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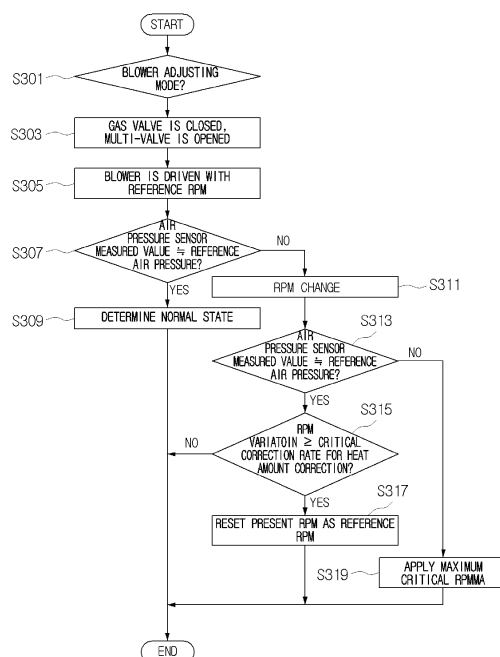
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(54) **AIR PROPORTIONAL CONTROL TYPE COMBUSTION DEVICE AND METHOD FOR ADJUSTING HEAT AMOUNT THEREOF**

(57) Disclosed are an air proportional control type combustion device and a method for adjusting the heat amount thereof. The combustion device according to the present invention, which controls the output heat amount by controlling the RPM of a blower, is capable of compensating for an air flow rate with respect to external circumstances such as place of installation, blocking of a gas duct, and seasonal changes, or the RPM of the blower caused by such situational changes. In a case where there is a difference between air pressure (Act. APS) measured after the blower is driven at a reference RPM (Ref. RPM) in a state where gas supply is blocked and reference air pressure (Ref. RPM), the combustion device compensates for the difference while causing the RPM to vary and applies the varied RPM as a new reference RPM.

Fig. 3



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Description

TECHNICAL FIELD

[0001] The present invention relates to an air proportional control (air ratio control) type combustion device controlling an output heat amount by controlling an RPM of a blower, which is capable of compensating for an air flow rate to the RPM of the blower according to external circumstances or changes of the circumstances and a method for adjusting a heat amount thereof.

BACKGROUND ART

[0002] Combustion devices are devices in which heat generated by burning mixed air in which a gas is mixed with air by using a burner is used to heat heating water or hot water that is used in boilers or hot water devices through heat exchangers. Here, in air proportional control type combustion devices, a heat amount generated by the combustion device is determined by a flow rate of air.

[0003] FIG. 1 is a view illustrating an example of a combustion part included in a combustion device according to a related art. Referring to the combustion part 100 of FIG. 1, an air tube 11 for supplying air to a blower 10 is connected to the blower 10, and a gas tube 13 through which a gas flows is connected to the air tube 11 at a front end of the blower 10. Thus, mixed air in which the gas is mixed with the air is introduced into the blower 10. A multi-stage valve 15 is disposed on one side of the air tube 11 through which the mixed air flows to control an amount of mixed air introduced into the blower 10. The mixed air delivered by the blower 10 is supplied to a burner 17 and burnt. Here, heat generated during the combustion process may heat direct water supplied to the combustion device through a heat exchanger 19 to generate hot water or heating water.

[0004] An amount of gas supplied to the blower 10 is controlled by a gas valve 21 disposed in the gas tube 13. An amount of air is adjusted by controlling an RPM of the blower 10 itself. An actual amount of air supplied to the blower 10 may be proportionally measured by an air pressure sensor (APS) 23. As described above, an output heat amount of air proportional control type combustion device is determined by the flow rate of the mixed air, and the flow rate of the air is controlled by the RPM of the blower 10.

[0005] There is a limitation in that since the flow rate of the air varies for each combustion device according to an installation space (a wet or dry area) or an installation height and a length of a gas duct, the air flow rate with respect to the RPM of the blower 10 may vary for each combustion device. Furthermore, since the air flow rate changes according to whether the gas duct is blocked or seasons even though the same combustion device is used, the air flow rate to the RPM of the blower 10 may continuously vary in spite of the same combustion device.

[0006] Thus, in order to accurately control the output heat amount of combustion device, it is necessary to measure and correct the air flow rate to the RPM of the blower 10 by periods as well as when the combustion device is installed.

[Related Art Document]

[0007] Korean Patent Publication No. 10-2003-0041366, AIR PROPORTIONALITY TYPE WATER HEATER

[0008] In the published patent document, although a water heater that is capable of directly controlling a gas proportional valve according to an air volume by using a low-cost AC blower, the gas proportional valve, and an air volume sensor to match a gas amount over all ranges of the air volume is disclosed, there is still no compensation function with respect to external circumstances.

DISCLOSURE OF THE INVENTION

TECHNICAL PROBLEM

[0009] An object of the present invention is to provide an air proportional control type combustion device controlling an output heat amount by controlling an RPM of a blower, which is capable of outputting an accurate heat amount by compensating an effect of external circumstances with respect to an air flow rate to the RPM of the blower and a method for adjusting the heat amount thereof.

[0010] Another object of the present invention is to provide an air proportional control type combustion device that is capable of measuring and compensating change of an air flow rate to an RPM of the blower to compensate the change of the air flow rate according to external circumstances that varies without being fixed, thereby outputting an accurate heat amount and a method of controlling the heat amount thereof.

TECHNICAL SOLUTION

[0011] A method for adjusting heat amount of an air proportional control type combustion device according to the present invention to achieve the objects includes: a process of storing a reference air pressure for each output heat amount of the combustion device and a reference RPM for outputting the reference air pressure in a memory; a first process of blocking supply of a gas introduced into the blower, driving the blower at the reference RPM, and measuring a pressure of the air introduced into the blower by using an air pressure sensor; a second process of changing the RPM of the blower until the measured value becomes to the reference air pressure when the measured air pressure value is different from the reference air pressure, to re-store the changed RPM in the memory as the reference RPM; and a process of controlling the blower at the reference RPM in the proc-

ess of adjusting the blower to output a heat amount requested by a user.

[0012] The first and second processes of adjusting the blower may be performed in a state in which a multi-valve controlling an amount of mixed air introduced to the blower is fully opened.

[0013] When a difference between the measured value in the first process of adjusting the blower and the reference air pressure is within a critical range, the reference RPM stored in the memory may be maintained as it is, and the second process of adjusting the blower may not be performed.

[0014] An air proportional control type combustion device according to another embodiment of the present invention includes: a blower for delivering mixed air in which a gas is mixed with air; a gas valve disposed in a gas tube connected to the blower to control an amount of gas introduced into the blower; an air pressure sensor disposed in an air tube connected to the blower to measure a pressure of the air introduced into the blower; a memory in which a reference air pressure for each output heat amount of a combustion device and a reference RPM for outputting the reference air pressure are stored; and a control part for controlling the blower at the reference RPM stored in the memory to output a heat amount requested by a user, wherein the control part includes a blower adjusting unit for changing the RPM of the blower until the measured value becomes to the reference air pressure when the measured value of the air pressure sensor read in a state in which the gas valve is closed, and the air blower is driven at the reference RPM is different from the reference air pressure to re-store the changed RPM as the reference RPM in the memory.

[0015] The blower adjusting unit may maintain the reference RPM stored in the memory as it is when a difference between the measured value of the air pressure sensor that is read in a state in which the gas valve is closed, and the blower may be driven with the reference RPM and the reference air pressure is within a critical range.

ADVANTAGEOUS EFFECTS

[0016] The combustion device according to the present invention may compensate the effect of the external circumstances with respect to the flow rate of the air to the RPM of the blower while controlling the output heat amount by controlling the RPM of the blower to output the accurate heat amount.

[0017] Also, the combustion device according to the present invention may measure and compensate the change of the flow rate of the air to the RPM of the blower by periods to compensate the change of the flow rate of the air according to the external circumstances that vary without being fixed, thereby outputting the accurate heat amount.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018]

FIG. 1 is a block diagram illustrating an example of a combustion part included in a combustion device according to the related art.

FIG. 2 is a block diagram of a combustion device of the present invention.

FIG. 3 is a flowchart showing a method for adjusting a heat amount of the combustion device according to the present invention.

MODE FOR CARRYING OUT THE INVENTION

[0019] Hereinafter, the present invention will be described in detail with reference to the accompanying drawings.

[0020] Referring to FIG. 2, a combustion device 200 according to the present invention includes a combustion part 100, a memory 201, and a control part 210. In the combustion device 200 of FIG. 2, components that are not necessary for description of the present invention are omitted. Of course, the combustion device 200 may further include a user interface and so on.

[0021] The combustion part 100 may have other components in addition to the components that are exemplarily illustrated in FIG. 1. However, the combustion part 100 has to be an air proportional control type combustion part so that an entire output heat amount of the combustion device 200 is controlled by controlling an RPM of a blower 10.

[0022] A combustion table on which reference RPM Ref. RPM information for outputting a reference air pressure Ref. APS for each output heat amount and a reference air pressure Ref. APS is recorded is stored in the memory 201. As described above, an output heat amount of the combustion device 200 may be controlled by a flow rate of air, that is, an air pressure measured by an air pressure sensor 23 according to an air proportional control method. Here, the reference air pressure Ref. APS may be an air pressure corresponding to a flow rate of the air for generating a corresponding output heat amount. Also, the reference RPM Ref. RPM may be a predetermined RPM of the blower 10, which generates a corresponding air pressure.

[0023] In addition, a maximum critical RPM Max. RPM is stored in the memory 201. The maximum critical RPM Max. RPM may be the maximum value in which the reference RPM Ref. RPM is corrected during a blower adjustment process that will be described later and determined by each output heat amount.

[0024] The control part 210 may include a combustion control unit 211 and a blower adjusting unit 213 to perform an overall operation of the combustion device 200 and a specific blower adjusting function according to the present invention.

[0025] The combustion control unit 211 may read the

reference RPM Ref. RPM mapped on the corresponding heat amount from the memory 201 to drive the blower 10 at the reference RPM Ref. RPM to output the heat amount requested by a user. Of course, although the combustion control unit 211 applies an RPM that is arithmetically additionally calculated from the reference RPM Ref. RPM according to a control method, a reference of the control is the reference RPM Ref. RPM mapped on the corresponding heat amount.

[0026] The blower adjusting unit 213 may perform a specific blower adjusting function according to the present invention. An operation of the blower adjusting unit 213 will be described with reference to FIG. 3.

[0027] The blower adjusting function according to the present invention may solve a limitation in that a corresponding reference air pressure Ref. APS is not generated and thus a desired heat amount is not outputted even though the blower 10 is driven at a predetermined reference RPM Ref. RPM. As described above, since the flow rate of the air varies for each combustion device according to an installation place (humid and dry areas), an installation height, a length of a gas duct, whether the gas duct is blocked, or seasons and also varies in spite of the same combustion device without being uniformly maintained, the flow rate may be corrected by periods to continuously correct the reference RPM Ref. RPM. The combustion control unit 211 does not operate while the blower adjusting function is performed.

<Blower adjusting mode; S301>

[0028] Referring to FIG. 3, the blower adjusting unit 213 may determine whether a predetermined blower adjusting mode is started. When the blower adjusting mode is started, the following blower adjusting process is performed. Although the blower adjusting mode is started only when the combustion device 200 is initially installed, the blower adjusting mode may be started by periods according to embodiments, for example, may be started a period of 30 days to compensate the changes of the external circumstances.

<First process of adjusting the blower; operations of S303 and S305>

[0029] In the blower adjusting mode, the blower adjusting unit 213 may firstly close a gas valve 21 to block supply of the gas introduced into the blower 10 and open all of a multi-stage valve 15. The multi-stage valve 15 is fully opened. Here, if the multi-stage valve 15 is a two-stage valve, two-stage opening is performed, and if the multi-stage valve 15 is a three-stage valve, three-stage opening is performed. However, it is unnecessary that the multi-stage valve 15 has to be applied to the combustion part 100 according to the present invention, and for example, a one-stage valve may be applied instead of the multi-stage valve 15 according to the embodiment. Thus, in operation S303, only air is supplied to the blower

10 but not the mixed air, and delivery ability of the blower 10 according to the control of the RPM of the blower adjusting unit 213 may be checked.

[0030] In operation S305, the blower adjusting unit 213 reads an air pressure Act. APS that is measured by the air pressure sensor 23 while driving the blower 10 at one of the reference RPM Ref. RPM stored in the memory 201.

<Second process of adjusting blower; operations of S307 to S321>

[0031] In operation S307, the air blower adjusting unit 213 determines whether the air pressure Act. APS measured in the operation of S305 is equal or similar to the reference air pressure Ref. APS. In operation S309, the blower adjusting unit 213 determines that the air pressure is in a normal state when a difference between the measured air pressure Act. APS and the reference air pressure Ref. APS is within a critical range.

[0032] According to the result determined in the operation of S307, when the difference between the measured air pressure Act. APS and the reference air pressure Ref. APS deviates from the critical range, it represents that the circumstances such as condition of the gas duct, or seasons are different compared to when the predetermined reference RPM Ref. RPM is set. Thus, in operations S311 and 313, the blower adjusting unit 213 continuously varies in RPM to drive the blower 10 so that the measured air pressure Act. APS read by the air pressure sensor 23 coincides with the reference air pressure Ref. APS within the critical range.

[0033] When the difference between the measured air pressure Act. APS and the reference air pressure Ref. APS is again within the critical range, it is assumed that a correction value (an RPM at the present) with respect to the reference RPM is determined. Thus, the blower adjusting unit 213 determines whether a "RPM variation" according to the correction has a value greater than that of a "critical correction rate for heat amount correction". Here, the "RPM variation" represents a ratio of the correction value to the reference RPM (the present RPM determined in the operation of S313). For example, when the reference RPM is 100, and the correction value (the present RPM) is 120, the RPM variation is 120%. The "critical correction rate for heat amount correction" may determine a critical value for applying only correction over a predetermined range as the minimum value of the RPM variation to which the correction is applied. For example, in operation S315, if the "critical correction rate for heat amount correction" is 103%, when the RPM variation is below 103%, the blower adjusting process is stopped without applying the heat amount correction value.

[0034] According to the result determined in the operation of S315, when the RPM variation is above the critical correction rate for heat amount correction, it is assumed that it is necessary to correct the reference RPM, and in operation S317, the reference RPM Ref. RPM

stored in the memory 201 is corrected to the current RPM to complete the correction of the blower.

[0035] According to the result determined in the operation of S315, when the RPM variation is less than the critical correction rate for heat amount correction, it is assumed that it is unnecessary to correct the reference RPM, the reference RPM Ref. RPM stored in the memory 201 is maintained, and the correction is not performed.

[0036] Also, if while the operations of S311 and S313 are performed, when the difference between the measured air pressure Act. APS and the reference air pressure Ref. APS deviates again from the critical range in spite of in a state where the maximum critical RPM Max. RPM of the corresponding output heat amount is applied the blower adjusting unit 213 determines that it is impossible to correct the reference RPM. Thus, in operation S319, the blower adjusting unit 213 applies the maximum critical RPM Max. RPM of the combustion device 200 as the RPM for controlling the corresponding heat amount to change the reference RPM Ref. RPM of the memory 201.

[0037] The method for correcting the heat amount of the combustion device according to the present invention is performed as described above. The combustion control unit 211 may control the blower 10 at the reference RPM Ref. RPM restored by the blower adjusting method of FIG. 3 to output the heat amount requested by the user. Thus, the combustion device 200 may output the heat amount requested by the user as it is in spite of changes of circumstances in which seasons change, or the gas duct is gradually blocked as it is used.

<Embodiment>

[0038] According to embodiments, the blower correction method of FIG. 3 may use a maximum reference air pressure Max. Ref. APS mapped on the maximum output heat amount of the combustion device 200 as a reference. Thus, the reference air pressure Ref. APS for each output heat amount may be proportionally readjusted on the basis of the corrected maximum reference air pressure Max. Ref. APS.

[0039] The above-disclosed subject matter is to be considered illustrative, and not restrictive, and the appended claims are intended to cover all such modifications, enhancements, and other embodiments, which fall within the true spirit and scope of the present invention. Thus, to the maximum extent allowed by law, the scope of the present invention is to be determined by the broadest permissible interpretation of the following claims and their equivalents, and shall not be restricted or limited by the foregoing detailed description. Therefore, the preferred embodiments should be considered in descriptive sense only and not for purposes of limitation.

Claims

1. An air proportional control type combustion device

comprising:

a blower for delivering mixed air in which a gas is mixed with air;
a gas valve disposed in a gas tube connected to the blower to control an amount of gas introduced into the blower;
an air pressure sensor disposed in an air tube connected to the blower to measure a pressure of the air introduced into the blower;
a memory in which a reference air pressure for each output heat amount of a combustion device and a reference RPM for outputting the reference air pressure are stored; and
a control part for controlling the blower at the reference RPM stored in the memory to output a heat amount requested by a user, wherein the control part comprises a blower adjusting unit for changing the RPM of the blower until the measured value becomes to the reference air pressure when the measured value of the air pressure sensor read in a state in which the gas valve is closed, and the air blower is driven at the reference RPM is different from the reference air pressure to re-store the changed RPM as the reference RPM in the memory.

2. The air proportional control type combustion device of claim 1, further comprising a multi-stage valve for controlling an amount of the mixed air introduced into the blower, and
an operation of the blower adjusting unit is performed in a state in which the multi-stage valve is fully opened.

3. The air proportional control type combustion device of claim 1, wherein the blower adjusting unit maintains the reference RPM stored in the memory as it is when a difference between the measured value of the air pressure sensor that is read in a state in which the gas valve is closed, and the blower is driven with the reference RPM and the reference air pressure is within a critical range.

4. A method for adjusting heat amount of an air proportional control type combustion device, the method comprising:

a process of storing a reference air pressure for each output heat amount of the combustion device and a reference RPM for outputting the reference air pressure in a memory;
a first process of blocking supply of a gas introduced into the blower, driving the blower at the reference RPM, and measuring a pressure of the air introduced into the blower by using an air pressure sensor;
a second process of changing the RPM of the

blower until the measured value becomes to the reference air pressure when the measured air pressure value is different from the reference air pressure, to re-store the changed RPM in the memory as the reference RPM; and
a process of controlling the blower at the reference RPM in the process of adjusting the blower to output a heat amount requested by a user.

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5. The method of claim 4, wherein the first and second processes of adjusting the blower are performed in a state in which a multi-valve controlling an amount of mixed air introduced to the blower is fully opened.

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6. The method of claim 4, wherein when a difference between the measured value in the first process of adjusting the blower and the reference air pressure is within a critical range, the reference RPM stored in the memory is maintained as it is, and the second process of adjusting the blower is not performed.

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Fig. 1

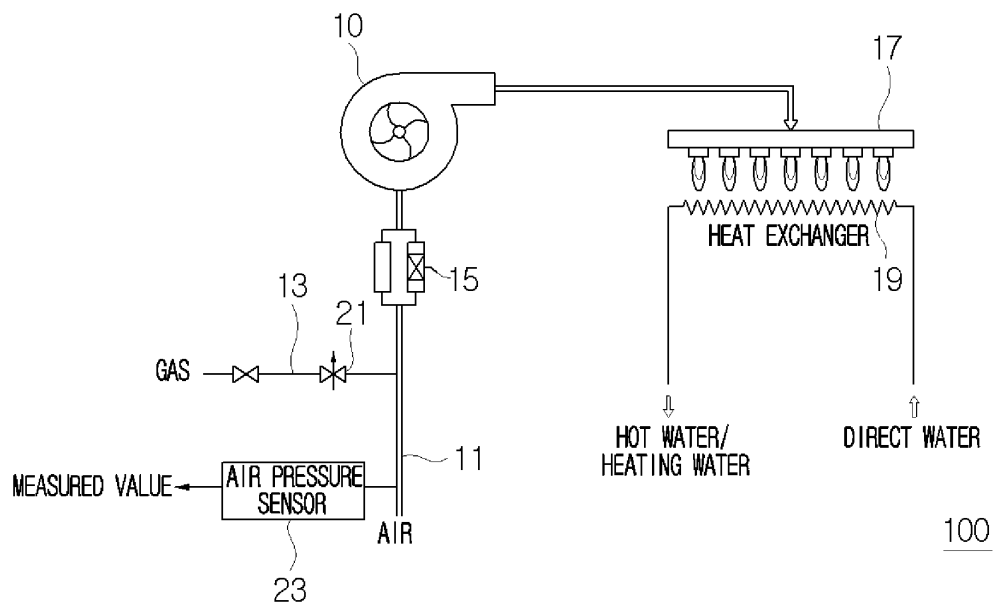


Fig. 2

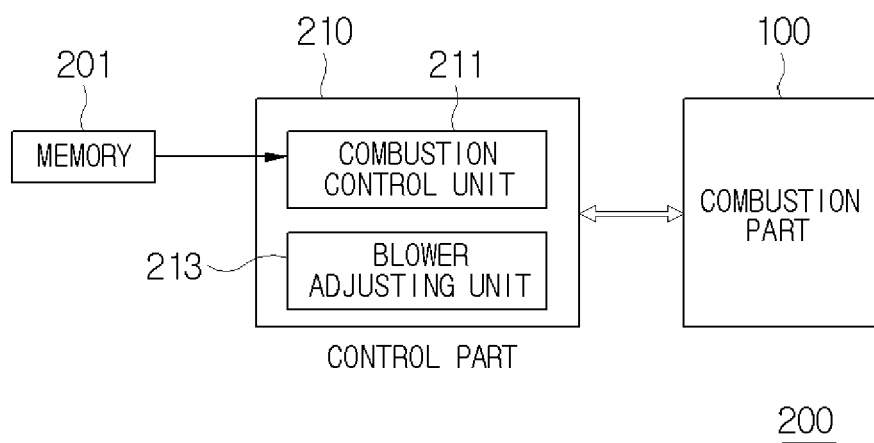
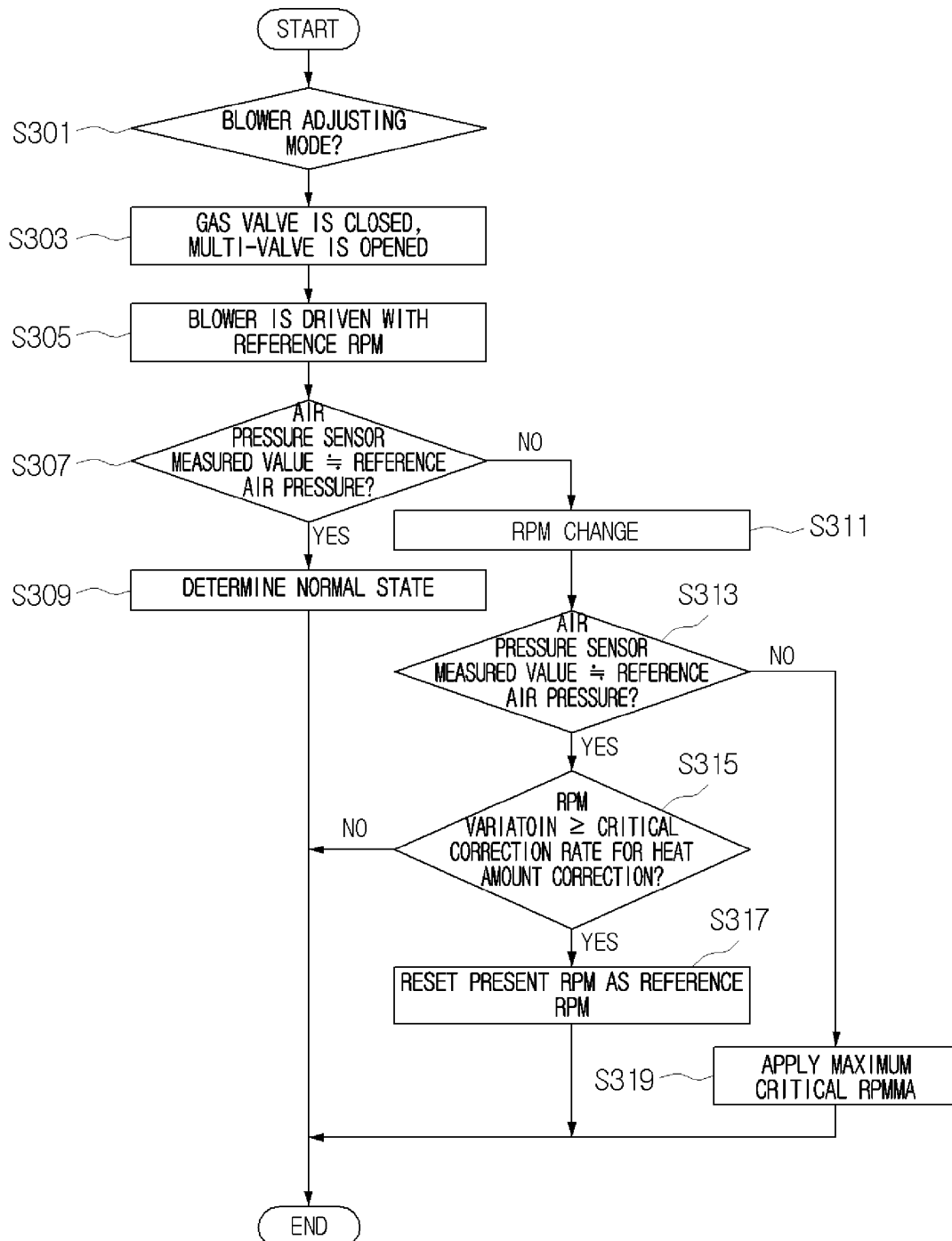


Fig. 3



INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2013/011553

A. CLASSIFICATION OF SUBJECT MATTER

F23N 1/04(2006.01)i, F23N 5/00(2006.01)i, F23D 14/60(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F23N 1/04; F23N 5/20; F23N 3/08; F24H 9/00; F24H 8/00; F24H 9/20; F23N 5/24; F23N 5/18; F23N 5/00; F23D 14/60

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean Utility models and applications for Utility models: IPC as above

Japanese Utility models and applications for Utility models: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS (KIPO internal) & Keywords: "combustion", "fan", "gas valve", "air pressure sensor", "memory" and "control unit"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 10-0629780 B1 (KYUNG DONG NAVIEN CO., LTD.) 02 October 2006 See abstract, claim 1 and figure 1	1-6
A	JP 2000-104921 A (HARMAN CO LTD) 11 April 2000 See claim 1 and figure 1	1-6
A	JP 10-110944A (PALOMA IND LTD) 28 April 1998 See abstract, claim 1 and figure 1	1-6
A	KR 10-2011-0021551 A (KYUNG DONG NETWORK CO., LTD.) 04 March 2011 See abstract and claim 1	1-6

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search

26 MARCH 2014 (26.03.2014)

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/KR2013/011553

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REFERENCES CITED IN THE DESCRIPTION

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