United States Patent

Asakawa

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[54] APPARATUS AND METHOD FOR HEATING WATER

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[52] **U.S. Cl.**.....**219/279**, 122/17, 219/294

[51] **Int. Cl.**.....**F27d 11/00**

[58] **Field of Search**.....219/279, 285, 314, 288–289, 219/291–292, 294–295, 271–275; 122/17

[56] **References Cited**

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[57] **ABSTRACT**

An apparatus and method for heating water to generate steam or provide hot water. The water is heated by a conventional heat source and is simulataneously subjected to an electric field. In a steam generator the field is produced by an electrode in the steam chamber. In a water heater the field is produced by immersing an electrode in the water.

10 Claims, 4 Drawing Figures

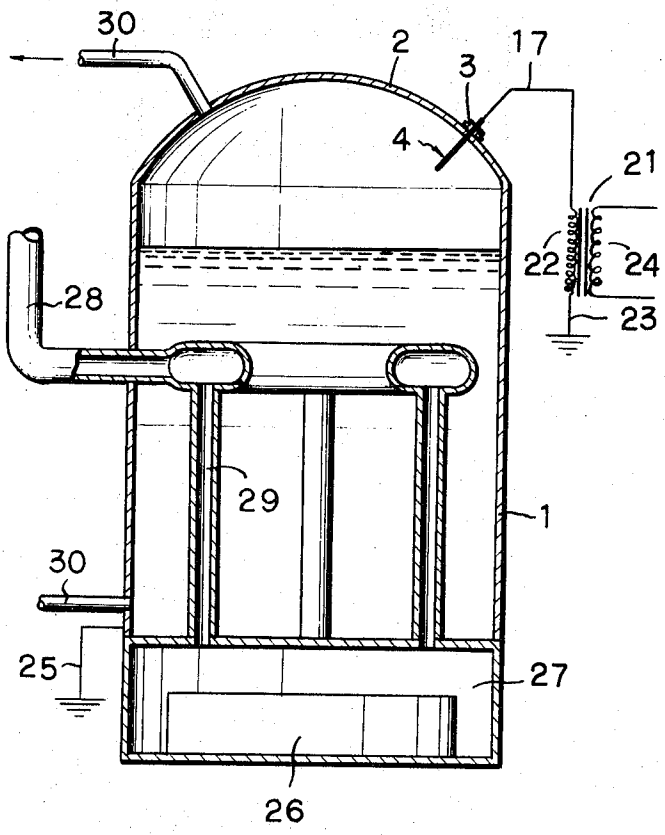


FIG.1

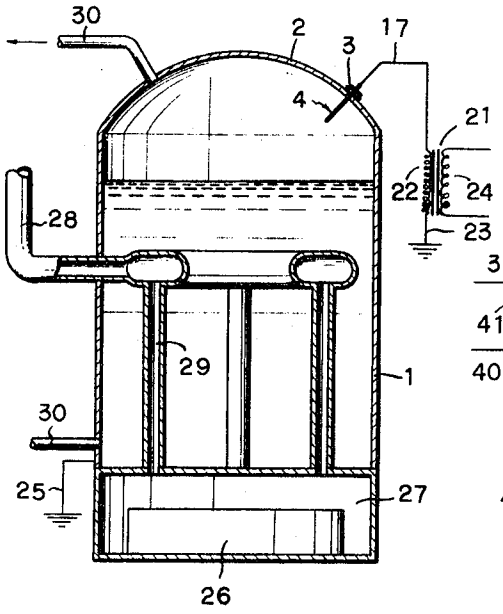


FIG.3

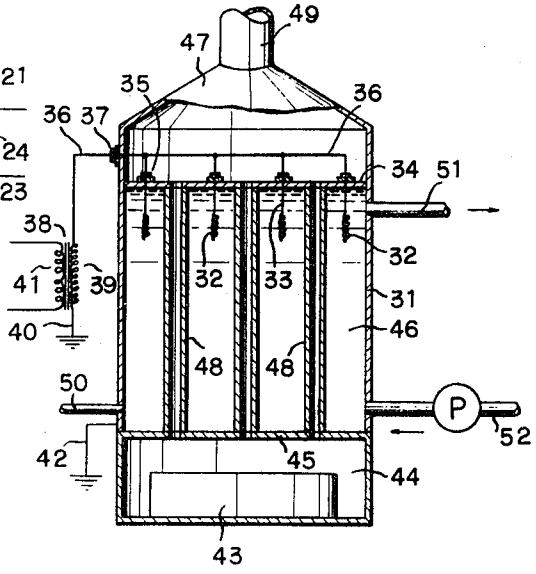


FIG.2

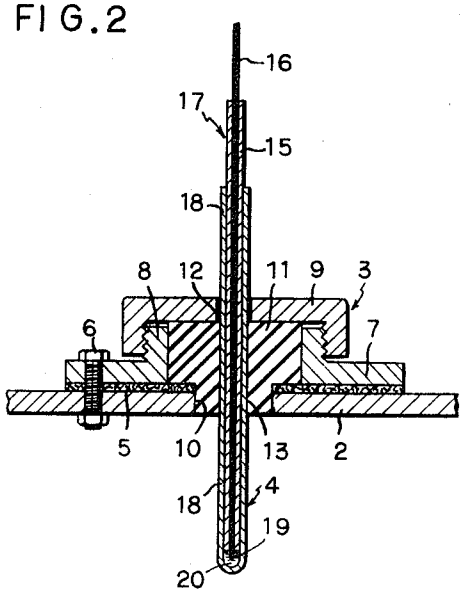
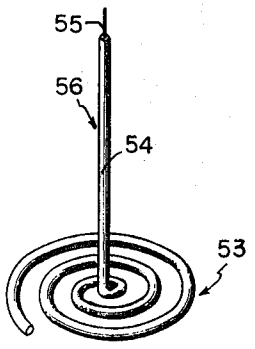


FIG.4



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APPARATUS AND METHOD FOR HEATING WATER

This invention relates to a heating vessel and particularly to a water heater.

The conventional steam generator or hot water heater comprises a combustion chamber where the fuel is burned, to create a hot gas, a heat exchanger where the heat from the hot gas is transferred to the water, and a discharge for the gas after the heat is removed. The efficiency of this apparatus in transferring the amount of heat available in the fuel to the steam or water is low. It is an object of this invention to produce an apparatus which operates at a higher efficiency than the conventional generator or heater.

It is a further object of this invention to provide a method for increasing the efficiency of a steam generator or water heater.

These and other objects of the invention will become manifest upon reading the following description in conjunction with the accompanying drawing wherein;

FIG. 1 is a section of a steam generator of this invention,

FIG. 2 is a section of the electric pole used in FIG. 1,

FIG. 3 is a section of a hot water heater of this invention, and,

FIG. 4 is a perspective view of a modification of an electric pole.

In accordance with this invention the water in a steam generator or boiler is subjected to an electric field while it is being heated.

With reference to FIG. 1 there is illustrated a boiler 1 formed with a dome 2 having secured therein a pole 4. The pole is secured by a fitting 3 consisting of a washer plate 7 mounted on an insulator 5 and secured to the dome by bolts 6. Plate 7 is formed with a threaded sleeve portion 8 on which is screwed a cap 9. A heat resisting elastic rubber packing 11 is mounted in plate 7 and is formed with an extension that projects into opening 10 in the dome 2.

The pole 4 consists of a porcelain or glass tube 18 lined with a cord 17 which consists of a wire core 16 covered with an insulating coating 15 of polyamide (nylon) or fluoride resin known as a heat-resisting high insulating synthetic resin or rubber. The bottom of tube 18 contains a pool of mercury 20. The end 19 of wire 16 extends into the pool.

The glass tube 18 extends through an opening 12 in cap 9 and an opening 13 in packing 11. The packing 11 is compressed by screwing cap 9 on the threaded sleeve 8 to thereby secure the pole and form a seal to prevent the escape of steam. The wire 16 is connected to the secondary winding 22 of a transformer 21 which is connected to ground by a lead 23. The primary winding 24 is connected to a power source having a frequency under 7,000 Hz. The boiler 1 is gounded by a lead wire 25.

A burner 26 is positioned in a combustion chamber 27 which is connected by heat exchanger pipes 29 to a chimney 28. The water in the boiler is heated by the hot gas produced by the combustion of the fuel and is evaporated into steam which is collected in dome 2. Water is fed into the boiler by a conduit 30 and steam flows out through outlet tube 30.

An electric field created by pole 4 is applied to the water as it is heated to produce steam. The pole is energized to 2–30KV having a frequency of 50–7000 Hz. Table 1 shows the results of tests on a boiler having the following parameters: Total height : 1,750mm ; main height : 1,340mm ; diameter : 390mm ; heating surface : 0.95m² ; type of feeding of water : automatically, temperature of feed water : 15° C.; fuel : kerosene; method of combustion : single burner driven by ⅛ HP blower; boiler pressure : 0.4 kg/cm² ; quantity evaporation 32 kg/hr ; distance between water level and an electric pole : 20mm.

FIG. 3 discloses a hot water heater comprising a shell 31 having a combustion chamber 44 equipped with a burner 43. Fire tubes 48 secured to plates 34 and 45 connect the combustion chamber with chamber 47 and chimney 49. The heat transfer chamber 46 which is a hot water reservoir is connected to a water inlet feed pipe 50 and an outlet pipe 51 for the hot water. A pump P in return conduit 52 circulates the water in the system.

Spiral shaped insulated poles 32 are inserted in the water and are connected by lead wires 33 to a common lead wire 36. The lead wires 33 exit from chamber 46 through sealing and insulating fittings 35 to prevent the escape of water. The wire exits from the heater through a fitting 37 and is joined to the secondary winding 39 of a transformer 38 and to ground through a line 40.

The shell is connected to ground through a lead 42.

The primary winding 41 of the transformer 38 is connected to a power source having a frequency under 7,000 Hz. The poles are energized to 2–30 KV having a frequency between 50–7,000 Hz. The electric field created by the poles 32 is applied while the water is being heated. Table II shows the results of tests on a heater having the following parameters: Total height 2,350mm ; main height : 1,250mm ; diameter : 1,200mm ; heating surface : 8.5m² ; hot water reservoir : 1,450 liters feeding rate : automatic feeding ; fuel : kerosene ; combustion method : single burner with ⅛ HP fan ; feed water tube : 50mm ; return tube 50mm ; quantity of feeding of hot water : 2,400 liters/hr ; temperature of feeding hot water : 90° C.; temperature of return water : 15° C.

FIG. 4 illustrates another form of electric pole. The pole 56 comprises a spiral segment 53 and a lead wire segment 55 covered by a coating of insulating material 54 such as polyamide, fluoride resin known as a heat resisting high insulating synthetic resin or synthetic rubber.

TABLE 1

Hz	50	500	1,000	3,000	5,000
Kv.:					
0	4.27				
7	4.01	3.95	3.87	3.80	3.78
10	3.90	3.85	3.77	3.72	3.69
15	3.76	3.70	3.65	3.58	3.54
20	3.68	3.60	3.56	3.50	3.46

NOTE.—Fuel consumption 1/hr.

TABLE 2

Hz	50	500	1,000	3,000	5,000
Kv.:					
0	25.9				
7	24.0	23.7	23.4	23.1	22.9
10	23.2	22.8	22.6	22.3	22.1
15	22.7	22.1	21.5	21.3	21.0
20	22.2	22.7	21.0	20.8	20.5

NOTE.—Fuel consumption 1/hr.

I claim:

1. A water heater comprising a water storage reservoir, a combustion chamber, a fuel burner in said chamber for burning fuel and forming a hot gas, a heat exchanger for transferring heat from the hot gas to the water in said reservoit, and means insulated from the water for applying an electric field thereto.

2. A heater as defined in claim 1 wherein said means for applying an electric field comprises an electrode positioned above the surface of the water in the reservoir, means for energizing said electrode and the water in the reservoir by connection to a respective opposite potentials of an electric source.

3. A heater as defined in claim 2 wherein the means for energizing the electrode comprises a transformer and means connecting the electrode in circuit with the secondary winding.

4. A heater as defined in claim 3 wherein the transformer is energized to energize the electrode with a voltage in the range of 2–30KV and with a frequency in the range of 50–7,000 Hz.

5. A heater as defined in claim 3 wherein the means positioning the electrode comprises a housing secured to the reservoir, a resilient pad having an opening therethrough mounted in the housing, the electrode extending through said opening, and means for compressing the pad.

6. A heater as defined in claim 1 wherein said means for applying an electric field comprises an insulated electrode positioned in the water, means for energizing said electrode and the water in the reservoir with opposite potentials.

7. A heater as defined in claim 6 wherein the electrode and water are energized with a voltage on the range of 2–30KV and with a frequency of 50–7,000 Hz.

8. A heater as defined in claim 2 wherein the electrode comprises a glass tube, a pool of mercury in the bottom of the tube, a wire dipping into the pool, and an insulating cover on the wire.

9. A heater as defined in claim 2 wherein the electrode comprises a flat spiral and a lead wire connected to one end of the spiral, the spiral and lead wire being coated with an insulating material.

10. A method for heating water comprising the steps of applying heat to the water and simultaneously subjecting at least a portion of the volume of the water to an electric field without direct connection thereof to the source of the field.

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