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(54) Pressurization system of a cooling circuit of a utility vehicle

(57) The invention relates to a pressurization system (10, 100) of a cooling circuit of a utility vehicle, comprising a coolant tank (14), a pressure source (12) and a pressurization line (16) connecting the pressure source (12) and the coolant tank (14) and comprising a first pressure limiting valve (18), a solenoid valve (20) arranged in line with the first pressure limiting valve (18) and control means (42) for controlling the operation state of the solenoid valve (20) dependent on an operation state of the vehicle. The solenoid valve (20) is disposed between the first pressure limiting valve and (18) the coolant tank (14) as a 3/2-way valve comprising a first port (22) communicating with the first pressure limiting valve (18), a second port (32) communicating with the coolant tank (14), and a third port (36) communicating with a second pressure limiting valve (40, 104), wherein the first port (22) and second port (32) are flow connected in the activated state of the solenoid valve (20), and the third port (36) and second port (32) are flow connected in the deactivated state of the solenoid valve (20).

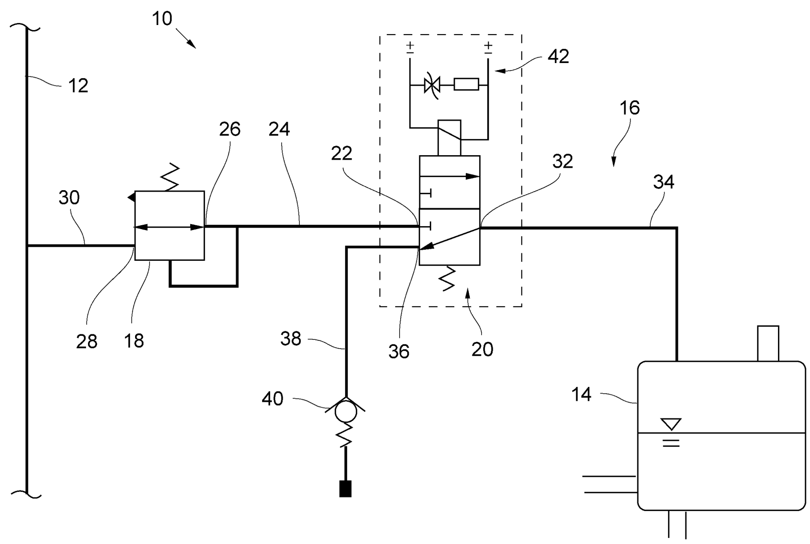

Fig. 1

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Description

[0001] The present invention is related to a pressurization system of a cooling circuit of a utility vehicle, according to the preamble of claim 1.

[0002] In utility vehicles, it is common to pressurize the cooling circuit for cooling the motor to a certain pressure, for example, to avoid boiling of the cooling fluid (i. e. water) or cavitation within the cooling circuit. Usually the coolant tank of the vehicle is pressurized by a pressure source like the common air pressure circuit of the vehicle, that is also used for other purposes.

[0003] The pressure of the common pressure circuit is usually very high, for example, in the region of about 9 bar (900 kPa) absolute pressure (abs). For pressurizing the cooling circuit by means of this pressure source, this high pressure must be reduced down to a value of, for example, 1,6 bar (160 kPa) (abs). For this reason a pressure limiting valve can be disposed within the pressurizing line connecting the pressure source and the coolant tank. Such a pressure limiting valve is provided with an inlet port and an outlet port, with the high pressure of the pressure source acting on the inlet port and being reduced to a constant predetermined output pressure in the outlet port to be supplied to the coolant tank. By means of this pressure limiting valve, the coolant tank is protected from an overpressure. In many applications it is desired to control the pressure within the cooling circuit dependent on an operation state of the utility vehicle. For example, these operation states may include the on/off state of the motor (i. e. the ignition), the operation state of the water pump, the temperature within the cooling circuit, or other conditions. To control the pressure within the cooling circuit accordingly, a solenoid valve can also be disposed within the pressurization line that is operated dependent on the operation state of the vehicle, as described above. Control means serve to control the operation of the solenoid valve. In this arrangement, the solenoid valve is activated only if predetermined conditions are fulfilled. It can further be desired to control a pressure applied to the coolant tank such that different predetermined pressure levels can be applied according to different operating states of the vehicle. For example, DE 10 2007 058 575 B4 discloses a pressurization system of the above kind with two different pressure limiting valves in two parallel branches of the pressurization line connecting the pressure source with the coolant tank. Within each branch, a solenoid valve is arranged in front of the respective pressure limiting valve so that the high pressure of the pressure source is applied to the respective pressure limiting valve only in case the solenoid valve is activated. This activation is controlled by electronic control means dependent on operation states of the vehicle. With the first and second pressure limiting valves in the two branches being set to different output pressures to be supplied to the coolant tank, it is possible to pressurize the coolant tank with a desired pressure by activation of the respective first or second solenoid valve in the corresponding branch, while deactivating the respective other solenoid valve to cut off the other branch.

[0004] Because of the layout of this known pressurization system, there is the disadvantage that not only one pressure limiting valve is necessary for each branch also one solenoid valve allocated to this pressure limiting valve, each solenoid valve being connected to a common control means.

[0005] It is therefore an object of the present invention to simplify the pressurization system of the cooling circuit of the above kind in such a way that the coolant tank can be pressurized with a certain limited pressure with a layout with a reduced number of components.

[0006] This object is achieved by a pressurization system comprising the features of claim 1.

[0007] According to the present invention, one solenoid valve is disposed between a first pressure limiting valve and the coolant tank. This solenoid valve is a 3/2-way valve, comprising a first port, a second port and a third port. Its first port communicates with the first pressure limiting valve, the second port communicates with the coolant tank, and the third port communicates with a second pressure limiting valve. In the activated state of the solenoid valve, the first port and the second port are flow connected to connect the coolant tank with the first pressure limiting valve. In this activated state, a pressure from the pressure source is reduced down to a first lower pressure to be supplied to the coolant tank via a solenoid valve. If the solenoid valve is deactivated, the first port and the third port are flow connected to connect the coolant tank with the second pressure limiting valve.

[0008] In this arrangement, only one solenoid valve is necessary to pressurize the coolant tank with a predetermined pressure. This 3/2-way valve can be controlled accordingly by an electronic control means according to an operation state of the vehicle.

[0009] According to one preferred embodiment of the present invention, the second pressure limiting valve is a venting valve with an opening pressure being a second pressure different from the first pressure. In this arrangement, in the deactivated state of the solenoid valve, the coolant tank is flow connected to the venting valve so that an over pressure (i. e. a pressure higher than the opening pressure of the venting valve) is reduced by opening the venting valve and reducing the pressure within the coolant tank down to the second pressure. According to another preferred embodiment of the present invention, the second pressure limiting valve is a pressure reducing valve for reducing the pressure supplied to the coolant tank to a second pressure different from the first pressure. By activating and disactivating the solenoid valve according to an operation state of the vehicle, the coolant tank can be pressurized either with the first pressure via the first pressure limiting valve and the third port or via the second pressure limiting valve (being also a pressure reducing valve) and the third port. With other words, the solenoid valve can switch between the first and second pressure limiting valves, being set to different pressures, to pressurize the coolant tank accordingly.

[0010] Preferably the second pressure is lower than the first pressure. For example, if the pressure of the pressure source is about 900 kPa or 9 bar (abs), the first pressure may be 160 kPa or 1,6 bar (abs), while the second pressure may be 130 kPa or 1,3 bar (abs).

[0011] More preferably, the solenoid valve is activated only if at least a first condition is fulfilled according to which the vehicle ignition is activated.

[0012] More preferably, the solenoid valve is activated only if at least a second condition is fulfilled according to which the front hatch of the vehicle is closed.

[0013] According to another preferred embodiment, the solenoid valve is activated only if at least both first and second conditions as mentioned above are fulfilled, i. e. the vehicle ignition is activated and the front hatch of the vehicle is closed.

[0014] More preferably, the solenoid valve is activated only if at least an additional third condition is fulfilled according to which the water pump of the vehicle is activated and/or in a predetermined operation state. In this embodiment, only if this third condition is fulfilled, while at the same time the vehicle ignition is activated and the front hatch is closed, the solenoid valve is activated.

[0015] According to another preferred embodiment, the solenoid valve is activated if a fourth condition is fulfilled according to which a temperature within the cooling system is higher than a predetermined temperature value.

[0016] More preferably, the solenoid valve is activated either

- if both first and second conditions are fulfilled and the third condition is fulfilled,
- or the fourth condition is fulfilled.

[0017] This means that the solenoid valve is activated if either the vehicle ignition is activated and the front hatch is closed, while at the same time the water pump of the vehicle is activated and/or in a predetermined operation state, or the temperature within the cooling system is higher than the predetermined temperature value.

[0018] The present invention further refers to a utility vehicle comprising a pressurization system as described above.

[0019] These and other aspects of the invention will be apparent from and elucidated with reference to preferred embodiments described hereinafter.

Fig. 1 and 2	are schematic views of layouts of pressurization systems representing the first embodiment and a second embodiment, respectively, of the present invention;
Fig. 3	is a logic diagram demonstrating the control logic for controlling the solenoid valve in the first and the second embodiment of the present invention;
Fig. 4	is an electric wiring plan as an embodiment of the control logic shown in Fig. 3, based on a relay circuit; and
Fig. 5	is an electric wiring plan as another embodiment, which the control logic of Fig. 3 is integrated into an Engine Control Unit (ECU).

[0020] Fig. 1 is a schematic view of a pressurization system 10 according to a first embodiment of the present invention. Within this pressurization system, a common pressure circuit 12 of the vehicle (shown only partially) represents a pressure source. The pressurization system 10 further comprises a coolant tank 14 in which a coolant fluid (e.g., water) is contained. This coolant tank 14 is pressurized to a pressure above the environmental pressure. For this purpose, the common pressure circuit 12 and the coolant tank 14 are connected by a pressurization line 16.

[0021] Within this pressurization line 16, a first pressure limiting valve 18 and a solenoid valve 20 are provided and arranged in line such that the solenoid valve 20 is disposed between the first pressure limiting valve 18 and the coolant tank 14. It is noted that the term "between" refers to the flow connection of the pressurized fluid and not to the spatial arrangement of the respective members. With other words, the pressure circuit 12 and the coolant tank 14 can be flow connected via the first pressure limiting valve 18 and the solenoid valve 20 so that the coolant tank 14 can be pressurized by a pressure from the pressure circuit 12 which has been reduced by the first pressure limiting valve 18 to a predetermined pressure, which will be referred to as a "first pressure" in the further description.

[0022] The solenoid valve 20 is a 3/2-way valve, i. e. comprising three ports, as described hereinafter, and comprising two operation states, namely an activated state (in which the solenoid valve is energized) and a deactivated state (in which the solenoid valve 20 is not energized). The first port 22 of the solenoid valve 20 communicates via a pressure line section 24 with an outlet port 26 of the first pressure limiting valve 18, while the inlet port 28 of the first pressure limiting valve 18 communicates with the pressure circuit 12 via a second pressure line section 30. The terms "inlet port 28" and "outlet port 26" with reference to the first pressure limiting valve 18 shall denote a high pressure side and a low pressure side of this valve, respectively. With other words, the high pressure of the pressure circuit 12 is supplied via the pressure line section 30 to the inlet port 28 of the first pressure limiting valve 18, to be reduced to the first pressure at the outlet port 26 of the first pressure limiting valve 18. This first pressure is applied to the first port 22 of the solenoid valve 20.

[0023] The second port 32 of the solenoid valve 20 communicates with the coolant tank 14 via a third pressure line section 34. The third port 36 of the solenoid valve 20 is connected to an outlet pressure line section

38 in which a venting valve 40 is disposed. If the pressure at the third port 36 exceeds the opening pressure of the venting valve 40, the venting valve 40 opens to reduce the pressure at the third port 36 to the level of the opening pressure. With other words, the pressure at the third port 36 can never exceed the opening pressure of the venting valve 40. In this function, the venting valve 40 operates as a second pressure limiting valve.

[0024] In the activated (energized) operation state of the solenoid valve 20, its first port 22 and its second port 32 are flow connected so that the coolant tank 14 is connected with the outlet port 26 of the first pressure limiting valve 18. This means that in the activated state of the solenoid valve 20, so that the coolant tank 14 is pressurized by the first pressure as defined above. The activation of the solenoid valve 20 is controlled by a control means 42 (demonstrated in Fig. 1 only schematically) for controlling the operation state of the solenoid valve 20 dependent on an operation state of the vehicle, which can be defined by a number of different conditions, as will be described later in connection with Fig. 3 and 4. On the other hand, when the solenoid valve 20 is deactivated (not energized), dependent from other conditions referring to the operation states of the vehicle, the third port 36 and the second port 32 are flow connected so that the coolant tank 14 communicates with the venting valve 40 as a second pressure limiting valve. The opening pressure of the venting valve 40 is different, preferably lower than the first pressure at the outlet port 26 of the first pressure limiting valve 18. By this arrangement, the solenoid valve 20 can be operated to switch between an activated state in which the first pressure is applied to the coolant tank 14, and a deactivated state in which the pressure within the coolant tank 14 is reduced to the limit of the opening pressure (i. e. the second pressure) lower than the first pressure. For example, it may be desired to pressurize the coolant tank 14 in the operation of the coolant system up to a pressure lower than the pressure within the pressure line 12 but still relatively high, corresponding to the first pressure. In this case the solenoid valve 20 is activated according to certain conditions of the operation state of the vehicle. If the coolant system is deactivated, the coolant tank 14 can be relieved down to a lower pressure, corresponding to the second pressure (i. e. the opening pressure of the venting valve 40). This is automatically the case when the solenoid valve 20 is deactivated.

[0025] Fig. 2 shows a pressurization system 100 of the cooling circuit of a utility vehicle, representing a second embodiment of the present invention. In this pressurization system 100, elements corresponding to those of the pressurization system 10 of Fig. 1 are denoted by the same reference numerals. This pressurization system 100 also comprises a pressure circuit 12 of the vehicle, a pressurization line 16, a coolant tank 14, a solenoid valve 20 and a first pressure limiting valve 18. Also in this embodiment, the solenoid valve 20 is a 3/2-way valve comprising a first port 22, a second port 32 and a third port 36, with the first port 22 being connected to an outlet port 26 of the first pressure limiting valve 18, with its inlet port 28 being directly connected to the pressure circuit 12. In the activated state of the solenoid valve 20, the first port 22 and the second port 32 are flow connected to connect the coolant tank 14 with the outlet port 26 of the first pressure limiting valve 18, so that the coolant tank 14 is pressurized by the first pressure, as described above in connection with the first embodiment of the pressurization system 10.

[0026] The pressurization system 100 of the second embodiment further comprises a fourth pressure line section 102 connecting the third port 36 of the solenoid valve 20 with a second pressure limiting valve 104 that is arranged as a pressure reducing valve for reducing the pressure of the pressure circuit 12 to a second pressure different from the first pressure, to be supplied to the coolant tank via the solenoid valve 20. The pressure reduction function of the first pressure limiting valve 18 and the second pressure limiting valve 104 is generally the same in the pressurization system 100 of the second embodiment, while a first pressure behind the first pressure limiting valve 18 is higher than the second pressure after the second pressure limiting valve 104. The second pressure can be, for example, the atmospheric pressure of the environment. By activation or deactivation of the solenoid valve 20, the coolant tank 14 can communicate alternatively with the first pressure limiting valve 18 or with the second pressure limiting valve 104, so that the coolant tank 14 can be pressurized alternatively with the first pressure or with a second pressure. Also in this embodiment, the second pressure is lower than the first pressure. If the solenoid valve 20 is deactivated, the pressure within the coolant tank 14 is reduced from the first pressure down to the second pressure. Control of the solenoid valve 20 is provided by the same control means 42 as in the first embodiment of the pressurization system 10, dependent on an operation state of the vehicle which is defined by a number of conditions, as will be described hereinafter.

[0027] According to one example, the solenoid valve 20 is activated only if the vehicle ignition is activated. This condition "vehicle ignition being activated" will be further denoted as first condition S_i. In a second case, the solenoid valve 20 is activated only if at least the front hatch of the vehicle is closed, which will be further denoted as second condition S_F. According to a preferred embodiment, the solenoid valve 20 is activated only if at least both first and second conditions S_i and S_F are fulfilled, i. e. the vehicle ignition being activated and its front hatch being closed at the same time.

[0028] As an additional third condition S_W, the water pump of the vehicle must be activated and/or operated in a predetermined operation stage.

[0029] According to a fourth condition S_T, for activation of the solenoid valve 20, the temperature within the cooling system must be higher than a predetermined temperature value. The fulfillment of this fourth condition S_T

might be sufficient alone, i. e. without the first, second and third condition S_I, S_F and S_W mentioned above, for activation of the solenoid valve 20.

[0030] According to another preferred embodiment, the solenoid valve 20 is activated only in the following case: either both first and second conditions S_I and S_F are fulfilled with the third condition S_W being fulfilled, or the fourth condition S_T is fulfilled. With other words, in this arrangement, it is sufficient to fulfill the conditions "vehicle ignition activated" (S_I) and "front hatch closed" (S_F) with the additional condition "water pump activated and/or in a predetermined stage" (S_W) being fulfilled, to activate the solenoid valve 20. On the other hand, fulfilling the fourth condition "temperature within the cooling system higher than predetermined value" (S_T) is also sufficient alone for activation of the solenoid valve 20.

[0031] The control logic of this embodiment is demonstrated in the diagram in Fig. 3.

[0032] Fig. 3 comprises a number of logic gates. Reference number 200 denotes a logic AND gate with the conditions S_I and S_F as input variables. If S_I and S_F are both true (i.e. set to a logic value "1"), the output of this logic end gate 200 is also true (or set to 1). Parallel to this gate, another logic gate 202 is an OR gate with the input variables S_1 and S_2 being two predetermined operation stages of the water pump. If one of S_1 and S_2 is set to 1, i. e. one of these stages of the water pump being activated, the output of this logic OR gate 202 is set to 1. This corresponds to the third condition S_W mentioned above being fulfilled (S_W = 1).

[0033] A third logic gate 204 is an AND gate, with the output of the AND gate 200 and the output of OR gate 202 as input variables. That is, if the output of the AND gate 200 is set to the value 1 and the output of the OR gate 202 being also set to 1, the output of the AND gate 204 is also set to 1.

[0034] The output of gate 204 is input to an OR gate 206 as one input variable, while the other input variable of gate 206 is the condition S_T, i. e. the temperature within the cooling system being higher than a predetermined temperature value. If S_T is set to 1, i. e. this conditions is fulfilled, or the output of gate 204 is set to 1, the output of gate 206 is also set to be set to 1. Setting the output of gate 206 to the value 1 or "true" activates the solenoid valve 20 (in Fig. 3, designated by the reference $V_{3/2}$).

[0035] There is an additional safety function in this logic layout, with an additional logic AND gate 208 with the output of gate 206 as one input and a value S_P as another input. This value S_P is a condition that a pressure switch is not opened, in case the pressure within the coolant tank 14 is below a certain predetermined level. The output L_W of the end gate 208 is set to 1 if both input conditions are fulfilled. This positive output L_W can activate a warning lamp.

[0036] Fig. 4 shows a electric wiring plan as an embodiment of the control logic of Fig. 3. In this wiring plan, there is a ground line 302 at a voltage level of 0 V, and a voltage level line 304 setting at a higher voltage level of + 24 V. These lines 302 and 304 are connected by a first connection line being generally denoted by 306, which branches via a first branch 308 and a parallel second branch 310 into the voltage line 304, and into the ground line 302 by means of a branch 312 and a parallel branch 314. Branch 308 comprises a relay switch 316 for the solenoid valve 20, while branch 310 comprises a temperature switch 318. On the other hand, branch 312 comprises the solenoid valve 20, while branch 314 comprises a pressure switch 320. Within branch 320, in series with the pressure switch 320, the warning lamp 322 is disposed.

[0037] According to this arrangement, if the relay switch 316 for the solenoid valve 20 is closed, the solenoid valve 20 within the branch 312 is energized via branch 308, because a connection between ground line 302 and the voltage line 304 is established. On the other hand, the solenoid valve 20 can also be energized via branch 310, in case the temperature switch 318 is closed. Together with the energization of the solenoid valve 20 and the closure of the pressure switch 320 (i.e. the pressure within the coolant tank 14 is below a certain predetermined level), warning lamp 322 is activated.

[0038] The closure of relay switch 316 for the solenoid valve 20 depends on the energization of relay element 324 in a second connection line line 326 connecting ground line 302 and voltage line 304 parallel to the first connection line 306, which will be explained in the following.

[0039] The second connection line 326 comprises the relay activation element 324 for activation of the relay switch 316 in branch 308, a logic OR gate 202 (represented by two parallel branches 328, 330), each branch 328 and 330 comprising one relay switch 332 being activated if the water pump is in a first activation stage, and a second relay switch 334 if the water pump is in a second activation stage. In series with this OR gate 202, a switch 336 and a switch 338 are disposed. Switch 336 is closed if the vehicle ignition is activated, and the other switch 338 is closed if the front hatch of the vehicle is closed.

[0040] The connection between the ground line 302 and the voltage line 304 is established only via the second connection line 326 if both switches 336 and 338 are closed (representing a logic state in which S_I and S_F are both set to 1), and at the same time, either relay switch 332 or relay switch 334 is closed (representing a logic OR state in which the water pump has one of the two determined stages). On energization of the relay activation element 324, switch 316 in branch 308 is closed.

[0041] A third connection line 340 connects the ground line 302 with the voltage line 304 parallel to the first connection line 306 and the second connection line 326. It comprises an water pump control element or ECU (Engine Control Unit) 342. The ECU 342 is connected, on one hand, to the power line 304 via one single line 343 and to the ground line 302 via two parallel lines 344 and 346, each comprising a relay activation element 348, 350, in which the relay activation element 348 activates relay switch 332, while the relay activation element 350 closes relay switch 334 in logic gate 202.

[0042] Fig. 5 is an electric wiring plan 400 as another embodiment of a control logic based on an ECU integrated control logic. In this wiring plan 400, there is a ground line 302 at a voltage level of 0 V, and a voltage level line 304 setting at a higher voltage level of + 24 V.

[0043] The ECU 342 in Fig. 5 integrates the system logic of Fig. 3. For this logic there are a temperature sensor 402 and a pressure sensor 404, which are connected and controlled by the ECU 342.

[0044] The control logic of the Water Pump is also integrated in the ECU 342. The ECU 342 is connected to the voltage line 304 by means of lines 343 and 406, with the ignition switch 336 integrated into the line 406, so that the ECU 342 is supplied by the voltage line 304 in case the ignition switch 336 is closed. The state of the ignition switch 336 also serves as a control variable in the control logic of Fig. 3. The control variables of the water pump stage 0 and stage 1 are available internally by the internal logic of the ECU 342. The temperature is monitored by the ECU 342 via the temperature sensor 402 and compared to a default value stored within in the ECU 342.

[0045] The ECU 342 is connected to the ground line 302 by means of a line 408 in which the solenoid valve 20 is disposed. According to this arrangement, if the ECU 342 outputs a corresponding signal, the solenoid valve 20 within the branch 353 is energized via line 408, because a connection between ground line 302 and the voltage from the ECU 342 is established.

[0046] The ECU 342 is further connected to the ground line 302 by means of a another line 410 in which the warning lamp 322 is disposed. The activation of the warning lamp 322 is also controlled according to the system logic of Fig. 3, which is integrated in the control logic of the ECU 342. The ECU 342 determines the pressure from the pressure sensor 320 and compares this pressure with a theoretical value. If the pressure is on a lower level than the predetermined theoretical value, the ECU 342 activates the warning lamp 322. The warning lamp 322 can be replaced by another warning device, like means for outputting a an error message on an instrumental panel or the like.

Claims

1. Pressurization system (10, 100) of a cooling circuit of a utility vehicle, comprising:

   a coolant tank (14),
   a pressure source (12)
   and a pressurization line (16) connecting the pressure source (12) and the coolant tank (14) for pressurizing the coolant tank (14),
   said pressurization line (16) comprising a first pressure limiting valve (18) which is a pressure reducing valve for reducing the pressure supplied to the coolant tank (14) to a first pressure,
   a solenoid valve (20) arranged in line with the first pressure limiting valve (18) and control means (42) for controlling the operation state of the solenoid valve (20) dependent on an operation state of the vehicle,
   characterized in that the solenoid valve (20) is disposed between the first pressure limiting valve and (18) the coolant tank (14) and being a 3/2-way valve comprising a first port (22), a second port (32) and a third port (36),
   with the first port (22) communicating with the first pressure limiting valve (18),
   the second port (32) communicating with the coolant tank (14),
   and the third port (36) communicating with a second pressure limiting valve (40, 104),
   wherein the first port (22) and second port (32) are flow connected in the activated state of the solenoid valve (20) to connect the coolant tank (14) with the first pressure limiting valve (18),
   and the third port (36) and second port (32) are flow connected in the deactivated state of the solenoid valve (20) to connect the coolant tank (14) with the second pressure limiting valve (40, 104).

2. Pressurization system according to claim 1, **characterized in that** the second pressure limiting valve is a venting valve (40) with an opening pressure being a second pressure different from the first pressure.

3. Pressurization system according to claim 1, **characterized in that** the second pressure limiting valve is a pressure reducing valve (104) for reducing the pressure supplied to the coolant tank (14) to a second pressure different from the first pressure.

4. Pressurization system according to claim 2 or 3, **characterized in that** the second pressure is lower than the first pressure.

5. Pressurization system according to one of the preceding claims, **characterized in that** the solenoid valve (20) is activated only if at least a first condition (S_I) is fulfilled that the vehicle ignition is activated.

6. Pressurization system according to one of the preceding claims, **characterized in that** the solenoid valve (20) is activated only if at least a second condition (S_F) is fulfilled that the front hatch of the vehicle is closed.

7. Pressurization system according to one of the preceding claims, **characterized in that** the solenoid valve (20) is activated only if at least both first and second conditions (S_I) and (S_F) are fulfilled.

8. Pressurization system according to claim 7, **characterized in that** the solenoid valve (20) is activated only if at least an additional third condition (S_W) is fulfilled that the water pump of the vehicle is activated and/or in a predetermined operation state.

9. Pressurization system according to one of the preceding claims, **characterized in that** the solenoid valve (20) is activated if a fourth condition (S_T) is fulfilled that a temperature within the cooling system is higher than a predetermined temperature value.

10. Pressurization system according to one of the preceding claims, **characterized in that** the solenoid valve (20) is activated either

- if both first and second conditions (S_I) and (S_F) are fulfilled and the third condition (S_W) is fulfilled,
- or the fourth condition (S_T) is fulfilled.

11. Pressurization system according to one of the preceding claims, **characterized in that** the pressure source (12) is a common pressure circuit of the vehicle.

12. Utility vehicle, **characterized by** a pressurization system (10, 100) according to one of the preceding claims.

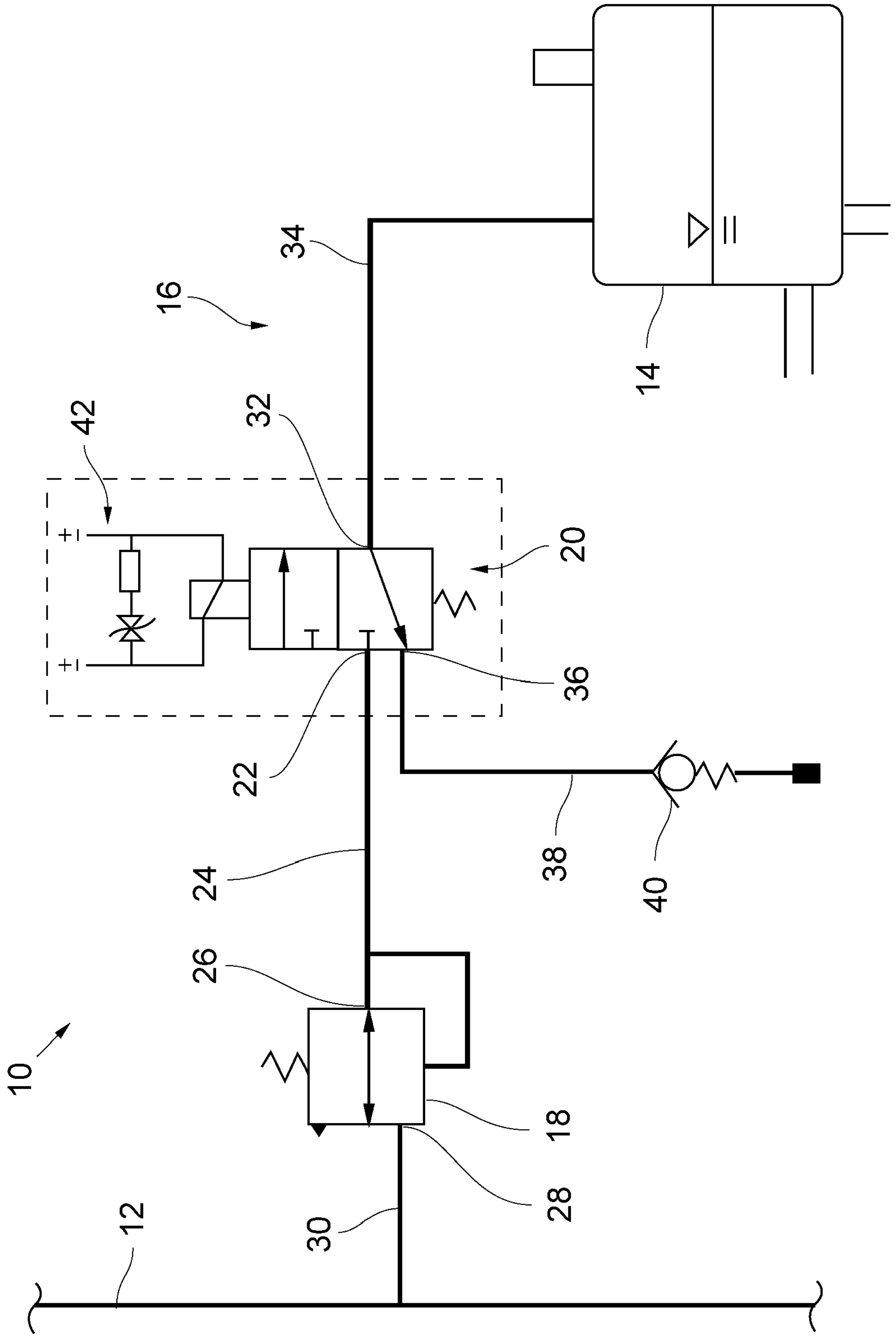

Fig. 1

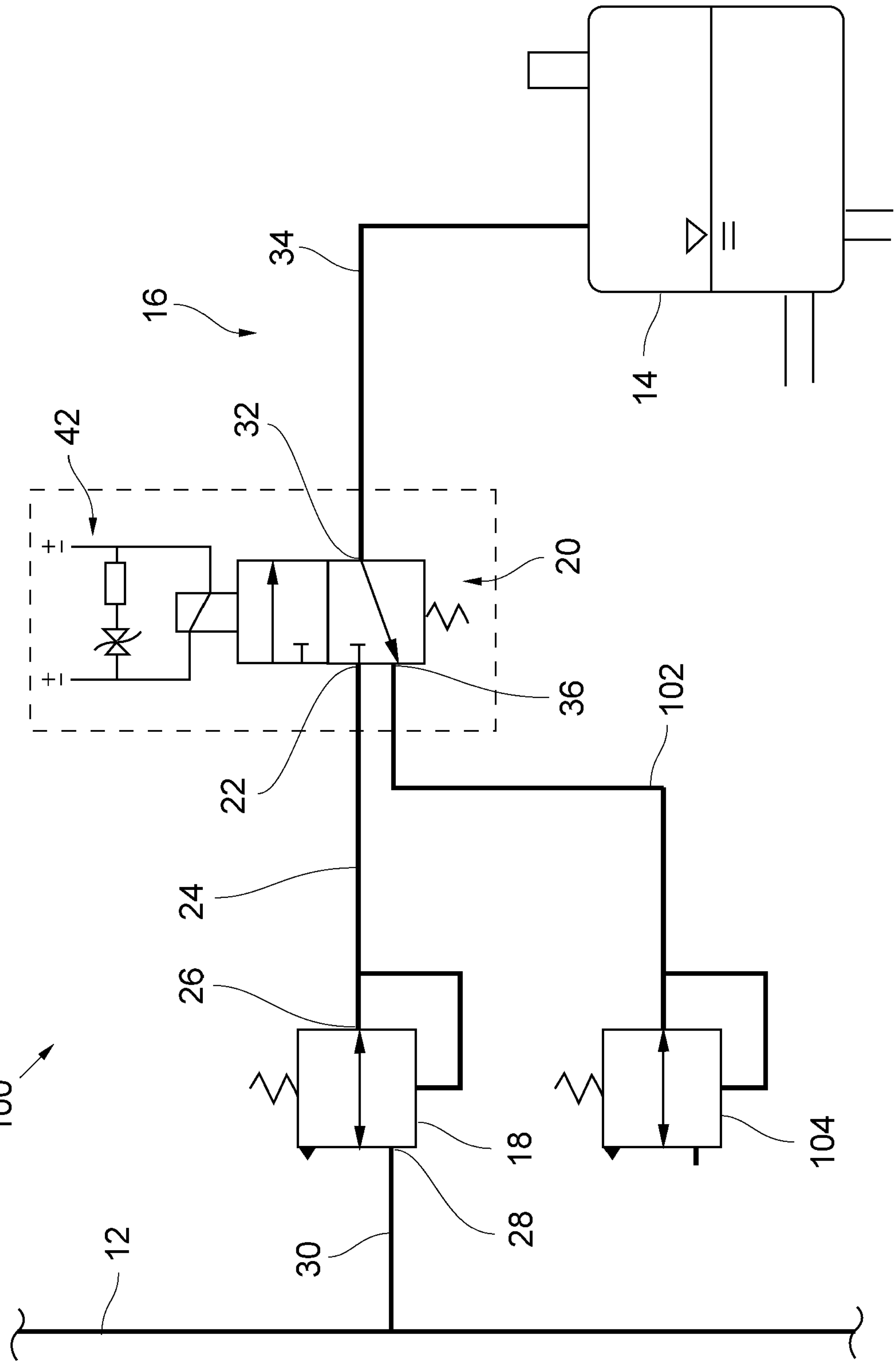

Fig. 2

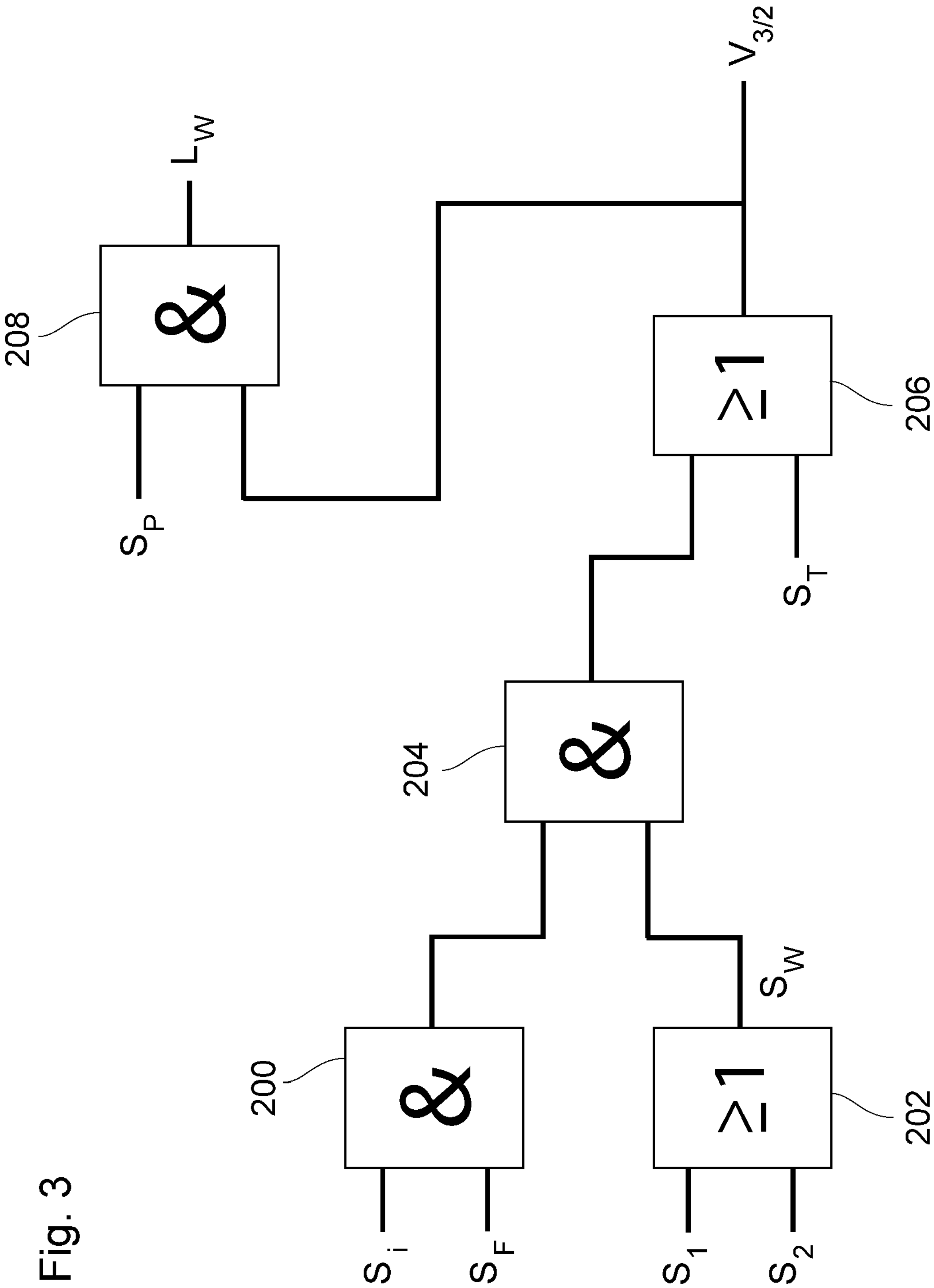

Fig. 3

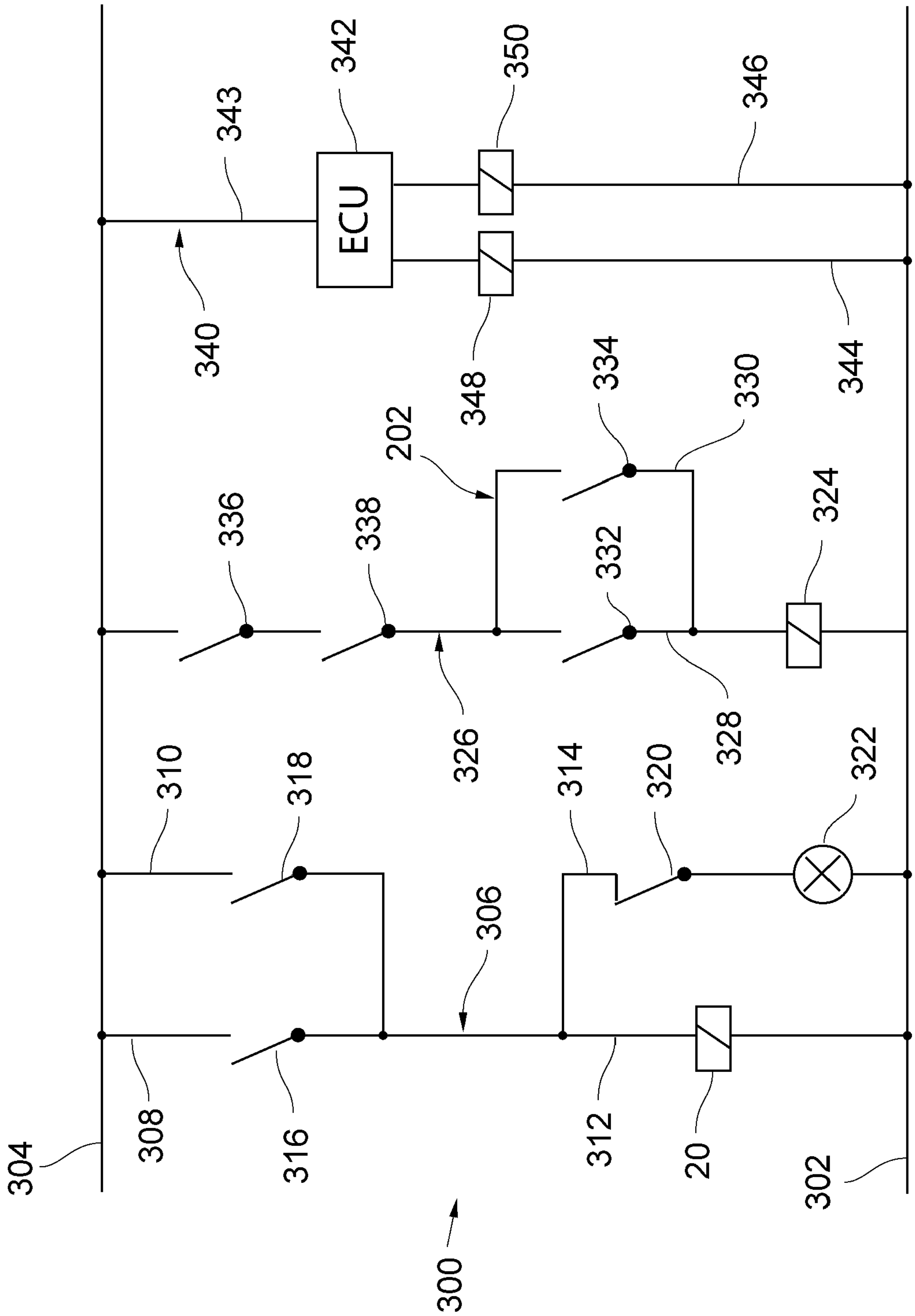
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Fig. 4

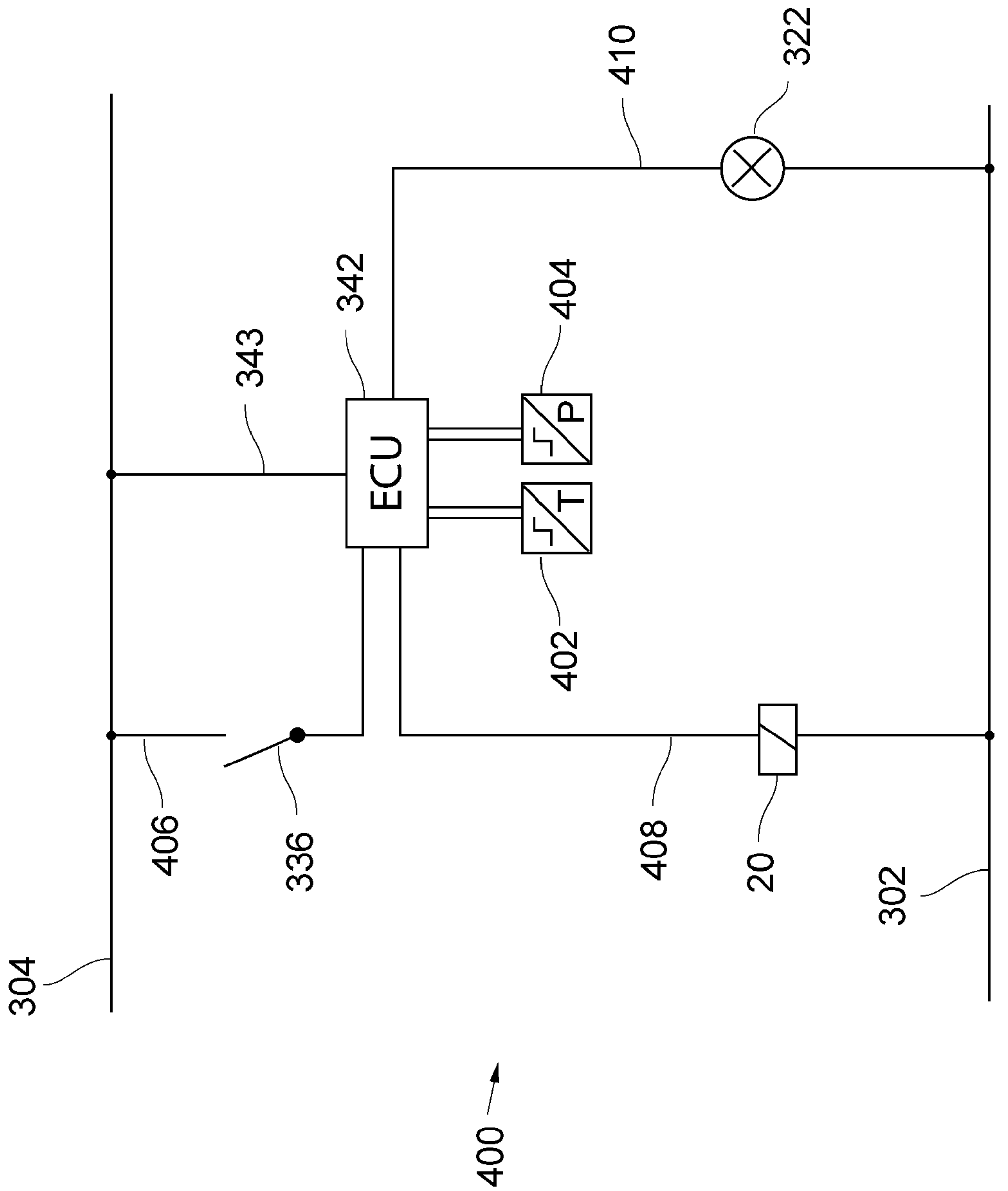

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 14 16 3015

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims

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Place of search	Date of completion of the search	Examiner
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