 12. The outlets are connectable to a source of water which, in the present example, comprises a water tank 14, via at least one, but typically a network of, conduits. In

**[0021]** Figure 1, the water outlet(s) 12 are located internally of a structure 16 which, in the present example, is assumed to be a caravan, mobile home, recreational vehicle (RV) or similar structure, but which in alternative embodiments could comprise any other structure, e.g. building or vehicle. The water tank 14 is located externally of the caravan 16 and so may be referred to as an external water source. Alternatively, the water source may be located internally or under floor of the caravan 16 or other structure/vehicle. The plumbing system 10 comprises at least one, but typically a network of, pipes for delivering the water to the outlets 12. In Figure 1, only one pipe 18

is shown.

**[0022]** The plumbing system 10 further includes a connector 20 for connecting the pipe(s) 18 to the external water supply 14 via an external conduit, typically a hose or pipe 22. The connector 20 may take any suitable form, typically comprising a plug 24 and a socket 26, the arrangement being such that when the plug 24 is connected to the socket 26, liquid is able to flow from the tank 14 to the outlet(s) 12 via the conduits 18, 22. The connector 20 is typically also configured to facilitate any necessary electrical connections, e.g. for the pump motor described below.

**[0023]** A pump 30 is connected to the conduit 22 and is arranged to draw liquid, in this case water, from the water source, in this case the tank 14, and pump it through the conduit 22. The pump 30 is a submersible pump and, in typical embodiments, is an electrically operable submersible pump. The pump 30 is therefore operable by an electric motor 32.

**[0024]** A control apparatus 34 is provided for controlling the operation of the pump 30. The control apparatus 34 is conveniently located in the connector 20. In Figure 1 it is shown incorporated into the plug 24, although it may alternatively be incorporated into the socket 26, or distributed between the plug and socket, or located elsewhere in the system 10.

**[0025]** In particular, the control apparatus 34 is arranged to control the operation of pump 30 by controlling the electrical power supply to the motor 32. To this end, the control apparatus 34 is connected to a power supply, typically comprising one or more batteries 36. Usually, the battery 36 is located in the caravan 16 (or other structure).

**[0026]** In use, when a user operates the tap 12 or other outlet to demand water, the pump control apparatus 34 activates the pump 30 so that water is drawn from the tank 14 and delivered to the tap 12. When the user closes the outlet, e.g. turns off the tap, the control apparatus 34 deactivates the pump 30.

**[0027]** Referring now to Figure 2 of the drawings, a preferred embodiment of the control apparatus 34 is described in more detail. The control apparatus 34 includes a pressure sensor conveniently comprising a pressure switch 36 that is exposed (directly or indirectly) during use to the fluid in the plumbing system, i.e. in the conduits 18 and/or 22, such that it is operable in response to changes in fluid pressure. The pressure switch 36 may be provided at any convenient location in the plumbing system, e.g. in the hose 22 or pipe 18, or more conveniently, incorporated into the connector 20.

**[0028]** Typically, the pressure switch 36 is provided separately from the remainder of the control apparatus, which itself may be provided on a circuit board 38. The pressure switch 36 may be connected to the remainder of the control apparatus by any convenient means, typically a wired connection. In the preferred embodiment, the pressure switch 36 facilitates the detection of at least a decrease in fluid pressure, and in particular a decrease

to below a first pressure threshold value. Typically, the first pressure threshold value corresponds to an absolute pressure value in the plumbing system, and more particularly to an absolute pressure value that is deemed to correspond to one or more outlets being opened. Hence, the pressure switch 36 may be configured to generate a signal to indicate when the fluid pressure drops to or below the threshold value. Alternatively, the pressure switch 36 is configured to detect a relative decrease in fluid pressure that can be deemed to correspond to one or more outlets being opened. In either case, the decrease in fluid pressure corresponds to an outlet, e.g. tap 12, being opened at hence may be interpreted as a call for the pump 30 to be activated.

**[0029]** The control apparatus 34 includes a controller 40 for controlling the activation and deactivation of the pump 30. In the preferred embodiment, the controller 40 is arranged to receive an input signal from the pressure switch, indicating that a drop in fluid pressure below the relevant threshold value has been detected (or a requisite relative drop in pressure has been detected). Alternatively, the pressure sensor 36 may provide a measure of fluid pressure and the controller 40 determines whether or not the measured value drops to or below the threshold value. In either case, in response to determining that a requisite decrease in pressure has occurred, the controller 40 causes the pump 30 to be activated. More particularly, the controller 40 switches on the motor 32 to activate the pump 30.

**[0030]** The controller 40 also includes current monitoring means (not shown) for monitoring the current drawn by the motor during use. The current monitoring means may take any suitable form, for example it may comprise a current detector circuit (not shown) connected to the motor's electrical supply to measure the current drawn by the motor. Typically, a current sensing resistor is incorporated in series with the motor and associated circuitry produces an output signal depending on the voltage developed across the current sensing resistor. In preferred embodiments, the current monitoring means is arranged to produce an output signal that is indicative of whether or not the motor current reaches or drops below one or more current thresholds.

**[0031]** In this connection, it is observed that as the rate of output fluid flow caused by the pump 30 reduces, for example as a result of tap 12 being closed, the operating current drawn by the motor 32 reduces correspondingly. The controller 40 is arranged to deactivate the pump 30 in response to detecting that the operating current drawn by the motor 32 has dropped below a first current threshold since this may be taken as an indirect indication that the demand for water has stopped. As indicated above, the current monitoring means may produce an output signal in response to determining that the pump current has reached or dropped below said threshold, or the controller may monitor the output of the current monitoring means to determine when its level reaches or drops below said threshold.

**[0032]** By deactivating the pump 30 in response to changes, and in particular a reduction, in motor current the above-identified problem concerning a pulsing and uneven water flow is obviated. This is because the pump 30 is not deactivated by the pressure switch 36.

**[0033]** Conveniently, the controller 40 comprises a programmable processor, for example microcontroller or microprocessor programmed with suitable computer program(s). In the illustrated embodiment, the controller 40 has an analogue digital converter 42 that receives an analogue signal indicative of motor current and converts the signal to a corresponding digital signal for analysis by the controller. The microcontroller typically also includes I/O ports 44 for receiving input signals from peripheral components, such as the pressure switch 36. An input buffer 46 may be provided as required. Conveniently, communications port 48 and associated programming connector 50 are provided to allow the controller 40 to be programmed by, for example, an external PC.

**[0034]** Preferably, an input device is provided for adjusting the flow rate level at which the pump 30 is turned off. In the illustrated embodiment, the input device takes the form of a switch 52, e.g. a rotary trim switch or a push button switch, that is operable by user and provides an input signal to the microcontroller 40 depending on its setting. The controller 40 determines the current threshold for turning the pump 30 off depending on the setting of the input device 52. This enables the flow rate at which the pump 30 is turned off to be adjusted for individual system configuration, and/or to compensate for pump variations.

**[0035]** The controller apparatus 38 receives an electrical power supply from an external source, typically one or more batteries (as shown in Figure 2). By way of example, the power supply may be between 10 and 14½ volts DC. A voltage regulator 54 is provided for supplying electrical power to the controller 40. The motor 32 is a DC motor but in alternatively embodiments could be an AC or brushless motor.

**[0036]** In preferred embodiments, a pulse width modulating (PWM) system is provided for controlling the speed of the motor 32. The PWM system comprises a PWM driver 56 that controls the voltage supplied to the motor 32, and a PWM generator 58 incorporated into, or otherwise associated with, controller 40 for controlling the operation of the PWM driver 56. The PWM driver 56 modulates the electrical supply voltage such that the voltage supply signal to the motor 32 takes the form of a square wave. This controls the effective voltage that is supplied to the motor 32. For example, for a 12V DC supply voltage modulation may be applied at a frequency of 8 kHz. With an exemplary PWM duty cycle of 66.6%, the effective applied voltage, to the pump is 8 volts. The use of PWM on the voltage supply to the motor 32 reduces the risk of water pulsating due to rapid changes in pressure and provides a relatively smooth transition between the state where the pump is off and the state where the pump creates maximum flow rate. PWM also limits

the pump in rush current thereby reducing electrical interference and prolonging pump motor life.

[0037] Another advantage in turning the pump 30 off depending on the measured motor current is that it addresses the above-identified problem whereby, at lower battery voltages, the pump is unable to produce sufficient pressure to cause the pressure switch to activate to turn the pump off. This may be achieved by compensating the first current threshold value depending on changes in the battery voltage (DC voltage in this example). The controller 40 may therefore include means for monitoring the supply voltage provided by the battery or other source, e.g. a voltage comparator (not shown) or other voltage monitoring circuit. As a result, the pump 30 is turned off by the controller 40 when a respective current threshold value is reached that corresponds to a given flow rate across the range of operating voltages.

[0038] Advantageously, the control apparatus 38 may be arranged to switch off the pump 30 after it has been operated for a continuous period of a pre-determined length, e.g. 10 minutes.

[0039] A still further advantage of switching off the pump 30 in response to measured motor current is that it addresses the above-identified problem that occurs when the water supply runs dry and the pump 30 would normally continue to run which may cause overheating and permanent damage. Because the pump 30 (or more particularly the motor 32) draws less current when the pump is running dry, the current monitoring means provided in the controller is arranged to detect when the motor current drops below a second current threshold that is deemed to correspond to "dry running" of the pump. When the controller 40 determines that the motor current has dropped below the dry running threshold, the controller turns off the motor 32.

[0040] Referring now to Figure 3, there is shown a flow chart illustrating how the controller 40 may be programmed in order to implement preferred embodiments of the invention. At 300, the pump 30 is in its off state. At 302 a demand event occurs, namely the opening of an outlet (e.g. tap 12) of the plumbing system 10. At 304 the corresponding reduction in fluid pressure is detected by the pressure switch 36 which sends a corresponding signal to the controller 40. At 306, in response to receiving the signal from the pressure switch 36, the controller causes the pump 30 to activate. At 308, the controller 40 monitors the load current of the motor 32. At 310, the controller determines whether or not the measured motor current is less than the dry running threshold. If so, then the controller 40 causes the pump to stop and may also recycle power to reset the pump (312). If the controller 40 determines that the motor current exceeds (which in the present sense means drops below) the dry running threshold, then at 314 the controller determines whether or not the motor current is below the first current threshold for switching the pump off. If so, the controller 40 causes the pump to be switched off, returning to state 300. If the motor current exceeds the stop threshold, then the con-

troller 40 allows the pump to continue running (316).

[0041] While the invention is described herein in the context of water systems, it will be understood that the invention is not limited to use with such.

[0042] The invention is not limited to the embodiment described herein which may be modified or varied without departing from the scope of the invention, which is defined by the appended claims.

## Claims

1. A pump system comprising an electric pump, an electric power supply, a control apparatus, at least one fluid dispensing outlet, and a pressure sensor that is responsive to the pressure of said fluid, wherein said pump is configured to pump fluid to at least one fluid dispensing outlet and the control apparatus is arranged to activate the pump when the pressure sensor indicates that said fluid pressure has decreased to the extent that it is deemed to correspond to a demand for fluid at said at least one fluid outlet, and wherein the control apparatus comprises a current monitor for monitoring the current drawn by said pump from said electrical power supply, wherein said current drawn by said pump from said electrical power supply reduces correspondingly with reduction of output fluid flow caused by said pump,

### characterised in that

said control apparatus is arranged to deactivate said pump when said current monitor indicates that said current decreases to or below one or more current threshold values, wherein said one or more current threshold values includes a first current threshold value that corresponds to the current drawn by said pump when pumping fluid at a rate corresponding to said at least one dispensing outlet being closed, **in that** said control apparatus is arranged to adjust said first current threshold value depending on the voltage level provided to the pump by said power supply, and **in that** the pump system further includes a user operable input device for adjusting at least one of said one or more threshold values.

2. A system as claimed in claim 1, wherein said at least one current threshold includes a second current threshold value corresponding to the current drawn by said pump when running dry.
3. A system as claimed in claim 1, wherein the control apparatus is arranged to activate the pump when said pressure sensor indicates that said fluid pressure meets or drops below a first pressure threshold value.
4. A system as claimed in any preceding claim, wherein the control apparatus is arranged to adjust said first current threshold value depending on said voltage

level to maintain said first current threshold value at a level that corresponds to substantially the same fluid flow rate from the pump.

5. A system as claimed in any preceding claim, wherein said power supply comprises one or more batteries. 5
6. A system as claimed in preceding claim, further including means for monitoring said voltage level to which said control apparatus is responsive to adjust said first threshold value. 10
7. A system as claimed in any preceding claim, further including a pulse width modulation (PWM) system for supplying said pump with a pulse width modulated voltage supply. 15
8. A system as claimed in any preceding claim, wherein said pump is a submersible pump. 20
9. A system as claimed in any preceding claim, incorporated into a water delivery system, preferably the water delivery system of a vehicle, caravan or mobile home. 25
10. A method of controlling a pump system comprising an electric pump, an electric power supply, a control apparatus, at least one fluid dispensing outlet, and a pressure sensor that is responsive to the pressure of said fluid, wherein said pump is configured to pump fluid to at least one fluid dispensing outlet, said method comprising: activating the pump when said pressure sensor indicates that said fluid pressure has decreased to the extent that it is deemed to correspond to a demand for fluid at said at least one fluid outlet; and monitoring the current drawn by said pump from said electrical power supply, wherein said current drawn by said pump from said electrical power supply reduces correspondingly with reduction of output fluid flow caused by said pump, 30  
**characterised by**  
deactivating the pump in response to determining that the pump operating current decreases to or below said one or more current threshold values, wherein said one or more current threshold values includes a first current threshold value that corresponds to the current drawn by said pump when pumping fluid at a rate corresponding to said at least one dispensing outlet being closed, by adjusting said first current threshold value depending on the voltage level provided to the pump by said power supply, wherein the pump system further includes a user operable input device for adjusting at least one of said one or more threshold values. 40 45 50

## Patentansprüche

1. Pumpsystem, das eine elektrische Pumpe, eine elektrische Leistungsversorgung, eine Steuerungsvorrichtung, mindestens einen Fluidabgabeauslass und einen Drucksensor umfasst, der auf den Druck des Fluids reagiert, wobei die Pumpe dazu konfiguriert ist, ein Fluid zu mindestens einem Fluidabgabeauslass zu pumpen und die Steuerungsvorrichtung angeordnet ist, um die Pumpe zu aktivieren, wenn der Drucksensor anzeigt, dass der Fluiddruck soweit abgenommen hat, dass angenommen wird, dass er einem Fluidbedarf an dem mindestens einen Fluidauslass entspricht, und wobei die Steuerungsvorrichtung einen Strommonitor umfasst, um den Strom zu überwachen, den die Pumpe von der elektrischen Leistungsversorgung zieht, wobei der Strom, den die Pumpe von der elektrischen Leistungsversorgung zieht, sich entsprechend einer von der Pumpe verursachten Verringerung der Ausgangsfluidströmung verringert, **dadurch gekennzeichnet, dass** die Steuerungsvorrichtung angeordnet ist, um die Pumpe zu deaktivieren, wenn der Strommonitor anzeigt, dass der Strom sich auf einen oder mehrere Stromschwellenwerte verringert oder unter diese fällt, wobei der eine oder die mehreren Stromschwellenwerte einen ersten Stromschwellenwert beinhalten, der dem Strom entspricht, der von der Pumpe gezogen wird, wenn sie ein Fluid mit einer Rate pumpt, die einem Schließen von dem mindestens einen Abgabeauslass entspricht, dass die Steuerungsvorrichtung angeordnet ist, um den ersten Stromschwellenwert abhängig von dem Spannungsniveau anzupassen, das der Pumpe von der Leistungsversorgung bereitgestellt wird, und dass das Pumpsystem ferner eine benutzerbetreibbare Eingabevorrichtung beinhaltet, um mindestens einen von dem einen oder den mehreren Schwellenwerten anzupassen. 25 30 35 40
2. System nach Anspruch 1, wobei der mindestens eine Stromschwellenwert einen zweiten Stromschwellenwert beinhaltet, der dem Strom entspricht, der von der Pumpe gezogen wird, wenn diese trocken läuft.
3. System nach Anspruch 1, wobei die Steuerungsvorrichtung angeordnet ist, um die Pumpe zu aktivieren, wenn der Drucksensor anzeigt, dass der Fluiddruck einen ersten Druckschwellenwert erreicht oder unter diesen fällt.
4. System nach einem der vorhergehenden Ansprüche, wobei die Steuerungsvorrichtung angeordnet ist, um den ersten Stromschwellenwert abhängig von dem Spannungsniveau anzupassen, um den ersten Stromschwellenwert auf einem Niveau zu halten, das im Wesentlichen der gleichen Fluidströmungsrate von der Pumpe entspricht. 55

5. System nach einem der vorhergehenden Ansprüche, wobei die Leistungsverorgung eine oder mehrere Batterien umfasst.
6. System nach einem der vorhergehenden Ansprüche, ferner Mittel beinhaltend, um das Spannungsniveau zu überwachen, auf das die Steuerungsvorrichtung reagiert, um den ersten Schwellenwert anzupassen.
7. System nach einem der vorhergehenden Ansprüche, ferner ein Pulsweitenmodulationssystem (PWM-System) beinhaltend, um die Pumpe mit einer pulsweitenmodulierten Spannungsversorgung zu versorgen.
8. System nach einem der vorhergehenden Ansprüche, wobei die Pumpe eine Tauchpumpe ist.
9. System nach einem der vorhergehenden Ansprüche, eingebaut in ein Wasserverteilungssystem, vorzugsweise das Wasserverteilungssystem eines Fahrzeugs, eines Wohnwagens oder eines Wohnmobils.
10. Verfahren zum Steuern eines Pumpsystems, das eine elektrische Pumpe, eine elektrische Leistungsverorgung, eine Steuerungsvorrichtung, mindestens einen Fluidabgabeauslass und einen Drucksensor umfasst, der auf den Druck des Fluids reagiert, wobei die Pumpe dazu konfiguriert ist, ein Fluid zu mindestens einem Fluidabgabeauslass zu pumpen, wobei das Verfahren Folgendes umfasst: Aktivieren der Pumpe, wenn der Drucksensor anzeigt, dass der Fluiddruck soweit abgenommen hat, dass angenommen wird, dass er einem Fluidbedarf an dem mindestens einen Fluidabgabeauslass entspricht; und Überwachen des Stroms, den die Pumpe von der elektrischen Leistungsverorgung zieht, wobei der Strom, den die Pumpe von der elektrischen Leistungsverorgung zieht, sich entsprechend einer von der Pumpe verursachten Verringerung der Ausgangsfluidströmung verringert, **gekennzeichnet durch** Deaktivieren der Pumpe als Reaktion darauf, dass bestimmt wird, dass der Betriebsstrom der Pumpe sich auf den einen oder die mehreren Stromschwellenwerte verringert oder unter diese fällt, wobei der eine oder die mehreren Stromschwellenwerte einen ersten Stromschwellenwert beinhalten, der dem Strom entspricht, der von der Pumpe gezogen wird, wenn sie ein Fluid mit einer Rate pumpt, die einem Schließen von dem mindestens einen Abgabeauslass entspricht, und durch Anpassen des ersten Stromschwellenwertes in Abhängigkeit von dem Spannungsniveau, das der Pumpe von der Leistungsverorgung bereitgestellt wird, wobei das Pumpsystem ferner eine benutzerbetreibbare Eingabevorrichtung beinhaltet, um mindestens ei-

nen von dem einen oder den mehreren Schwellenwerten anzupassen.

## 5 Revendications

1. Système de pompe comprenant une pompe électrique, une alimentation en courant électrique, un appareil de contrôle, au moins une sortie de distribution de fluide, et un capteur de pression qui est sensible à la pression dudit fluide, dans lequel ladite pompe est conçue pour pomper le fluide vers au moins une sortie de distribution de fluide et l'appareil de contrôle est agencé pour activer la pompe lorsque le capteur de pression indique que ladite pression de fluide a diminué à tel point qu'elle est jugée correspondre à une demande pour le fluide au niveau de ladite au moins une sortie de fluide, et dans lequel l'appareil de contrôle comprend un dispositif de surveillance de courant destiné à surveiller le courant prélevé par ladite pompe de ladite alimentation en courant électrique, dans lequel ledit courant prélevé par ladite pompe de ladite alimentation en courant électrique diminue proportionnellement à la réduction du débit de fluide en sortie provoquée par ladite pompe, **caractérisé en ce que** ledit appareil de contrôle est agencé pour désactiver ladite pompe lorsque ledit dispositif de surveillance de courant indique que ledit courant diminue jusqu'à atteindre une valeur inférieure ou égale à une ou plusieurs valeurs de seuil de courant, dans lequel ladite une ou plusieurs valeurs de seuil de courant comprend une première valeur de seuil de courant qui correspond au courant prélevé par ladite pompe lorsque le pompage du fluide à un débit correspondant à ladite au moins une sortie de distribution est arrêté, **en ce que** ledit appareil de contrôle est agencé pour ajuster ladite première valeur de seuil de courant en fonction du niveau de tension fourni à la pompe par ladite alimentation électrique, et **en ce que** le système de pompe comprend en outre un dispositif d'entrée pouvant être actionné par un utilisateur pour ajuster au moins l'une desdites une ou plusieurs valeurs de seuil.
2. Système selon la revendication 1, dans lequel ledit au moins un seuil de courant comprend une seconde valeur de seuil de courant correspondant au courant prélevé par ladite pompe lorsque celle-ci tourne à sec.
3. Système selon la revendication 1, dans lequel l'appareil de contrôle est agencé pour activer la pompe lorsque ledit capteur de pression indique que ladite pression de fluide atteint ou chute jusqu'à une valeur inférieure à une première valeur de seuil de pression.
4. Système selon une quelconque revendication précédente, dans lequel l'appareil de contrôle est agen-

cé pour ajuster ladite première valeur de seuil de courant en fonction dudit niveau de tension pour maintenir ladite première valeur de seuil de courant à un niveau qui correspond sensiblement au même débit de fluide en provenance de la pompe.

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5. Système selon une quelconque revendication précédente, dans lequel ladite alimentation électrique comprend une ou plusieurs batteries.

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6. Système selon la revendication précédente, comprenant en outre un moyen pour surveiller ledit niveau de tension auquel ledit appareil de contrôle est sensible pour ajuster ladite première valeur de seuil.

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7. Système selon une quelconque revendication précédente, comprenant en outre un système de modulation d'impulsions en largeur (MIL) pour alimenter ladite pompe avec une alimentation en tension à modulation d'impulsions en largeur.

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8. Système selon une quelconque revendication précédente, dans lequel ladite pompe est une pompe submersible.

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9. Système selon une quelconque revendication précédente, incorporé dans un système de distribution d'eau, de préférence le système de distribution d'eau d'un véhicule, d'une caravane ou d'une maison mobile.

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10. Procédé de contrôle d'un système de pompe comprenant une pompe électrique, une alimentation en courant électrique, un appareil de contrôle, au moins une sortie de distribution de fluide, et un capteur de pression qui est sensible à la pression dudit fluide, dans lequel ladite pompe est conçue pour pomper le fluide vers au moins une sortie de distribution de fluide, ledit procédé comprenant : l'activation de la pompe lorsque ledit capteur de pression indique que ladite pression de fluide a diminué à tel point qu'elle est jugée correspondre à une demande pour le fluide au niveau de ladite au moins une sortie de fluide ; et la surveillance du courant prélevé par ladite pompe de ladite alimentation en courant électrique, dans lequel ledit courant prélevé par ladite pompe de ladite alimentation en courant électrique diminue proportionnellement à la réduction du débit de fluide en sortie provoquée par ladite pompe, **caractérisé par** la désactivation de la pompe en réponse à la détermination selon laquelle le courant faisant actionner la pompe diminue jusqu'à atteindre une valeur inférieure ou égale à ladite une ou plusieurs valeurs de seuil de courant, dans lequel ladite une ou plusieurs valeurs de seuil de courant comprend une première valeur de seuil de courant qui correspond au courant prélevé par ladite pompe lorsque le pompage du fluide à un débit correspondant à ladite au moins une

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sortie de distribution est arrêté, par l'ajustement de ladite première valeur de seuil de courant en fonction du niveau de tension fourni à la pompe par ladite alimentation électrique, dans lequel le système de pompe comprend en outre un dispositif d'entrée pouvant être actionné par un utilisateur pour ajuster au moins l'une desdites une ou plusieurs valeurs de seuil.

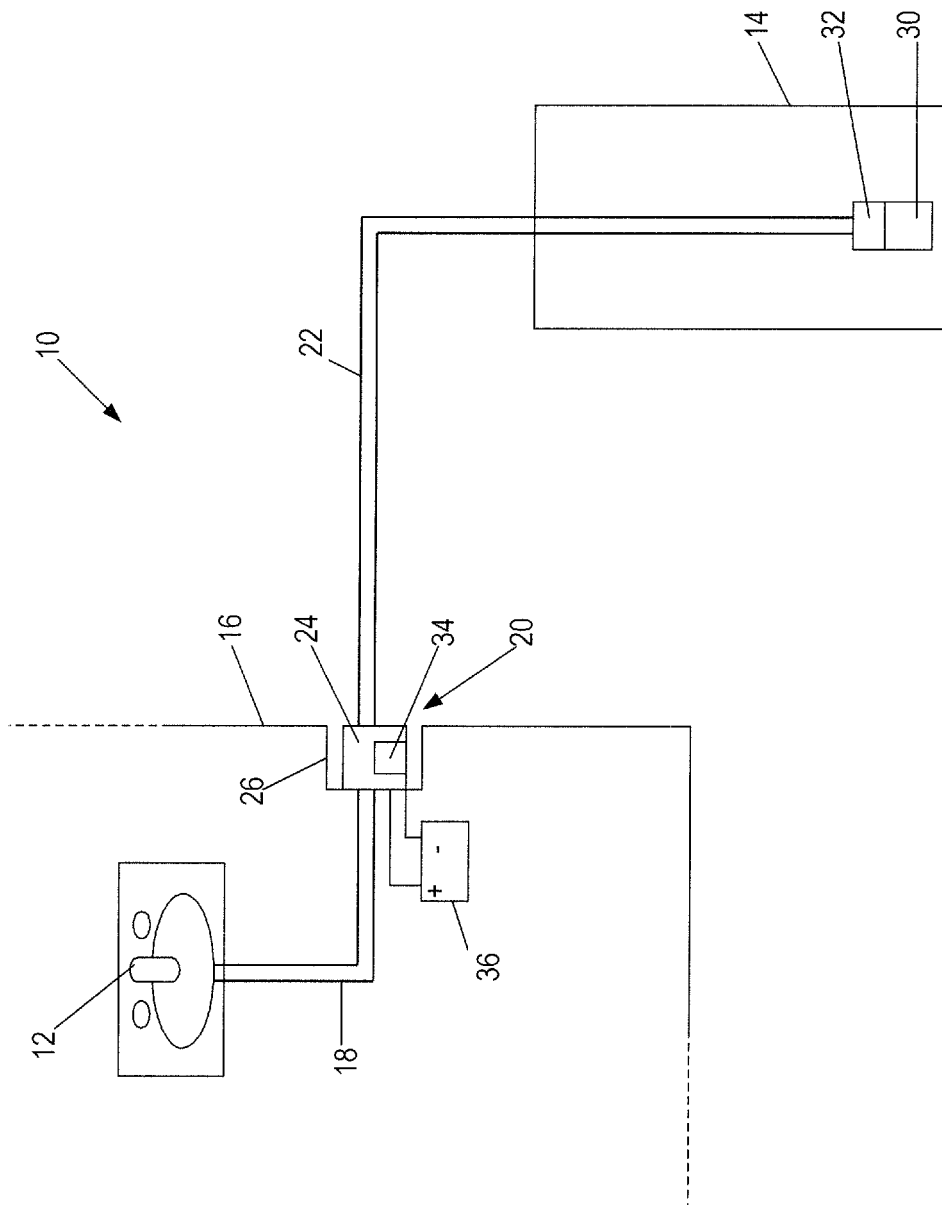
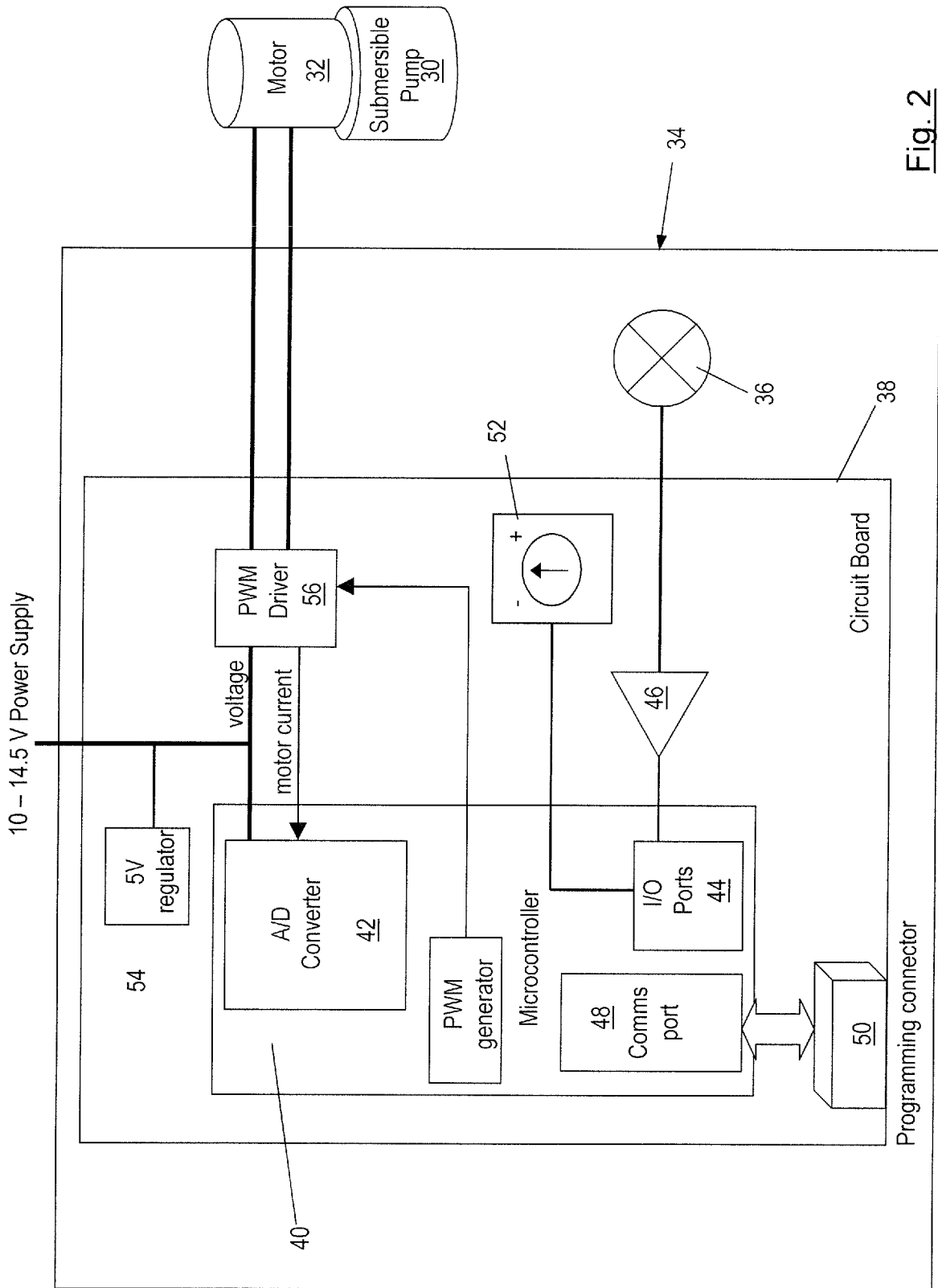


Fig. 1



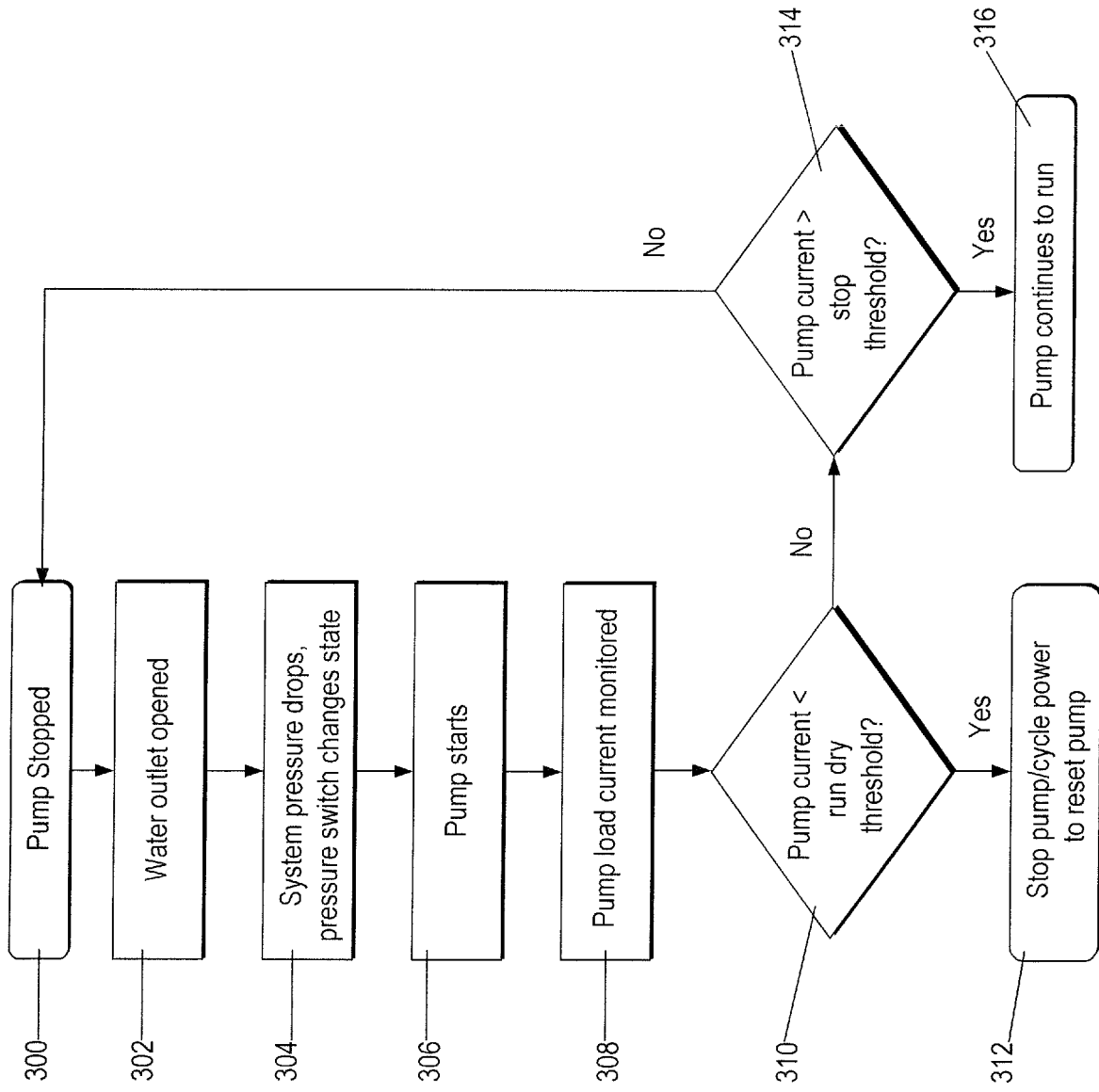


Fig. 3

**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

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