(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 317 687 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
07.02.2024 Bulletin 2024/06

(21) Application number: **23190023.4**

(22) Date of filing: **07.08.2023**

(51) International Patent Classification (IPC):
F04B 41/02 *(2006.01)* ***F04B 49/02*** *(2006.01)*
F04B 49/06 *(2006.01)* ***F04B 49/08*** *(2006.01)*
F04B 49/10 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
F04B 41/02; F04B 49/022; F04B 49/06; F04B 49/065; F04B 49/08; F04B 49/10

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

(30) Priority: **05.08.2022 CN 202210938775**

(71) Applicants:
- **HEFEI MIDEA HEATING & VENTILATING EQUIPMENT CO., LTD.**
Boyan Science Park,
High-Tech Zone, Hefei
Anhui 230088 (CN)
- **GD Midea Heating & Ventilating Equipment Co., Ltd.**
Foshan, Guangdong 528311 (CN)

(72) Inventor: **ZHENG, Junchao**
Hefei, 230088 (CN)

(74) Representative: **Whitlock, Holly Elizabeth Ann et al**
Maucher Jenkins
Seventh Floor Offices
Artillery House
11-19 Artillery Row
London SW1P 1RT (GB)

(54) TURN-OFF PROTECTION, DRIVING AND OVERPRESSURE TURN-OFF SYSTEMS, HEAT PUMP APPARATUS, AND ELECTRICAL DEVICE

(57) The present application provides turn-off protection, driving and overpressure turn-off systems, a heat pump apparatus, and an electrical device. The turn-off protection system includes a first control apparatus and a second control apparatus. The first control apparatus is in signal connection with a pressure switch apparatus when in use to output a first drive signal, and is used for stopping outputting the first drive signal according to a pressure switch action signal, where the pressure switch apparatus is turned off when a pressure of the system is detected to be overpressure and outputs the pressure switch action signal, the first drive signal is used to instruct the drive apparatus to drive a compression apparatus to operate. The second control apparatus is used to output a fault protection signal to the drive apparatus upon obtaining the pressure switch action signal and the first drive signal from the first control apparatus, where the fault protection signal is used to control the drive apparatus to stop outputting the second drive signal to the compression apparatus. An efficiency and a success rate of turning off the compression apparatus and a safety factor of an air conditioning system and a heat pump system can be improved by the present application.

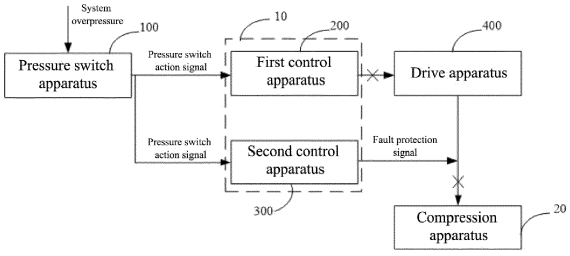

FIG. 1

EP 4 317 687 A1

Description

TECHNICAL FIELD

[0001] The present application relates to control technologies and, in particular to turn-off protection, driving, and overpressure turn-off systems, a heat pump apparatus, and an electrical device.

BACKGROUND

[0002] Compression apparatus (including a compressor and a pressure vessel, where pressure in the pressure vessel is changed when the compressor is operating) are important components of an air conditioning system and a heat pump system for working. In a system containing a compression apparatus, if no measure is taken to turn off the compression apparatus when the system pressure is high, the system pressure will continue to rise, thereby generating danger.

[0003] An existing method of turning off the compression apparatus is collecting by a main control board a switch signal of the compression apparatus, outputting the signal by the main control board to a module board according to the switch signal, and controlling by the module board the compression device to be turned off. This method of turning off the compression apparatus involves a lot of elements, has low response speed, and as long as any one element is damaged, a situation that the compression device cannot be turned off will occur, thereby leading to a serious consequence.

[0004] Thus, it still needs to be solved how to improve efficiency and success rate of turning off the compression apparatus, and to improve safety factors of an air conditioning system and a heat pump system.

SUMMARY

[0005] The present application provides turn-off protection, driving, and overpressure turn-off systems, a heat pump apparatus, and an electrical device, to improve a success rate of turning off a compression apparatus and improve safety factors of an air conditioning system and a heat pump system.

[0006] In one aspect, the present application provides a turn-off protection system, including:

a first control apparatus, configured to be in signal connection with a pressure switch apparatus when in use to output a first drive signal and further configured to stop outputting the first drive signal according to a pressure switch action signal, where the pressure switch apparatus is configured to be turned off when a pressure of the system is detected to be overpressure and output the pressure switch action signal; and the first drive signal is used for instructing a drive apparatus of a compression apparatus to drive the compression apparatus to operate;

a second control apparatus, configured to be connected to the first control apparatus, and further connected to the drive apparatus when in use, where the second control apparatus is used to output a fault protection signal to the drive apparatus upon obtaining the pressure switch action signal and the first drive signal from the first control apparatus, and the fault protection signal is used for controlling the drive apparatus to stop outputting a second drive signal to the compression apparatus.

[0007] In an optional embodiment, the turn-off protection system further includes:

a third control apparatus, configured to be connected to the first control apparatus and the pressure switch apparatus to output a third drive signal and further configured to stop outputting the third drive signal according to the pressure switch action signal, where the third drive signal is used for driving the first control apparatus to output the first drive signal.

[0008] In an optional embodiment, the turn-off protection system further includes:

a signal output circuit, where an end of the signal output circuit is connected to the second control apparatus and the other end of the signal output circuit is connected to the drive apparatus.

[0009] In an optional embodiment, the signal output circuit includes:

a first triode, where a base electrode of the first triode is connected to an output of the second control apparatus and an emitter electrode of the first triode is grounded;

a second triode, where an emitter electrode of the second triode is connected to a first power supply, a base electrode of the second triode is connected to a collector of the first triode, and a collector of the second triode is connected to a first pin of the drive apparatus; and

the fault protection signal is used to turn on the first triode and the second triode, so that the drive apparatus stops outputting the second drive signal after receiving by the first pin a voltage signal outputted by the first power supply.

[0010] In an optional embodiment, the signal output circuit further includes:

a diode, where a positive electrode of the diode is connected to the collector of the second triode and a negative electrode of the diode is connected to the first pin.

[0011] In an optional embodiment, the drive apparatus further includes a second pin connecting to a first feedback pin of the second control apparatus; and

a pulse signal is transmitted to the first feedback pin through the second pin when the drive apparatus stops outputting the second drive signal.

[0012] In an optional embodiment, the turn-off protection system further includes a pressure switch apparatus,

the pressure switch apparatus includes:

a pressure detection switch, where one end of the pressure detection switch is connected to an enable pin of the first control apparatus, and further connected to the pin of the second control apparatus and the pin of the third control apparatus, respectively, and further connected to a second power supply; the other end of the pressure detection switch is grounded; the pressure detection switch is turned off when a pressure of the system is detected to be overpressure;
the enable pin of the first control apparatus is grounded when the pressure detection switch is turned on, and
a voltage signal that is outputted by the second power supply and received by the enable pin of the first control apparatus is the pressure switch action signal when the pressure detection switch is turned off.

[0013] In an optional embodiment, the second control apparatus is further connected to the third control apparatus;
the second control apparatus is configured to transmit a reset signal to the third control apparatus upon obtaining the pressure switch action signal and the first drive signal from the first control apparatus, and the reset signal is used to control the third control apparatus to stop outputting the third drive signal.

[0014] In an optional embodiment, the first control apparatus includes N bridge arm pulse width modulation, PWM, circuits, and each bridge arm PWM circuit has a different on time; where N is an integer greater than 1.

[0015] In an optional embodiment, each bridge arm PWM circuit includes a triode.

[0016] In an optional embodiment, the first control apparatus includes an 8-channel buffer.

[0017] In an optional embodiment, the turn-off protection system further includes a first protection apparatus and a second protection apparatus;
one ends of the first protection apparatus and the second protection apparatus are both connected to the drive apparatus, and the other ends of the first protection apparatus and the second protection apparatus are both connected to the first control apparatus to buffer an output of the control apparatus.

[0018] In an optional embodiment, the first protection apparatus includes:

a first resistor, where one end of the first resistor is connected to a bridge arm PWM circuit, and the other end of the first resistor is connected to the drive apparatus; and
a first capacitor, where one end of the first capacitor is connected to the other end of the first resistor, and the other end of the first capacitor is grounded.

[0019] In an optional embodiment, the second protection apparatus includes:

a second resistor, where one end of the second resistor is connected to a bridge arm PWM circuit, and the other end of the second resistor is connected to the drive apparatus;
a third resistor, where one end of the third resistor is connected to one end of the second resistor, and the other end of the third resistor is grounded; and
a second capacitor, where one end of the second capacitor is connected to the other end of the second resistor, and the other end of the second capacitor is grounded.

[0020] In an optional embodiment, the turn-off protection system further includes:
a drive apparatus, configured to be connected to a compression apparatus when in use to output the second drive signal to the compression apparatus after receiving the first drive signal, where the second drive signal is used to drive the compression apparatus to operate.

[0021] In another aspect, the present application provides a heat pump apparatus, including the turn-off protection system provided in the first aspect, and further including:

a compression apparatus; and
a heat-exchange apparatus for heating liquid water.

[0022] In another aspect, the present application provides an electrical device, including the heat pump apparatus provided in the second aspect.

[0023] In another aspect, the present application provides a driving system, including the turn-off protection system as described in the first aspect, and further including:
a drive apparatus, configured to be connected to the compression apparatus when in use to output the second drive signal to the compression apparatus after receiving the first drive signal outputted by the first control apparatus, so as to drive the compression apparatus to operate.

[0024] In another aspect, the present application provides an overpressure turn-off system, including the turn-off protection system as described in the first aspect, and further including:
a pressure switch apparatus, configured to be turned off when a pressure of the system is detected to be overpressure, and output a pressure switch action signal.

[0025] The present embodiment provides a turn-off protection system including a first control apparatus and a second control apparatus. The first control apparatus is configured to be in signal connection with the pressure switch apparatus to output a first drive signal and further configured to stop outputting the first drive signal according to a pressure switch action signal. The pressure switch apparatus is configured to be turned off when a pressure of the system is detected to be overpressure

and output the pressure switch action signal. The second control apparatus is connected to the first control apparatus, and further connected to the drive apparatus of the compression apparatus when in use. The second control apparatus is used to output a fault protection signal to the drive apparatus upon obtaining the pressure switch action signal and the first drive signal from the first control apparatus. The fault protection signal is used to control the drive apparatus to stop outputting the second drive signal to the compression apparatus.

[0026] Thus, when the system is in overpressure, the control apparatus controls the drive apparatus of the compression apparatus to stop outputting a drive signal, so as to control the compression apparatus to be turned off. The second control apparatus is further configured to control the drive apparatus to stop outputting a drive signal when the system is in overpressure. The first control apparatus and the second control apparatus not only provide dual turn-off protection but also improve efficiency and success rate of turning off the compression apparatus, as well as improve safety factors of an air conditioning system and a heat pump system.

[0027] In addition, there is no need to make a software logic judgement in overpressure protection. It can use a signal to directly drive hardware to perform turn-off. Thus, fewer elements are needed, and the response is more quick and safer, the efficiency and success rate of turning off the compression apparatus is improved, and safety factors of the air conditioning system and heat pump system are improved.

BRIEF DESCRIPTION OF DRAWINGS

[0028] The drawings herein are incorporated into the specification and constitute a part of this specification, showing embodiments that comply with the present disclosure, and are used together with the specification to explain the principles of the present disclosure.

FIG. 1 is a schematic structural diagram of a turn-off protection system provided by an embodiment of the present application.

FIG. 2 is a schematic structural diagram of a turn-off protection system provided by another embodiment of the present application.

FIG. 3 is a partial schematic structural diagram of a turn-off protection system provided by another embodiment of the present application.

FIG. 4 is a schematic structural diagram of a turn-off protection system provided by another embodiment of the present application.

FIG. 5 is a schematic structural diagram of a turn-off protection system provided by another embodiment of the present application.

FIG. 6 is a schematic structural diagram of a turn-off protection system provided by another embodiment of the present application.

FIG. 7 is a schematic diagram of a heat pump apparatus provided by an embodiment of the present application.

FIG. 8 is a schematic diagram of an electrical device provided by an embodiment of the present application.

FIG. 9 is a schematic diagram of a driving system provided by an embodiment of the present application.

FIG. 10 is a schematic diagram of an overpressure turn-off system provided by an embodiment of the present application.

Description of reference numerals:

[0029] turn-off protection system 10; pressure switch apparatus 100; pressure detection switch 110; first control apparatus 200; PWM circuit 210; second control apparatus 300; drive apparatus 400; third control apparatus 500; signal output circuit 600; first protection apparatus 700; second protection apparatus 800; compression apparatus 20; first power supply 21; second power supply 22; heat pump apparatus 30; heat-exchange apparatus 31; electrical device 40; driving system 50; overpressure turn-off system 60

[0030] Through the above drawings, specific embodiments of the present disclosure have been shown, and will be described in detail below. These drawings and descriptions are not intended to limit the scope of the concept of the present disclosure in any way, but rather to illustrate the concepts of the present disclosure with referring to specific embodiments to those technical personnel in the field.

DESCRIPTION OF EMBODIMENTS

[0031] Herein, exemplary embodiments will be described herein in detail, and examples of the exemplary embodiments are represented in the drawings. When the following description refers to the drawings, unless otherwise indicated, the same numbers in different drawings represent the same or similar elements. The implementation modes described in the following exemplary embodiments do not represent all implementation modes that are consistent with the present disclosure. Rather, they are only examples of apparatus and methods that are consistent with some aspects of the present disclosure as detailed in the appended claims.

[0032] In the description of the present application, it should be understood that the terms "first" and "second" are only used for descriptive purposes and cannot be understood as indicating or implying relative importance or implicitly indicating the quantity of indicated technical features. Therefore, features defined by "first" and "second" can explicitly or implicitly include one or more such features. In the description of the present application, "more" refers to two or more than two, unless otherwise specified.

[0033] Compression apparatus (including a compres-

sor and a pressure vessel, where pressure in the pressure vessel is changed when the compressor is operating) are important components of an air conditioning system and a heat pump system for working. In a system containing a compression apparatus, if no measure is taken to turn off the compression apparatus when the system pressure is high, the system pressure will continue to rise, thereby generating danger.

[0034] An existing method of turning off the compression apparatus is collecting by a main control board a switch signal of the compression apparatus, outputting the signal by the main control board to a module board according to a switch signal, and controlling by the module board the compression device to be turned off. This method of turning off the compression apparatus involves a lot of elements, has slow response speed, and as long as any one element is damaged, a situation that the compression device cannot be turned off will occur, thereby leading to a serious consequence.

[0035] There are also some methods of turning off the compression apparatus: directly connecting a pressure switch to and controlling a power supply of a compressor, thereby stopping the compressor by disconnecting the power supply. However, if the power supply is a unidirectional power supply, an effect of controlling the compressor to stop cannot be achieved.

[0036] Thus, it still needs to be solved how to improve efficiency and the success rate of turning off the compression apparatus, and to improve safety factors of an air conditioning system and a heat pump system.

[0037] In view of this, the present application provides a turn-off protection system, a driving system, an overpressure turn-off system, a heat pump apparatus, and an electrical device. The turn-off protection system includes a pressure switch apparatus, a first control apparatus, a drive apparatus, and a second control apparatus. This pressure switch apparatus is turned off when a pressure of the system is detected to be overpressure and outputs a pressure switch action signal. The first control apparatus is in signal connection with the pressure switch apparatus to output a first drive signal and is used for stopping outputting the first drive signal according to the pressure switch action signal. The drive apparatus is connected to a compression apparatus to output a second drive signal to the compression apparatus after receiving the first drive signal, the second drive signal is used to drive the compression apparatus to operate. The second control apparatus is connected to the first control apparatus and the drive apparatus so as to output a fault protection signal to the drive apparatus when the pressure switch action signal and the first drive signal are obtained from the first control apparatus, where the fault protection signal is used for controlling the drive apparatus to stop outputting the second drive signal. When the system is in overpressure, the control apparatus controls the drive apparatus of the compression apparatus to stop outputting the drive signal, thereby controlling the compression apparatus to be turned off. The second control apparatus is further used for controlling the drive apparatus to stop outputting the drive signal when the system is in overpressure. The first control apparatus and the second control apparatus not only provide dual turn-off protection, but also improve efficiency and success rate of turning off the compression apparatus, as well as improve the safety factors of an air conditioning system and heat pump system.

[0038] Referring to FIG. 1, some embodiments of the present application provide a turn-off protection system 10, where the turn-off protection system 10 is in signal connection with a pressure switch apparatus 100 when in use. The pressure switch apparatus 100 is configured to be turned off when the system is detected to be overpressure and output a pressure switch action signal. The pressure of the system is, for example, a pressure of an air conditioning system, or a pressure of part of the air conditioning system (for example, a pressure of air-conditioner indoor unit).

[0039] When the system is operating normally (the system is not in overpressure), the pressure switch apparatus 100 may be in a normal closed state, and the pressure switch apparatus 100 is disconnected when the system is in overpressure. The pressure switch apparatus 100 may be in a normal open state when the system is operating normally, and the pressure switch apparatus 100 is closed when the system is in overpressure. When the pressure of the system is overpressure, the state of the pressure switch apparatus 100 is needed to be changed to a state opposite to a normal state.

[0040] The pressure switch apparatus 100 can be a switch of an external device to detect whether the system is in overpressure.

[0041] The turn-off protection system 10 includes a first control apparatus 200 and a second control apparatus 300.

[0042] The first control apparatus 200 is in signal connection with the pressure switch apparatus 100 when in use to output a first drive signal and is used for stopping outputting the first drive signal according to a pressure switch action signal, where the first drive signal is used for instructing a drive apparatus 400 of a compression apparatus 20 to drive the compression apparatus 20 to operate. The drive apparatus 400 is connected to the compression apparatus 20, the drive apparatus 400 can be understood as a drive module of a compression apparatus. The drive apparatus 400 is used for outputting a second drive signal to the compression apparatus 20 after receiving the first drive signal, the second drive signal is used for driving the compression apparatus 20 to operate. If there is no first drive signal, the drive apparatus 400 will not output the second drive signal and will not drive the compression apparatus 20 to operate. The first control apparatus 200 is, for example, a logic chip, and mechanically triggered to stop outputting the first drive signal after receiving the pressure switch action signal.

[0043] The second control apparatus 300 is connected to the first control apparatus 200, and further connected

to the drive apparatus 400 when in use, the second control apparatus 300 outputs a fault protection signal to the drive apparatus 400 upon obtaining the pressure switch action signal and the first drive signal from the first control apparatus 200. This fault protection signal is used for controlling the drive apparatus 400 to stop outputting the second drive signal to the compression apparatus 20. A purpose that the second control apparatus 300 outputs the fault protection signal to the drive apparatus 400 is to prevent a situation where the first control apparatus 300 does not stop outputting the first drive signal when the first control apparatus 200 have received the pressure switch action signal. The drive apparatus 400 can be further controlled to stop outputting the second drive signal by inputting the fault protection signal to the drive apparatus 400.

[0044] In summary, the embodiments provide a turn-off protection system 10, including a first control apparatus 200 and a second control apparatus 300. The first control apparatus 200 is in signal connection with the pressure switch apparatus 100 to output the first drive signal and is used for stopping outputting the first drive signal according to the pressure switch action signal. The pressure switch apparatus 100 is to be turned off when the pressure of the system is detected to be overpressure and outputs the pressure switch action signal. The second control apparatus 300 is connected to the first control apparatus 200, and further connected to the drive apparatus 400 of the compression apparatus 20 when in use, the second control apparatus 300 outputs a fault protection signal to the drive apparatus 400 upon obtaining the pressure switch action signal and the first drive signal from the first control apparatus 100. The fault protection signal is used to control the drive apparatus 400 to stop outputting the second drive signal to the compression apparatus 20.

[0045] So, when the system is in overpressure, the control apparatus controls the drive apparatus 400 of the compression apparatus 20 to stop outputting a drive signal, thereby controlling the compression apparatus 20 to be turned off. The second control apparatus 300 is further used for controlling the drive apparatus 400 to stop outputting drive signal when system is in overpressure. The first control apparatus 200 and the second control apparatus 300 not only provide dual turn-off protection, but also improve efficiency and success rate of turning off the compression apparatus 20, and improve safety factors of an air conditioning system and a heat pump system.

[0046] In addition, in overpressure protection, there is no need to make a software logic judgment. It is to use a signal to directly drive hardware to perform turn-off. Thus, fewer elements are needed, response is faster and safer, the efficiency and success rate of the turning off the compression apparatus 20 are improved, and the safety factors of the air conditioning system and heat pump system are improved.

[0047] Referring to FIG. 2, a turn-off protection system 10 provided by some embodiments of the present application further includes a third control apparatus 500, where the third control apparatus 500 is connected to the first control apparatus 200 and the pressure switch apparatus 100 to output a third drive signal, the third drive signal is used to drive the first control apparatus 200 to output the first drive signal. The third control apparatus 500 is further used to stop outputting the third drive signal according to the pressure switch action signal.

[0048] In some optional embodiments, the second control apparatus 300 is connected to the pressure switch apparatus 100. The second control apparatus 300 outputs a reset signal to the third control apparatus 500 according to the pressure switch action signal, the third control apparatus 500 is in signal connection with the first control apparatus 200, the third control apparatus 500 controls the first control apparatus 200 to stop outputting the first drive signal according to the pressure switch action signal.

[0049] A purpose that the second control apparatus 300 outputs the reset signal to the third control apparatus 500 is to prevent a situation where the first control apparatus 200 does not stop outputting the first drive signal when the first control apparatus 200 has received the pressure switch action signal; and to control the first control apparatus 200 to stop outputting the first drive signal through the third control apparatus 500.

[0050] Specifically, the third control apparatus 500 is used to obtain the signal outputted by the first control apparatus 200 while obtaining the pressure switch action signal. When the obtained signal that is outputted by the first control apparatus 200 is the first drive signal, the reset signal is outputted to the third control apparatus 500. Upon receiving the reset signal, the third control apparatus 500 stops outputting the third drive signal to the first control apparatus 200. More specifically, when the signal outputted by the first control apparatus 200 is determined as the first drive signal, the second control apparatus 300 outputs by a pin a fault signal of the first control apparatus 200 to the third control apparatus 500. The third control apparatus 500 stops outputting the third drive signal to the first control apparatus 200 upon receiving the fault signal of the first control apparatus 200. Therefore, controlling the first control apparatus 200 to stop outputting the first drive signal by the third control apparatus 500 can be further ensured to turn off the compression apparatus 20.

[0051] In summary, the turn-off protection system 10 provided by the embodiments further includes a third control apparatus 500. The second control apparatus 300 is used to output a reset signal to the third control apparatus 500 according to the pressure switch action signal, and the third control apparatus 500 is used to control the first control apparatus 200 to stop outputting the first drive signal according to the reset signal. In this way, if the first control apparatus 200 does not stop outputting the first drive signal after receiving the pressure switch action signal, the third control apparatus 500 can be used to further

control the first control apparatus 200 to stop outputting the first drive signal, thereby improving the success rate of turning off the compression apparatus 20.

[0052] Referring to FIG. 3, a turn-off protection system 10 provided by some embodiments of the present application further includes a signal output circuit 600. One end of the signal output circuit 600 is connected to the second control apparatus 300, and the other end thereof is connected to the drive apparatus 400. The second control apparatus 300 outputs the fault protection signal to the drive apparatus 400 through the signal output circuit 600. Optionally, the drive apparatus 400 also outputs a low-pulse feedback signal to the second control apparatus 300 through the signal output circuit 600. The low-pulse feedback signal is used to indicate that the drive apparatus 400 has stopped outputting the second drive signal.

[0053] Specifically, the fault protection signal is used to excite the signal output circuit 600 to transmit a high-level signal to the drive apparatus 400, so that the drive apparatus 400 stops outputting the second drive signal under an action of the high-level signal. The high-level signal comes from a high-level power supply connected to the signal output circuit 600, the high-level power supply can be a built-in power supply in a module where the compression device 20 is located, and may be such as a 15V power supply.

[0054] The signal output circuit 600 shown in FIG. 3 is a schematic representation of the signal output circuit 600. The signal output circuit 600 includes a first triode Q1 and a second triode Q2.

[0055] Abase electrode of the first triode Q 1 is connected to an output of the second control apparatus 300, and an emitter electrode of the first triode Q1 is grounded. An emitter electrode of the second triode Q2 is connected to the first power supply 21, a base electrode of the second triode Q2 is connected to a collector of the first triode, and a collector of the second triode Q2 is connected to a first pin of the drive apparatus 400. The first triode Q1 can be an NPN-type triode, and the second triode Q2 can be a PNP-type triode. The second control apparatus 300 firstly outputs the fault protection signal to turn on the first triode Q1, and the emitter electrode of the second triode Q2 is connected to the first power supply 21. After the first triode Q1 is turned on, the second triode Q2 is turned on. Then, the first power supply 21 outputs a high-level signal to the drive apparatus 400, and the drive apparatus 400 stops outputting the second drive signal upon receiving the high-level signal.

[0056] That is, the fault protection signal is used to turn on the first triode Q 1 and the second triode Q2, so that the drive apparatus 400 stops outputting the second drive signal after receiving by the first pin a voltage signal (i.e., the high-level signal described above) outputted by the first power supply 21.

[0057] In some optional embodiments, the signal output circuit 600 further includes a diode D1, a positive electrode of the diode D1 is connected to the collector of the second triode, and a negative electrode of the diode D1 is connected to the first pin of the drive apparatus 400. The diode D1 can filter out an impurity signal in the voltage signal (i.e., the high-level signal described above) outputted by the first power supply 21.

[0058] In some optional embodiments, the signal output circuit 600 further includes a resistor R1, resistor R2, resistor R3, and resistor R4.

[0059] One end of the resistor R1 is connected to an output of the second control apparatus 300, and the other end of the resistor R1 is connected to the base electrode of the first triode Q1. One end of the resistor R2 is connected to the collector of the first triode Q1, and the other end of the resistor R2 is connected to the base electrode of the second triode Q2. One end of the resistor R3 is connected to the other end of the resistor R2; and the base electrode of the second triode Q2, and the other end of the resistor R3 is connected to an output of the first power supply 21. One end of the resistor R4 is connected to the negative electrode of the diode D1, and the other end of the resistor R4 is connected to the first pin of the drive apparatus 400.

[0060] The function of the resistors R1, R2, R3, and R4 is to stabilize the transmission of signals, to improve a probability that the drive apparatus 400 successfully receives the voltage signal (i.e., the high-level signal as described above) outputted by the first power supply 21, thereby improving the probability of turning off the compression apparatus 20.

[0061] In some optional embodiments, the drive apparatus 400 further includes a second pin, the second pin is connected to a first feedback pin of the second control apparatus 300, and a power supply (3.3V power supply as shown in FIG. 3) is further provided on a connection link. When the drive apparatus 400 stops outputting the second drive signal, a pulse signal is transmitted to the first feedback pin through the second pin. If the second control apparatus 300 does not receive the pulse signal, the fault protection signal can be transmitted to the drive apparatus 400 again so as to trigger the drive apparatus 400 again to stop outputting the second drive signal. In this way, the success rate of controlling the drive apparatus 400 to stop outputting the second drive signal is improved through pulse signal feedback, thereby improving the success rate of turning off the compression apparatus 20 when the system is in overpressure.

[0062] Multiple resistors (two resistors are exemplarily shown in FIG. 3) can be further provided on a line connecting the second pin of the drive apparatus 400 to the first feedback pin of the second control apparatus 300, the multiple resistors are used to stabilize the signal outputted by the drive apparatus 400 and filter out some of impurity signals.

[0063] In summary, the turn-off protection system 10 provided by these embodiments further includes a signal output circuit 600. The signal output circuit 600 is provided with a first triode Q1 and a second triode Q2 that can be sequentially turned on. The base electrode of the first

triode Q1 is connected to the output of the second control apparatus 300, and the emitter electrode of the first triode Q1 is grounded. The emitter electrode of the second triode Q2 is connected to the first power supply 21, the base electrode of the second triode Q2 is connected to the collector of the first triode, and the collector of the second triode Q2 is connected to the first pin of the drive apparatus 400. The fault protection signal turning on the first triode Q1 causes the second triode Q2 to be turned on, so that the drive apparatus 400 stops outputting the second drive signal after receiving by the first pin the voltage signal outputted by the first power supply 21. By the signal output circuit 600, the success rate of controlling the drive apparatus 400 to stop outputting the second drive signal can be improved, thereby improving the success rate of turning off the compression apparatus 20 when the system is in overpressure.

[0064] Referring to FIG. 4, a turn-off protection system 10 provided by some embodiments of the present application further includes the pressure switch apparatus 100 described above. The pressure switch apparatus 100 includes a pressure detection switch 110.

[0065] As shown in FIG. 4, one end of the pressure detection switch 110 is connected to an enable pin of the first control apparatus 200, and further connected to a pin of the third control apparatus 500, as well as connected to a second power supply 22. The second power supply 22 may be a built-in power supply in a module board where the compression apparatus 20 is located, and may be, for example, a 3.3 V power supply. The other end of the pressure detection switch 110 is grounded.

[0066] When the pressure detection switch 110 is closed, the enable pin of the first control apparatus 200 is grounded, and the pin of the second control apparatus 300 and the pin of the third control apparatus 500 cannot receive a voltage signal, that is, the pin of the second control apparatus 300 and the pin of the third control apparatus 500 cannot receive the pressure switch action signal.

[0067] When the pressure detection switch 110 is turned off, the voltage signal that is outputted by the second power supply 22 and received by the enable pin of the first control apparatus 200 is the pressure switch action signal. Similarly, the voltage signal that is outputted by the second power supply 22 and received by the second control apparatus 300 and the third control apparatus 500 is the pressure switch action signal.

[0068] In some optional embodiments, the pressure switch apparatus 100 further includes a resistor R5, resistor R6, resistor R7, and resistor R8.

[0069] One end of the resistor R5 is connected to the second power supply 22, and the other end of the resistor R5 is connected to one end of the pressure detection switch 110, and further connected to the enable pin of the first control apparatus 200. One end of the resistor R6 is connected to the second power supply 22, and the other end of the resistor R6 is connected to the other end of the resistor R5, and further connected to the enable pin of the first control apparatus 200. The resistor R5 and the resistor R6 are in a parallel state. A function of the resistors R5 and R6 is to stabilize a voltage signal outputted by the second power supply 22 when the pressure detection switch 110 is turned off due to overpressure of the system, and filter out some of impurity signals in the voltage signal.

[0070] One end of the resistor R7 is connected to one end of the pressure detection switch 110, and further connected to the enable pin of the first control apparatus 200, and the other end of the resistor R7 is connected to the pin of the second control apparatus 300. One end of the resistor R8 is connected to one end of the resistor R7, and further connected to the enable pin of the first control apparatus 200, and the other end of the resistor R8 is connected to another pin of the second control apparatus 300. A function of the resistors R7 and R8 is to stabilize the voltage signal outputted by the second power supply 22 and filter out some of impurity signals in the voltage signal when the pressure detection switch 110 is turned off due to overpressure of the system.

[0071] In summary, the pressure switch apparatus 100 in the turn-off protection system 10 provided by these embodiments include a pressure detection switch 110, the pressure detection switch 110 is connected to a second power supply 22, and is further connected to the first control apparatus 200, the second control apparatus 300, and the third control apparatus 500, respectively. When the system is not in overpressure, the pressure detection switch 110 is in a normally closed state, and the enable pin of the first control apparatus 200 does not receive the pressure switch action signal. Similarly, neither the second control apparatus 300 nor the third control apparatus 500 receives the pressure switch action signal. When the system is in overpressure, the pressure detection switch 110 is turned off, the voltage signal that is outputted by the second power supply 22 and received by first control apparatus 200, the second control apparatus 300 and the third control apparatus 500 is the pressure switch action signal.

[0072] Referring to FIG. 5, in a turn-off protection system 10 provided by some embodiments of the present application, the first control apparatus 200 includes N bridge arm pulse width modulation, PWM, circuits 210, and the number of N is determined by the requirements of the drive apparatus 400. FIG. 5 shows that the first control apparatus 200 includes two bridge arm PWM circuits 210, namely an upper bridge arm 3-channel PWM circuit 210 and a lower bridge arm 3-channel PWM circuit 210. Each bridge arm PWM circuit 210 includes a triode, and the first control apparatus 200 includes a triode array.

[0073] The N bridge arm PWM circuits 210 are all driven to be turned on by the third drive signal outputted by the third control apparatus 500. In order to prevent mutual influence between the bridge arm PWM circuits 210, conduction time of each bridge arm PWM circuit 210 in the N bridge arm PWM circuits 210 can be different. The third drive signal outputted by the third control apparatus 500

is a pulse signal, and the first drive signal outputted by the first control apparatus 200 is also a pulse signal. Optionally, the first control apparatus 200 can be an 8-channel buffer.

[0074] In some optional embodiments, the turn-off protection system further includes a first protection apparatus 700 and a second protection apparatus 800. One ends of the first protection apparatus 700 and the second protection apparatus 800 are both connected to the drive apparatus 400, and the other ends of the first protection apparatus 700 and the second protection apparatus 800 are both connected to the first control apparatus 200. The first protection apparatus 700 and the second protection apparatus 800 are both used to buffer the output of the first control apparatus 200.

[0075] Optionally, the first protection apparatus 700 includes a first resistor R9 and a first capacitor C1. One end of the first resistor R9 is connected to a bridge arm PWM circuit 210 (the upper bridge arm 3-channel PWM circuit 210 shown in FIG. 5), and the other end of the first resistor R9 is connected to the drive apparatus 400. One end of the first capacitor C1 is connected to the other end of the first resistor R9, and the other end of the first capacitor C1 is grounded. The first resistor R9 and the first capacitor C1 can stabilize and buffer the first drive signal outputted by the upper bridge arm 3-channel PWM circuit 210.

[0076] Optionally, the second protection apparatus 800 includes a second resistor R10, a third resistor R11, and a second capacitor C2. One end of the second resistor R10 is connected to a bridge arm PWM circuit 210 (the lower bridge arm 3-channel PWM circuit 210 shown in FIG. 5), and the other end of the second resistor R10 is connected to the drive apparatus 400. One end of the third resistor R11 is connected to one end of the second resistor R10, and the other end of the third resistor R11 is grounded. One end of the second capacitor C2 is connected to the other end of the second resistor R10, and the other end of the second capacitor C2 is grounded.

[0077] The second resistor R10, the third resistor R11, and the second capacitor C2 can stabilize and buffer the first drive signal outputted by the lower bridge arm 3-channel PWM circuit 210.

[0078] The resistance values of the first resistor R9, the second resistor R10, and the third resistor R11 can be selected according to actual needs, and these embodiments have no limitation on this.

[0079] The specifications of the first capacitor C1 and the second capacitor C2 can be selected according to actual needs, and these embodiments have no limitation on this.

[0080] In some optional embodiments, a circuit, which is used for transmitting the output signal of the first control apparatus 200 and is between the first control apparatus 200 and the second control apparatus 300, includes a resistor R12 and a capacitor C3.

[0081] One end of the resistor R12 is connected to the output of the first control apparatus 200 (for example, connected to the lower bridge arm PWM circuit 210 shown in FIG. 5), and the other end of the resistor R12 is connected to the pin of the second control apparatus 300. One end of the capacitor C3 is connected to one end of the resistor R12, and the other end of the capacitor C3 is grounded. The resistor R12 and the capacitor C3 can stabilize the signal outputted by the first control apparatus 200, and can filter out an impurity signal in the signal outputted by the first control apparatus 200.

[0082] In summary, in the turn-off protection system provided by the above embodiments of the present application, the first control apparatus 200 controls the drive apparatus 400 of the compression apparatus 20 to stop outputting a drive signal when the system is in overpressure, thereby controlling the compression apparatus 20 to be turned off. During overpressure protection, there is no need to make software logic judgments. It is to use a signal to directly drive hardware to perform turn-off, fewer elements are needed, the response is faster and safer, the efficiency and success rates of turning off the compression apparatus 20 are improved, and the safety factors of the air conditioning system and heat pump system are improved.

[0083] It should also be noted that the type of power supply in the turn-off protection system provided in the above embodiments of the present application is not limited, and the power supply can be a unidirectional power supply.

[0084] Referring to FIG. 6, a turn-off protection system 10 provided by some embodiments of the present application further includes the drive apparatus 400. The model and specification of the drive apparatus 400 can be selected according to actual needs, and these embodiments have no limitation on this. The drive apparatus 400 determines the number of PWM circuits 210 in the first control apparatus 200.

[0085] Referring to FIG. 7, some embodiments of the present application further provide a heat pump apparatus 30, where the heat pump apparatus includes the turn-off protection system 10 provided by any one of the above embodiments, as well as a compression apparatus 20 and a heat-exchange apparatus 31 for heating liquid water. The heat pump apparatus 30, such as a heat pump swimming pool machine, is generally installed at an edge of a swimming pool to heat the water in the swimming pool. The compression apparatus 20 can be provided inside or outside of the heat-exchange apparatus 31.

[0086] Referring to FIG. 8, some embodiments of the present application further provide an electrical device 40, where the electrical device 40 includes the heat pump apparatus 30 as provided in any one of the above embodiments, and may further include other apparatus, which is not limited in these embodiments.

[0087] Referring to FIG. 9, some embodiments of the present application provide a driving system 50, where the driving system 50 includes the turn-off protection system 10 as provided in any one of the above embodiments, and further includes a drive apparatus 400. The drive

apparatus 400 is connected to the compression apparatus 20 when in use, so as to output the second drive signal to the compression apparatus 20 after receiving the first drive signal outputted by the first control apparatus 200, and then drive the compression apparatus 20 to operate. The model and specification of the drive apparatus 400 can be selected according to actual needs, and these embodiments have no limitation on this. The number of the PWM circuits 210 in the first control apparatus 200 is determined by the drive apparatus 400. The driving system 50 may further include the pressure switch apparatus 100 as described above.

[0088] Referring to FIG. 10, some embodiments of the present application provide an overpressure turn-off system 60, where the overpressure turn-off system 60 includes the turn-off protection system 10 provided in any one of the above embodiments, and further includes a pressure switch apparatus 100, where the pressure switch apparatus 100 is turned off when the system is detected to be overpressure, and outputs a pressure switch action signal. For the description of the pressure switch apparatus 100, please refer to the description of the pressure switch apparatus 100 when describing the turn-off protection system 10 in the above embodiments, and it will not be repeated here. The overpressure turn-off system 60 can further include the drive apparatus 400 as described above.

[0089] It should be noted that in this description, the terms "includes", "comprises", or any other variation thereof are intended to cover non-exclusive inclusion, so that a process, method, article, or apparatus that includes a series of elements not only includes those elements, but further include other elements that are not explicitly listed, or include elements inherent in such process, method, article, or apparatus. Without limitations, the element limited by the statement "including a..." does not exclude the existence of another identical element in the process, method, article, or apparatus that includes this element.

[0090] The serial numbers of the above embodiments in the present application are only for description and do not represent the advantages or disadvantages of the embodiments.

Claims

1. A turn-off protection system (10), comprising:

a first control apparatus (200), configured to be in signal connection with a pressure switch apparatus (100) when in use to output a first drive signal and further configured to stop outputting the first drive signal according to a pressure switch action signal, wherein the pressure switch apparatus (100) is configured to be turned off when a pressure of the system is detected to be overpressure and output the pressure switch action signal, wherein the first drive signal is used for instructing a drive apparatus (400) of a compression apparatus (20) to drive the compression apparatus (20) to operate; and

a second control apparatus (300), configured to be connected to the first control apparatus (200), and further connected to the drive apparatus (400) when in use, wherein the second control apparatus (300) is used for outputting a fault protection signal to the drive apparatus (400) upon obtaining the pressure switch action signal and the first drive signal from the first control apparatus (200), and the fault protection signal is used for controlling the drive apparatus (400) to stop outputting a second drive signal to the compression apparatus (20).

2. The turn-off protection system (10) according to claim 1, further comprising:

a third control apparatus (500), configured to be connected to the first control apparatus (200) and the pressure switch apparatus (100) to output a third drive signal and further configured to stop outputting the third drive signal according to the pressure switch action signal, wherein the third drive signal is used for driving the first control apparatus (200) to output the first drive signal.

3. The turn-off protection system (10) according to claim 2, further comprising:

a signal output circuit (600), wherein one end of the signal output circuit (600) is connected to the second control apparatus (300) and the other end of the signal output circuit (600) is connected to the drive apparatus (400).

4. The turn-off protection system (10) according to claim 3, wherein the signal output circuit (600) comprises:

a first triode (Q1), wherein a base electrode of the first triode (Q1) is connected to an output of the second control apparatus (300) and an emitter electrode of the first triode (Q1) is grounded; and

a second triode (Q2), wherein an emitter electrode of the second triode (Q2) is connected to a first power supply (21), a base electrode of the second triode (Q2) is connected to a collector of the first triode (Q1), and a collector of the second triode (Q2) is connected to a first pin of the drive apparatus (400);

wherein the fault protection signal is used to turn on the first triode (Q1) and the second triode (Q2), so that the drive apparatus (400) stops outputting the second drive signal after receiving by the first pin a voltage signal outputted by the first power supply (21).

5. The turn-off protection system (10) according to claim 4, wherein the signal output circuit (600) further comprises:
a diode (D1), wherein a positive electrode of the diode (D1) is connected to the collector of the second triode (Q2) and a negative electrode of the diode (D1) is connected to the first pin.

6. The turn-off protection system (10) according to claim 3, wherein the drive apparatus (400) further comprises a second pin connecting to a first feedback pin of the second control apparatus (300); and a pulse signal is transmitted to the first feedback pin through the second pin when the drive apparatus (400) stops outputting the second drive signal.

7. The turn-off protection system (10) according to claim 2, further comprising a pressure switch apparatus (100), wherein the pressure switch apparatus (100) comprises:

a pressure detection switch (110), wherein one end of the pressure detection switch (110) is connected to an enable pin of the first control apparatus (200), further connected to pins of the second control apparatus (300) and the third control apparatus (500), respectively, and further connected to a second power supply (22), and the other end of the pressure detection switch (110) is grounded; the pressure detection switch (110) is configured to be turned off when the pressure of the system is detected to be overpressure;
the enable pin of the first control apparatus (200) is grounded when the pressure detection switch (110) is turned on; and
a voltage signal that is outputted by the second power supply (22) and received by the enable pin of the first control apparatus (200) is the pressure switch action signal when the pressure detection switch (110) is turned off, or, wherein the second control apparatus (300) is further connected to the third control apparatus (500); and the second control apparatus (300) is configured to transmit a reset signal to the third control apparatus (500) upon obtaining the pressure switch action signal and the first drive signal from the first control apparatus (200), and the reset signal is used for controlling the third control apparatus (500) to stop outputting the third drive signal.

8. The turn-off protection system (10) according to any one of claims 1-7, wherein the first control apparatus (200) comprises N bridge arm pulse width modulation, PWM, circuits, each bridge arm PWM circuit (210) has a different conduction time, and N is an integer greater than 1.

9. The turn-off protection system (10) according to claim 8, wherein each bridge arm PWM circuit (210) comprises a triode, or, wherein the first control apparatus (200) comprises an 8-channel buffer.

10. The turn-off protection system (10) according to claim 8, further comprising: a first protection apparatus (700) and a second protection apparatus (800); wherein one ends of the first protection apparatus (700) and the second protection apparatus (800) are both connected to the drive apparatus (400), and the other ends of the first protection apparatus (700) and the second protection apparatus (800) are both connected to the first control apparatus (200) to buffer an output of the control apparatus, optionally, wherein the first protection apparatus (700) comprises:

a first resistor (R9), wherein one end of the first resistor (R9) is connected to a bridge arm PWM circuit (210) and the other end of the first resistor (R9) is connected to the drive apparatus (400); and
a first capacitor, wherein one end of the first capacitor is connected to the other end of the first resistor (R9) and the other end of the first capacitor is grounded, or, wherein the second protection apparatus (800) comprises:

a second resistor (R10), wherein one end of the second resistor (R10) is connected to a bridge arm PWM circuit (210) and the other end of the second resistor (R10) is connected to the drive apparatus (400);
a third resistor (R11), wherein one end of the third resistor (R11) is connected to one end of the second resistor (R10) and the other end of the third resistor (R11) is grounded; and
a second capacitor, wherein one end of the second capacitor is connected to the other end of the second resistor (R10) and the other end of the second capacitor is grounded.

11. The turn-off protection system (10) according to claim 1, further comprising:
a drive apparatus (400), configured to be connected to the compression apparatus (20) when in use so as to output the second drive signal to the compression apparatus (20) after receiving the first drive signal when the drive apparatus (400) is in use, wherein the second drive signal is used for driving the compression apparatus (20) to operate.

12. A heat pump apparatus (30), comprising the turn-off protection system (10) according to any one of claims 1-10, and further comprising:

a compression apparatus (20);
a heat-exchange apparatus (31) for heating liquid water.

13. An electrical device (40), comprising the heat pump apparatus (30) according to claim 16.

14. A driving system (50), comprising the turn-off protection system (10) according to any one of claims 1-10, and further comprising:
a drive apparatus (400), configured to be connected to the compression apparatus (20) when in use to output the second drive signal to the compression apparatus (20) after receiving the first drive signal outputted by the first control apparatus (200), so as to drive the compression apparatus (20) to operate.

15. An overpressure turn-off system (60), comprising the turn-off protection system (10) according to any one of claims 1-10, and further comprising:
a pressure switch apparatus (100), configured to be turned off when the pressure of the system is detected to be overpressure and to output a pressure switch action signal.

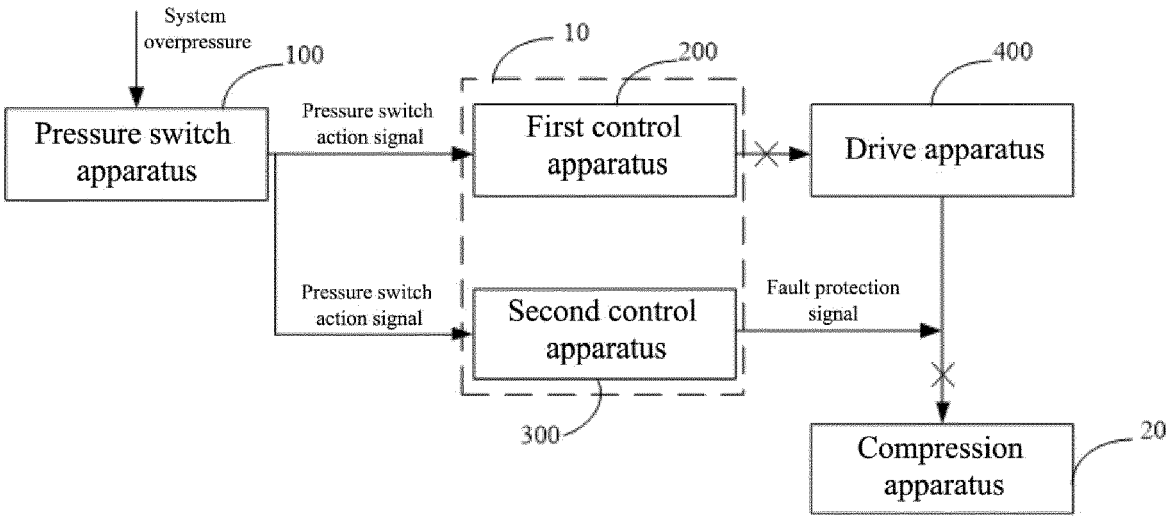
System overpressure
100
10
200
400
Pressure switch apparatus
Pressure switch action signal
First control apparatus
Drive apparatus
Pressure switch action signal
Second control apparatus
Fault protection signal
300
Compression apparatus
20

FIG. 1

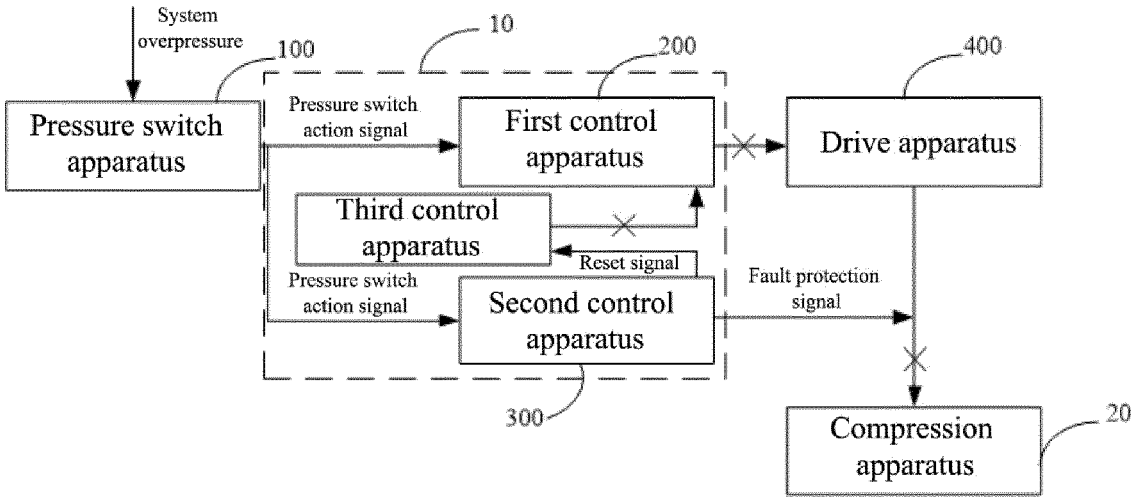
System overpressure
100
10
200
400
Pressure switch apparatus
Pressure switch action signal
First control apparatus
Drive apparatus
Third control apparatus
Reset signal
Pressure switch action signal
Second control apparatus
Fault protection signal
300
Compression apparatus
20

FIG. 2

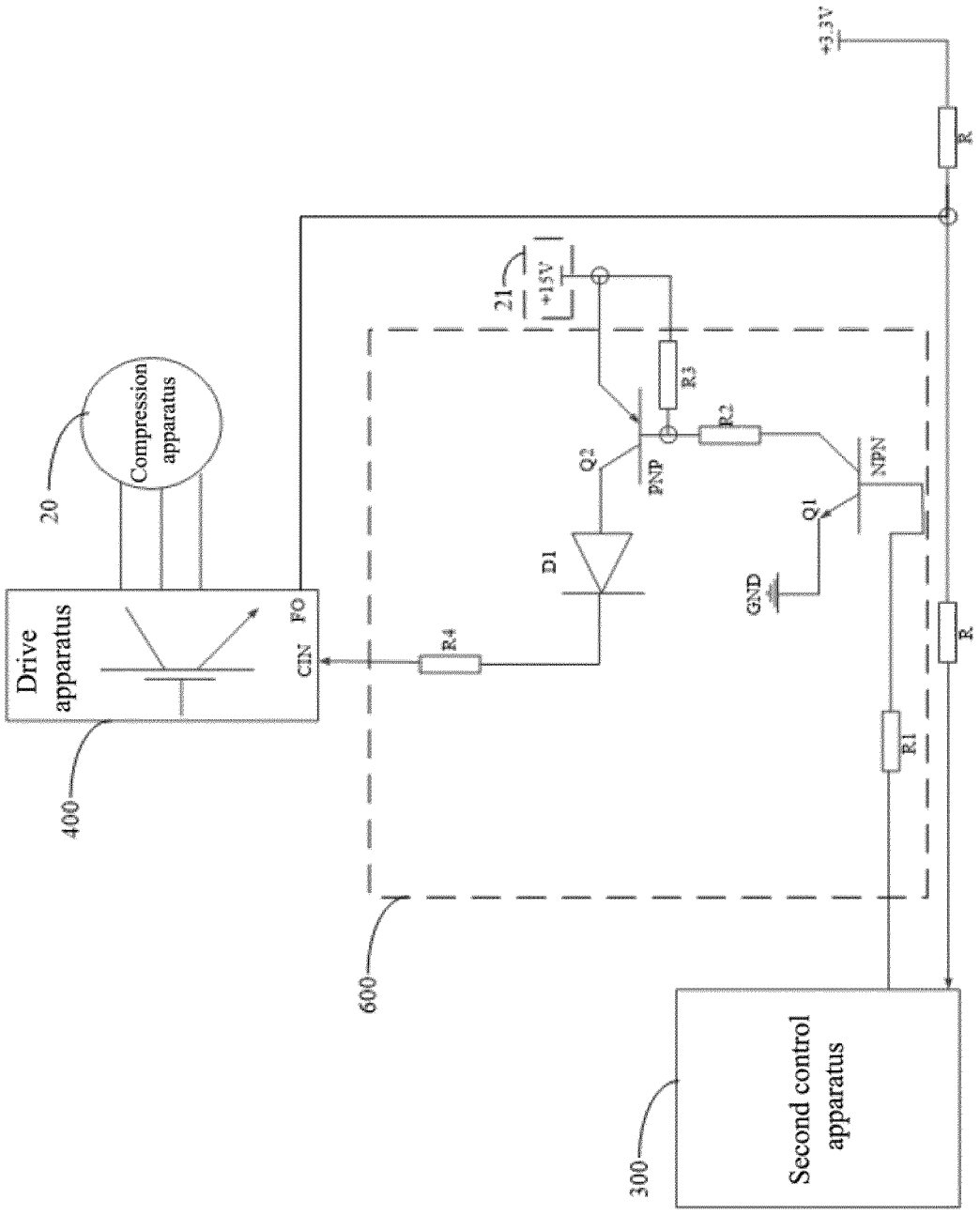
+3.3V
R
21
+15V
R3
R2
Q2
PNP
NPN
Q1
D1
GND
R
R1
R4
Compression apparatus
20
Drive apparatus
FO
CIN
400
600
300
Second control apparatus

FIG. 3

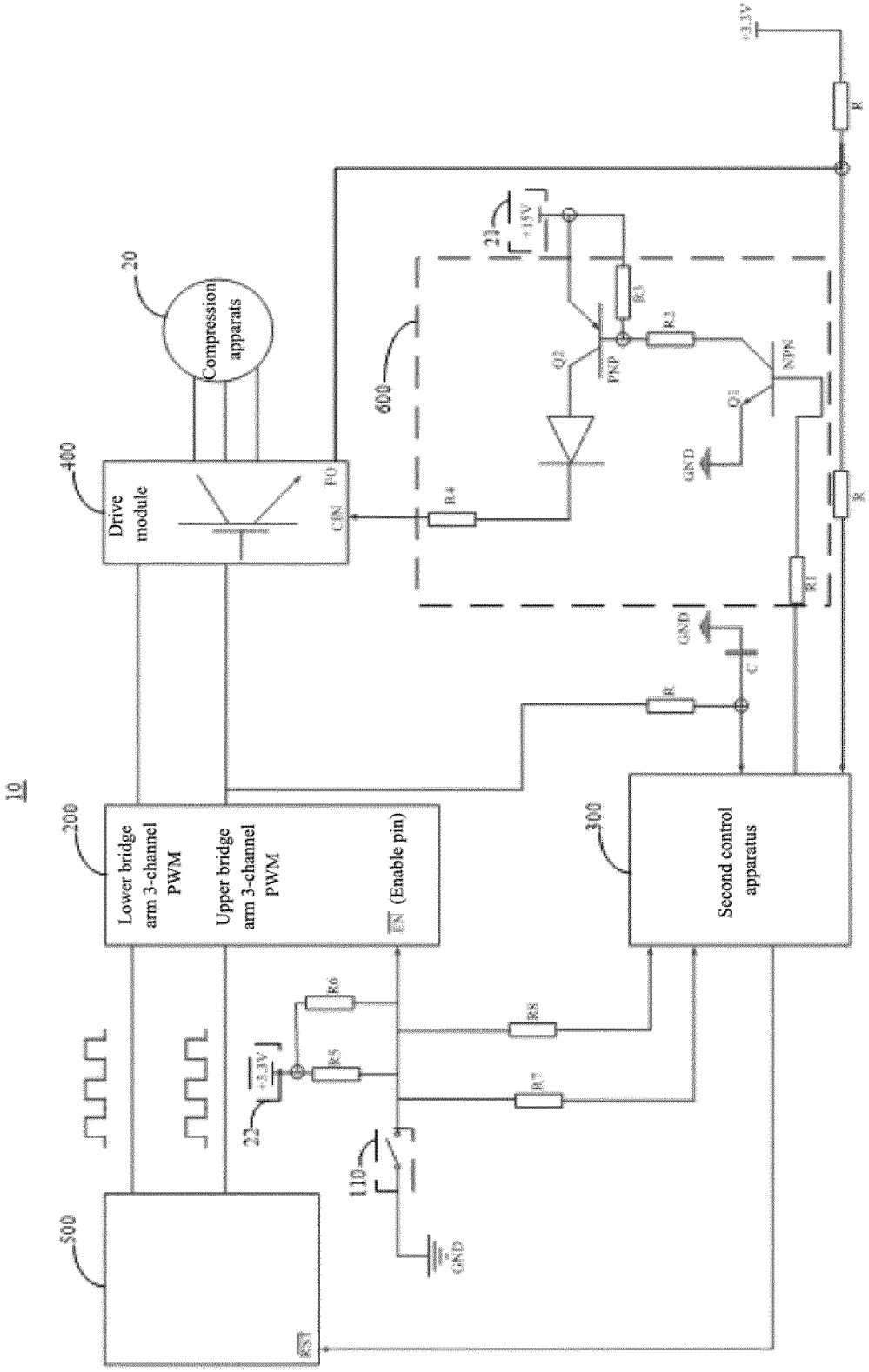
10
20
Compression apparats
400
Drive module
FO
CIN
600
21
+15V
R3
R2
Q2
PNP
NPN
Q1
GND
R4
R
RT
C1
200
Lower bridge arm 3-channel PWM
Upper bridge arm 3-channel PWM
EN (Enable pin)
300
Second control apparatus
R6
R5
+3.3V
22
R8
R7
110
500
GND

FIG. 4

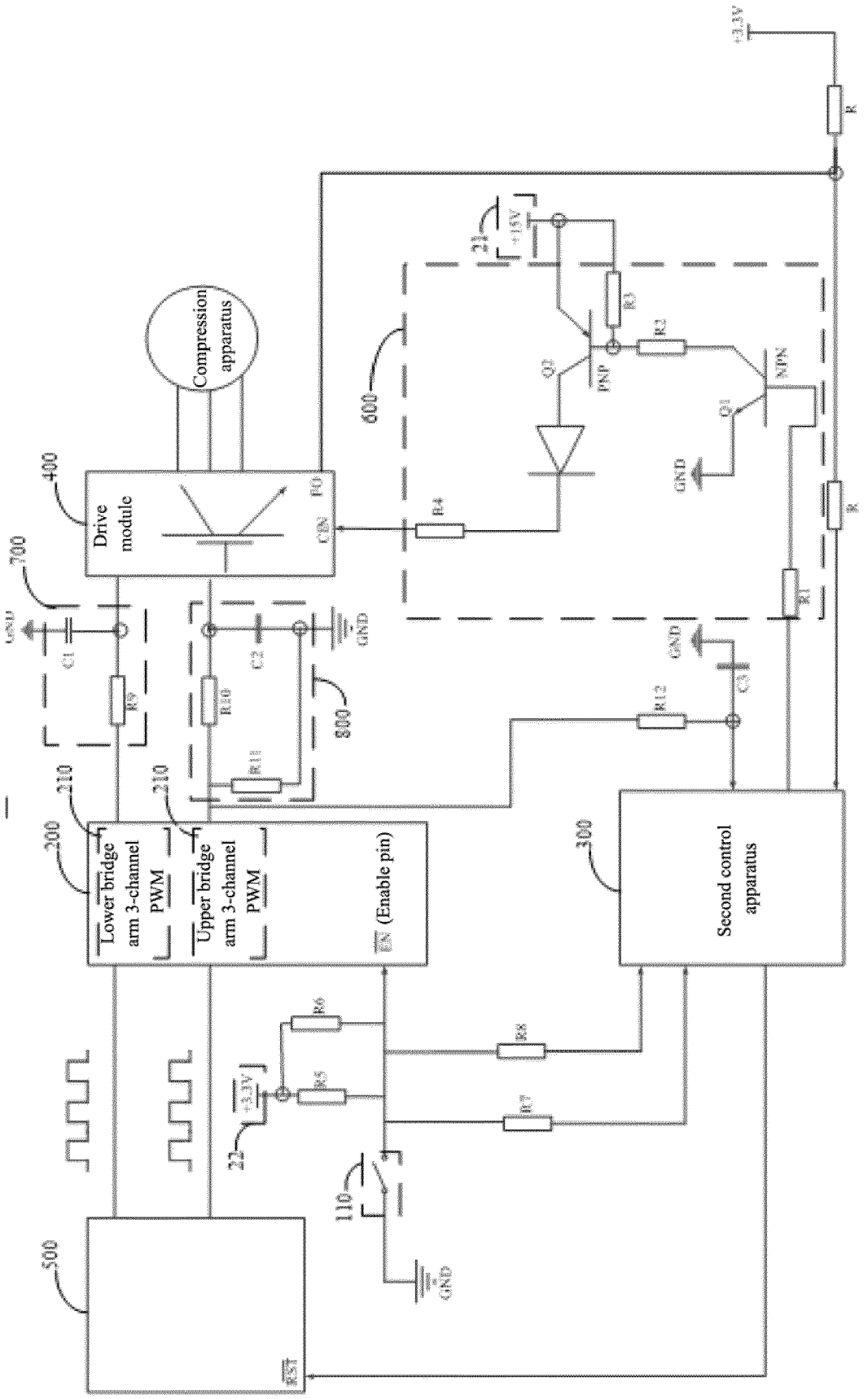
Compression apparatus
Drive module
400
700
600
800
500
200
210
300
Lower bridge arm 3-channel PWM
Upper bridge arm 3-channel PWM
EN (Enable pin)
Second control apparatus
RST
GND
+3.3V
+15V
21
22
110
Q1
Q2
NPN
PNP
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
C1
C2
C3

FIG. 5

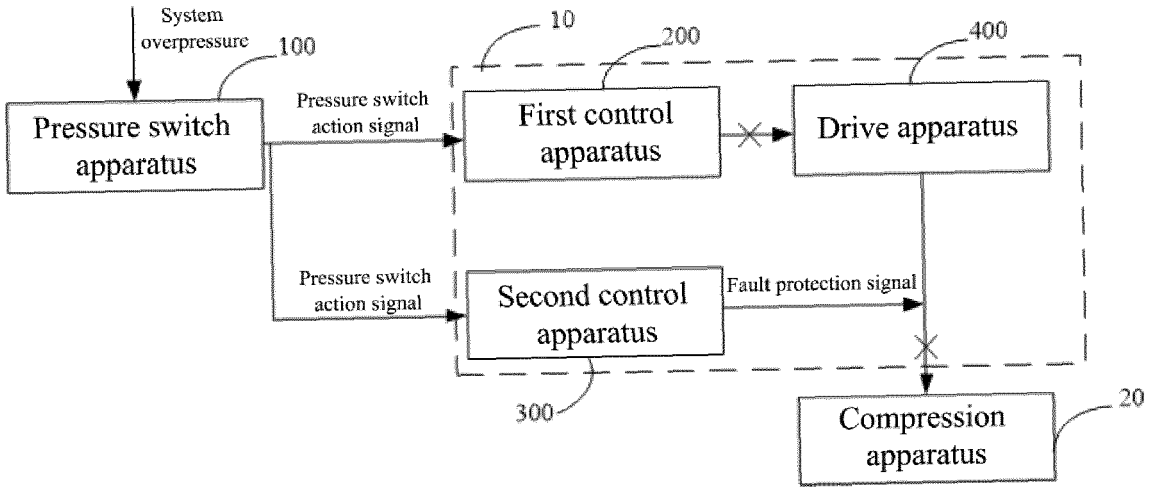
System overpressure
100
Pressure switch apparatus
Pressure switch action signal
10
200
First control apparatus
400
Drive apparatus
Pressure switch action signal
Second control apparatus
Fault protection signal
300
Compression apparatus
20

FIG. 6

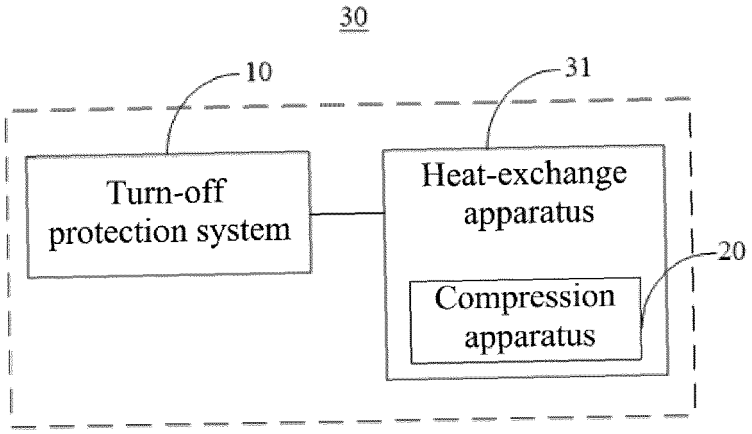
30
10
31
Turn-off protection system
Heat-exchange apparatus
Compression apparatus
20

FIG. 7

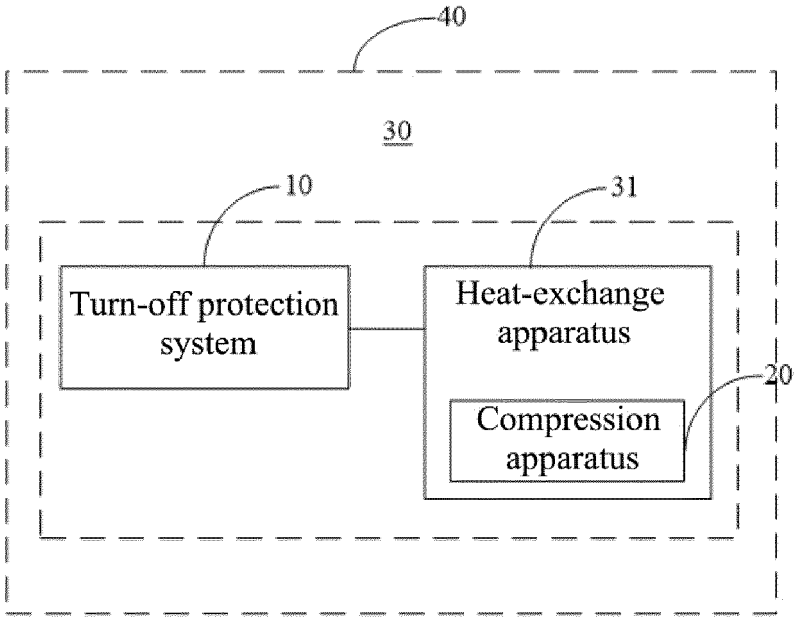

FIG. 8

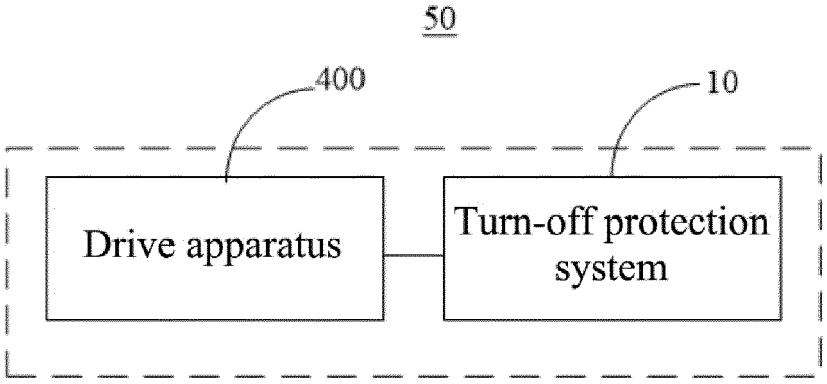

FIG. 9

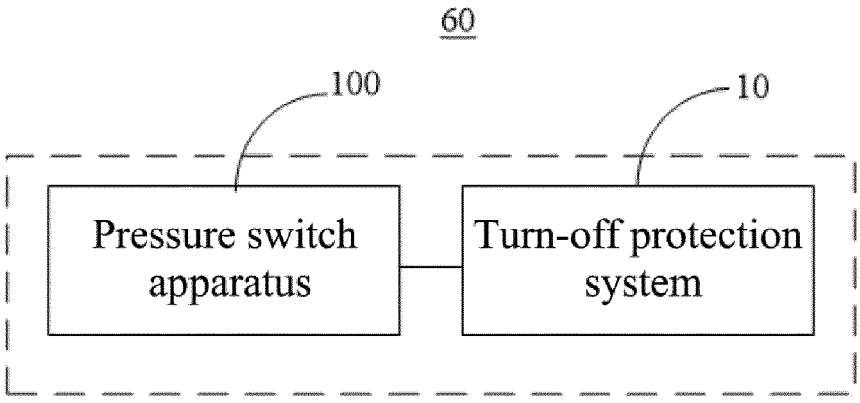

FIG. 10

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 23 19 0023

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 3 450 882 A1 (LG ELECTRONICS INC [KR]) 6 March 2019 (2019-03-06) * paragraphs [0044] - [0065]; figures * * claims 1-5 *	1-15	INV. F04B41/02 F04B49/02 F04B49/06 F04B49/08 F04B49/10
A	KR 2019 0072893 A (LG ELECTRONICS INC [KR]) 26 June 2019 (2019-06-26) * abstract *; figures * * paragraphs [0013] - [0023] *	1-15	
A	US 2017/037842 A1 (OHKUBO SHINICHI [JP] ET AL) 9 February 2017 (2017-02-09) * abstract *paragraph 74-78; claims; figures 1-4 *	1-15	

TECHNICAL FIELDS SEARCHED (IPC)

F04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	27 November 2023	Pinna, Stefano

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 23 19 0023

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

27-11-2023

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 3450882 A1	06-03-2019	EP 3450882 A1	06-03-2019
		KR 20190023609 A	08-03-2019
KR 20190072893 A	26-06-2019	NONE	
US 2017037842 A1	09-02-2017	CN 106438295 A	22-02-2017
		DK 3128171 T3	14-12-2020
		EP 3128171 A1	08-02-2017
		EP 3779191 A1	17-02-2021
		JP 7010578 B2	26-01-2022
		JP 2017036676 A	16-02-2017
		US 2017037842 A1	09-02-2017
		US 2020173434 A1	04-06-2020