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(54) Title: HOT WATER SUPPLY TYPE BOILER INCLUDING WASTE HEAT RECOVERY UNIT AND HOT WATER SUPPLY HEAT EXCHANGER

(57) Abstract: A hot water supply type boiler is disclosed, in which cold water is heated by a waste heat recovery unit and a hot water supply heat exchanger, and then is again heated in a boiler container, thereby remarkably improving a fuel saving efficiency and heat exchanging efficiency. The boiler includes a waste heat exchanging means for primarily heating the water supplied from an exterior using waste heat of an exhaust gas, a hot water supply heat exchanging means for secondarily and thirdly heating mixed water of the primarily heated water and the water supplied from the exterior, and a boiler heat exchanging means for heating the water through the hot water heat exchanging means using the heat generated by a burner or heater and fourthly heating the thirdly heated water.
Title: HOT WATER SUPPLY TYPE BOILER INCLUDING WASTE HEAT RECOVERY UNIT AND HOT WATER SUPPLY HEAT EXCHANGER

Technical Field

The present invention relates to a hot water supply type boiler, and more particularly to a hot water supply type boiler including a waste heat recovery unit and a hot water supply heat exchanger, in which cold water supplied from an exterior is heated by the waste heat recovery unit and the hot water supply heat exchanger, and then is again heated in a boiler container, thereby remarkably improving a fuel saving efficiency and heat exchanging efficiency.

Background Art

In general, domestic or industrial boilers include a burner or heater for generating heat using gas, oil or electricity. Also, such a boiler includes a heat exchange pipe for heat-exchanging cold water supplied from a water supply pipe to circulate hot water.

In the heat exchanging method of the existing boilers, the cold water is heated by the heat generated from the burner, and the hot water is circulated, in which the heat exchanger is cooled during circulation of the hot water.

In order to improve the performance of the boiler that heats the cold water, as a lot of fuel should be supplied to the burner, the fuel consumption is increased to increase operating expenses of the boiler, and an exhaust gas is discharged to cause environmental pollution.

Also, in case of using the heater in the boiler, since it should heat the cold water passing continuously, increased power consumption leads to increase of
operating expenses.

As described above, the water is not stored in the existing boiler, but continuously passes through the boiler, thereby increasing the consumption of fuel and electric power and thus increasing the operating expenses.

Disclosure

Technical Problem

As described above, the conventional boiler has problems that a lot of fuel is consumed and that, in case of using the heater, the power consumption is increased which leads to increase of operating expenses.

Also, since a lot of fuel is used, a quantity of exhaust gas is discharged to cause environmental pollution. This drawback should be solved to meet the agreement on reduction of greenhouse gas in accordance with effectuation of Kyoto Protocol.

The water is not stored in the conventional boiler, but continuously passes through the boiler, hereby increasing the consumption of fuel and electric power and thus increasing the operating expenses.

In addition, since the conventional boiler directly heats the cold water using a heating means, vapor is produced, and condensate water is generated, which causes corrosion of the boiler and incomplete combustion.

Technical solution

Accordingly, the present invention has been made to solve the above-mentioned problems occurring in the prior art while advantages achieved by the prior
art are maintained intact.

One object of the present invention is to provide a hot water supply type boiler including a waste heat recover unit and a hot water supply heat exchanger which are mounted on an exterior of a boiler casing, in which cold water is not heat-exchanged in the boiler casing, in order to solve drawbacks in that cold water is heat-exchanged with hot water by using a lot of fuel and energy in a boiler casing. Hot water stayed and circulated in the hot water supply heat exchanger and primarily, secondarily and thirdly heated hot water are fourthly heated to save fuel and energy and achieve complete combustion and thus extend its lifespan.

Another object of the present invention is to provide a hot water supply type boiler capable of remarkably increasing the heat exchange efficiency by simultaneously supplying water through a plurality of micro-channels of a heat exchanger.

Still another object of the present invention is to provide a hot water supply type boiler capable of further improving a thermal efficiency by heat-exchanging waste heat of a discharged waste gas with cold water.

In order to accomplish the object, there is provided a hot water supply type boiler includes a waste heat exchanging means for primarily heating the water supplied from an exterior using waste heat of an exhaust gas, a hot water supply heat exchanging means for secondarily and thirdly heating mixed water of the water primarily heated by the waste heat exchanging means and the water supplied from the exterior using hot water passing through the hot water supply heating exchanging means, and a boiler heat exchanging means, connected to the waste heat exchanging means, for guiding the exhaust gas generated therein to the waste heat exchanging means to heat the water through the hot water heat exchanging means
using the heat generated by a burner or heater and fourthly heating the thirdly heated water.

**Advantageous Effects**

According to a preferred embodiment, the remaining heat of an exhaust gas can be utilized by using a waste heat exchanger to heat cold water, thereby remarkably improving a thermal efficiency.

A small volume of hot water circulated by a hot water supply heat exchanging means is heat-exchanged with the hot water secondarily and thirdly heat-exchanged by the hot water supply heat exchanging means in the boiler heat exchanging means, in which cold water is not directly heat-exchanged.

As a result, vapor and condensate water are not produced in the boiler heat exchanging means to prevent corrosion of the boiler and thus prolong its lifespan.

Also, an amount of exhaust gas is minimized through complete combustion.

Therefore, the present invention has an advantage of reducing the energy to prevent environmental pollution and global warming.

**Brief Description of the Drawings**

The foregoing and other objects, features and advantages of the present invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings in which:

FIG. 1 is a view schematically showing a boiler according to an embodiment of the present invention;

FIG. 2 is a cross-sectional view of the boiler in FIG. 1;

FIG. 3 is a perspective view of a heat exchanger of the boiler in FIG. 1;
FIG. 4 is a partially cut perspective view of the heat exchanger in FIG. 3;
FIG. 5 is a plan cross-sectional view of the heat exchanger in FIG. 3;
FIG. 6 is a front cross-sectional view of the heat exchanger in FIG. 3;
FIG. 7 is a diagram showing hot water circulation in the boiler in FIG. 1;
FIG. 8 is a view schematically showing a boiler according to another embodiment of the present invention;
FIG. 9 is a partially cut perspective view of a waste heat recovery unit in the boiler in FIG. 8;
FIG. 10 is a cross-sectional view of the waste in FIG. 9;
FIG. 11 is a cross-sectional view taken along line A-A’ in FIG. 10; and
FIG. 12 is a diagram showing hot water circulation in the boiler in FIG. 8;

**Best Mode**

**Mode for Invention**

Hereinafter, exemplary embodiments of the present invention will be described with reference to the accompanying drawings.

A hot water supply type boiler according to a preferred embodiment of the present invention includes a waste heat exchanging means for primarily heating the water supplied from an exterior, a hot water supply heat exchanging means secondarily and thirdly heating the water heated primarily heated by the waste heat exchanging means and the water supplied from the exterior by using hot water stayed and passing therein, and a boiler heat exchanging means for heating the water stayed in the hot water supply heat exchanging means using boiler heat generated by a burner or a heater and fourthly heating the thirdly heated water, the
boiler heat exchanging means being connected to the waste heat exchanging means to supply the exhaust gas generated therein to the waste heat exchanging means.

Although the waste heat exchanging means is not provided, the object of the present invention can be achieved. Therefore, the hot water supply type boiler including the hot water supply heat exchanger and the boiler heat exchanging means according to an embodiment of the present invention will now be described.

Also, a hot water supply type boiler further including the waste heat exchanger means according to another embodiment of the present invention will be describe.

A hot water supply type boiler according to an embodiment of the present invention including a hot water supply heat exchanger for heating the cold water supplied form an exterior to generate hot water is characterized by comprising a burner installed on one end of the boiler and operated by a combustion fuel, a heating means heated by the heat generated by the burner for heating the cold water stayed in a plurality of chambers during a predetermined time, and a hot water supply heat exchanger for heating the cold water supplied from the exterior by using the hot water supplied from the heating means to generate hot water.

The boiler including the hot water supply heat exchanger for heating the cold water supplied from the exterior to generate hot water includes a burner 8, a heating rod 12 housing the burner 8 therein and having an exhaust hole 10 formed on an upper end thereof, a heat exchanger 14 housing the heating rod 12 therein and having a guide hole 18 formed on a lower portion thereof, a boiler casing 22 housing the heat exchanger 14 therein and having an exhaust pipe 24 coupled to an upper end thereof, primary and secondary heating pipes 26 and 28 wound around an outer
periphery of the heating rod 12, and a tertiary heating pipe 30 wound around an inner periphery of the boiler casing 22.

The hot water supply heat exchanger 40 is connected to the primary and secondary heating pipes 26 and 28 to circulate the heat heated by the burner 8, and the hot water supply heat exchanger 40 is connected to a conduit 60 to heat-exchange the passing water.

The hot water supply heat exchanger 40 includes a hollow housing 42 coupled to inlets and outlets of the primary and secondary heating pipes 26 and 28, a partition 44, horizontally installed at a middle portion of the housing 42, for separating an internal space into upper and lower chambers 46 and 48, micro-channels 50 horizontally installed in each of the upper and lower chambers 46 and 48 and connected to both sides of the housing 42, a guide pipe 52 installed on one side of the housing 42 and housing the outlets of the micro-channels 50 positioned in the upper and lower chambers 46 and 48, an upper distributing pipe 54 installed on the other side of the housing 42, housing the inlets of the micro-channels 50 positioned in the upper chamber 46 and connected to the conduit 60, a lower distributing pipe 56 installed on the other side of the housing 42, and housing the inlets of the micro-channels 50 positioned in the lower chamber 48, and a drain line 62 connected to the lower distributing pipe 56 and connected to the tertiary heating pipe 30.

The primary heating pipe 26 connects an upper feed pipe 68 having a nozzle 70 with one side of the upper chamber 46, and the secondary heating pipe 28 connects a lower feed pipe 78 having a nozzle 80 with one side of the lower chamber 48. An upper inlet pipe 72 having a nozzle 74 is disposed in one side of the upper chamber 46, and is connected to the primary heating pipe 26 via a recovery line 76, and a lower inlet pipe 82 having a nozzle 84 is disposed in one side of the lower
chamber 72, and is connected to the secondary heating pipe 28 via a recovery line 86.

Pumps 36 and 38 are installed in the feed lines 32 and 34, and a subsidiary line 64 is connected to the tertiary heating pipe 30 which is connected to an opening/closing valve 66.

The cold water supplied from the conduit 60 is primarily heated by the hot water supply heat exchanger 40, and the heated water passes through the drain line 62 to the tertiary heating pipe 30 so that the water is again heated.

The hot water supply type boiler 1a including the hot water heat exchanger according to an embodiment of the present invention will now be described with reference to a boiler heat exchanger 2 shown in FIG. 2.

The boiler heat exchanger 2 includes a burner operated by a combustion fuel and a heating means heated by the heat supplied from the burner and heating the water supplied from a plurality of chambers, the water being staying in the chambers during a predetermined time.

The hot water supply heat exchanger 40 shown in FIGs. 3 to 6 will be described as the hot water supply heat exchanger means in this embodiment. The hot water supply heat exchanger 40 is connected to the heating means 3 to heat the cold water supplied from the exterior by using the supplied hot water.

The construction of the hot water supply boiler 1a including the hot water supply heat exchanger will now be described with reference to FIGs. 2 to 7.

Referring to FIG. 2, the boiler heat exchanger 2 includes a burner 8 for supplying heat, in which the burner may be operated by a heater using oil, gas or electricity.

The burner 8 is installed in the heating rod 12 having the exhaust hole 10
formed on the upper end of the heating rod. The heat exchanger 14 of a large diameter and height is disposed at an outside of the heating rod 12 to form a first passage 16 for guiding the heat and the exhaust gas therebetween. The guide hole 18 is formed on the lower portion of the heat exchanger 14.

The boiler casing 22 of a large diameter and height is disposed at an outside of the heat exchanger 14 to form a second passage 20, and has the exhaust pipe 24 coupled to the upper end of the boiler casing 22.

The primary and secondary heating pipes 26 and 28 which are heated by the heat supplied from the heating rod 12, and the heat and exhaust gas flowing through the first passage 16 are wound around the outer periphery of the heating rod 12, with the primary and secondary heating pipes 26 and 28 being suspended. In this instance, the primary heating pipe 26 is positioned at the lower portion of the heating rod 12, while the secondary heating pipe 28 is positioned at the upper portion of the heating rod 12.

The tertiary heating pipe 30 is wound around an inner periphery of the boiler casing 22, and is heated by the heat supplied from the heat exchanger 14 and the heat and exhaust gas flowing through the second passage 20.

The feed lines 32 and 34 are respectively coupled to the outlets of the primary and secondary heating pipes 26 and 28, and the pumps 36 and 38 are respectively coupled to the feed lines 32 and 34 to forcibly circulate the hot water. The hot water supply heat exchanger 40 is connected to the outlets of the pumps 36 and 38.

The hot water supply heat exchanger 40 includes the hollow housing 42, as shown in FIG. 4. The partition 44 is horizontally installed at the middle portion of the housing 42 to separate the internal space into the upper and lower chambers 46 and
48.

A plurality of micro-channels 50 are horizontally installed in each of the upper and lower chambers 46 and 48, and both ends of the micro-channels 50 are connected to both sides of the housing 42. The box-shaped guide pipe 52 is installed on one side of the housing 42 to guide a flow of the water, and is extended over the entire sides of the upper and lower chambers 46 and 48 to house the outlets of the micro-channels 50 positioned in the upper chamber 46 and the inlets of the micro-channels 50 positioned in the lower chamber 48.

The upper distributing pipe 54 is installed on the other side of the housing 42, and is positioned at the outside of the upper chamber 46 to connect the inlets of the micro-channels 50 positioned in the upper chamber 46. The lower distributing pipe 56 is installed on the other side of the housing 42, and is positioned at the outside of the lower chamber 48 to connect the outlets of the micro-channels 50 positioned in the lower chamber 48.

The channel 60 having a filter 58 is connected to the upper distributing pipe 54, and the drain line 62 is connected to the lower distributing pipe 56 and thus the tertiary heating pipe 30. The subsidiary line 64 is connected to the outlet of the tertiary heating pipe 30, and the opening/closing valve 66 is mounted on the subsidiary line 64.

The front end of the feed line 32 connected to the primary heating pipe 26 is connected to the front side of the housing 42, and is positioned in the upper chamber 46. The front end of the feed line 32 connected to the upper feed pipe 68 is installed in the upper chamber 46 in a longitudinal direction. In this instance, the upper feed pipe 68 is positioned in the space formed between the micro-channels 50 and the partition 44, and a plurality of nozzles 70 are installed on one side of the upper feed
pipe 68 in a longitudinal direction at regular intervals.

Consequently, the hot water supplied from the upper feed pipe 68 is evenly dispersed and moved to one side of the upper chamber 46 by the nozzles 70.

The upper inlet pipe 72 is installed on one side of the upper chamber 46 in a longitudinal direction. The upper inlet pipe 72 is positioned in the space formed between the micro-channels 50 and the partition 44, and a plurality of nozzles 74 are installed on one side of the upper inlet pipe 72 at regular intervals.

As a result, the hot water moving from one side of the upper chamber 46 is evenly dispensed and moved to the upper inlet pipe 72.

One end of the upper inlet pipe 72 is connected to the front surface of the housing 42, and is connected to the recovery line 76 which is connected to the primary heating pipe 26.

The front end of the feed line 34 connected to the secondary heating pipe 28 is connected to the front surface of the housing 42, and is positioned in the lower chamber 48. A lower feed pipe 78 is coupled to the front end of the feed line 34, and is installed in the interior of the lower chamber 48 in a longitudinal direction. In this instance, the lower feed pipe 48 is positioned in the space formed between the micro-channels 50 and the bottom surface of the housing 42, and a plurality of nozzles 80 are installed in a longitudinal direction on one side of the lower feed pipe 78 at regular intervals.

The hot water supplied from the lower feed pipe 78 is evenly dispersed and moved to one side of the lower chamber 48 by the nozzles 80.

The lower feed pipe 82 is installed on one side of the lower chamber in a longitudinal direction. In this instance, the lower feed pipe 82 is positioned in the space formed between the micro-channels 50 and the bottom surface of the housing
42, and a plurality of nozzles 84 are installed on one side of the lower feed pipe 82 at regular intervals.

The hot water supplied from one side of the lower chamber 48 is evenly dispersed and moved to the lower inlet pipe 82.

One end of the lower inlet pipe 82 penetrates the front surface of the housing 42, and is connected to the recovery line 86 which is connected to the secondary heating pipe 28.

The opening/closing valve 88 is installed in the recovery lines 76 and 86 which are connected to the primary and secondary heating pipes 26 and 28, so that a user utilizes the hot water, if necessary. The controller 90 is connected to the pumps 36 and 38 which are installed in the burner 8 and the feed lines 32 and 34 to transfer an operation command to the burner and the feed lines. The controller 90 is connected to a manipulation unit 92.

Also, the upper and lower chambers 46 and 48 are provided with a pressure control valve 92 and a water supply pipe 94, respectively.

The operation of the hot water supply type boiler including the hot water supply heat exchanger according an embodiment of the present invention will now be described.

First, if a start mode is selected by using the manipulation unit 92, the controller 90 outputs an operation command to drive the burner 8 and the pumps 36 and 38. In this instant, the burner 8 is turned on to generate the heat, so that the heating rod 12 is heated. At the same time, the primary and secondary heating pipes 26 and 28 are heated by the heat conducted through the heating rod 12.

The combustion gas produced from the burner 8 is moved upwards together with a part of the heat, and is passed through the exhaust hole 10. Then, the
combustion gas is moved downwards along the first passage 16 to sequentially heat the secondary heating pipe 28 and the primary heating pipe 26.

As a result, the primary and secondary heating pipes 26 and 28 are heated by the heat directly transferred through the heating rod 12 and the heat and the combustion gas flowing along the first passage 16.

After that, the heat and the combustion gas is passed through the guide hole 18 formed at the lower portion of the heat exchanger 14, is moved upwards along the second passage 20, and then is discharged outwardly through the exhaust pipe 24 while heating the tertiary heating pipe 30 which is wound around the inner periphery of the boiler casing 22.

At that time, the tertiary heating pipe 30 is also heated by the heat directly supplied by the heat exchanger 14.

The pumps 36 and 38 are driven by the command outputted from the controller 90 to supply the hot water from the primary and secondary heating pipes 26 and 28 through the feed lines 32 and 34. In this instance, the hot water supplied from the primary heating pipe 26 which has temperature lower than that of the hot water supplied from the secondary heating pipe 28 is moved along the feed line 32, and then is sprayed onto the upper chamber 46 through the nozzles 70 of the upper feed pipe 68.

Since the nozzles 70 are provided on the entire surface of the upper feed pipe 68 at regular intervals, the hot water is simultaneously sprayed by the nozzles 70 over the whole space from the front side of the upper chamber 46 to the rear side, so that the hot water is uniformly sprayed onto one side of the upper chamber 46.

The hot water is supplied by the nozzles 74 of the upper inlet pipe 72 positioned at one side of the upper chamber 46, and then is returned to the primary
heating pipe 26 along the recovery line 76, so that the hot water is again heated and circulated.

At the same time, the hot water supplied from the secondary heating pipe 28 which has temperature higher than that of the hot water supplied from the primary heating pipe 26 is moved along the feed line 34, and then is sprayed onto the lower chamber 48 through the nozzles 80 of the lower feed pipe 78.

Since the nozzles 80 are provided on the entire surface of the lower feed pipe 78 at regular intervals, the hot water is simultaneously sprayed by the nozzles 80 over the whole space from the front side of the lower chamber 48 to the rear side, so that the hot water is uniformly sprayed onto one side of the lower chamber 48.

The hot water is supplied by the nozzles 84 of the lower inlet pipe 82 positioned at one side of the lower chamber 48, and then is returned to the secondary heating pipe 28 along the recovery line 86, so that the hot water is again heated and circulated.

Meanwhile, the cold water supplied from the conduit 60 is passed through the filter 58 to filter alien substances, and then only the pure water is reached to the upper distributing pipe 54. After that, the cold water is divided into the plurality of micro-channels 50 at the upper distributing pipe 54.

In this state, the hot water supplied to the upper chamber 46 transfers directly the heat to the micro-channels 50 since the hot water is stayed. Thus, the cold water passing through the micro-channels 50 is heated by the transferred heat.

The water stayed in the upper chamber 46 is pushed by the hot water supplied from the upper feed pipe 68, and then is moved to the upper inlet pipe 72 in the cold state due to the heat exchange.

As the water supplied from the primary heating pipe 26 is not hot, there is not
difference between cold tap water passing through the micro-channels 50 and the water supplied from the primary heating pipe 26. Consequently, the micro-channels 50 are not deformed even though the micro-channels 50 have small diameter.

The water simultaneously passing through the plurality of micro-channels 50 is supplied to the guide part 52, and then is moved downward so that the water is dispensed and passed through the plurality of micro-channels 50 positioned at the lower chamber 48.

In this instance, the water stayed in the lower chamber 48 conducts the heat directly to the micro-channels 50. Consequently, the hot water passing through the micro-channels 50 is again heated by the conducted heat, so that the hotter water flows.

The water passing through the micro-channels 50 of the lower chamber 48 is passed through the lower dispensing pipe 56, and then is moved to the tertiary heating pipe 30 through the drain line 62, so that the water is again heated.

As described above, the water again heated by the tertiary heating pipe 30 is maintained at temperature of 100°C because the hot water is heated by the primary and secondary heating pipes 26 and 28. The user can utilize the hot water using the opening/closing valve 66, if necessary.

A hot water supply type boiler according to another embodiment of the present invention further includes a waste heat exchange means, in addition to the characteristics of the above-described embodiment. A waste heat recovery unit 100 will be described as one example of the waste heat exchanger according to another embodiment.

The waste heat recovery unit 100 is connected to the exhaust pipe 24 at one side thereof, through which the exhaust gas passes, and is connected to the conduit
at the other side, through which the water passes for heat exchange.

The waste heat recovery unit 100 includes a hollow cylindrical duct 110, a gas flow part 116, installed in the cylindrical duct 110, for guiding an exhaust gas from one side of cylindrical duct 110 to the other side, a water inlet pipe 112, connected to one side of the cylindrical duct 110, for supplying the water from the conduit 60, and a water outlet pipe 114, connected to the other side of the cylindrical duct 110, for discharging the water to the conduit 60.

The gas flow part 116 is composed of a plurality of gas pipes.

The gas flow part 116 includes a gas staying chamber 120, a plurality of gas inlet pipe 118a having one end connected to one side of the cylindrical duct 110 and the other end connected to the gas staying chamber 120, and a plurality of gas outlet pipe 118b having one end connected to the other side of the gas staying chamber 120 and the other end connected to the other side of the cylindrical duct 110.

The hot water supply type boiler 1b including the hot water supply heat exchanger and the waste heat recovery unit according to another embodiment of the present invention will now be described with reference to FIGs. 8 to 12. In the entire description of the present invention comprising the claims, the same drawing reference numerals are used for the same elements across various figures, and the detailed description thereof will be omitted.

In particular, it is preferable that if the waste recovery unit 100 is regarded as a start point in the heat exchanging operation of the cold supplied from the exterior, that is, the cold water is primarily heated by the waste heat recovery unit 100, the primary, secondary and the tertiary heating pipes according to the above embodiment of the present invention are regarded as secondary, tertiary and quaternary heating pipes.
Therefore, reference numerals indicating the secondary, tertiary and quaternary heating pipes are identical to the primary, secondary and tertiary heating pipes 26, 28 and 30 in the above embodiment of the present invention, respectively.

The waste heat recovery unit 100 is connected to the exhaust pipe 24, so that the exhaust gas discharged from the exhaust pipe 24 passes through the waste heat recovery unit 100 to heat-exchange the cold water with the heat remaining in the exhaust gas.

The waste heat recovery unit 100 includes the hollow cylindrical duct 110, through which the water passes, the gas flow part 116, installed in the cylindrical duct 110, for guiding the exhaust gas, and the water inlet pipe 112 and the water outlet pipe 114 connected to the conduit 60 for guiding inlet and outlet of the water.

One side of the cylindrical duct 110 is connected to the water inlet pipe 112 for supplying the cold water to the cylindrical duct 110 through the conduit 60 which is connected to the water inlet pipe 112. In this instance, the water inlet pipe 112 is provided with a pump (not shown) for smoothly supplying the cold water from the conduit 60.

The other side of the cylindrical duct 110 is connected to the water outlet pipe 114 for discharging the water which is passed from one side of the cylindrical duct 110 to the other side, to the conduit 60.

The water outlet pipe 114 is connected to one side of the conduit 60 adjacent to the hot water supply heat exchanger rather than the point where the water inlet pipe 112 is connected to the conduit 60. The water outlet pipe 114 may be provided with a pump (not shown) for smoothly discharging the cold water to the conduit 60.

The gas flow part 116 is installed in the cylindrical duct 110, and is connected
to both ends of the cylindrical duct 110.

One end of the cylindrical duct 110 is connected to the exhaust pipe 24, and the exhaust gas is moved from one end of the gas flow part 116 which is connected to one end of the cylindrical duct 110, to the interior of the gas flow part 116.

In this instance, the exhaust gas 24 may be directly connected to one end of the cylindrical duct 110 at the front end thereof. As shown in FIGs. 9 and 10, however, the cylindrical duct 110 may be provided at one end thereof with a gas discharge chamber 124, one end of the gas discharge chamber 124 being connected to the front end of the exhaust pipe 24.

Although not shown in the accompanying drawings, one end of the gas flow part 116 may penetrate and protrude from one end of the cylindrical duct 110, and the protruding portion may be directly connected to the exhaust pipe 24.

The exhaust gas passing through the gas flow part 116 is discharged outwardly from the exhaust pipe 128 which is connected to the cylindrical duct 110 at the other end of the gas flow part 116.

In this instant, the exhaust pipe 128 may be directly connected to the other end of the cylindrical duct 110, but, as shown in FIGs. 9 and 10, the cylindrical duct 110 may be provided at the other end thereof with a gas discharge chamber 126, the other end of the gas discharge chamber 126 being connected to the exhaust pipe 128.

Although not shown in the accompanying drawings, the other end of the gas flow part 116 may penetrate and protrude from the other end of the cylindrical duct 110, and the protruding portion may be directly connected to the exhaust pipe 128.

The gas flow part 116 is installed within the cylindrical duct 110, with the gas flow part 116 being spaced apart from an inner surface of the cylindrical duct 110.
As shown in FIGs. 10 and 11, a space, that is, a water staying chamber 130, is provided between the outer surface of the gas flow part 116 and the inner surface of the cylindrical duct 110, so that the water passes through the water staying chamber 130, with the water coming in contact with the outer surface of the gas flow part 116.

The water supplied to the interior of the cylindrical duct 110, that is, the water staying chamber 130, comes in contact with the outer surface of the gas flow part 116. It is required to enlarge a surface area of the gas flow part 116 in order to achieve the effective heat exchange.

Preferably, the gas flow part 116 is composed of a plurality of gas pipes, which is not shown.

Also, it is required to slightly delay a passing time of the exhaust gas so that the heat remaining in the exhaust gas is sufficiently heat-exchanged with the cold water. As shown in FIGs. 9 and 10, the gas flow part 116 has the gas staying chamber 120 at the center portion thereof, and a plurality of gas pipes are preferably connected to both ends of the gas staying chamber 120.

In this instance, the gas pipes are composed of a gas inlet pipe 118a having one end connected to one end of the cylindrical duct 110 and the other end connected to one end of the gas staying chamber 120, and a gas outlet pipe 118b having one end connected to the other end of the gas staying chamber 120 and the other end connected to the other end of the cylindrical duct 110.

The operation of the hot water supply type boiler including the hot water supply heat exchanger and the waste heat exchanger according to another embodiment of the present invention will now be described.

The exhaust gas discharged from the boiler passes through the exhaust pipe
24, and is supplied to the waste heat recovery unit 100 through the gas inlet pipe 118a disposed at one end of the waste heat recovery unit 100.

Then, the flow speed of the exhaust gas in the gas staying chamber 120 is slightly delayed, and passes through the gas outlet pipe 118b to discharge outwardly from the waste heat recovery unit 100.

A part of the cold water passing through the conduit 60 is supplied to the interior of the cylindrical duct 110, that is, the water staying chamber 130, through the water inlet pipe 112.

The supplied cold water moves from one side of the water staying chamber 130 to the other side in the cylindrical duct 110, while coming in contact with the outer surface of the exhaust flow part, that is, the gas inlet pipe 118a, the gas staying chamber 120, and the gas outlet pipe 118b.

The heat remaining in the exhaust gas is heated by heat exchange of the outer surface of the gas flow part 116 during flow of the supplied cold water, and thus is heated.

The heated water is discharged through the water outlet pipe 114 at the other side of the cylindrical duct 110, and then is again supplied to the conduit 60.

The water supplied to the conduit 60 is mixed with the cold water directly supplied from the conduit 60, and then is supplied to the hot water supply heat exchanger 40, in state the temperature of water is higher than the cold water passing through the conduit 60.

In this embodiment, the hot water heat-exchanged by the waste heat recovery unit 100 is mixed with the remaining cold water which does not pass through the waste heat recovery unit 100, and then is supplied to the hot water supply heat exchanger 40, as shown in FIG. 12.
In the water flow, all cold water may pass through the waste heat recovery unit 100 by connecting the conduit 60 with one side of the waste heat recovery unit 100.

After that, the heat exchange of the water supplied to the hot water supply heat exchanger 40 is performed in accordance with the above embodiment of the present invention, and the whole hot water circulating process is shown in FIG. 12.

Although several exemplary embodiments of the present invention have been described for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.
Claims

1. A hot water supply type boiler including a hot water supply heat exchanger for heating cold water supplied from an exterior to generate hot water, the hot water supply type boiler comprising:
   - a burner installed on one end of the boiler and operated by a combustion fuel;
   - a heating means heated by the heat generated by the burner for heating the cold water stayed in a plurality of chambers during a predetermined time; and
   - a hot water supply heat exchanger for heating the cold water supplied from the exterior by using the hot water supplied from the heating means to generate hot water.

2. A hot water supply type boiler including a hot water supply heat exchanger for heating cold water supplied from an exterior to generate hot water, the hot water supply type boiler comprising:
   - a burner 8;
   - a heating rod 12 housing the burner 8 therein and having an exhaust hole 10 formed on an upper end thereof;
   - a heat exchanger 14 housing the heating rod 12 therein and having a guide hole 18 formed on a lower portion thereof;
   - a boiler casing 22 housing the heat exchanger 14 therein and having an exhaust pipe 24 coupled to an upper end thereof;
   - primary and secondary heating pipes 26 and 28 wound around an outer periphery of the heating rod 12; and
   - a tertiary heating pipe 30 wound around an inner periphery of the boiler
casing 22.

3. The hot water supply type boiler as claimed in claim 2, wherein the hot water supply heat exchanger 40 is connected to the primary and secondary heating pipes 26 and 28 to circulate the heat heated by the burner 8, and the hot water supply heat exchanger 40 is connected to a conduit 60 to heat-exchange the passing water.

4. The hot water supply type boiler as claimed in claim 3, wherein the hot water supply heat exchanger 40 comprises:

- a hollow housing 42 coupled to inlets and outlets of the primary and secondary heating pipes 26 and 28;
- a partition 44, horizontally installed at a middle portion of the housing 42, for separating an internal space into upper and lower chambers 46 and 48;
- micro-channels 50 horizontally installed in each of the upper and lower chambers 46 and 48 and connected to both sides of the housing 42;
- a guide pipe 52 installed on one side of the housing 42 and housing the outlets of the micro-channels 50 positioned in the upper and lower chambers 46 and 48;
- an upper distributing pipe 54 installed on the other side of the housing 42, housing the inlets of the micro-channels 50 positioned in the upper chamber 46 and connected to the conduit 60;
- a lower distributing pipe 56 installed on the other side of the housing 42, and housing the inlets of the micro-channels 50 positioned in the lower chamber 48; and
- a drain line 62 connected to the lower distributing pipe 56 and connected to the tertiary heating pipe 30.
5. The hot water supply type boiler as claimed in claim 4, wherein the primary heating pipe 26 connects an upper feed pipe 68 having a nozzle 70 with one side of the upper chamber 46;

the secondary heating pipe 28 connects a lower feed pipe 78 having a nozzle 80 with one side of the lower chamber 48;

an upper inlet pipe 72 having a nozzle 74 is disposed in one side of the upper chamber 46, and is connected to the primary heating pipe 26 via a recovery line 76;

and

a lower inlet pipe 82 having a nozzle 84 is disposed in one side of the lower chamber 72, and is connected to the secondary heating pipe 28 via a recovery line 86.

6. The hot water supply type boiler as claimed in claim 5, wherein the primary heating pipe 26 is connected to the upper feed pipe 68 via a feed line 32, the secondary heating pipe 28 is connected to the lower feed pipe 78 via a supply line 34, pumps 36 and 38 are installed in the feed lines 32 and 34, and a subsidiary line 64 is connected to the tertiary heating pipe 30 which is connected to an opening/closing valve 66.

7. The hot water supply type boiler as claimed in claim 6, wherein the cold water supplied from the conduit 60 is primarily heated by the hot water supply heat exchanger 40, and the heated water passes through the drain line 62 to the tertiary heating pipe 30 so that the water is again heated.

8. A hot water supply type boiler comprising:
waste heat exchanging means for primarily heating water supplied from an exterior using waste heat of an exhaust gas;

hot water supply heat exchanging means for secondarily and thirdly heating mixed water of the water primarily heated by the waste heat exchanging means and the water supplied from the exterior using hot water passing through the hot water supply heating exchanging means; and

boiler heat exchanging means, connected to the waste heat exchanging means, for guiding the exhaust gas generated therein to the waste heat exchanging means to heat the water through the hot water heat exchanging means using heat generated by a burner or heater and fourthly heating the thirdly heated water.

9. A hot water supply type boiler including a waste heat recovery unit and a hot water supply heat exchanger 40, the hot water supply type boiler comprising:

a waste heat recovery unit 100 connected to an exhaust pipe 24 at one side thereof and connected to a conduit 60 at the other side, in which water supplied from the conduit 60 is primarily heated by waste heat of an exhaust gas supplied from the exhaust pipe 24;

a boiler heat exchanger including a burner 8, a heating rod 12 housing a burner 8 therein and having an exhaust hole 10 formed on an upper end thereof, a heat exchanger 14 housing the heating rod 12 therein and having a guide hole 18 formed on a lower portion thereof, a boiler casing 22 housing the heat exchanger 14 therein and having an exhaust pipe 24 coupled to an upper end thereof, secondary and tertiary heating pipes 26 and 28 wound around an outer periphery of the heating rod 12, and a quaternary heating pipe 30 wound around an inner periphery of the boiler casing 22; and
a hot water supply heat exchanger 40 connected to the secondary and tertiary heating pipes 26 and 28 at one end thereof to circulate the heat heated by the burner 8, and connected to a conduit 60 at the other end, in which the mixture of the water primarily heated by the waste heat exchanger and the water supplied from the conduit 60 passes through the hot water supply heat exchanger, and is heat-exchanged by the hot water supplied from the secondary and tertiary heating pipes 26 and 28.

10. The hot water supply type boiler as claimed in claim 9, wherein the waste heat recovery unit 100 comprises:
   a hollow cylindrical duct 110;
   a gas flow part 116, installed in the cylindrical duct 110, for guiding an exhaust gas from one side of cylindrical duct 110 to the other side;
   a water inlet pipe 112, connected to one side of the cylindrical duct 110, for supplying the water from the conduit 60; and
   a water outlet pipe 114, connected to the other side of the cylindrical duct 110, for discharging the water outwardly.

11. The hot water supply type boiler as claimed in claim 10, wherein the gas flow part 116 is composed of a plurality of gas pipes.

12. The hot water supply type boiler as claimed in claim 10, wherein the gas flow part 116 comprises:
   a gas staying chamber 120;
   a plurality of gas inlet pipe 118a having one end connected to one side of the
cylindrical duct 110 and the other end connected to the gas staying chamber 120; and

a plurality of gas outlet pipe 118b having one end connected to the other side of the gas staying chamber 120 and the other end connected to the other side of the cylindrical duct 110.

13. The hot water supply type boiler as claimed in any one of claims 9 to 12, wherein the hot water supply type boiler 40 comprises:

a hollow housing 42 coupled to inlets and outlets of the secondary and tertiary heating pipes 26 and 28;

a partition 44, horizontally installed at a middle portion of the housing 42, for separating an internal space into upper and lower chambers 46 and 48;

micro-channels 50 horizontally installed in each of the upper and lower chambers 46 and 48 and connected to both sides of the housing 42;

a guide pipe 52 installed on one side of the housing 42 and housing the outlets of the micro-channels 50 positioned in the upper and lower chambers 46 and 48;

an upper distributing pipe 54 installed on the other side of the housing 42, housing the inlets of the micro-channels 50 positioned in the upper chamber 46 and connected to the conduit 60;

a lower distributing pipe 56 installed on the other side of the housing 42, disposed under the upper chamber, and housing the inlets of the micro-channels 50 positioned in the lower chamber 48; and

a drain line 62 connected to the lower distributing pipe 56 and connected to the quaternary heating pipe 30.
14. The hot water supply type boiler as claimed in claim 13, wherein the secondary heating pipe 26 connects an upper feed pipe 68 having a nozzle 70 with one side of the upper chamber 46;

the tertiary heating pipe 28 connects a lower feed pipe 78 having a nozzle 80 with one side of the lower chamber 48;

an upper inlet pipe 72 having a nozzle 74 is disposed in one side of the upper chamber 46, and is connected to the primary heating pipe 26 via a recovery line 76; and

a lower inlet pipe 82 having a nozzle 84 is disposed in one side of the lower chamber 72, and is connected to the tertiary heating pipe 28 via a recovery line 86.

15. The hot water supply type boiler as claimed in claim 14, wherein the secondary heating pipe 26 is connected to the upper feed pipe 68 via a feed line 32, the tertiary heating pipe 28 is connected to the lower feed pipe 78 via a supply line 34, pumps 36 and 38 are installed in the feed lines 32 and 34, and a subsidiary line 64 is connected to the quaternary heating pipe 30 which is connected to an opening/closing valve 66.

16. The hot water supply type boiler as claimed in claim 15, wherein the water supplied from the conduit 60 is primarily heated by the waste heat recovery unit 100, the mixture of the heated water and the water supplied from the conduit 60 is secondarily and thirdly heated by the hot water supply heat exchanger 40, and the thirdly heated water passes through the drain line 62 to the quaternary heating pipe 30 so that the water is again heated.
Fig. 7