United States Patent [19]

Miyahara

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[54] **DIRECT CONTACT WATER HEATER**

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[52] **U.S. Cl.** **126/355,** 126/359

[51] **Int. Cl.** **F24h 1/10**

[58] **Field of Search** ..... 126/344, 355, 359, 350 R, 126/375, 390, 400

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Assistant Examiner—William C. Anderson
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[57] **ABSTRACT**

A water heater comprising a body and a lattice-like partition plate dividing the interior of the body into an upper heat absorbing chamber and a lower combustion chamber, burner means being provided in said combustion chamber so that the flow of combustion product is directed upwardly from the combustion chamber through the heat absorbing chamber, cold water being supplied into said heat absorbing chamber and passed downwardly as a counterflow to and in direct contact with said flow of combustion product. A plurality of heat absorbing members are disposed in said heat absorbing chamber and the cold water is supplied onto the heat absorbing members.

4 Claims, 8 Drawing Figures

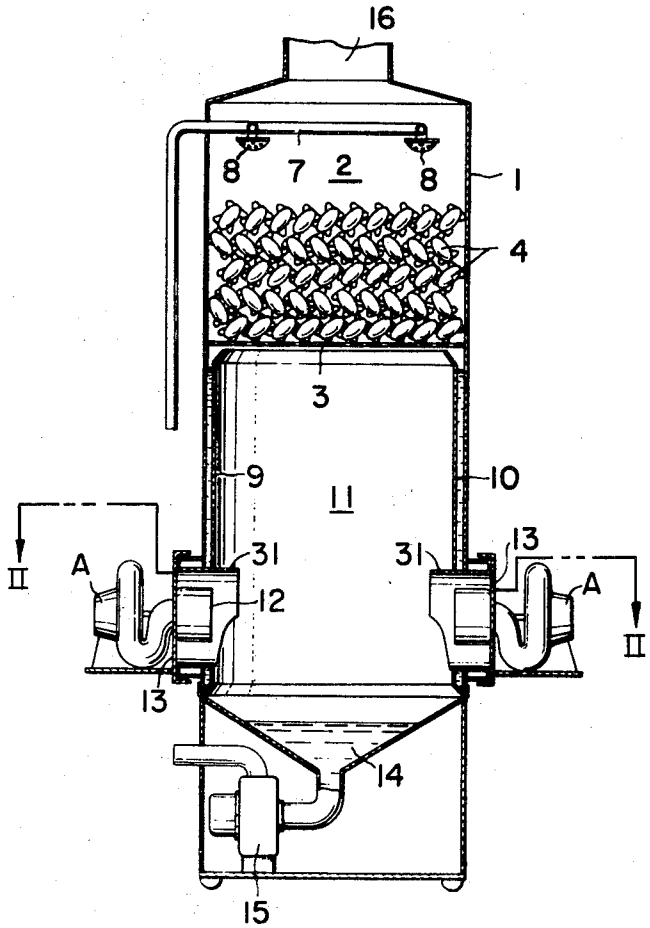


FIG. 1

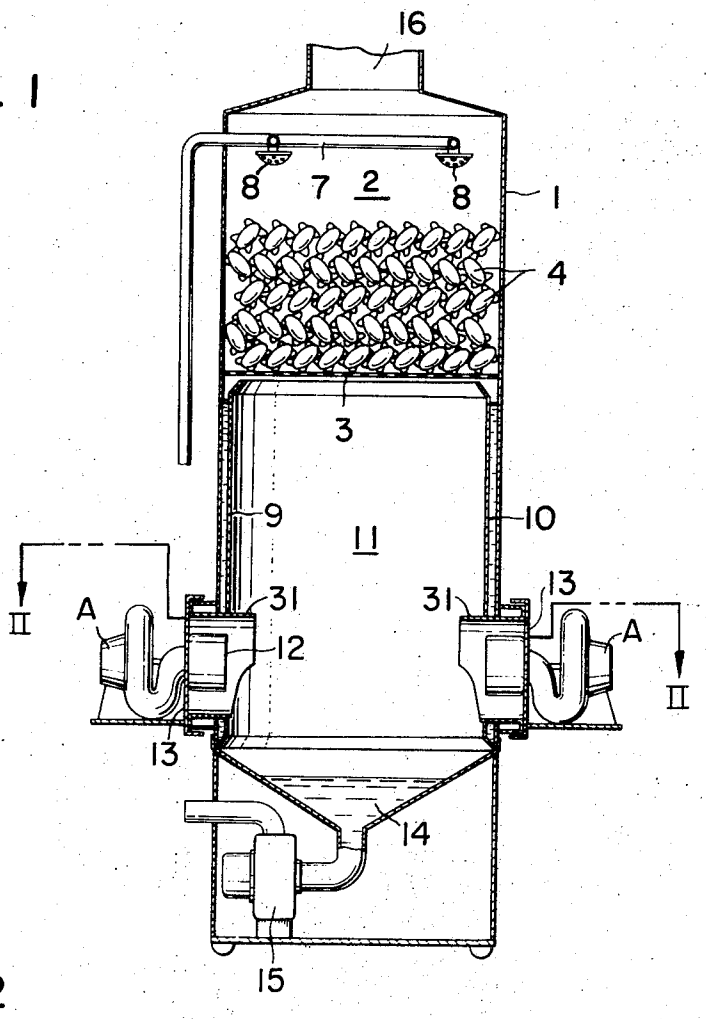


FIG. 2

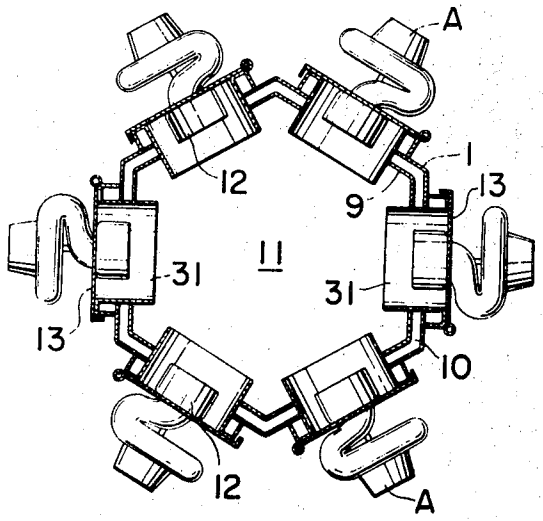


FIG. 3

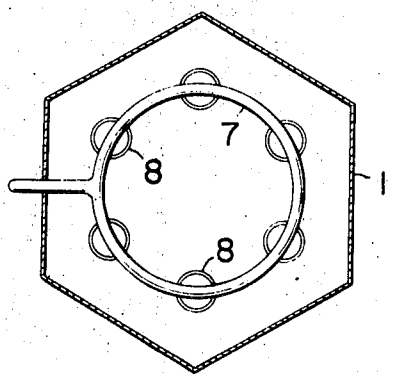


FIG. 4

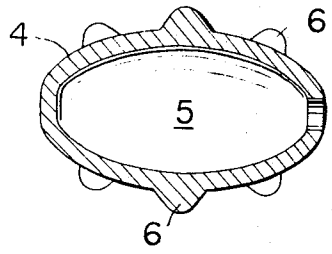


FIG. 5

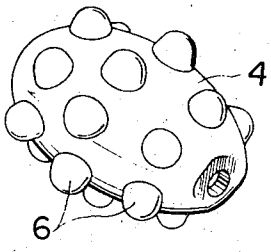


FIG. 6

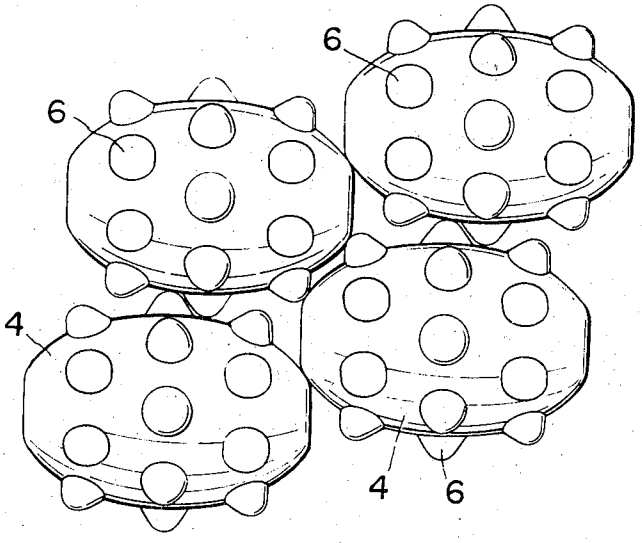
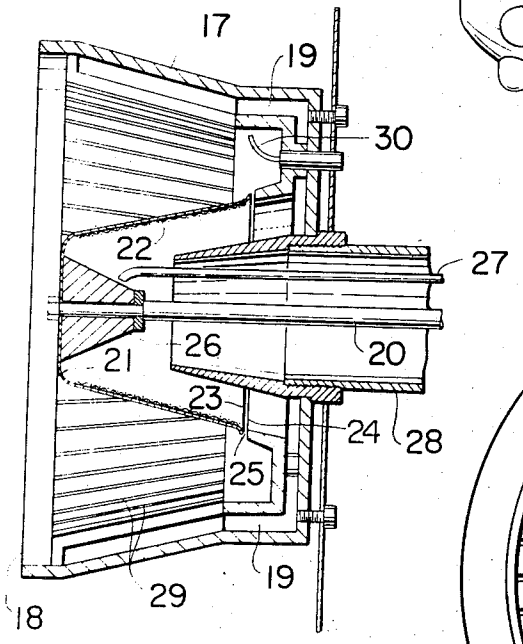


FIG. 7



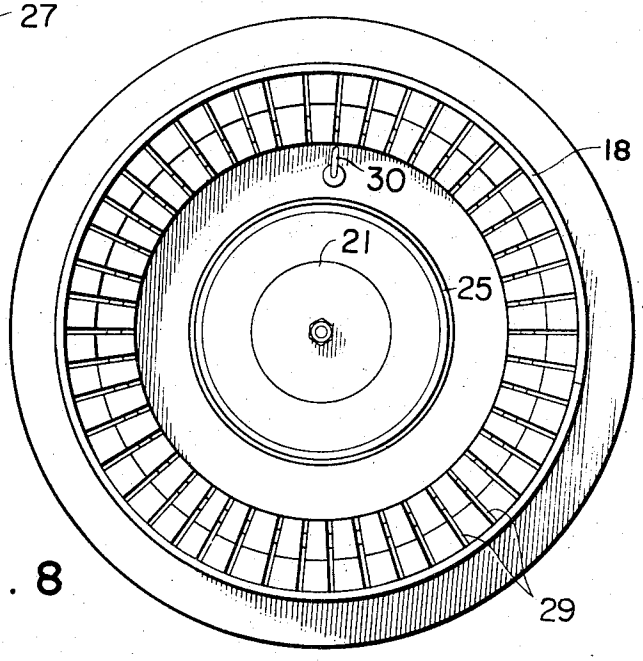


FIG. 8

DIRECT CONTACT WATER HEATER

The present invention relates to a water heater and more particularly to a novel and improved direct heating type water heater.

The present invention has a primary object to provide a water heater which can efficiently heat a large amount of water so as to instantaneously obtain highly heated hot water.

Hithertofore, there has been provided a water heater in which cold water is passed through the heater in the form of a down flow and combustion flame or combustion product is directly applied to the water flow to obtain heated water. In the known type of water heater, the down flow of water is conventionally formed by making the water to flow along a plurality of heating plates while heat is applied to the cold water.

However, this type of water heater cannot provide an efficient heat exchanging contact between the cold water and heating medium. Therefore, it is impossible in this type of water heater to instantaneously heat the cold water. Further, since the city gas which has a relatively low heat value is used to heat the water, it is impossible to instantaneously provide hot water of a desired temperature. Thus, it has been very difficult to heat a large amount of water instantaneously and continuously to a temperature above 70°C.

Therefore, it is an object of the present invention to provide a water heater in which a large amount of cold water is brought into direct contact with a combustion gas when the water is passed vertically downwardly so as to provide instantaneously and continuously hot water of a desired temperature.

A further object of the present invention is to provide a water heater in which a large amount of water is widely spread and passed downwardly with a limited flow speed, and a heat absorbing chamber is provided above a relatively large combustion chamber for bringing the down flow of water into direct contact with hot combustion gas which is passed upwardly in the water heater so that the water is heated with an increased efficiency.

Still further object of the present invention is to provide a water heater in which cold water is passed downwardly with a limited speed and there is provided, in order to improve heat exchange characteristic, a heat absorbing chamber having a plurality of layers of heat absorbing members for transmitting the heat in the hot gas to the cold water.

A further object of the present invention is to provide a water heater which has a heat absorbing chamber provided with a plurality of heat absorbing members, each being of a hollow oval configuration having a plurality of heat radiating fins integrally provided therewith.

A still further object of the present invention is to provide a water heater comprising a main body, a heat absorbing chamber provided in the upper region of said main body, a combustion chamber provided in the intermediate of said main body and having a water jacket, and a hot water vessel provided in the lower region of said main body and connected to means for discharging the hot water, in which a plurality of relatively flat oval heat absorbing members are provided in said heat absorbing chamber, said heat absorbing members having a plurality of heat radiating projections integrally formed thereon, and burner means is provided adjacent to said combustion chamber so as to eject a burning flame into said combustion chamber.

These and other objects and features of the present invention will become apparent from the following descriptions of a preferred embodiment shown in the accompanying drawings, in which;

FIG. 1 is a vertical sectional view of a water heater in accordance with one embodiment of the present invention;

FIG. 2 is a horizontal sectional view taken substantially along the line II—II of FIG. 1;

FIG. 3 is a horizontal sectional view showing water distributing means;

FIG. 4 is an enlarged sectional view of a heat absorbing member;

FIG. 5 is a vertical sectional view of the heat absorbing member shown in FIG. 4;

FIG. 6 is an elevational view showing an arrangement of the heat absorbing members;

FIG. 7 is a vertical sectional view of a burner used in the illustrated water heater; and,

FIG. 8 is a side view of the burner.

Referring to the drawings, particularly to FIGS. 1 and 2, the reference numeral 1 designates an upright body of any desired cross-section, such as a circle or a rectangular shape.

The body 1 is provided in its upper portion with a lattice-like partition plate 3 to form a heat absorbing chamber 2 above the plate 3. The number and shape of this plate 3 are not limited to the one shown in the drawing. In the heat absorbing chamber 2, there are disposed a plurality of heat absorbing members 4, each being of a relatively flat oval configuration having a plurality of heat radiating projections 6 integrally formed thereon. The heat absorbing members 4 are disposed in the heat absorbing chamber 2 with substantially uniform spacings therebetween. A circular water supply pipe 7 is disposed above the layers of the heat absorbing members 4 in the chamber 2 and provided with a plurality of water distributing nozzles 8 at equidistant positions, so that a large amount of cold water may be uniformly distributed on the heat absorbing member 4. The heat absorbing member 4 is hollow and has a cavity 5 to increase the strength thereof.

The body 1 is further provided along its inner wall surface below the heat absorbing chamber 2 with an inner annular partition wall 9 to form a water jacket 10. The upper edge of the inner partition wall 9 is inwardly tapered as shown in FIG. 1 so as to effectively direct the water from the chamber 2 into the jacket 10. This arrangement is effective to prevent the partition wall from being excessively heated. The wall 9 forming the water jacket also defines a relatively large combustion chamber 11 in which a plurality of burners 12 are mounted at equidistant peripheral positions. The burners 12 are simultaneously put into operation by suitable automatic control means so as to discharge odorless combustion flame into the combustion chamber 11. The flame and combustion product are then directed into the heat absorbing chamber 2 as a counterflow to the water, and heat the heat absorbing members 4.

Each of the burners 12 is mounted on a door 13 which is hinged to the body 1 so that it is moved into and out of the combustion chamber 11 by moving the door 13. A downwardly tapered water vessel 14 is provided below the combustion chamber 11 and a pump

15 is connected to the water vessel 14 for supplying the hot water therein to any desired positions.

According to the present invention, burner means are employed as a heat source. Therefore, the burner means must be of a type which utilizes fully atomized or gaseous fuel. If the burner means is of such a type in which liquid fuel particles are burnt, imperfect combustion will take place whereby the flame is brought into contact with the water shower, and the raw oil will be mixed with the water to be heated. Thus, when liquid fuel is used, it must be effectively vapourized by preheating before it is mixed with fresh air, and ignited. The body 1 further includes an exhaust pipe 16 at the upper portion thereof.

FIGS. 7 and 8 show the construction of the burner 12. Referring to the drawings, the burner 12 comprises a combustion cylinder 17 having a flame port 18 and a gas chamber 19. Within the gas chamber 19, there is co-axially disposed a rotatable shaft 20 which is directly connected to an electric motor (A) shown in FIG. 1. The rotatable shaft 20 has an atomizing cylinder 21 which is secured thereto and has a rough surface constituted by for example a screen 22. The atomizing cylinder 21 is of a cup-shape having one end closed and the other end opened, with the open end 23 being disposed in confronting relationship with an open end 24 provided in a central boss in the combustion cylinder 17. A fuel discharge gap 25 is provided between the ends 23, 24 so as to connect the interior of the atomizing cylinder 21 and the gas chamber 19. Within the atomizing cylinder 21, there is co-axially disposed a conical fuel diffuser 26 which is secured to the inner end of the rotatable shaft 20. A fuel supply pipe 27 is disposed in the atomizing cylinder with its end located adjacent to the conical surface of the fuel diffuser 26. An air supply conduit 28 is co-axially secured to the combustion cylinder 17 for directing fresh air flow to the fuel diffuser 26. The combustion cylinder 17 has an inner surface provided with a plurality of gas discharge openings 29 for discharging atomized or vapourized fuel into the combustion cylinder 17. The burner is further provided with an ignition plug 30 and a cover 31 as shown in FIG. 1 secured to the body 1 for preventing the burner from being wetted by the water shower.

In operation of the water heater shown in FIG. 1, the burners are initially operated by energizing the motor (A) to rotate the atomizing cylinder 21 at a high speed and simultaneously supply fresh air into the atomizing cylinder 21. Then liquid fuel is supplied through the fuel pipe 27 to the rotating fuel diffuser 26. Thus, the fuel is finely divided by being splashed by the rotating fuel diffuse 26 and blown by swirling air flow. The fuel is further finely divided by the rough surface of the atomizing cylinder 21 and discharged through the gap 25 together with the forced flow of fresh air. Then, the fuel is ignited by the ignition plug 30 and combustion is started. During this stage of combustion, the atomizing cylinder 21 is rapidly heated to a normal operating temperature under which the fuel in the atomizing cylinder 21 is heated and atomized or vapourized by the heat given from the cylinder 21. Thus, the fuel in the vapourized form is mixed with forced flow of fresh air and the mixture is introduced into the gas chamber 19. The mixture is further discharged through the openings 29. With this arrangement, it is possible to attain a noiseless and odorless perfect combustion.

The combustion is thus performed in the combustion chamber 11 and the combustion product ascends to the heat absorbing chamber 2 to heat the heat absorbing members 4. Further, the water in the water jacket 10 is heated by the combustion heat transmitted through the wall 9. Then, a large amount of cold water is distributed uniformly from the nozzles 8 onto the heat absorbing members 4, so that the water is heated by the heat absorbing members 4 as well as by the combustion product from the combustion chamber 11. The heated water falls in part into the combustion chamber and in part into the water jacket 10. As the water level in the jacket 10 increases, the water overflows from the upper edge of the wall 9 into the combustion chamber 11. It should thus be noted that, in accordance with the illustrated arrangement, water flow is heated not only by the heat absorbing members 4 in the chamber 2 but also by the direct contact with the combustion flame and the combustion product in the chambers 2 and 11, so that it is possible to rapidly obtain a large amount of hot water in the water vessel 14 from which the hot water is supplied to any desired locations by means of the pump 15. Thus, according to the present invention, a large amount of cold water may be discharged from the nozzles 8 onto the heat absorbing members 4. Then, the members 4 together with the hot odorless combustion flame instantaneously heat the water. There will be no risk that the water is contaminated by unburnt fuel because the fuel is perfectly atomized or vapourized before it is ignited. Thus, it is possible to obtain clean hot water although the water is brought into direct contact with combustion flame.

The invention has thus been shown and described with reference to a preferred embodiment but it should be noted that the invention is in no way limited to the details of the illustrated arrangements and that various changes and modifications may be made thereto without departing from the scope of the accompanied claims.

I claim:

1. A water heater comprising a main body, a heat absorbing chamber provided in the upper region of said main body, a combustion chamber provided in an intermediate portion of said main body below said upper region, a water jacket surrounding said combustion chamber, a hot water collecting vessel mounted in the lower region of said main body below said combustion chamber, means for discharging hot water connected to said hot water vessel, a plurality of relatively flat oval heat absorbing members mounted in said heat absorbing chamber and heated by combustion products from said combustion chamber, said heat absorbing members having a plurality of heat radiating projections integrally formed thereon, burner means mounted adjacent said combustion chamber so as to eject a burning flame into said combustion chamber, and a water inlet providing water supply onto said heat absorbing members such that said water passes down over said heat absorbing members and falls through said combustion chamber and into said hot water collecting vessel or said water passing into said water jacket and overflows therefrom into said combustion chamber to said water collecting vessel.

2. A water heater according to claim 1, in which said heat absorbing members are hollow.

3. A water heater according to claim 1, in which said burner means is a plurality of burners provided around

said combustion chamber and being capable of vaporizing the liquid fuel and burning the vapourized fuel.

4. A water heater according to claim 3 wherein said burner means includes a shaft rotatably supported, a motor driving said shaft, an atomizing cylinder mounted on said shaft, a liquid fuel supply line supplying fuel onto said atomizing cylinder so as to break the fuel into small particles such that it will be completely converted in said combustion chamber.

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