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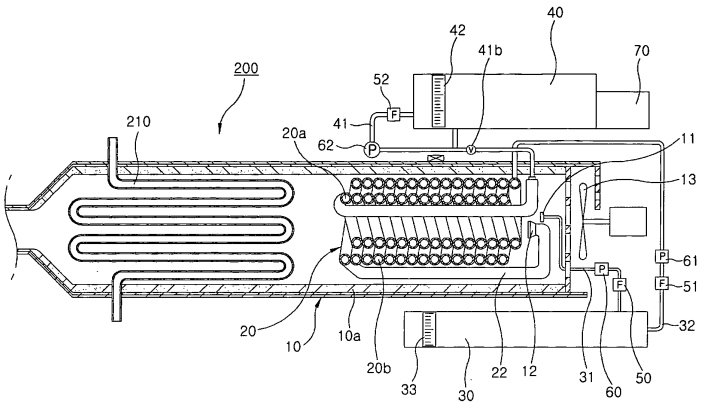
## (54) Combustion apparatus for fan heaters and boilers

(57) This invention relates to a combustion apparatus for fan heaters or boilers, which can improve heat efficiency, save fuel, increase capacity of fan heaters or boilers, and reduce hazardous gas emission.

The present invention comprises; a combustion cylinder(10) comprising the first and second burners(11)(12) and a blower fan(13); a heat exchanger(20) which is installed in the said combustion cylinder(10) to vaporize water and fuel and feed the mixture of the vapour into the second burner(12); a fuel container(30) which feeds fuel to the first burner(11) and heat exchanger(20) via the first and second fuel feed lines(31)(32); a water container(40) which feeds water to the heat exchanger(20) via water feed line(41); filters(50)(51)(52) and pumps(60)(61)(62) installed in the first and second fuel feed lines (31)(32) and the water feed line(41), respectively, and; a control box(70) which controls the first and second burners(11)(12), blower fan(13), and pumps(60)(61)(62).

【Fig. 6】

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## Description

### BACKGROUND OF THE INVENTION

#### Field of the Invention

**[0001]** This invention relates to a combustion apparatus for fan heaters or boilers, in particular, which can improve heat efficiency, save fuel consumption, increase capacity of fan heater or boiler, and reduce hazardous gas emission

#### Background of the Invention

**[0002]** In general, the combustion apparatuses of fan heaters or boilers generate heat by injecting and burning fuel from fuel container into combustion chamber through burner nozzles. Since the combustion apparatuses in conventional fan heaters or boilers burn fuel by direct injection through burner nozzles, their heat generating capacities are restricted by their structures, and costs are relatively higher.

**[0003]** In particular, since the combustion apparatuses of conventional fan heaters and boilers burn by injecting only fuel through burners, their efficiencies are relatively lower due to their structural reasons, which results in higher fuel consumption rate and higher emission of hazardous gases due to incomplete combustion.

### SUMMARY OF THE INVENTION

**[0004]** To solve above mentioned problems of the conventional apparatuses, the present invention provides a combustion apparatus, for fan heaters and boilers, which burns vaporized fossil fuel (diesel, LPG, LNG, etc.) mixed with dissociated water, which is obtained by passing water a through long, high temperature tube device, to improve heat efficiency and reduce hazardous gas emission by improving combustion efficiency.

**[0005]** In order to achieve the above described technical objects, a preferred embodiment of the present invention comprises; a combustion cylinder equipped with a first burner, a second burner, a blower fan, and a heat exchanger which feeds the mixture of vaporized fuel and dissociated water gas to the second burner; and the said first burner and the heat exchangers are fed with fuel from a fuel container through the first and second fuel feed lines; and the said heat exchanger is fed with water from a water container through a water feed line; and the said first and second fuel feed lines and water feed line are installed with filters and pumps; and the said first and second burners, blower fan and the pumps are automatically controlled by a control box.

**[0006]** The combustion apparatus for fan heaters and boilers in accordance with the present invention can generate heat at high efficiency by burning the high temperature and high pressure mixture of vaporized fuel and water which is dissociated in said heat exchanger at high combustion efficiency, which in turn reduces fuel consumption and hazardous gas emission generated by incomplete combustion.

### BRIEF DESCRIPTION OF THE DRAWINGS

**[0007]** Fig. 1 shows a schematic drawing of the combustion apparatus in accordance with the present invention.

**[0008]** Fig. 2 shows a perspective view of the heat exchanger in accordance with the present invention.

**[0009]** Fig. 3 shows a perspective view of a section of the heat exchanger in accordance with the present invention.

**[0010]** Fig. 4 shows a block diagram of the control box in accordance with the present invention.

**[0011]** Fig. 5 shows an exemlpary embodiment of the combustion apparatus in accordance with the present invention applied in a fan heaters.

**[0012]** Fig. 6 shows an exemlpary embodiment of the combustion apparatus in accordance with the present invention applied in a boilers.

### DETAILED DESCRIPTION OF THE INVENTION

**[0013]** The functions and their effects of the said members set forth and described hereinabove are described hereinbelow, referring to the attached drawings.

**[0014]** As illustrated in the Fig. 1 through Fig. 6, the combustion apparatus in accordance with the present invention for fan heaters and boilers is substantially characterized by being comprised of; a combustion cylinder(10) equipped with a first burner(11), a second burner(12) and a blower fan(13); a heat exchanger(20) which is installed in the said combustion cylinder(10), which feeds the mixture of vaporized fuel and dissociated water to the second burner(12); a fuel container(30) which is connected with the said first burner(11) and the heat exchanger(20) via the first and second fuel feed lines(31)(32); a water container(40) which is connected with the heat exchanger(20) via a water feed line(41)

to feed water; the filters(50)(51)(52) and pumps(60)(61)(62) which are installed in the said first and second fuel feed lines(31)(32) and water feed line(41), respectively, and; a control box(70) which controls the first and second burners (11)(12), blower fan(13), and pumps(60)(61)(62), automatically.

**[0015]** Here, the said combustion cylinder(10) which burns fuel, as illustrated in the Fig. 1, is provided with the first burner(11) and the second burner(12) which burn fuel and gaseous fuel-water mixture, respectively, to heat the said heat exchanger(20), and a blower fan(13) is provided in the rear sides of the said first burner(11) and the second burner (12). The inner surface of the said combustion cylinder(10) is applied with heat insulation(10a) to prevent heat loss to outside, and the said first and second burners(11)(12) and blower fan(13) are electrically connected with and controlled by the said control box(70).

**[0016]** In the combustion apparatus in accordance with this invention, the said first burner(11) burns the fuel from the fuel container(30), and the second burner(12) burns the hot mixture of vaporized fuel and water fed from the said heat exchanger(20).

**[0017]** The said heat exchanger(20), as illustrated in the Fig. 1, which is installed inside the combustion cylinder(10), vaporizes fuel and water at very high temperature and feed the mixture of the fuel and water vapour to the second burner (12). As illustrated in the Fig. 2 and Fig. 3, the heat exchanger(20) is comprised of the first and second coil tubes(20a) (20b) formed with an inlet and outlet(21)(22) and an intermediate inlet(23), wherein, the inlet(21) of the first coil tube (20a) is connected with the water feed line(41), the outlet(22) of the second coil tube(20b) is connected with the second burner(12), and the intermediate inlet(23) of the second coil tube(20b) is connected with the second fuel feed line(32). Here, the said heat exchanger(20) in accordance with this invention is preferably is made of cast iron.

**[0018]** In a prefered embodiment of the combustion apparatus in accordance with the present invention, the said heat exchanger(20) is heat up to very high temperature by the heat generated by the first and second burners(11)(12), water is fed into the first coil tube(20a) through the inlet(21), and the fuel is fed into the second coil tube(20b) through the intermediate inlet(23). The water fed into the heat exchanger(20) through the inlet(21) circulates through the first coil tube(20a) and the second coil tube(20a)(20b), the fuel fed into the heat exchanger(20) through the intermediate inlet (23) from the second fuel feed line(32) flows into the second coil tube(20b), in which the gas generated from the dissociated water are mixed and then fed into the second burner(12).

**[0019]** In a preferable embodiment of the combustion apparatus in accordance with the present invention, the ratio of the fuel and water fed into the heat exchanger(20) is 100%:40-80%. That is, the ratio between the fuel fed into the heat exchanger(20) via intermediate inlet(23) and the water fed into the inlet(21) is preferably 100%:40-80%.

**[0020]** In a preferable embodiment of the combustion apparatus in accordance with the present invention, the water fed into the heat exchanger(20) is added with alkali water as a catalyst at the ratio of 7-15 cc per 50$\ell$ of water. The alkali water which has the far-infrared (5 - 20 $\mu$m) radiation efficiency of 92.1 %, turns hard water into soft water and acts as a catalyst for the dissociation of the water molecules.

**[0021]** The said fuel container(30) which feeds fuel to the the first burner(11) and the intermediate inlet(23) of the heat exchanger(20), is connected with the first burner(11) via the first fuel feed line(31), and connected with the intermediate inlet(23) of the heat exchanger(20) via the second fuel feed line(32). The said fuel container(30) is provided with a fuel level gauge(33) to check fuel level.

**[0022]** The said water container(40) which feeds water to the heat exchanger(20) through the inlet(21), is connected with the inlet(21) of the heat exchanger(20) via the water feed line(41). The said water container(40) is provided with a water level gauge(42) to check water level, and the said water feed line(41) is formed with the return line(41a) which returns excess water to the water container(40) and a valve(41b) for water flow control.

**[0023]** The said filter(50) which is installed in the the first fuel feed line(31), filters off impurities from the fuel fed to the first burner(11) via the first fuel feed line(31).

**[0024]** The said filter(51) which is installed in the second fuel feed line(32), filters off impurities from the fuel fed into the intermediate inlet(23) of the heat exchanger(20) via the second fuel feed line(32).

**[0025]** The said filter(52) which is installed in the water feed line(41), filters off impurities from the water fed inlet(21) of the heat exchanger(20) via the water feed line(41).

**[0026]** The said pump(60) which is installed in the first fuel feed line(31), feeds the fuel in the fuel container(30) to the first burner(11), by being electrically connected to and automatically controlled by the said control box(70).

**[0027]** The said pump(61) which is installed in the second fuel feed line(32), feeds the fuel in the fuel container(30) to the intermediate inlet(23) of the heat exchanger(20), by being electrically connected to and automatically controlled by the said control box(70).

**[0028]** The said pump(62) which is installed in the water feed line(41), feeds the water in the water container(40) to the inlet(21) of the heat exchanger(20), by being electrically connected to and automatically controlled by the said control box(70).

**[0029]** The said control box(70), in accordance with the present invention, which automatically controls the combustion apparatus for fan heaters and boilers, is electrically connected with and controls the first and second burners(11)(12), blower fan(13) and pumps(60)(61)(62) automatically.

**[0030]** The Fig. 4 presents a block diagram of the control box(70) in accordance with the present invention. In the Fig. 4, the controller(71) in the control box(70) receives the temperature signal from the temperature sensor(72) installed on the combustion cylinder(10) and controls the operation of the pumps(60)(61)(62) according to the temperature data set up in the memory device(73) in order to maintain the temperature in the said combustion cylinder(10) at desired level.

**[0031]** The Fig. 5 shows an exemplary embodiment of the combustion apparatus in accordance with the present invention applied in a fan heaters(100). In the Fig. 5, the combustion apparatus in accordance with the present invention exhausts hot air to the atmosphere, and the fan heater(100) is provided with wheels(110) on its bottom for easy movement and a cover(120) which opens and closes the exhaust outlet of the combustion cylinder(10).

**[0032]** The Fig. 6 shows an exemplary embodiment of the combustion apparatus in accordance with the present invention applied in a boiler(200), wherein the combustion apparatus in accordance with the present invention provides heat to the heat exchanger(210) of the boiler(200).

**[0033]** The functions and their effects of the members set forth and described hereinabove are described hereinbelow regarding their functions in relation with the whole system.

**[0034]** With the fuel container(30) and water container(40) filled with fuel and water, respectively, when the power switch of the control box(70) is turned on, the first burner(11), blower fan(13) and pump(60) starts respective operation, and the fuel in the fuel container(30) is pumped by the pump(60) to the first burner(11) via the first fuel feed line(31), and the first burner(11) in the combustion cylinder(10) is ignited and burns the fuel fed by the pump(60) via the first fuel feed line(31). The first coil tube(20a) and the second coil tube(20b) of the heat exchanger(20) is heated by the heat generated by the first burner(11).

**[0035]** When the first coil tube(20a) and the second coil tube(20b) of the heat exchanger(20) are heated by the first burner(11) up to the temperature at which water and fuel can be vaporized, the pumps(61)(62) and the second burner (12) start to operate, and the water in the water container(40) is pumped to the inlet(21) of the heat exchanger(20) by the pump(62) via the water feed line(41) and the fuel in the fuel container(30) is pumped to the intermediate inlet(23) of the heat exchanger(20) by the pump(61) via the second fuel feed line(32).

**[0036]** The water pumped into the inlet(21) of the heat exchanger(20) flows to the second coil tube(20b) along ths spiral line of the first coil tube(20a), and preheated by the first coil tube(20a) of the heat exchanger(20) and evaporated into high temperature and high pressure gas, which flows into the second coil tube(20b) of the heat exchanger(20) and mixed with vaporized fuel.

**[0037]** The fuel pumped into the intermediate inlet(23) of the heat exchanger(20) flows to the outlet(22) along the spiral line of the second coil tube(20b), heated in the second coil tube(20b) of the heat exchanger(20) and evaporated into high temperature and high pressure gas, and at the same time, the gas flows in the second coil tube(20b) of the heat exchanger(20) flows to the outlet(22) and heated again by the second coil tube(20b) to be dissociated into hydrogen and oxygen and mixed with the vaporized fuel gas. In this way, the high temperature and high pressure fuel gas heated and evaporized in the second coil tube(20b) is mixed with the hydrogen and oxygen dissociated by the secondary heating to form gaseous fuel mixture, whichi is fed to the second burner(12) via the outlet(22) of the heat exchanger(20). The second burner(12) in the combustion cylinder(10) is ignited and burns the high temperature and high pressure gaseous fuel mixture fed through the outlet(22) to heat the first coil tube(20a) and the second coil tube(20b) of the heat exchanger (20).

**[0038]** When the second burner(12) begins to burn the gaseous fuel mixture, the first burner(11) stops operation, and the first coil tube(20a) and the second coil tube(20b) of the heat exchanger(20) is kept heated to high temperature, as water and fuel are kept supplied through the inlet(21) and intermediate inlet(23) of the heat exchanger(20), respectively, to continue to generate the high temperature and high pressure gaseous fuel mixture which is to be burnt by the second burner(12).

**[0039]** In the combustion apparatus in accordance with the present invention for fan heaters and boilers, the original fuel is used only in the first burner(11) for the time while the first coil tube(20a) and the second coil tube(20b) of the heat exchanger(20) are heated up, and afterwards, the high temperature and pressure gaseous mixture of fuel and dissociated water formed in the heat exchanger(20) are used in the second burner(20). However, with the combustion apparatus in accordance with the present invention, the first burner(11) can also be operated in addition to the second burner(12), as necessary, by adjusting the setting of the controller(70).

**[0040]** The high temperature and pressure gaseous mixture of fuel and dissociated water burnt with the second burner (12) can increase the combustion efficiency by almost-complete combustion. In more detail, the water is dissociated into hydrogen and oxygen by being heated to very high temperature in the first and second coil tubes(20a)(20b) of the heat exchanger(20), and the fossil fuel is vaporized by being heated up in the second coil tube(20b) of the heat exchanger (20). The hydrogen and vaporized fuel are mixed in the second coil tube(20b) to form gaseous fuel mixture which is burnt with the second burner(12). Because gaseous fuel is highly active due to high temeprature and high pressure, and with the help of the oxygen, the combustion efficiency can be enhanced.

**[0041]** For information purpose, the fossil fuel in the combustion apparatus in accordance with the present invention can be burnt at higher efficiency with the help of the thermal decomposition of water, into hydrogen and oxygen (a

phenomenon, discovered by French scientist Lavorisier (1743-1794), where water passing through very hot metal tube is dissociated into hydrogen and oxygen, or if carbon is present, the water is decomposited into carbon dioxide and hydrogen gas by the reaction of; $C + 2H2\,O \rightarrow CO2 + 2H2\uparrow$), and by being injected from burner at high temperature and pressure in active, gaseous state.

**[0042]** It should be noted that the water is dissociated into hydrogen and oxygen, and then the hydrogen and oxygen are combined again in the process of combustion, therefore, there is no loss of heat. In addition, no hazardous gas is generated.

**[0043]** When the water is supplied into the pipe, a portion of the water is dissociated into hydrogen and oxygen, which are mixed up with the residual water vapor and vaporized fuel, which is injected through the burner nozzle and burnt. Here, the water itself requires no additional supply of oxygen in the air, for its complete combustion reaction.

**[0044]** All kinds of fossil fuels are consisted of hydrogen and carbon atoms, and when burnt, the first reaction is thermal decomposition, followed by the combustion of hydrogen and then carbon. Therefore, in the area close to the burner nozzle tip, the hydrogen is burnt and the flame generated by the carbon and the oxygen from the secondary air surrounds the area.

**[0045]** In a Brown gas, water is decomposed into hydrogen and oxygen atoms, which are not separated but form a mixture, therefore, the chemical energy generated from the process of the atoms forming molecules. This increases the calorific value of the atomic hydrogen and oxygen by 3.8 times more than that of molecular hydrogen and oxygen.

**[0046]** The combustion reaction process of molecular hydrogen and oxygen is as follow;

$$H2 \rightarrow H\bullet + H\bullet$$

$$02 \rightarrow O: + O:$$

$$H + O2 \rightarrow O: + OH\bullet$$

$$O: + H2 \rightarrow H\bullet + OH\bullet$$

$$O: + H2O \rightarrow OH\bullet + OH\bullet$$

$$OH\bullet + OH\bullet \rightarrow H2O + O:$$

**[0047]** Heat is generated when the electrons of the OH• radicals are excited and then return to their base status, and the energy generated from the reaction of atoms forming molecules are also available.

**[0048]** This was proved by Dr. Randolmills with his hydrogen atom model theory which showed that there is a stable orbit of the electrons in hydrogen atom below the base state of the atom, therefore, the ionization energy of the electrons become the potential energy for resonance, and a lot of energy can be generated by energy resonance transfer.

**[0049]** Therefore, in the combustion apparatus in accordance with the present invention for fan heaters and boilers, the active, high temperature and high pressure fuel mixture is injected through the second burner(12) at very fine size to improve the combustion efficiency, substantially, of the combustion apparatus.

**[0050]** In addition, in the combustion apparatus in accordance with the present invention for fan heaters and boilers, fossil fuel is used only for heating up the heat exchanger(20), and the main combustion by the second burner(12) uses the gaseous fuel mixture, which enables achieving high combustion efficiency and fuel saving.

**[0051]** In addition, in the combustion apparatus in accordance with the present invention for fan heaters and boilers, the high temperature and high pressure mixture of water vapor, dissociated hydrogen and oxygen, and vaporized fossil fuel can be burnt at very high efficiency, hazardous gas emission can be greatly reduced.

## Claims

1. A combustion apparatus for fan heaters and boilers comprising; a combustion cylinder(10) equipped with a first burner(11), a second burner(12), and a blower fan(13); a heat exchanger(20) installed in the combustion cylinder (10) and feeds the mixture of vaporized fuel and dissociated water to the second burner(12); a fuel container(30) which feeds fuel to the first burner(11) and heat exchanger(20) via the first and second fuel feed lines(31)(32); a water container(40) which feeds water to the heat exchanger(20) via water feed line(41); the filters(50)(51)(52) and pumps(60)(61)(62) which are installed in the first and second fuel feed lines(31)(32) and water feed line(41), respectively, and; a control box(70) which controls the first and second burners(11)(12), blower fan(13) and pumps (60)(61)(62).

2. A combustion apparatus for fan heaters and boilers in accordance with the Claim 1, wherein the said combustion cylinder(10) is applied with heat insulation(10a) on its inner wall.

3. A combustion apparatus for fan heaters and boilers in accordance with the Claim 1, wherein the said heat exchanger (20) comprises double spiral first and second coil tubes(20a)(20b) which are formed with an inlet(21), outlet(22), and intermediate inlet(23), wherein the said inlet(21) is connected with a water feed line(41), the outlet(22) is connected with the second burner(12), and the intermediate inlet(23) is connected with the second fuel feed line(32).

4. A combustion apparatus for fan heaters and boilers in accordance with the Claim 3, wherein the said heat exchanger (20) is made of cast iron.

5. A combustion apparatus for fan heaters and boilers in accordance with the Claim 1, wherein the said fuel container (30) and water container(40) are provided with level gauges(33)(42), respectively.

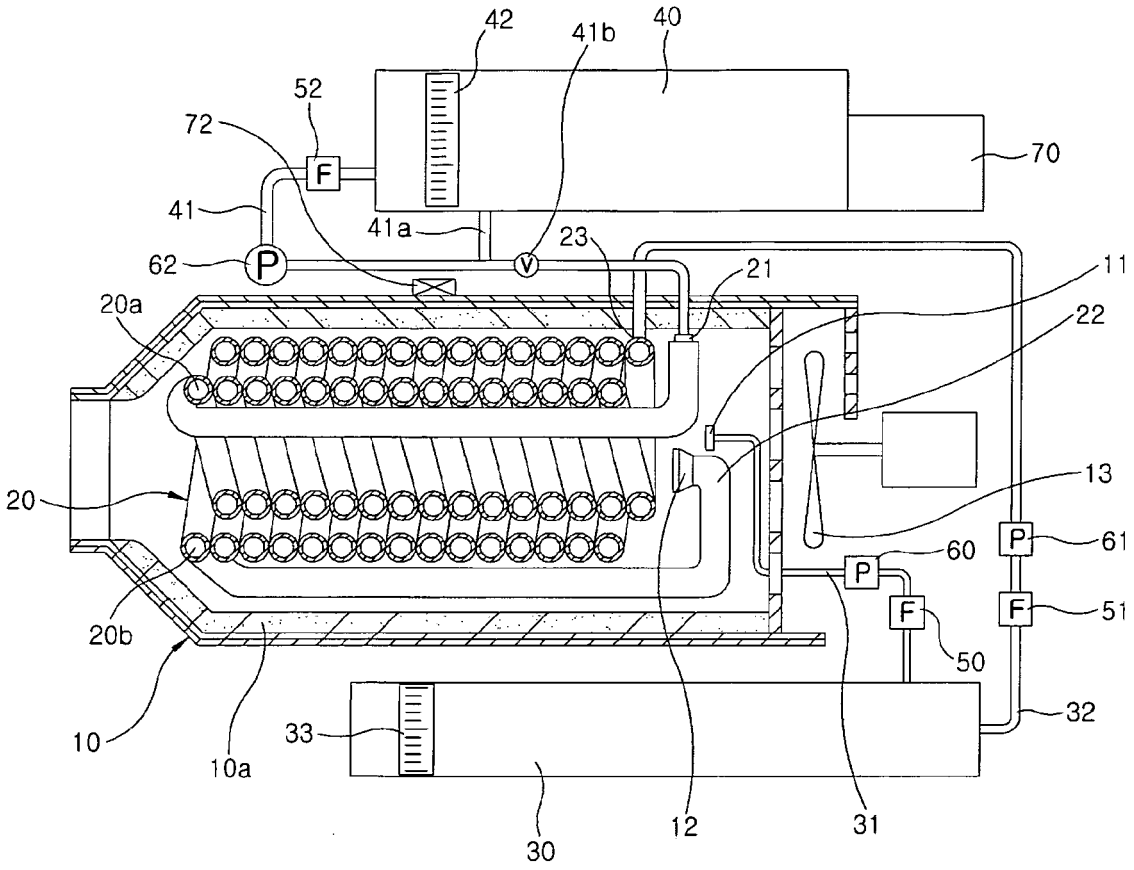
6. A combustion apparatus for fan heaters and boilers in accordance with the Claim 1, wherein the said water feed line(41) is provided with a return line(41 a) which returns excess water to the water container(40) and a valve(41 b) which controls water flow.

7. A combustion apparatus for fan heaters and boilers in accordance with the Claim 1, wherein the ratio of the fuel and water fed to the heat exchanger(20) is 100%:40-80%.

8. A combustion apparatus for fan heaters and boilers in accordance with the Claim 1, wherein the watr fed to the heat exchanger(20) is added with alkali water by the ratio of 7~15cc per 50ℓ of water.

9. A combustion apparatus for fan heaters and boilers in accordance with the Claim 1, wherein the said controller(71) installed in the control box(70) receives the temperature signal from the temperature sensor(72) installed on the combustion cylinder(10) and controls the operation of the pumps(61)(62) according to the temperature data set up in the memory device(73) in order to maintain the temperature in the said combustion cylinder(10) at desired level.

【Fig. 1】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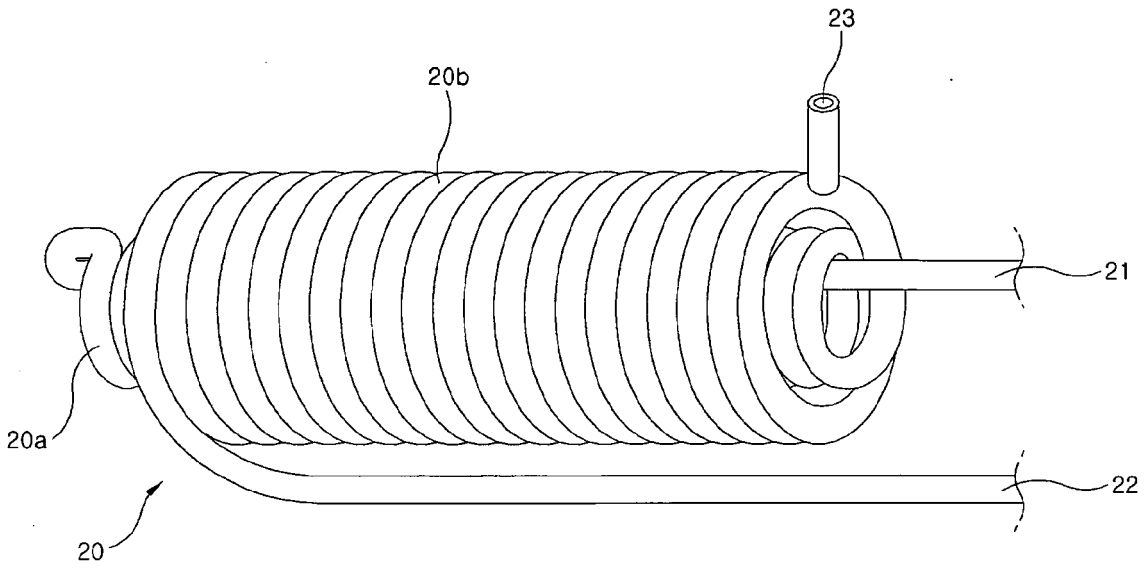
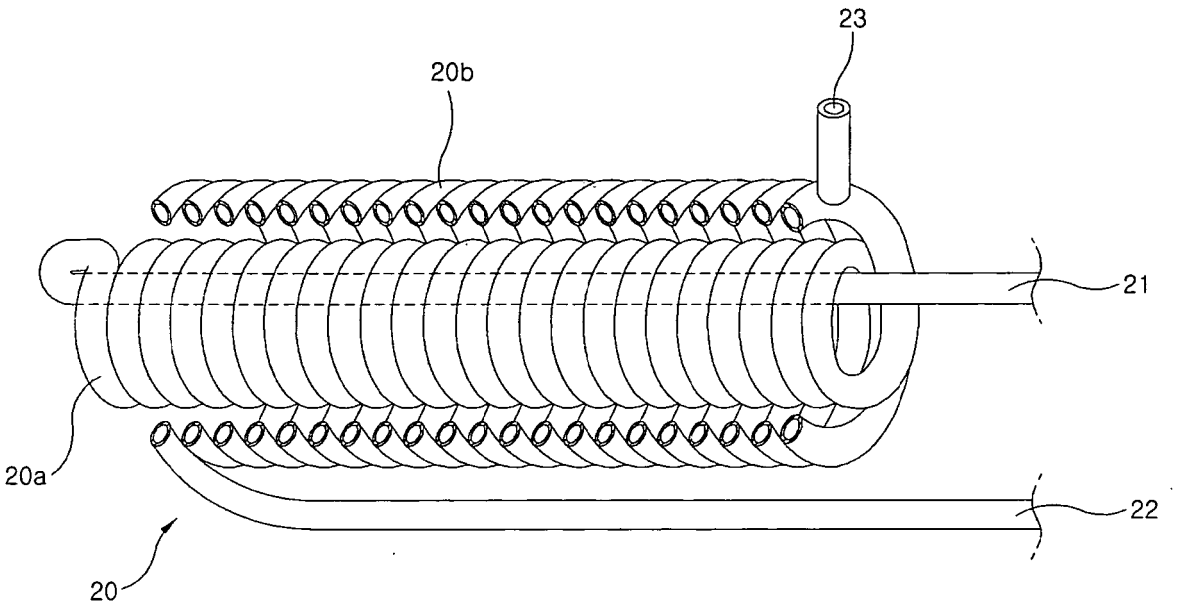
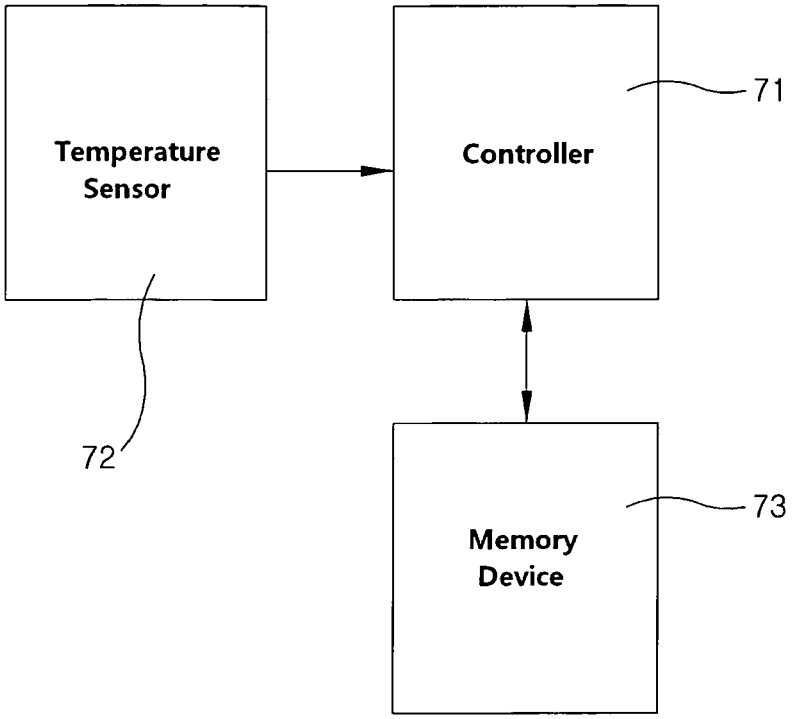
【Fig. 2】



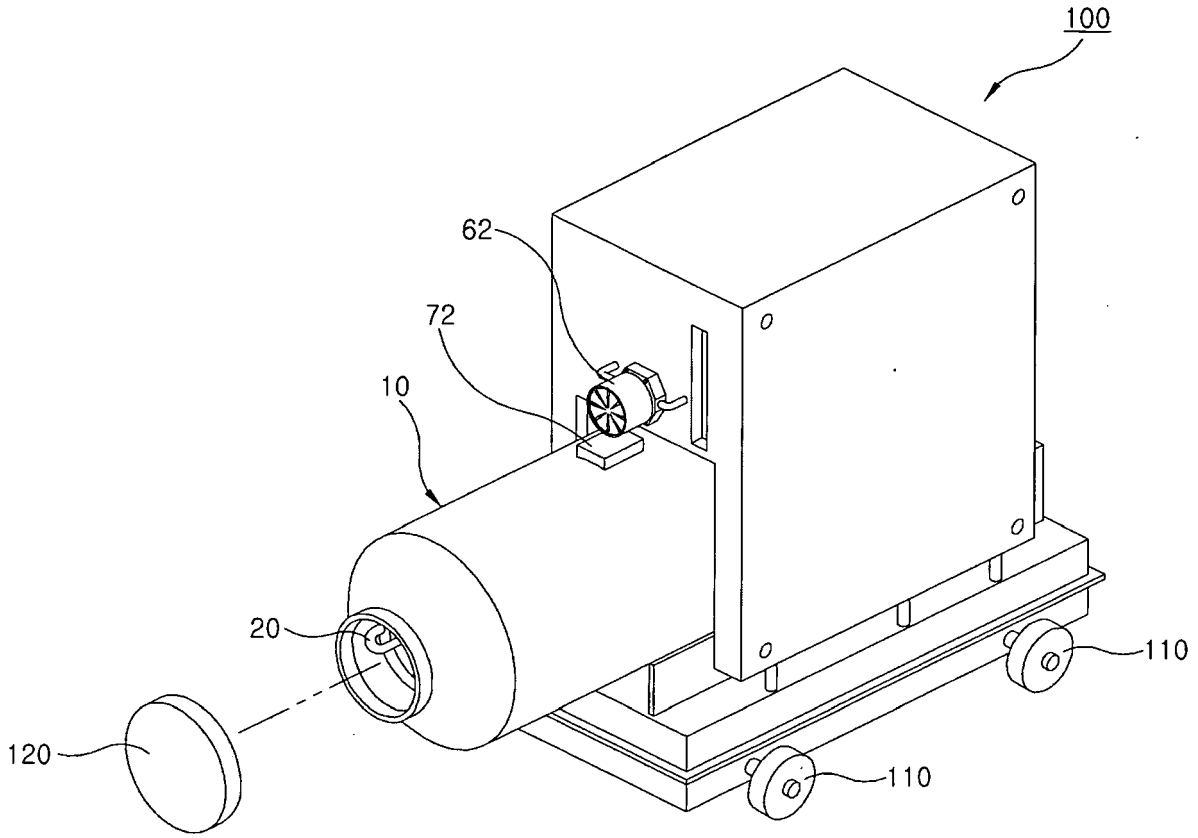
【Fig. 3】



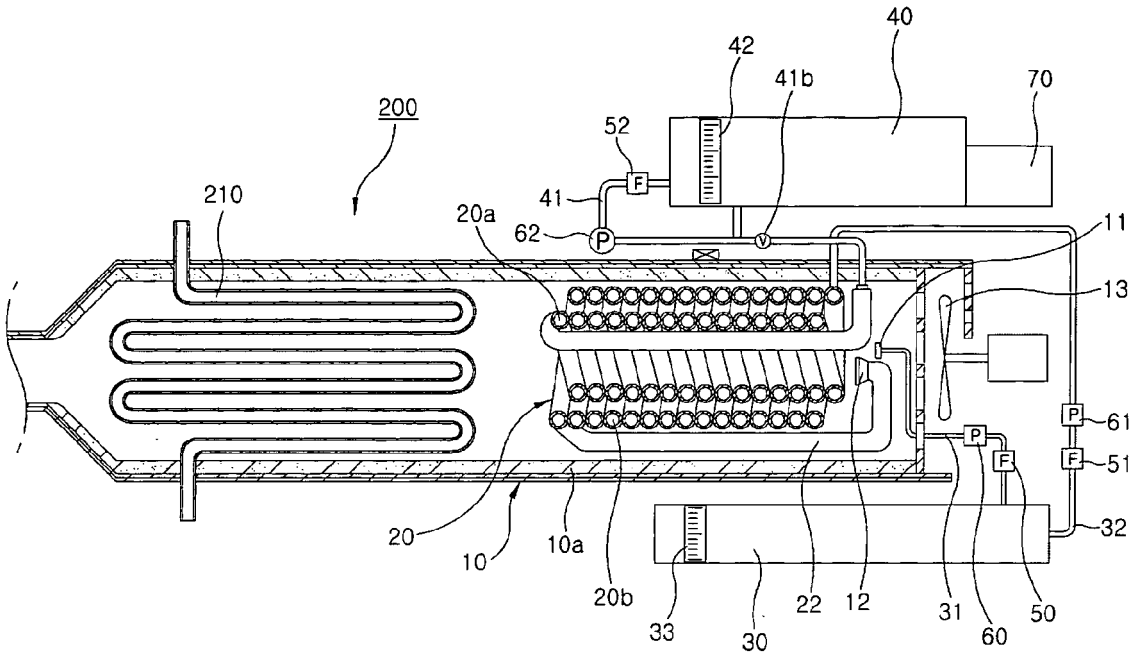
【Fig. 4】



【Fig. 5】



【Fig. 6】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