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

(11) **EP 4 477 952 A1**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
18.12.2024 Bulletin 2024/51

(21) Application number: **24180837.7**

(22) Date of filing: **07.06.2024**

(51) International Patent Classification (IPC):
F23N 5/24 *(2006.01)* ***F23D 11/44*** *(2006.01)*

(52) Cooperative Patent Classification (CPC):
F23N 5/242; F23D 11/44; F23D 2900/3102; F23K 2300/204; F23N 2221/04; F23N 2227/02; F23N 2239/06

(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:
GE KH MA MD TN

(30) Priority: **13.06.2023 KR 20230075674**

(71) Applicant: **Hephzibah Co., Ltd.**
Incheon (KR)

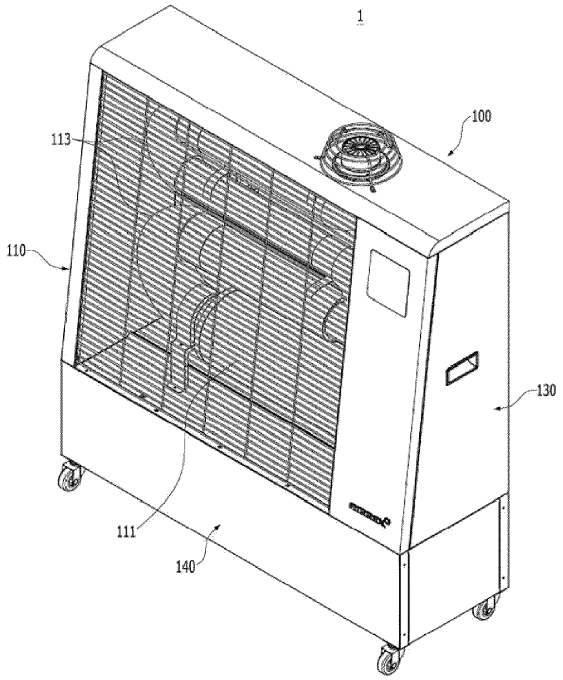
(72) Inventors:
- **SUNG, Cha Hyun**
  Incheon (KR)
- **JEONG, Hyeon Ho**
  Incheon (KR)
- **LEE, In Jae**
  Incheon (KR)
- **LEE, Don Jae**
  Incheon (KR)

(74) Representative: **Plougmann Vingtoft a/s**
Strandvejen 70
2900 Hellerup (DK)

(54) METHOD FOR CONTROLLING HEATING APPARATUS

(57) Provided is a method for controlling a heating apparatus. A method for controlling preheating of a heating apparatus, in which a fuel tank and a fuel injection part are provided in a first passage that provides a moving path, and fuel remaining in the first passage moves in a second direction opposite to a first direction while preheating a fuel injection part, which injects the supplied fuel in the first direction, before ignition, includes a passage opening process of allowing the first passage to communicate with the outside through a discharge valve provided in the first passage, and a preheating process of heating at least a portion of the fuel injection part before the fuel injected from the fuel injection part is ignited.

FIG. 1



EP 4 477 952 A1

Description

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to Korean Patent Application No. 10-2023-0075674 filed on June 13, 2023.

BACKGROUND

[0002] The present disclosure relates to a method for controlling a heating apparatus, and more particularly, to a method for controlling a heating apparatus having improved product effectiveness and user convenience.

[0003] In general, a heating apparatus such as heating heaters includes an oil (fuel) tank that accommodates oil such as diesel or kerosene, an oil (fuel) pump that pumps the oil in the oil tank to a burner (combustion device), and an oil (fuel) supply pipe connecting an oil (fuel) filter to the oil pump to transfer the fuel.

[0004] The heating apparatus pumps high-quality oil purified through the oil filter to the burner through the oil pump to burn the oil, thereby providing heat energy to a surrounding space so that heating is performed. While the heating is performed, the oil pump continues to pump the oil from the oil tank to the burner so that the oil is burned.

[0005] If the heating continues, the oil in the oil tank is consumed, and thus, the oil tank has to be refilled. In this process, the oil supply pipe connecting the oil tank to the burner and the oil pump provided on the oil supply pipe are filled with air.

[0006] If the oil supply pipe and the oil pump are filled with the air, the oil is not normally supplied to the burner even when the oil pump operates, and ignition is not easily achieved by an igniter.

[0007] To solve this limitation, in the related art, the oil pump operates to exhaust all the air through a nozzle of an injection device, and then the ignition has been performed. The ignition has to be attempted repeatedly several times until all the air inside the oil supply pipe and the oil pump is discharged and finally ignited. As a result, it causes inconvenience to a user and is a major complaint to the user because an odor is generated during the repeated ignition attempts.

[0008] To solve this problem, a deflating screw attached to the oil pump is used, but this means that a worker directly turns on power of the heating apparatus, opens the deflating screw of the oil pump, waits, and then has to tighten the screw at the moment when the ignition is attempted in the heating apparatus. In some cases, the ignition may not occur, and thus, there is inconvenience of having to repeat this operation several times.

[0009] In addition, if does not have good understanding of the operation of the oil pump or its structure, the work itself may be difficult.

[0010] The heating apparatus performs preheating so that the oil is smoothly injected from the nozzle of an injection device. The preheating is heating of a connection part such as a nozzle rod, which is disposed between a nozzle of the injection device and the oil supply pipe before the ignition of the injected fuel. When the preheating is performed, a temperature of the injected oil increases to enable smooth injection, and thus, it is greatly helpful for the ignition and ideal combustion.

[0011] However, while the preheating is performed, even though the oil pump does not operate, the fuel and air disposed inside the nozzle rod are expanded due to the preheating, and thus, the oil falls to the outside through the nozzle and is disposed inside a heating pipe. The oil attached on the inside of the heating pipe occurs white smoke after the ignition to cause an unpleasant odor.

[Prior Art Document]

[Patent Document]

[0012] Korean Patent Registration No. 10-0232603

SUMMARY

[0013] The present disclosure provides a method for controlling a heating apparatus, in which air filled in a fuel pump and a fuel supply pipe is removed in advance to easily transfer fuel, thereby igniting the fuel.

[0014] The present disclosure also provides a method for controlling a heating apparatus, fuel is prevented from falling through a fuel injection nozzle even while preheating is performed.

[0015] In an embodiment of the inventive concept, a method for controlling preheating of a heating apparatus, in which a fuel tank and a fuel injection part are provided in a first passage that provides a moving path, and fuel remaining in the first passage moves in a second direction opposite to a first direction while preheating a fuel injection part, which injects the supplied fuel in the first direction, before ignition, includes: a passage opening process of allowing the first passage to communicate with the outside through a discharge valve provided in the first passage; and a preheating process of heating at least a portion of the fuel injection part before the fuel injected from the fuel injection part is ignited.

[0016] The heating apparatus may include: a fuel inflow part provided downstream of the first passage from the fuel pump to allow the fuel tank and the fuel pump to communicate with each other; and a fuel discharge part provided upstream of the first passage to guide discharge of the fuel of the fuel pump, wherein the discharge valve may be provided in the fuel discharge part.

[0017] The heating apparatus may further include: a hot air discharge part configured to accommodate the fuel injection part and guide hot air generated by igniting the fuel injected from the fuel injection part to the outside; and a blowing fan configured to introduce external air so as to move to the hot air discharge part, wherein, when the passage opening process is performed, the method

may further include an external air supply process of supplying the external air by the blowing fan to a second passage provided so that the air moves from the blowing fan to the outside through the hot air discharge part.

[0018] The heating apparatus may include at least one of: a first sensor part configured to detect a fuel level of the fuel tank; and a user command input part configured to receive a user command, wherein whether the passage opening process starts may be determined based on one or more of a measured value of the first sensor part and the user command input through the user command input part.

[0019] The passage opening process may start when a value less than a level reference value and a value greater than the level reference value are continuously measured by the first sensor part.

[0020] The passage opening process may start based on the input user command even when a value less than a level reference value and a value greater than the level reference value are continuously measured by the first sensor part.

[0021] The method may further include, when a value greater than a level reference value is not measured after a value less than the level reference value is measured, an alarm process of indicating an alarm in response to a user command that instructs the start of the passage opening process in the user command input thereafter.

[0022] The method may further include, when the fuel moving in the fuel pressing process reaches the discharge valve, a pressing termination process of stopping an operation of the fuel pump.

[0023] The heating apparatus may further include a second sensor part provided in the discharge valve to detect fuel, and the pressing termination process may start when the fuel is detected by the second sensor part.

[0024] The heating apparatus may further include a third sensor part provided adjacent to the fuel injection part to detect fuel, and the pressing termination process may start when the fuel is detected by the third sensor part.

[0025] In an embodiment of the inventive concept, a method for controlling preheating of a heating apparatus, in which a fuel tank and a fuel injection part are provided in a first passage that provides a moving path, and fuel remaining in the first passage moves in a second direction opposite to a first direction while preheating a fuel injection part, which injects the supplied fuel in the first direction, before ignition, the method includes a passage opening process of allowing the first passage to communicate with the outside through a discharge valve provided in the first passage; and a preheating process of heating at least a portion of the fuel injection part before the fuel injected from the fuel injection part is ignited.

[0026] The passage opening process and the preheating process may be performed at the same time or at different times.

[0027] The heating apparatus may include: a fuel inflow part provided downstream of the first passage from the fuel pump to allow the fuel tank and the fuel pump to communicate with each other; and a fuel discharge part provided upstream of the first passage to guide discharge of the fuel of the fuel pump, wherein the discharge valve may be provided in the fuel discharge part.

[0028] The heating apparatus may further include: a hot air discharge part configured to accommodate the fuel injection part and guide hot air generated by igniting the fuel injected from the fuel injection part to the outside; and a blowing fan configured to introduce external air so as to move to the hot air discharge part, wherein, while the passage opening process and the preheating process are performed, the method may further include an external air supply process of supplying the external air by the blowing fan to a second passage provided so that the air moves from the blowing fan to the outside through the hot air discharge part.

[0029] While the passage opening process and the preheating process are performed, the method may further include an igniter operation process of operating an igniter configured to ignite the fuel injected from the fuel injection part.

[0030] The method may further include a passage closing process of closing the discharge valve to prevent the first passage to communicate with the outside.

[0031] The igniter operation process and the passage closure process may be performed at the same time or at the different times.

[0032] The method may further include a fuel supply process of operating a fuel pump provided downstream of the first passage from the discharge valve to allow the fuel to move to the fuel injection part after the passage closing process.

BRIEF DESCRIPTION OF THE DRAWINGS

[0033] Exemplary embodiments can be understood in more detail from the following description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a perspective view of a heating apparatus when viewed from one side according to an embodiment of the inventive concept;

FIG. 2 is a perspective view of a combustion device;

FIG. 3 is a side view of the combustion device;

FIG. 4 is a cross-sectional view for explaining an air flow, a fuel flow, and ignition of the combustion device;

FIG. 5 is a block diagram illustrating a configuration of performing a method for a heating apparatus;

FIG. 6 is a graph illustrating whether the configuration of performing a method for controlling discharge of residual air in the method for controlling the heating apparatus operates over time according to an embodiment of the inventive concept;

FIG. 7 is a flowchart for explaining the method for controlling the discharge of the residual air in the method for controlling the heating apparatus accord-

ing to an embodiment of the inventive concept;

FIG. 8 is a graph illustrating whether the configuration of performing a method for controlling preheating in the method for controlling the heating apparatus operates over time according to an embodiment of the inventive concept; and

FIG. 9 is a flowchart for explaining the method for controlling the preheating in the method for controlling the heating apparatus according to an embodiment of the inventive concept.

DETAILED DESCRIPTION OF EMBODIMENTS

[0034] Hereinafter, descriptions of following embodiments are intended to be illustrative, and those with ordinary skill in the technical field of the present disclosure pertains will be understood that the present disclosure can be carried out in other specific forms without changing the technical idea or essential features. However, in describing the present disclosure, if it is determined that detailed descriptions of related known functions or components may unnecessarily obscure the gist of the present disclosure, the detailed descriptions and specific illustrations will be omitted. Additionally, in order to facilitate understanding of the invention, the attached drawings are not drawn to scale and the dimensions of some components may be exaggerated.

[0035] The first and second terms used in this application may be used to describe various components, but the components should not be limited by the terms. Terms are only used to distinguish one component from other components.

[0036] In addition, in the following description, the technical terms are used only for explaining a specific exemplary embodiment while not limiting the present disclosure. The terms of a singular form may include plural forms unless referred to the contrary. In this application, terms such as "include," "constituted by," or "consist of" are intended to designate the presence of features, numbers, steps, operations, components, parts, or a combination thereof described in the specification, but it should be understood that this does not preclude the presence or addition of one or more other features, numbers, steps, operations, components, parts, or combinations thereof.

[0037] Hereinafter, descriptions of following embodiments are intended to be illustrative, and those with ordinary skill in the technical field of the present disclosure pertains will be understood that the present disclosure can be carried out in other specific forms without changing the technical idea or essential features. However, in describing the present disclosure, if it is determined that detailed descriptions of related known functions or components may unnecessarily obscure the gist of the present disclosure, the detailed descriptions and specific illustrations will be omitted. Additionally, in order to facilitate understanding of the invention, the attached drawings are not drawn to scale and the dimensions of some components may be exaggerated.

[0038] The first and second terms used in this application may be used to describe various components, but the components should not be limited by the terms. Terms are only used to distinguish one component from other components.

[0039] In addition, in the following description, the technical terms are used only for explaining a specific exemplary embodiment while not limiting the present disclosure. The terms of a singular form may include plural forms unless referred to the contrary. In this application, terms such as "include," "constituted by," or "consist of" are intended to designate the presence of features, numbers, steps, operations, components, parts, or a combination thereof described in the specification, but it should be understood that this does not preclude the presence or addition of one or more other features, numbers, steps, operations, components, parts, or combinations thereof.

[0040] FIG. 1 is a perspective view of a heating apparatus 1 when viewed from one side according to an embodiment of the inventive concept. Referring to FIG. 1, the heating apparatus 1 using ultrasonic waves according to an embodiment of the inventive concept includes a cabinet 100 defining an outer appearance thereof, a fuel tank (not shown), a combustion device 200 (see FIG. 2), and heating pipes 111 and 113.

[0041] The cabinet 100 has an accommodation space into which components that are necessary for heating are accommodated. The accommodation space includes a first accommodation part 110 that accommodates the heating pipes 111 and 113 that guide hot heat, a second accommodation part 130 adjacent to the first accommodation part 110 and accommodating the combustion device 200, and a third accommodation part 140 disposed below the first accommodation part 110 and the second accommodation part 130 and accommodating the fuel tank.

[0042] The first accommodation part 110, the second accommodation part 130, and the third accommodation part 140 are partitioned by partition walls. The partition wall dividing the first accommodation part 110 and the second accommodation part 130 has a through-hole defined so that the combustion device 200 and the heating pipes 111 and 113 are coupled to each other.

[0043] The partition wall dividing the second accommodation part 130 and the third accommodation part 140 has a through-hole formed so that the fuel tank and the combustion device 200 are connected to each other.

[0044] The first accommodation part 110 has an opened front surface to transfer heat discharged from the heating pipes 111 and 113 accommodated in the first accommodation part 110 to a front side and is provided with a safety net such as a grill or mesh for user's safety.

[0045] The heating pipes 111 and 113 accommodated in the first accommodation part 110 are disposed in a zigzag shape. The heating pipes 111 and 113 includes a first heating pipe 111 directly connected to the combustion device 200 to extend in an approximately straight line and a second heating pipe 113 including a straight

pipe and a curved section and provided in a zigzag shape.

[0046] The second accommodation part 130 may be provided so that the combustion device 200 is not exposed to the outside and may be provided with an opening/closing door so that the combustion device 200 is maintained and repaired from the outside.

[0047] The third accommodation part 140 may be provided with an opening/closing door (not shown) on one of front, side, and rear surfaces to allow the fuel tank to be withdrawn.

[0048] Hereinafter, the combustion device 200 according to an embodiment of the inventive concept will be described with reference to FIGS. 2 to 4. FIG. 2 is a perspective view of the combustion device 200, FIG. 3 is a side view of the combustion device 200, and FIG. 4 is a cross-sectional view for explaining an air flow, a fuel flow, and ignition of the combustion device 200.

[0049] Referring to FIGS. 2 to 4, the combustion device 200 according to an embodiment of the inventive concept is accommodated in the second accommodation part 130 and supplies heat to the heating pipes 111 and 113 accommodated in the first accommodation part 110.

[0050] The combustion device 200 includes a fuel pump 241, blowing fans 210 and 233, and fuel injection parts 262 and 263.

[0051] The fuel pump 241 may be configured to operate by receiving power, for example, and inject fuel from the fuel tank to the fuel injection parts 262 and 263. The fuel pump 241 is provided with a fuel inflow part 243, through which the fuel is introduced, at one end thereof, and a fuel discharge part 242, through which the fuel is discharged, at the other end thereof.

[0052] The fuel discharge part 242 is connected to a fuel transfer pipe 245, which will be described later, to provide a fuel line together with the fuel transfer pipe 245. The fuel discharge part 242 may be provided in a substantially cylindrical shape and may have a diameter greater than that of the fuel transfer pipe 245. The fuel discharge part 242 may be provided with a discharge valve 244, which will be described later.

[0053] The discharge valve 244 may be a solenoid valve, for example, and is selectively opened to allow the fuel discharge part 242 to communicate with the outside.

[0054] The fuel transfer pipe 245 allow the fuel pump 241 and the fuel injection parts 262 and 263 to communicate with each other so as to provide a passage through which that the fuel moves from the fuel pump 241 to the fuel injection parts 262 and 263.

[0055] Specifically, one end of the fuel transfer pipe 245 is connected to the fuel discharge part 242 of the fuel pump 241, and the other end of the fuel transfer pipe 245 is connected to a nozzle rod 263 of the fuel injection parts 262 and 263, which will be described later.

[0056] The fuel injection parts 262 and 263 include the nozzle rod 263 and a nozzle 262. The nozzle 262 is configured to inject the fuel. The nozzle rod 263 is configured to accommodate the nozzle 262 in one end thereof and has a passage that communicates with the fuel transfer pipe 245 therein. The nozzle rod 263 may be heated by a preheater 270 for preheating.

[0057] An igniter 264 capable of igniting the injected fuel is provided at a point adjacent to the nozzle 262 of the fuel injection parts 262 and 263. When ignited by the igniter 264, the injected fuel is combusted, and thus heat is transferred toward the heating pipes 111 and 113.

[0058] Blowing fans 210 and 233 are provided to more efficiently transfer the generated heat to the heating pipes 111 and 113. The blowing fans 210 and 233 include a fan motor 210 and a blade 233.

[0059] The fan motor 210 receives power from the outside to generate power and then transmit the power to the blade 233.

[0060] The blade 233 rotates by the power transmitted from the fan motor 210 to allow external air to be introduced through an air inflow part 220.

[0061] The igniter 264 may further include a first housing 231 accommodating the blowing fans 210 and 233, and as illustrated in FIG. 4, the first housing 231 may be configured to accommodate only the blade 233. In this case, the fan motor 210 may be provided on an outer surface of the first housing 231 and exposed to the outside.

[0062] The igniter 264 further includes a second housing 232 communicating with the first housing 231. The second housing 232 partially accommodates the fuel injection parts 262 and 263 and is provided to communicate with a hot air discharge part 261, which will be described later, through one side thereof.

[0063] The igniter 264 further includes the hot air discharge part 261. The hot air discharge part 261 is provided in the shape of a pipe having both opened ends to accommodate a portion of the fuel injection portions 262 and 263.

[0064] The open end of the hot air discharge part 261 is connected to the second housing 232. The hot air discharge part 261 introduces external air moving to the second housing 232 by the blowing fans 210 and 233 of the first housing 231 into the inside thereof.

[0065] The open other end of the hot air discharge part 261 is connected to the second heating pipe 113, and the heat generated when the fuel injected from the fuel injection parts 262 and 263 is burned by an ignition operation of the igniter 264 is guided to the second heating pipe 113. Here, the external air introduced through the opened end of the hot air discharge part 261 more quickly moves the hot air to the second heating pipe 113.

[0066] The fuel inflow part 243, the fuel pump 241, the fuel discharge part 242, the fuel transfer pipe 245, the nozzle rod 263, and the nozzle 262 from the fuel tank define one passage, through which fuel moves, and this passage is provided as a first passage. When the discharge valve 244 is opened, the first passage communicates with the outside.

[0067] The first housing 231, the second housing 232, and the hot air discharge part 261 provide one passage through which air moves by the blowing fans 210 and

233, and this passage is provided as a second passage. The air moving along the second passage moves to the second heating pipe 113 through the hot air discharge part 261.

[0068] Hereinafter, the configuration of performing a method for controlling the heating apparatus 1 according to an embodiment of the inventive concept will be described with reference to FIG. 5. FIG. 5 is a block diagram illustrating a configuration of performing a method for a heating apparatus 1.

[0069] Referring to FIG. 5, the component that perform the method for controlling the heating apparatus 1 includes a controller 300, a discharge valve 244, a fuel pump 241, an igniter 264, a preheater 270, and blowing fans 210 and 233, a sensor part 310, and a user command input part 320.

[0070] The controller 300 is connected to transmit and receive electrical signals to/from the discharge valve 244, the fuel pump 241, the igniter 264, the preheater 270, the blowing fans 210 and 233, the sensor part 310, and the user command input part 320 and receives a control command signal to control operations of the discharge valve 244, the fuel pump 241, the igniter 264, the preheater 270, the blowing fans 210 and 233, the sensor part 310, and the user command input part 320.

[0071] The preheater 270 is provided adjacent to the fuel injection parts 262 and 263 to heat a portion of the fuel injection parts 262 and 263. For example, the preheater 270 may heat the nozzle rod 263 of the fuel injection parts 262 and 263.

[0072] The sensor part 310 includes a level sensor, which is a first sensor part that detects a fuel level in the fuel tank, a valve sensor, which is a second sensor part provided in the discharge valve 244 to detect whether the fuel has arrived at the discharge valve 244, and a nozzle sensor, which is a third sensor part provided in the fuel injection parts 262 and 263 to detect whether the fuel has arrived at the fuel injection parts 262 and 263.

[0073] The user command input part 320 may be a device that receives a control command from a user and may be implemented in various forms such as a touch screen.

[0074] Hereinafter, a method of controlling discharge of residual air in the method for controlling the heating apparatus 1 according to an embodiment of the inventive concept will be described with reference to FIGS. 6 and 7. FIG. 6 is a graph illustrating whether the configuration of performing a method for controlling discharge of residual air in the method for controlling the heating apparatus operates over time according to an embodiment of the inventive concept, and FIG. 7 is a flowchart for explaining the method for controlling the discharge of the residual air in the method for controlling the heating apparatus according to an embodiment of the inventive concept.

[0075] In the method for controlling the heating apparatus 1 according to an embodiment of the inventive concept, the method for controlling discharge of residual air performs a function of discharging the residual air introduced to remain in the first passage while fuel is consumed and re-injected into the fuel tank.

[0076] The method for controlling the discharge of the residual air includes a passage opening process and a fuel pressing process.

[0077] The passage opening process is a process in which the first passage communicates with the outside through a discharge valve 244 provided in the first passage. When the discharge valve 244 is opened in the passage opening process, a space inside the fuel pump 241 and a space inside the fuel transfer pipe 245 may communicate with the outside through the discharge valve 244.

[0078] Whether or not to start the passage opening process may be determined based on one or more of a measured value of the first sensor part and a user command that is input through the user command input part 320.

[0079] When a value less than a level reference value and a value greater than the level reference value are continuously measured by the first sensor part, the controller 300 may determine that the fuel has been consumed and re-injected in the fuel tank, that is, determines that the fuel has been changed, and control the passage opening process to be performed.

[0080] If one of the user command input through the user command input part 320 corresponds to a command to perform the passage opening process, the controller 300 may control the passage opening process to be performed.

[0081] However, the passage opening process is initiated based on the input user command only when the value less than the level reference value is measured by at least the first sensor part. This is because the controller 300 determines that the air remaining in the first passage is less than the reference value.

[0082] The method for controlling the discharge of the residual air further includes an alarm process.

[0083] The alarm process is a process performed when the controller 300 determines that the user command instructing to start the passage opening process in the user command input through the user command input part 320 is inappropriate.

[0084] In the alarm process, even though a value less than the level reference value is not measured by the first sensor part, an alarm is displayed to warn the user for the user command that instructs the start of the passage opening process in the user commands input thereafter.

[0085] The fuel pressing process is a process in which the fuel pump 241 provided downstream of the first passage from the discharge valve 244 operates to move the fuel toward the discharge valve 244.

[0086] When the fuel pump 241 operates in the fuel pressing process, the air remaining inside the fuel pump 241 and the air remaining in the fuel discharge part 242 may be pushed by the fuel and then be discharged to the

outside through the discharge valve 244. The fuel pressing process is performed simultaneously with the passage opening process or is performed after the start of the passage opening process.

[0087] The method for controlling the discharge of the residual air further includes an external air supply process.

[0088] The external air supply process is a process of supplying external air the second passage provided so that air moves from the blowing fans 210 and 233 to the outside through the hot air discharge part 261 when the passage opening process is performed.

[0089] The method for controlling the discharge of the residual air further includes a pressing termination process.

[0090] In the pressing termination process, the operation of the blowing fans 210 and 233 and the fuel pump 241 is stopped, and the discharge valve 244 is closed.

[0091] For example, the pressing termination process may be performed when the fuel moving in the fuel pressing process reaches the discharge valve 244, that is, when the second sensor part detects the fuel in the discharge valve.

[0092] As another example, the pressing termination process may be performed when the third sensor part detects the fuel.

[0093] Referring to FIGS. 6 and 7, in the method for controlling the discharge of the residual air, first, it is determined whether the fuel is changed (S11).

[0094] If it is determined that the fuel is changed (S11-Y), the external air supply process performed by operating the blowing fan and the passage opening process performed by opening the discharge valve start are performed at different times or at the same time (S12).

[0095] A point at which the external air supply process and the passage opening process are performed at the different times or at the same time is a time point t1.

[0096] If it is determined that the fuel is changed (S11-N), it continues to determine whether the fuel is changed.

[0097] Thereafter, the fuel pressing process starts at a time point t2 (S13).

[0098] When the fuel pressing process starts, and a reference time elapses (S14-Y), the pressing termination process (S15) starts.

[0099] If the fuel pressing process starts, and the reference time elapses (S14-N), a pump operation is maintained.

[0100] It has been explained that whether the fuel pressing process starts by lapse of time, but it is not limited thereto and may depend on various factors as described above.

[0101] When the pressing termination process starts at a time point t3, operations of the blowing fans 210 and 233 and the fuel pump 241 are stopped, and the discharge valve 244 is closed.

[0102] Hereinafter, a method for controlling preheating in the method for controlling the heating apparatus 1 according to an embodiment of the inventive concept will be described with reference to FIGS. 8 and 9. FIG. 8 is a graph illustrating whether the configuration of performing the method for controlling the preheating in the method for controlling the heating apparatus operates over time according to an embodiment of the inventive concept, and FIG. 9 is a flowchart for explaining the method for controlling the preheating in the method for controlling the heating apparatus according to an embodiment of the inventive concept.

[0103] The method for controlling the preheating in the method for controlling the heating apparatus 1 according to an embodiment of the inventive concept is a process of moving the fuel remaining in the first passage in a second direction opposite to a first direction while preheating the fuel injection parts 262 and 263 while injecting the supplied fuel in the first direction before the ignition.

[0104] The method for controlling the preheating includes a passage opening process and a preheating process.

[0105] The passage opening process is a process in which the first passage communicates with the outside through a discharge valve 244 provided in the first passage.

[0106] The preheating process is a process in which a preheater 270 heats at least a portion of the fuel injection parts 262 and 263 before igniting the fuel injected from the fuel injection parts 262 and 263.

[0107] The passage opening process and the preheating process may be performed at the same time or at the different times.

[0108] The method for controlling the preheating may further include an external air supply process.

[0109] The external air supply process is a process of supplying the external air to the second passage provided so that the air moves by the blowing fans 210 and 233 from the blowing fans 210 and 233 to the outside through the hot air discharge part 261 while performing the passage opening process and the preheating process.

[0110] The method for controlling the preheating may further include an igniter operation process.

[0111] The igniter operation process is a process of operating an igniter 264 that ignites the fuel injected from the fuel injection parts 262 and 263 while performing the preheating process and the external air supply process.

[0112] The method for controlling the preheating may further include a passage closing process.

[0113] The passage closing process is a process of closing the discharge valve 244 to prevent the first passage from communicating with the outside.

[0114] The igniter operation process and the passage closure process may be performed at the same time or at the different times.

[0115] The method for controlling the preheating may further include a fuel supply process.

[0116] The fuel supply process is a process of operating the fuel pump 241 provided downstream of the first passage from the discharge valve 244 to move the fuel to the fuel injection parts 262 and 263 after the passage

closing process.

[0117] Referring to FIGS. 8 and 9, in the method for controlling the preheating, the passage opening process and the preheating process are performed at the time point t1 at the same time or at the different times (S21).

[0118] Thereafter, as an example, time elapse is measured (S22).

[0119] If the measured time is greater than the reference time (S22-Y), the external air supply process (S23) starts at the time point t2, which is a time point at which the measured time is greater than the reference time.

[0120] If the measured time is not greater than the reference time (S22-N), the time elapse is continuously measured.

[0121] Thereafter, the igniter operation process and the passage closure process start at the different times or at the same time (S24). A time point at which the igniter operation process and the passage closing process are performed at the same time, or one of the igniter operation process and the passage closing process is performed first is a time point t3.

[0122] Thereafter, the fuel supply process may start at a time point t4, and the combustion may be performed.

[0123] As described above, the embodiments of the inventive concept may have the following effects.

[0124] First, according to the embodiment of the inventive concept, the air filled in the fuel pump and the fuel supply pipe may be removed in advance to provide the effect of easily transferring and igniting the fuel.

[0125] Second, according to the embodiment of the inventive concept, it may provide the effect of preventing the fuel from falling through the fuel injection nozzle even while the preheating is performed.

[0126] While the embodiments of the inventive concept have been described with reference to the specific embodiments, it will be apparent to those skilled in the art that various changes and modifications may be made without departing from the spirit and scope of the invention as defined in the following claims.

Claims

1. A method for controlling preheating of a heating apparatus, in which a fuel tank and a fuel injection part are provided in a first passage that provides a moving path, and fuel remaining in the first passage moves in a second direction opposite to a first direction while preheating a fuel injection part, which injects the supplied fuel in the first direction, before ignition, the method comprising:

   a passage opening process of allowing the first passage to communicate with the outside through a discharge valve provided in the first passage; and
   a preheating process of heating at least a portion of the fuel injection part before the fuel injected from the fuel injection part is ignited.

2. The method of claim 1, wherein the passage opening process and the preheating process are performed at the same time or at different times.

3. The method of claim 1, wherein the heating apparatus comprises:

   a fuel pump;
   a fuel inflow part provided downstream of the first passage from the fuel pump to allow the fuel tank and the fuel pump to communicate with each other; and
   a fuel discharge part provided upstream of the first passage to guide discharge of the fuel of the fuel pump,
   wherein the discharge valve is provided in the fuel discharge part.

4. The method of claim 1, wherein the heating apparatus further comprises:

   a hot air discharge part configured to accommodate the fuel injection part and guide hot air generated by igniting the fuel injected from the fuel injection part to the outside; and
   a blowing fan configured to introduce external air so as to move to the hot air discharge part,
   wherein, while the passage opening process and the preheating process are performed, the method further comprises an external air supply process of supplying the external air by the blowing fan to a second passage provided so that the air moves from the blowing fan to the outside through the hot air discharge part.

5. The method of claim 1, further comprising, while the passage opening process and the preheating process are performed, an igniter operation process of operating an igniter configured to ignite the fuel injected from the fuel injection part.

6. The method of claim 5, further comprising a passage closing process of closing the discharge valve to prevent the first passage from communicating with the outside.

7. The method of claim 6, wherein the igniter operation process and the passage closing process are performed at the same time or at different times.

8. The method of claim 7, further comprising a fuel supply process of operating a fuel pump provided downstream of the first passage from the discharge valve to allow the fuel to move to the fuel injection part after the passage closing process.

FIG. 1

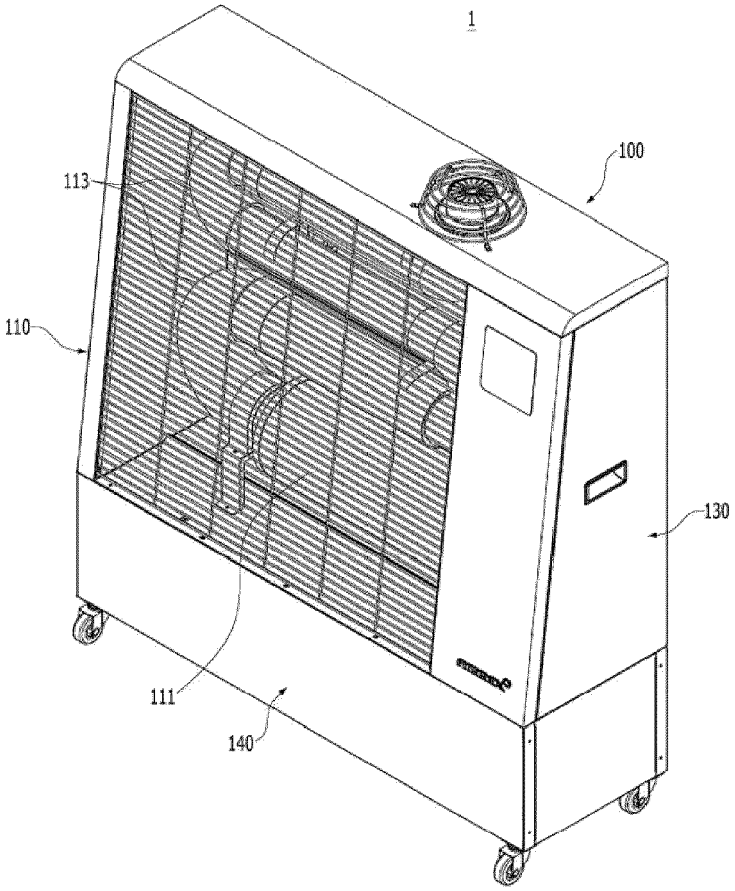


FIG. 2

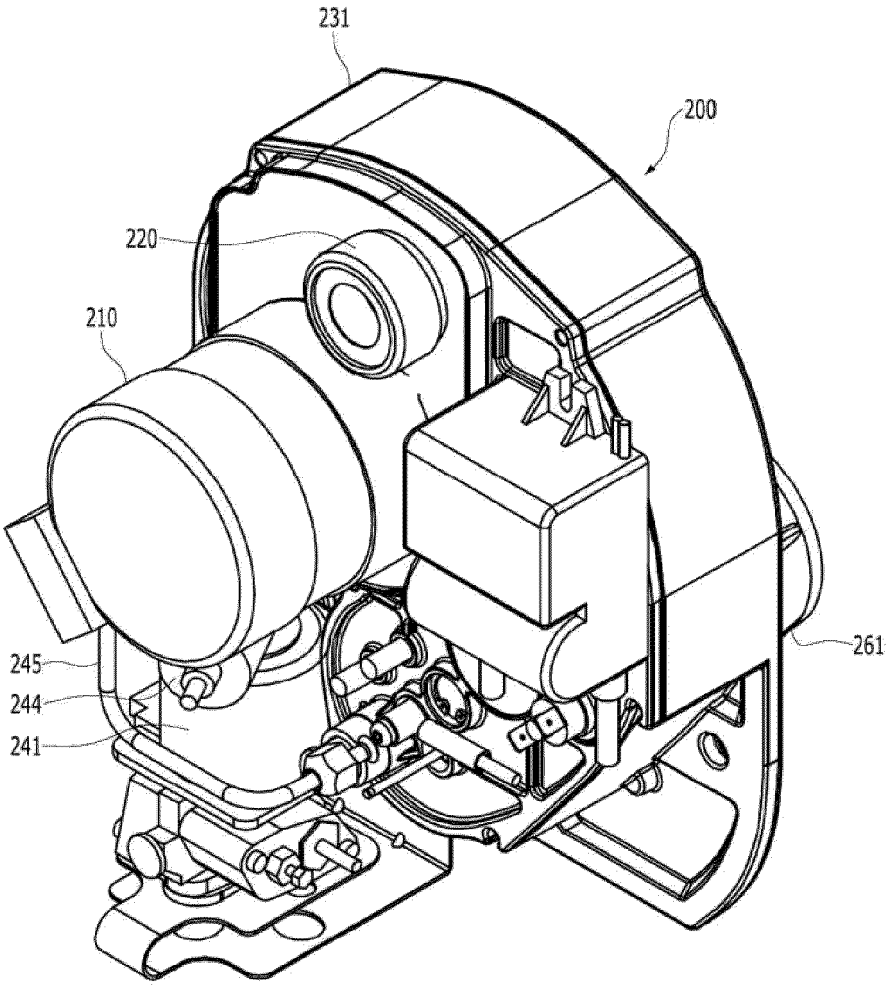


FIG. 3

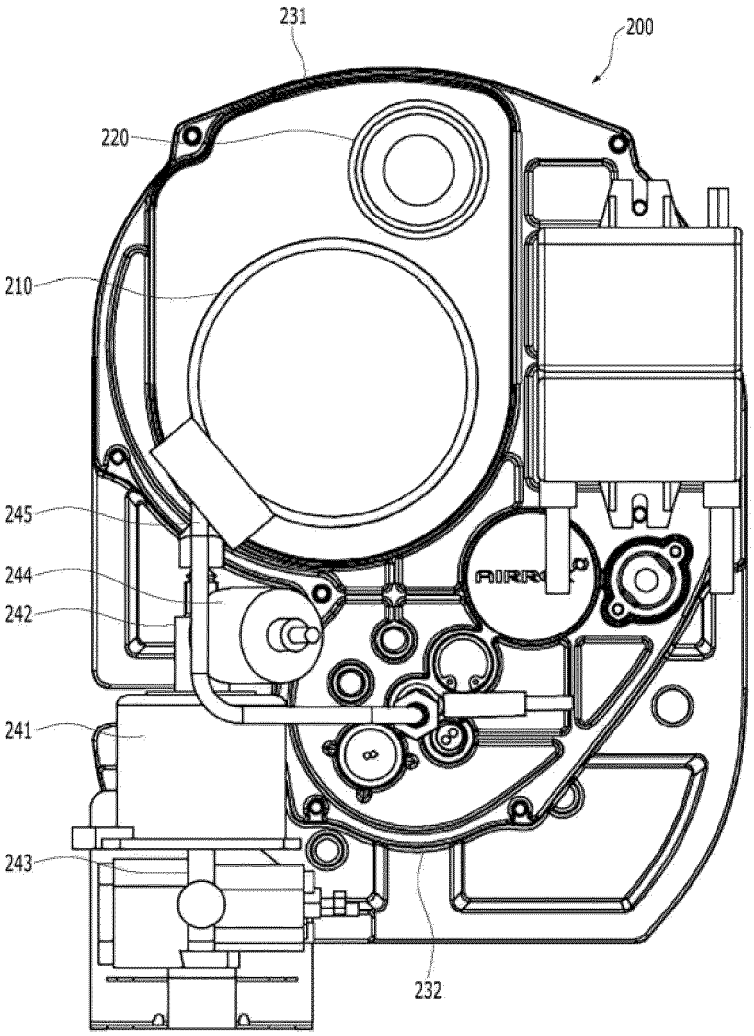


FIG. 4

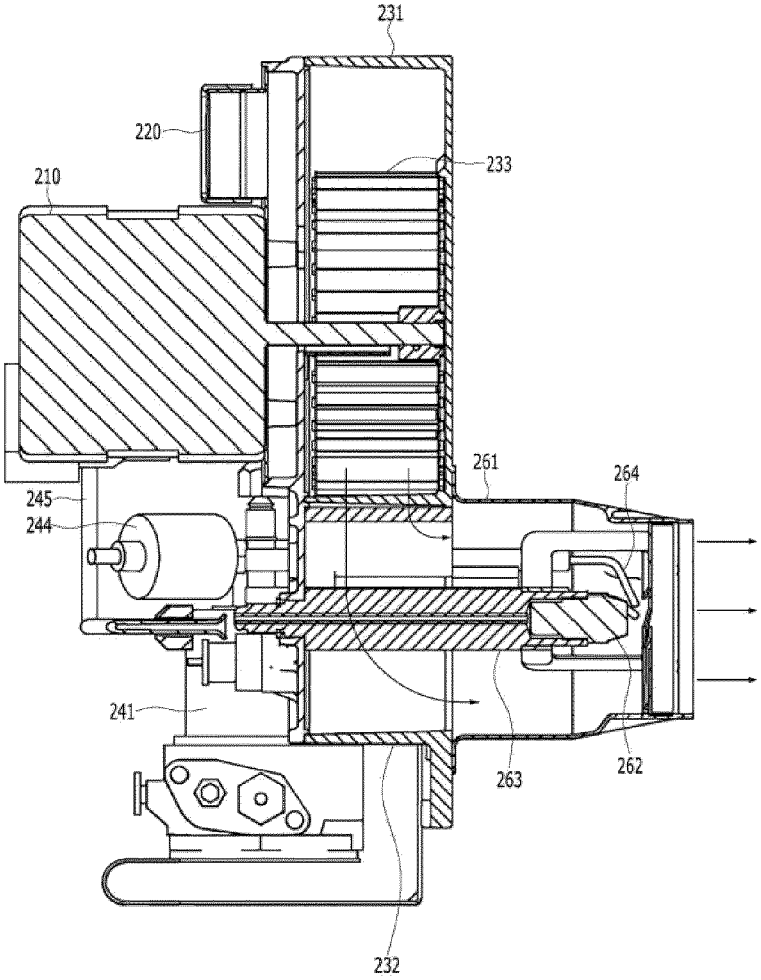


FIG. 5

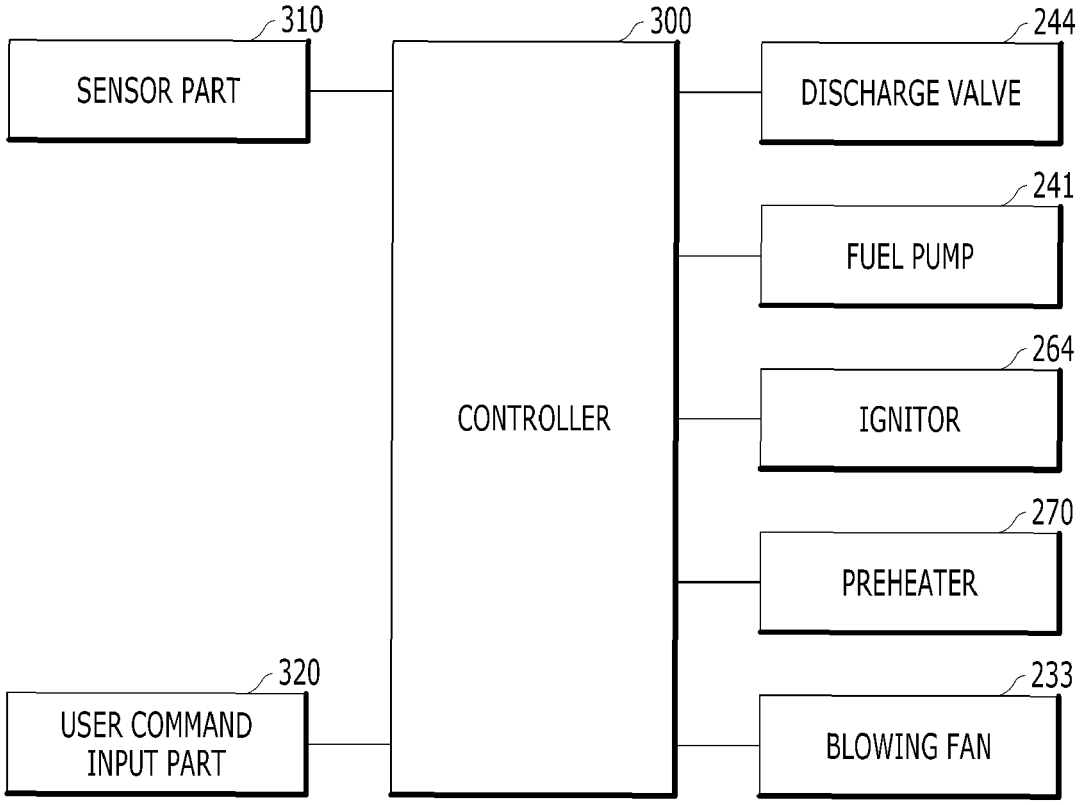

310
SENSOR PART
300
CONTROLLER
244
DISCHARGE VALVE
241
FUEL PUMP
264
IGNITOR
270
PREHEATER
233
BLOWING FAN
320
USER COMMAND INPUT PART

FIG. 6

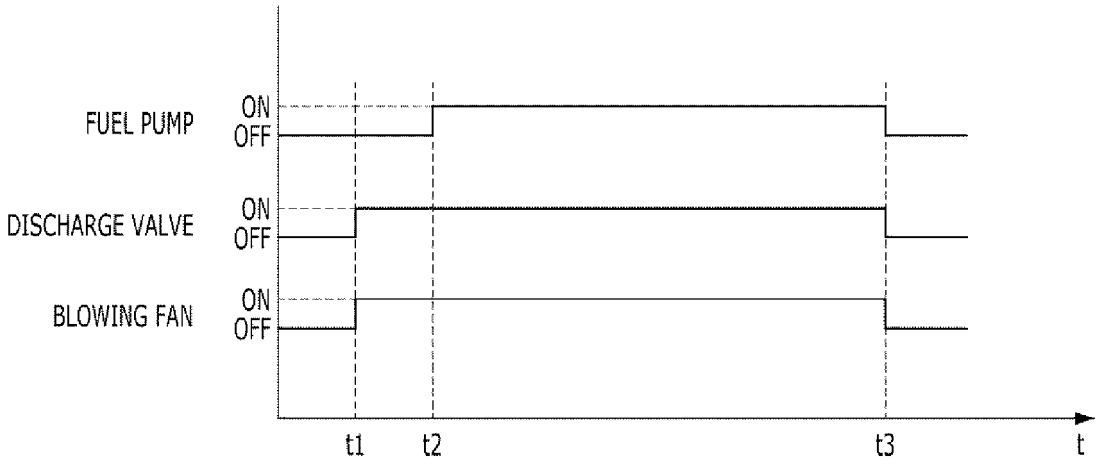

FUEL PUMP
ON
OFF
DISCHARGE VALVE
ON
OFF
BLOWING FAN
ON
OFF
t1
t2
t3
t

FIG. 7

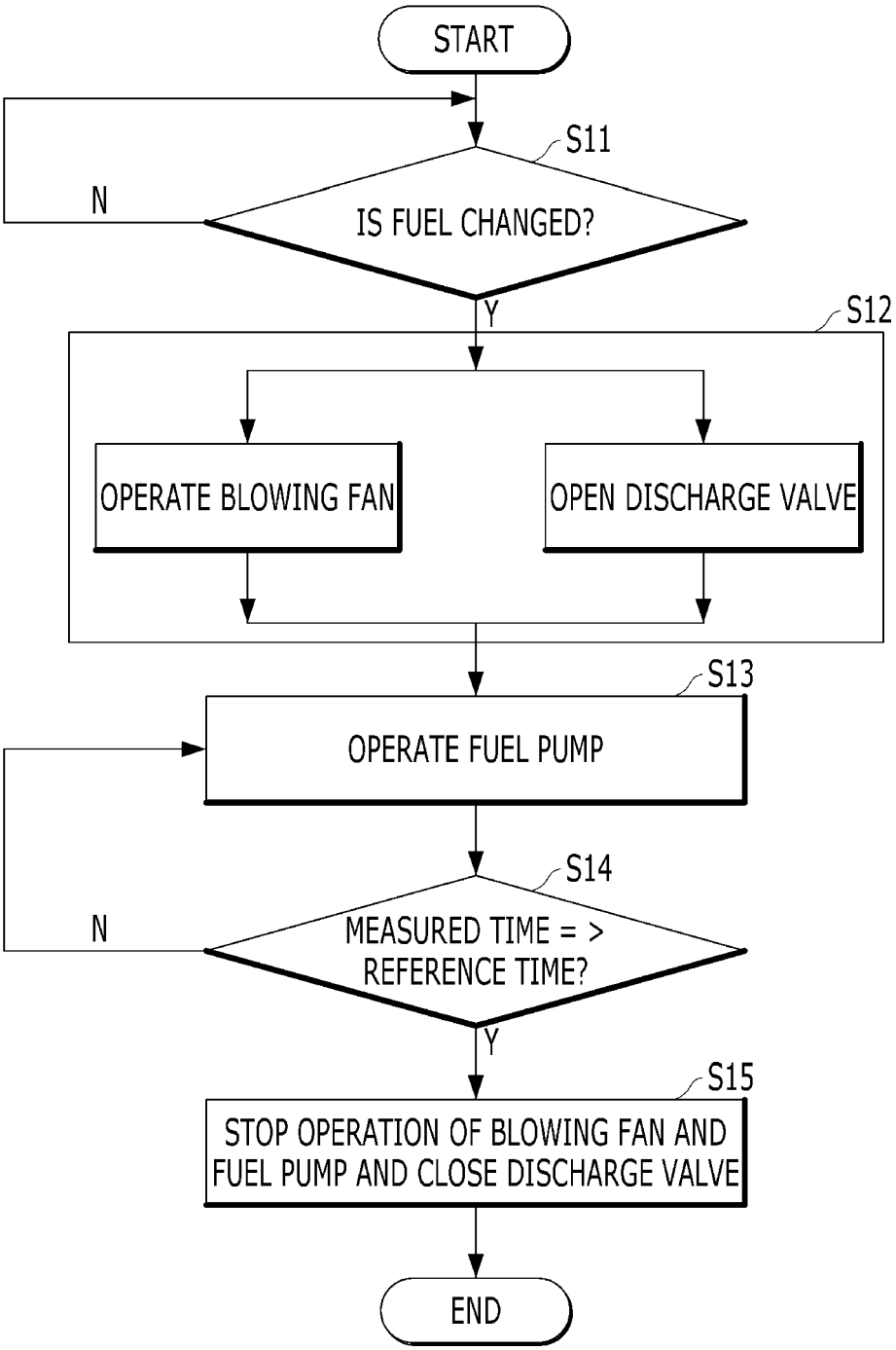

START
S11
IS FUEL CHANGED?
N
Y
S12
OPERATE BLOWING FAN
OPEN DISCHARGE VALVE
S13
OPERATE FUEL PUMP
S14
MEASURED TIME = > REFERENCE TIME?
N
Y
S15
STOP OPERATION OF BLOWING FAN AND FUEL PUMP AND CLOSE DISCHARGE VALVE
END

FIG. 8

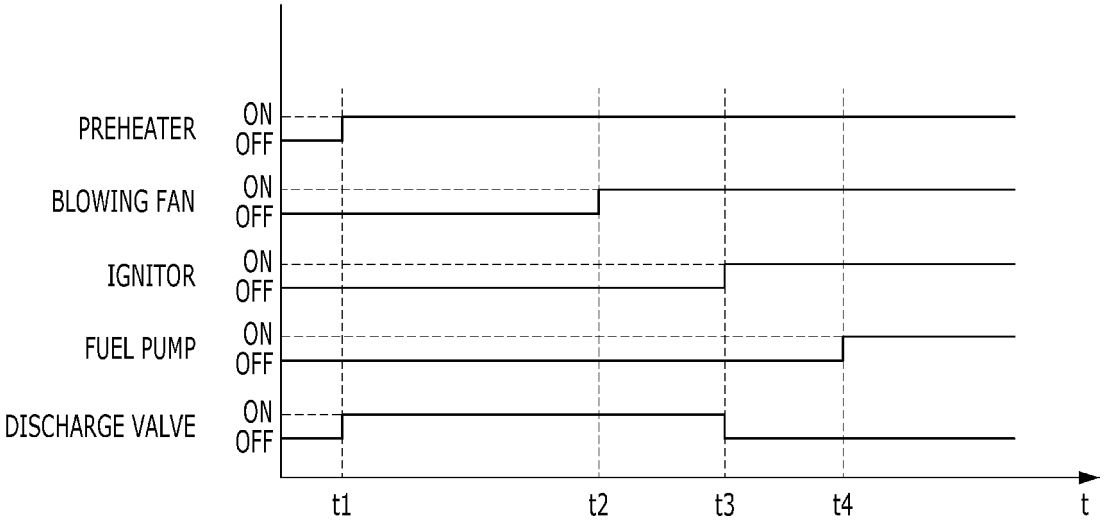
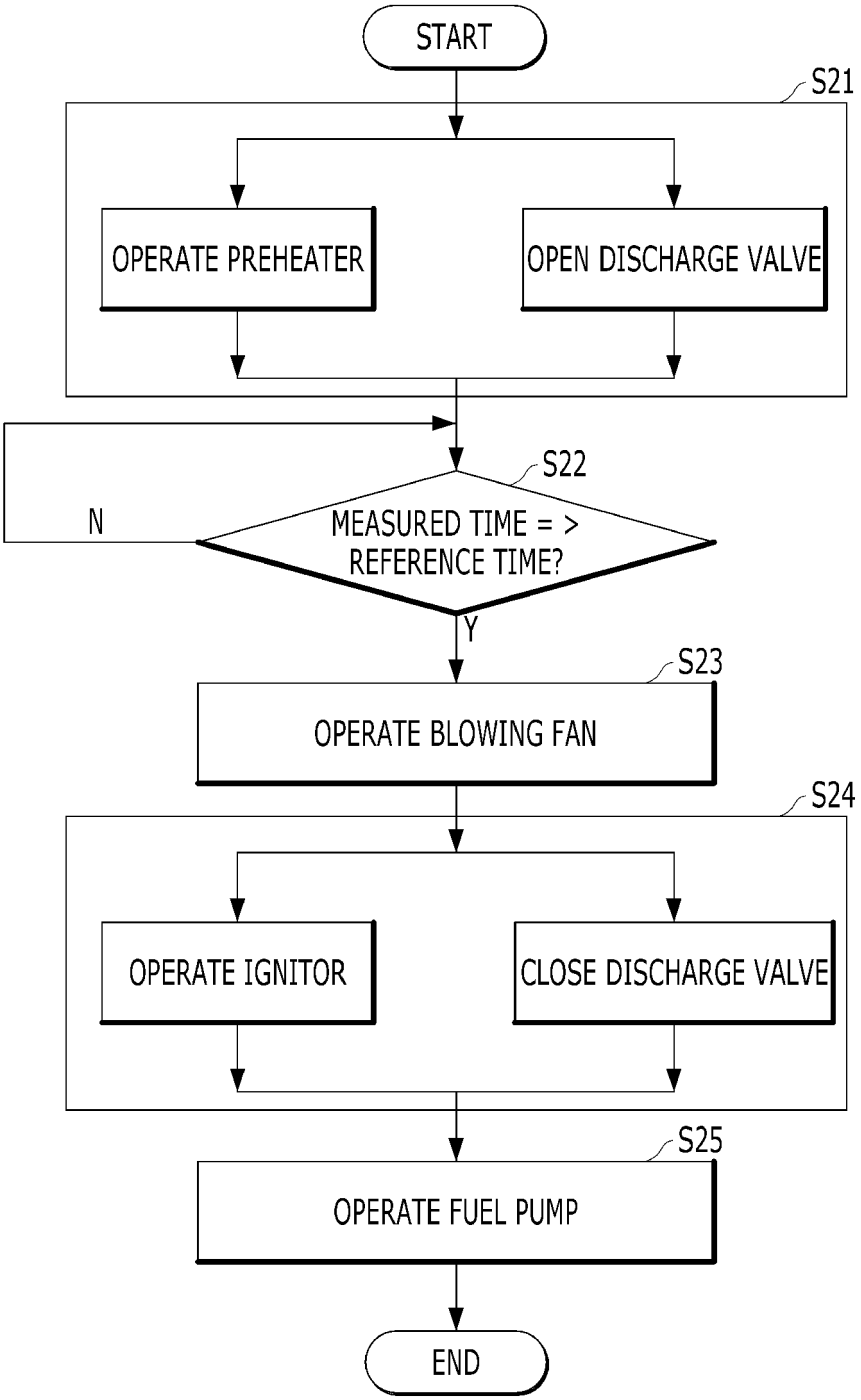

PREHEATER
BLOWING FAN
IGNITOR
FUEL PUMP
DISCHARGE VALVE
ON
OFF
t1
t2
t3
t4
t

FIG. 9


START
S21
OPERATE PREHEATER
OPEN DISCHARGE VALVE
S22
N
MEASURED TIME = > REFERENCE TIME?
Y
S23
OPERATE BLOWING FAN
S24
OPERATE IGNITOR
CLOSE DISCHARGE VALVE
S25
OPERATE FUEL PUMP
END

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 24 18 0837

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	GB 2 020 795 A (DANFOSS AS) 21 November 1979 (1979-11-21) * page 2, line 42 - page 3, line 30; figures 1-4 *	1-8	INV. F23N5/24 F23D11/44
X	DE 10 2012 008941 A1 (BOSCH GMBH ROBERT [DE]) 14 November 2013 (2013-11-14) * paragraph [0051] - paragraph [0053] * * paragraph [0056]; figures 3-5,8 *	1-8	
X	DE 27 19 573 A1 (SCHWARZ ANTON) 18 May 1978 (1978-05-18) * page 18, paragraph 2 - page 19, paragraph 4; figures 6-9 *	1-8	

TECHNICAL FIELDS SEARCHED (IPC)

F23N
F23K
F23D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	15 October 2024	Theis, Gilbert

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 24 18 0837

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.

15-10-2024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 2020795 A	21-11-1979	AT 388434 B	26-06-1989
		DE 2821207 A1	15-11-1979
		DK 190579 A	14-11-1979
		FR 2425612 A1	07-12-1979
		GB 2020795 A	21-11-1979
		JP S54149941 A	24-11-1979
		SE 445948 B	28-07-1986
DE 102012008941 A1	14-11-2013	NONE	
DE 2719573 A1	18-05-1978	AU 512672 B2	23-10-1980
		BE 860807 A	01-03-1978
		DE 2719573 A1	18-05-1978
		DE 7713840 U1	19-04-1979

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- KR 1020230075674 **[0001]**
- KR 100232603 **[0012]**