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(54) COMPLEX HEAT SOURCE APPARATUS

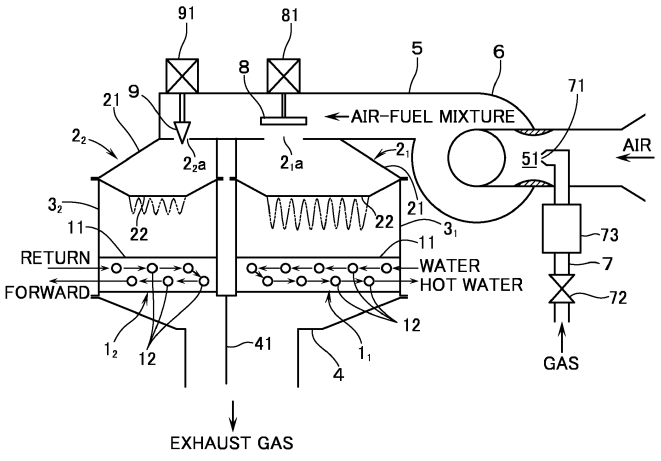
(57) [Problems]

A complex heat source apparatus is provided with: first and second, i.e., a total of two, heat exchangers (1_1, 1_2); and first and second, i.e., a total of two, burners (2_1, 2_2). A single fan (6) is interposed in a common air supply passage (5) which is connected to both the burners. A downstream end of a gas supply passage (7) which has interposed therein a flow control means (73) is connected to that portion of the air supply passage (5) which is on an upstream side or a downstream side of the fan (6). The air-fuel mixture of the primary air and the fuel gas is arranged to be supplied to both the burners (2_1, 2_2) through the air supply passage (5), and the amount of the air-fuel mixture supply to each of the first and the second burners (2_1, 2_2) is made to be independently adjusted.

[Solving Means]

An on-off valve (8) is provided in a connection portion (2_1a) between the first burner (2_1) and the air supply passage (5), and a flow control valve (9) is provided in a connection portion (2_2a) between the second burner (2_2) and the air supply passage (5). The amount of the air-fuel mixture supply to the first burner (2_1) is adjusted by the rotational speed of the fan (6), and the amount of the air-fuel mixture supply to the second burner (2_2) is adjusted by the rotational speed of the fan (6).

FIG.1



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Description

BACKGROUND OF THE INVENTION

1. Technical Field

[0001] The present invention relates to a complex heat source apparatus which is made up of first and second, i.e., a total of two, heat exchangers; a first burner for heating the first heat exchanger; and a second burner for heating the second heat exchanger.

2. Background Art

[0002] As this kind of complex heat source apparatus, there is known, e.g., in JP-A-2006-38423, a complex heat source apparatus in which both the first and the second burners are constituted by Bunsen burners such as rich and lean combustion burners and the like, and in which combustion air (primary air and secondary air) is supplied by a fan which is common to both the burners.

[0003] According to this arrangement, by making the fan to commonly serve both the burners, the costs can be reduced, but the following disadvantages exist. That is, at the time of a single operation in which only one of the first burner and the second burner is combusted to heat one of the heat exchangers corresponding to said one burner is heated, the air is supplied also to the other of the burners. This air passes, as it is, through the other heat exchanger corresponding to the other of the burners and, as a result, this heat exchanger is cooled. The thermal efficiency of this heat exchanger therefore becomes lower when the heat exchanger is heated again.

[0004] By the way, although not a complex heat source apparatus, there is known, e.g., in JP-A-2010-151395 the following heat source apparatus. That is, in a heat source apparatus having a plurality of burners for heating a single heat exchanger, the plurality of burners are constituted by totally aerated combustion burners (or "fully primary aerated burners"). In a common air supply passage connected to these burners there is interposed a single fan which supplies primary air. The downstream end of the fuel gas supply passage is connected to that portion of the air supply passage which is on an upstream side or a downstream side of the fan. It is thus so arranged that the mixture of the primary air and the fuel gas can be supplied to the plurality of burners through the air supply passage. The gas supply passage has interposed therein a flow control means which enables to vary the fuel gas feed amount in proportion to the amount of primary air supply so as to make the air-fuel ratio of the air-fuel mixture constant. Also the connection portions between each of the burners and the air supply passage are provided with on-off valves.

[0005] By applying this art to a complex heat source apparatus, the following arrangement is conceivable. That is, each of the first and the second burners to respectively heat each of the first and the second heat exchangers is constituted by a totally aerated combustion burner. The air-fuel mixture is supplied to both the first and the second burners through an air supply passage in which a single fan is interposed. Also, an on-off valve is disposed at each of the connection portion between each of the burners and the air supply passage. At the time of a single operation in which only one of the first burner and the second burner is combusted to heat one of the heat exchangers that corresponds to the said one burner, the on-off valve disposed at the connection portion between the other of the first and the second burners and the air supply passage is closed so as to stop the air-fuel mixture supply to the other burner. According to this arrangement, the other heat exchanger that corresponds to the other burner not combusted at the time of a single operation, can be prevented from being cooled by the air flow from the fan.

[0006] However, this arrangement gives rise to the following disadvantages. That is, at the time of a simultaneous operation in which both the first and the second burners are combusted for heating both the first and the second heat exchangers, when the rotational speed of the fan is changed, the amount of air-fuel mixture supply to the first burner and the amount of air-fuel mixture supply to the second burner will both be changed. As a result, the amount of air-fuel mixture supply to the first burner and the amount of air-fuel mixture supply to the second burner will no longer be adjustable independently.

SUMMARY

Problems that the Invention is to Solve

[0007] In view of the above-mentioned points, this invention has a problem of providing a complex heat source apparatus in which the amount of air-fuel supply to the first and the second burners through a common gas supply passage is independently controllable.

Means for Solving the Problems

[0008] In order to solve the above-mentioned problems, this invention has an advantage in providing a complex heat source apparatus comprising: first and second, i.e., a total of two, heat exchangers; a first burner for heating the first heat exchanger, and a second burner for heating the second heat exchanger, both the first and the second burners being constituted by totally aerated combustion burners; a single fan for supplying primary air, the fan being interposed in a common air supply passage connected to both the first and the second burners; a gas supply passage for supplying fuel gas wherein a downstream end of the gas supply passage is connected to that portion of the air supply passage which is on an upstream side or a downstream side of the fan so that a mixture of the primary air and the fuel gas can be supplied through the air supply passage to both the first and the second burners; and a flow control means interposed in

the gas supply passage so as to vary the amount of fuel gas supply in proportion to the amount of primary air supply, thereby making the air-fuel ratio of the air-fuel mixture constant. The complex heat source apparatus is characterized in: that an on-off valve is provided at a connection portion between one of the first and the second burners and the air supply passage, and that a flow control valve is provided at a connection portion between the other of the first and the second burners and the air supply passage; and that an amount of air-fuel mixture supply to said one of the burners is adjusted by a rotational speed of the fan and the amount of the air-fuel mixture supply to the other of the burners is adjusted by the rotational speed of the fan and by the flow control valve.

[0009] According to this invention, at the time of a simultaneous operation in which both the first and the second burners are combusted to thereby heat both the first and the second heat exchangers, the amount of air-fuel mixture supply to one burner out of the first and the second burners, is adjusted by the control of the rotational speed of the fan to an amount depending on the required amount of combustion at said one of the burners. Also, the amount of air-fuel mixture supply to the other of the burners can be adjusted by the control of the flow control valve to an amount depending on the required amount of combustion at the other burner. That is, the amount of air-fuel mixture supply to the first burner and the amount of air-fuel mixture supply to the second burner can be independently adjusted. Further, since the on-off valve is disposed at the connection portion between one burner and the air supply passage, the cost can be reduced as compared with an arrangement in which a flow control valve is also disposed at this connection portion.

[0010] Further, in this invention, when the first burner is made larger in rated combustion amount than the second burner, preferably the on-off valve is provided at a connection portion between the first burner and the air supply passage. According to this arrangement, even if the amount of air-fuel mixture supply to the second burner is increased or decreased by the control of the flow control valve, the amount of the air-fuel supply to the first burner that is a large-sized burner having a larger rated combustion amount does not vary so much, but the combustion amount of the first burner can be maintained at a value closer to the required amount of combustion. Therefore, precise cooperative control of the rotational speed of the fan and the flow control valve is not needed, with the result that the control becomes easier.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. 1 is a schematic sectional view showing the complex heat source apparatus according to an embodiment of this invention.

PREFERRED EMBODIMENTS FOR CARRYING OUT THE INVENTION

[0012] A complex heat source apparatus according to an embodiment of this invention as shown in FIG. 1 is made up of: a first heat exchanger 1_1 for supplying hot water; a second heat exchanger 1_2 for space heating; a first burner 2_1 for heating the first heat exchanger 1_1; and a second burner 2_2 for heating the second heat exchanger 1_2.

[0013] Each of the first and the second burners 2_1, 2_2 is constituted by a totally aerated combustion burner which ejects and combusts air-fuel mixture of fuel gas and primary air through a multiplicity of flame holes (not illustrated) formed in a combustion plate 22 that covers one surface of a box-shaped burner body 21, and is disposed in a posture facing downward with the combustion plate 22 lying on the lower side. Each of first and second combustion boxes 3_1, 3_2 that enclose the combustion space below each of the first and the second burners 2_1, 2_2 is disposed so as to house therein each of the first and the second heat exchangers 1_1 ,1_2, respectively. Further, there is provided an exhaust duct 4 which is in communication with the lower ends of the first and the second combustion boxes 3_1, 3_2. It is thus so arranged that the combustion exhaust gases from each of the first and the second burners 2_1, 2_2 can flow through each of the first and the second heat exchangers 1_1, 1_2 into the exhaust duct 4.

[0014] By the way, since hot water supply requires a larger heating capacity than space heating, the first burner 2_1 is arranged to be a large burner having a larger rated combustion amount (maximum combustion amount) than the second burner 2_2. Further, the exhaust duct 4 is partitioned by a partition plate 41 that is disposed therein into a duct portion through which the combustion exhaust gases from the first burner 2_1 flow and the other duct portion through which the combustion exhaust gases from the second burner 2_2 flow.

[0015] Each of the first and the second heat exchangers 1_1, 1_2 is made up of: a multiplicity of heat absorbing fins 11 which are laminated with one another in the direction perpendicular to the paper surface of FIG. 1; and a snaking heat absorbing tube 12 which penetrates through these fins 11. Although not illustrated, the heat absorbing tube 12 of the first heat exchanger 1_1 has connected thereto a water supply pipe on the upstream side and a hot water delivery pipe on the downstream side. It is thus so arranged that, when a hot water faucet on the downstream side of the hot water delivery pipe is opened to let the water flow to the first heat exchanger 1_1, the first burner 2_1 is combusted, so that hot water at a set temperature is delivered from the hot water faucet. Although not illustrated, the heat absorbing tube 12 of the second heat exchanger 1_2 is connected to the heating circuit of floor heating, and the like through a forward tube and a return tube. Space heating can thus be performed by circulating hot water to the heating circuit through the

second heat exchanger 1_2.

[0016] Further, the first and the second burners 2_1, 2_2 have connected thereto a common air supply passage 5. This air supply passage 5 has interposed therein a single fan 6 which supplies primary air. That portion of the air supply passage 5 which is on an upstream side of the fan 6 has connected thereto a gas outlet 71 which is on a downstream end of a gas supply passage 7 for supplying fuel gas. That portion of the of the air supply passage 5 to which the gas outlet 71 is connected is arranged to constitute a venturi portion 51 having a constricted sectional area.

[0017] The gas supply passage 7 has interposed therein a main valve 72, and a zero governor 73 as a flow control means which controls the secondary gas pressure to a pressure equivalent to the atmospheric pressure. It is to be noted here that the amount of fuel gas supply varies with a differential pressure between the atmospheric pressure which is the secondary gas pressure, and that suction negative pressure of the fan 6 which operates on the venturi portion 51. Since the suction negative pressure of the fan varies in proportion to the rotational speed of the fan, the amount of fuel gas varies in proportion to the rotational speed of the fan, i.e., the amount of the primary air supply.

[0018] Further, a connection portion 2_1a between the first burner 2_1 and the air supply passage 5 is provided with an on-off valve 8 driven by an actuator 81 such as an electromagnetic solenoid, and the like. A connection portion 2_2a between the second burner 2_2 and the air supply passage 5 is provided with a flow control valve 9 of a needle type which is driven by an actuator 91 made up of a combination of an electric motor and a feed screw mechanism.

[0019] At the time of a single operation of hot water supply in which only the first burner 2_1 is combusted to thereby heat the first heat exchanger 1_1, the on-off valve 8 opened to supply the air-fuel mixture to the first burner 2_1 and also the flow control valve 9 is totally closed to thereby stop the supply of air-fuel mixture to the second burner 2_2. Further, the amount of air-fuel mixture supply to the first burner 2_1 is adjusted by the rotational speed of the fan 6 so as to become a value corresponding to the hot water demand combustion amount (combustion amount necessary to supply hot water at a set temperature). Further, at the time of a single operation for space heating in which only the second burner 2_2 is combusted to thereby heat the second heat exchanger 1_2, the flow control valve 9 is fully opened to supply the air-fuel mixture to the second burner 2_2. The on-off valve 8 is closed to stop the supply of air-fuel mixture to the first burner 2_1. Further, the amount of air-fuel mixture supply to the second burner 2_2 is adjusted by the rotational speed of the fan 6 so as to attain a value corresponding to the space-heating demand combustion amount (combustion amount necessary to supply hot water to the space-heating circuit at a set temperature).

[0020] At the time of a simultaneous operation of hot water supply and hot air supply by combusting the first burner 2_1 for heating the first heat exchanger 1_1, and also by combusting the second burner 2_2 for heating the second heat exchanger 1_2, in a state in which the on-off valve 8 is opened, the amount of air-fuel mixture supply to the first burner 2_1 is adjusted by the rotational speed of the fan 6 so that the amount of air-fuel mixture supply becomes a value corresponding to the hot water demand combustion amount. In this case, if the flow control valve 9 is left fully opened, the amount of air-fuel mixture supply to the second burner 2_2 will fluctuate (i.e., increase or decrease) due to an increase or decrease in the rotational speed of the fan 6. As a result, the amount of combustion in the second burner 2_2 will no longer be maintained at the space-heating demand combustion amount. As a solution, in this embodiment, at the time of a simultaneous operation, the amount of air-fuel mixture supply to the second burner 2_2 is controlled by the flow control valve 9 so that the amount of air-fuel mixture supply to the second burner 2_2 becomes a value corresponding to the space-heating demand combustion amount. In this manner, also at the time of a simultaneous operation, the amount of air-fuel mixture supply to the first burner 2_1 and the amount of air-fuel mixture supply to the second burner 2_2 can be independently adjusted depending on the space-heating demand combustion amount of each of the burners 2_1, 2_2.

[0021] It is conceivable to dispose the flow control valve also at the connection portion 2_1a between the first burner 2_1 and the air supply passage 5. However, as in this embodiment, by selecting the valve disposed at this connection portion 2_1a to be the on-off valve 8, the cost reduction can advantageously be attained.

[0022] It is also conceivable to employ the following arrangement. That is, a flow control valve is disposed in the connection portion 2_1a between the first burner 2_1 and the air feed passage 5, and an on-off valve is disposed in the connection portion 2_2a between the second burner 2_2 and the air feed passage 5. At the time of a simultaneous operation in this arrangement, the amount of air-fuel mixture supply to the second burner 2_2 is controlled by the rotational speed of the fan 6, and the amount of air-fuel mixture supply to the first burner 2_1 is controlled by the flow control valve. In this arrangement, however, as a result of control of the amount of air-fuel mixture supply to the large-sized first burner 2_1, the amount of air-fuel mixture supply to the small-sized second burner 2_2 will largely be fluctuated. Accurate cooperation control of the rotational speed of the fan and control of the flow control valve will thus be required, thereby complicating the control.

[0023] According to the arrangement of this embodiment, on the other hand, even if the amount of air-fuel mixture supply to the small-sized second burner 2_2 is increased or decreased by the control of the flow control valve 9, the amount of air-fuel mixture supply to the large-sized first burner 2_1 will not vary much. As a result, the amount of combustion of the first burner 2_1 can be main-

tained at a value close to the required amount of combustion. Therefore, an accurate cooperative control between the rotational speed of the fan and the flow control valve 9 becomes needless, with the result that the control becomes easier.

[0024] Description has so far been made of the embodiment of this invention with reference to the accompanying drawing. This invention, however, shall not be limited to the above, but the following arrangement may be employed. For example, a venturi portion is provided in that portion of the air supply passage 5 which is on the downstream side of the fan 6. The downstream end of the gas supply passage 7 is made to lie proximate to the venturi portion. Then there may be interposed a zero governor in the gas supply passage 7 as the flow amount adjusting means, the zero governor serving to adjust the secondary gas pressure to a pressure equivalent to the outlet pressure of the fan 6. In this case, the differential pressure between the outlet pressure of the fan 6 and the venturi portion is proportional to the amount of the primary air supply by the fan 6. The amount of the fuel gas supply will also be proportional to the amount of the primary air supply.

[0025] Further, it is also conceivable to interpose a proportional valve in the gas supply passage 7 as a flow control means in order to make adjustments with the proportional valve so that the amount of the fuel gas supply is proportional to the amount of the primary air supply. In this case, the downstream end of the gas supply passage 5 may be connected to either an upstream portion or a downstream portion of the fan in the air supply passage 5. Further, the above embodiment is a complex heat source apparatus of serving the dual purposes of hot water supply and hot air supply in which the first heat exchanger 1_1 is for supplying hot water and the second heat exchanger 1_2 is for supplying hot air. However, this invention can similarly be applicable to the one in which the second heat exchanger 1_2 is other than for supplying hot air for space heating, e.g., for reheating a bath tab.

EXPLANATION OF MARKS

[0026]

1_1	first heat exchanger
1_2	second heat exchanger
2_1	first burner
2_2	second burner
2_1a	connection portion between the first burner and the air supply passage
2_2a	connection portion between the second burner and the air supply passage
5	air supply passage
6	fan
7	gas supply passage
71	gas outlet (downstream end of the gas supply passage)
73	zero governor (flow control means)
8	on-off valve
9	flow control valve

Claims

1. A complex heat source apparatus comprising:

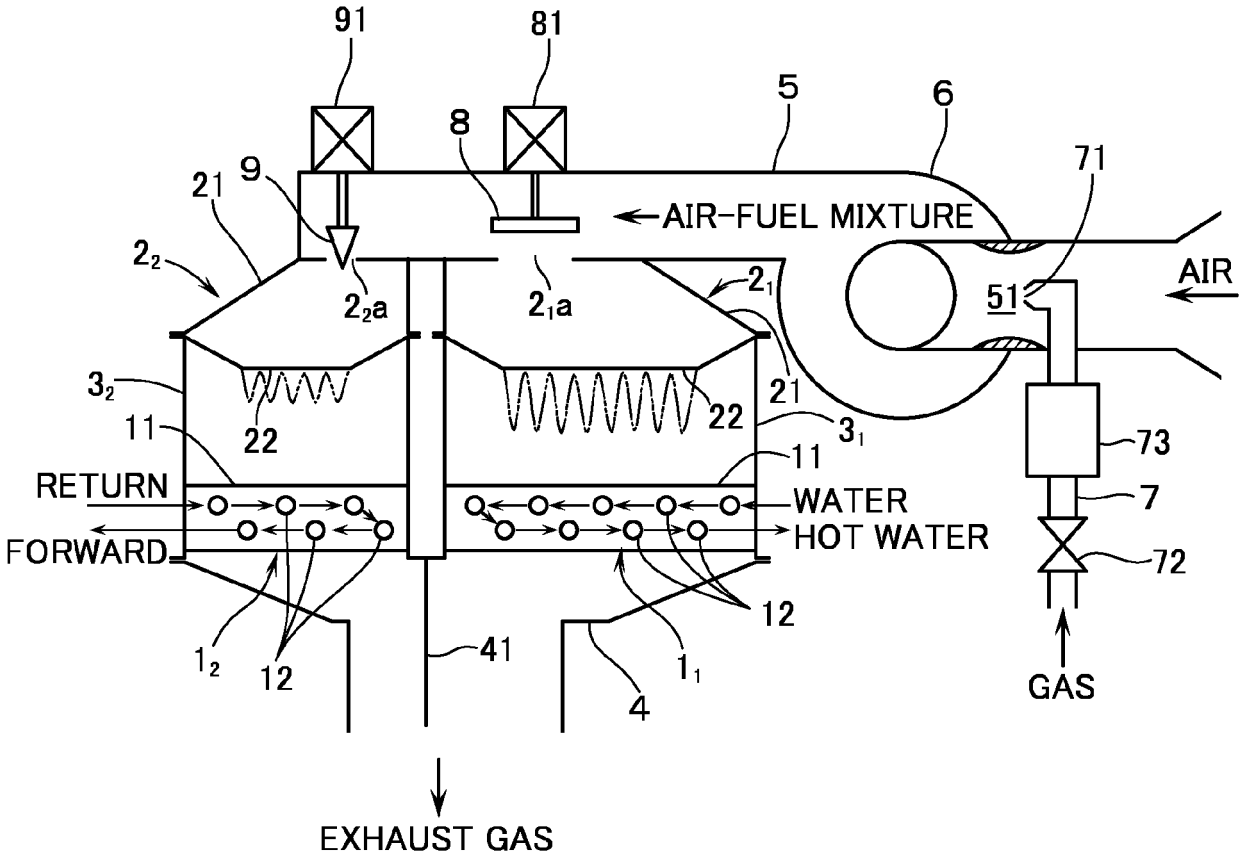
first and second, i.e., a total of two, heat exchangers (1_1, 1_2);
a first burner (2_1) for heating the first heat exchanger (1_1), and a second burner (2_2) for heating the second heat exchanger (1_2), both the first and the second burners (2_1, 2_2) being constituted by totally aerated combustion burners;
a single fan (6) for supplying primary air, said fan (6) being interposed in a common air supply passage (5) connected to both the first and the second burners (2_1, 2_2);
a gas supply passage (7) for supplying fuel gas wherein a downstream end (71) of the gas supply passage (7) is connected to that portion of the air supply passage (5) which is on an upstream side or a downstream side of the fan (6) so that a mixture of the primary air and the fuel gas can be supplied through the air supply passage (5) to both the first and the second burners (2_1, 2_2); and
a flow control means (73) interposed in the gas supply passage (7) so as to vary the amount of fuel gas supply in proportion to the amount of primary air supply, thereby making the air-fuel ratio of the air-fuel mixture constant;

characterized in:

that an on-off valve (8) is provided at a connection portion (2_1a, 2_2a) between one of the first and the second burners (2_1, 2_2) and the air supply passage (5), and that a flow control valve (9) is provided at a connection portion (2_1a, 2_2a) between the other of the first and the second burners (2_1, 2_2) and the air supply passage (5); and
that an amount of air-fuel mixture supply to said one of the burners is adjusted by a rotational speed of the fan (6) and the amount of the air-fuel mixture supply to the other of the burners is adjusted by the rotational speed of the fan (6) and by the flow control valve (9).

2. The complex heat source apparatus according to claim 1,
wherein the first burner (2_1) is made larger in rated combustion amount than the second burner (2_2); and
wherein the on-off valve (8) is provided at the connection portion (2_1a) between the first burner (2_1) and the air supply passage (5).

FIG.1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GAS
EXHAUST GAS

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EUROPEAN SEARCH REPORT

Application Number
EP 16 19 1574

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F23L
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	20 February 2017	Rudolf, Andreas

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

REFERENCES CITED IN THE DESCRIPTION

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