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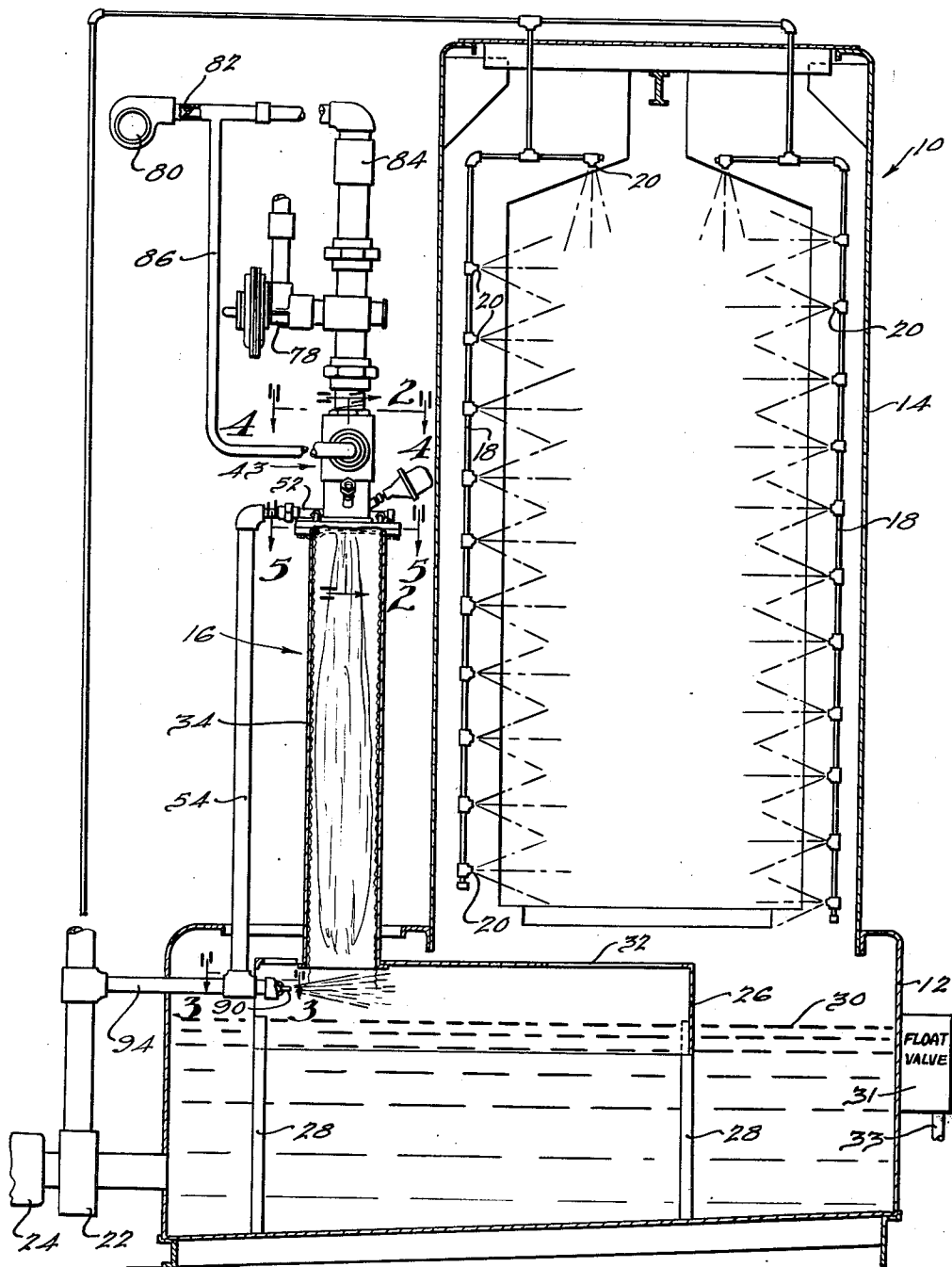
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2,677,368

WATER HEATER

Filed June 1, 1949

2 Sheets-Sheet 1



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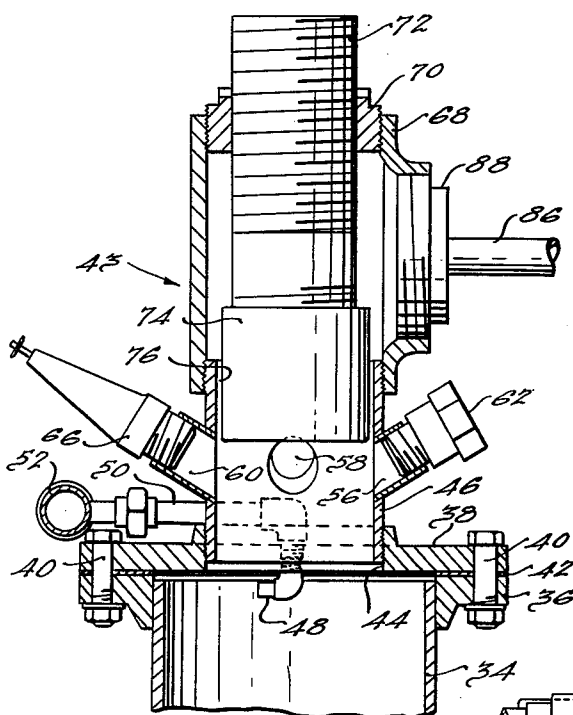


FIG. 2.

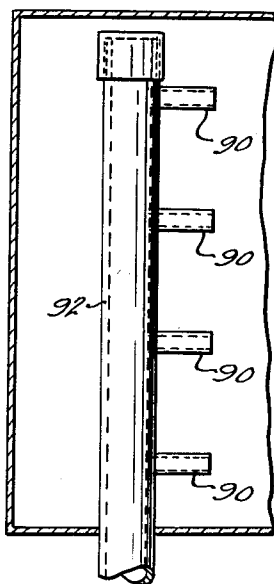


FIG. 3.

FIG. 4.

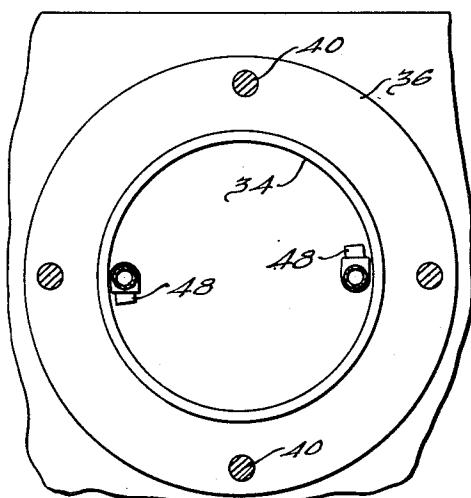
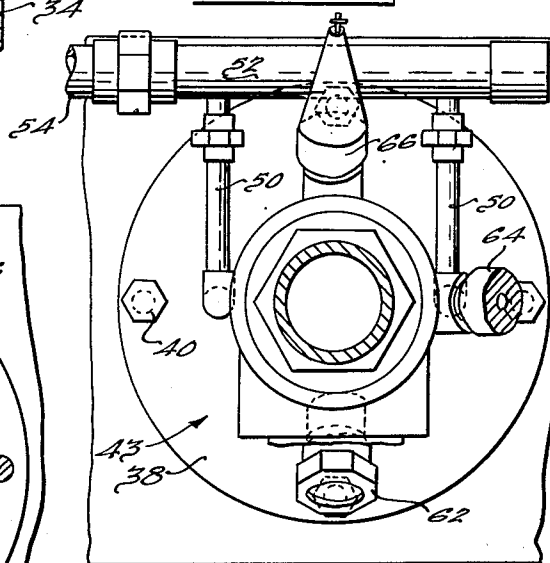


FIG. 5.

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WATER HEATER

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4 Claims. (Cl. 126—350)

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The present invention relates to an improved water heater having particular utility in an industrial washer.

It is an object of the present invention to provide an improved water heater particularly adapted for use in industrial spray washers, which is simple in construction, economical of manufacture, and reliable and efficient in operation.

Another object of the invention is to provide an improved water heater adapted for heating a body of water such as that maintained in the tank of an industrial washer and which has no connections in the tank and no submerged parts.

A further object of the invention is to provide an improved water heater including means for mixing finely divided particles of the water to be heated with hot gases so that the heat of the latter may be absorbed by the former.

It is also an object of the invention to provide an improved water heater including a burner and which is so arranged that the products of combustion, after passing through the heat exchange chambers of the heater, may be concentrated for discharge at a desired point in the lower part of the washing chamber.

Another object of the invention is to provide a cylindrical heat exchange chamber in which the water to be heated forms a jacket for the inner wall of the chamber and is heated by combustion within the chamber.

A further object of the invention is to provide an improved water heater of the just mentioned type including a burner and means for controlling the secondary air supply.

Other and more detailed objects of the invention will become apparent from a consideration of the following specification, the appended claims and the accompanying drawings wherein:

Figure 1 is a broken view in vertical section showing an industrial washer embodying a water heater constructed according to the present invention; and

Figs. 2, 3, 4 and 5 are broken enlarged sectional views of the construction illustrated in Fig. 1 taken respectively along the lines 2—2, 3—3, 4—4 and 5—5 thereof.

It will be appreciated from a complete understanding of the present invention that the water heater thereof may be readily adapted for use in widely differing equipment. It has a particular utility in connection with equipment such as industrial spray washers in which a recirculating body of water is used, and accordingly applicant's water heater is illustrated and described herein as embodied in such a washer.

Referring to the drawings, the washer generally indicated at 10 comprises a generally rectangular tank 12, a generally rectangular spray washing chamber 14 supported thereon at one side thereof, and the water heater generally indicated at 16. It will be appreciated, of course, that the length of the washer 10, measured in a direction at right angles to the plane of the section of Fig. 1 may be varied as desired to provide adequate washing. The washer, in accordance with conventional design, includes water lines 13 in the washing chamber 14 and having a plurality of jet openings or spray nozzles 20 to which water is supplied from the tank 12 by means of a suitable pump 22 which may be driven by any suitable means such as an electric motor 24.

The water heater 16 includes a rectangular box 26 open at its lower side and supported in the tank 12 on legs 28 with its open lower side disposed slightly below the normal water level 30 which may be automatically maintained by conventional float valve means indicated at 31 and to which water is supplied through a supply line 33. The box 26 has a restricted opening 32 in its upper side adjacent one end thereof and disposed substantially centrally of said washing chamber 14 at the bottom thereof. The upper side of the box 26, in spaced relation to its other end, carries a large upwardly extending pipe 34 communicating at its lower end with the interior of the box 26 and having an annular flange 36 welded or otherwise suitably secured to its upper end. An annular flange 38, secured to the flange 36 by bolts 40 and sealed thereto by means of a gasket 42, carries a burner housing generally indicated at 43. The flange 38 has a threaded central opening 44 which threadedly engages and supports an upwardly projecting pipe section 46 forming the lower part of the housing 43. Radially outwardly of the central opening 44 and at diametrically opposite sides thereof, the flange 38 carries oppositely directed depending nozzles 48 connected by suitable water lines 50 to a header 52 and adapted to discharge solid streams of water onto the inner wall of the pipe 34 in a tangential direction and adjacent to the top thereof. Water is supplied to the header 52 by means of the pump 22 through water line 54.

The pipe section 46 is provided with three circumferentially spaced openings 56, 58 and 60 which, in the construction illustrated, are spaced at intervals of 90° and receive respectively a sight glass 62, a flame safety device 64, which may be of conventional construction, and a pilot burner 66.

A T-fitting 68 is mounted on the upper end of the pipe section 46 and forms the upper part of the burner housing 43. The T-fitting 68 carries a bushing 70 having a threaded connection with a gas pipe 72 extending downwardly therethrough and carrying a burner tip 74 mounted on its lower end and projecting to the upper end of the pipe section 46. The position of the burner tip 74, axially of the pipe section 46, may be adjusted by rotation of the bushing 70. The burner tip 74 has a small annular clearance indicated at 76 permitting secondary air to be supplied around the burner tip to the pipe 34.

A mixture of gas and primary air is supplied to the gas line 72, the gas being supplied through a line 78 and the primary air being supplied from a blower 80 through a line 34. The supply of air from the blower 80 is controlled by a temperature control valve 82 responsive to a bulb (not shown) mounted in the tank 12. The discharge from the blower 80 in addition to the primary air supplied through the line 34 provides secondary air which is supplied to the burner housing through a secondary line 36 which is connected to the T-fitting 68 through a bushing 88. From the T-fitting 68 the secondary air flows around the burner tip 74 through the annular opening 76 and into the pipe 34. In operation the flame from the burner tip 74 extends downwardly axially into the pipe 34 in spaced relation to the inner walls thereof substantially as illustrated in Figure 1.

In addition to the primary heat exchange effected in the chamber provided within the pipe 34, a secondary heat exchange takes place in the box 26 through which the gaseous products of combustion pass from the pipe 34. It will be appreciated that in the broader aspects of the invention any suitable means may be employed for providing a plurality of relatively small water particles within the box 26 for intermingling with and absorbing heat from the hot gases passing through the box 26. In the preferred construction illustrated, the means for providing the finely divided water particles in the box 26 comprises a plurality of spray nozzles generally indicated at 90, which are mounted on a header 92 disposed within the box 26 above the level 30 of the water in the tank 12 and between the lower end of the pipe 34 and the adjacent end of the box 26. By virtue of this arrangement the nozzles 90 spray water directly across the path of the hot gases entering the box 26 from the pipe 34. The outlet opening 32, through which the hot gases are expelled is disposed as described so that gases pass up through the washing chamber where additional heat may be absorbed from them by the water sprayed from the nozzles 20.

The construction of the pipe 34 and the burner tip 74, and the means for controlling the flame extending downwardly from the burner tip 74 is such that, as indicated in Fig. 1, the flame may extend substantially throughout the entire length of the pipe 34 but burns itself out inside of the water jacket provided within the pipe 34 by means of the nozzles 48.

It will now be appreciated that the number of pipes 34 and boxes 26 may be multiplied as required to provide the proper heating capacity, adjacent boxes and pipes being spaced along the tank 12 in a direction measured at right angles to the plane of the section shown in Figure 1.

From the foregoing description of the present invention, it will be appreciated that in use the pump 22 provides a steady supply of washing

water to the nozzles 20 in the washing chamber 14 and in addition provides water to the nozzles 48 from which the water runs down the interior of the pipe 34, completely jacketing the pipe, and also provides water to the nozzles 90 from which it is sprayed to the interior of the box 26. The water is heated directly by the flame from the burner 74 as it passes down the interior of the pipe 34 and is also heated within the box 26 by the hot gaseous products of combustion which pass into the box 26 from the pipe 34, along the length of the box 26 and out through the restricted opening 32. It will also be appreciated that within the tank 26 these hot gases will also come in direct contact with the upper surface of the water standing in the box 26 and some heat will be exchanged in this manner. It will be noted that the nozzles 90 are disposed so that they spray water directly across the bottom of the pipe 34 from which the hot gases enter the box 26. Additional heat is extracted from the gaseous products of combustion after they leave the box 26 through the opening 32 and during their passage upwardly through the washing chamber 14.

Although only one specific embodiment of the present invention has been illustrated and described in detail, it will be readily appreciated by those skilled in the art that numerous modifications and changes may be made without departing from the spirit of the invention.

What is claimed is:

1. A water heater comprising means defining a cylindrical heat exchange chamber having a substantially vertically extending wall, means for providing a cylindrical layer of water to be heated running down said wall, means for providing flame means disposed in spaced relation to said wall for heating said layer of water, means defining a second heat exchange chamber communicating with said first named heat exchange chamber and adapted to receive the gaseous products of combustion from the burning of said flame therein, and means for mixing, in said second chamber, said gaseous products of combustion with finely divided particles of the water to be heated, said means defining said second heat exchange chamber including means for maintaining a bath of the water to be heated substantially at a predetermined level, at which level the surface of said bath of water cooperates to define the lower boundary of said second heat exchange chamber.

2. A water heater comprising means defining a cylindrical heat exchange chamber having a substantially vertically extending wall, means for providing a cylindrical layer of water to be heated running down said wall, means for providing flame means disposed in spaced relation to said wall for heating said layer of water, means defining a second heat exchange chamber communicating with said first named heat exchange chamber and adapted to receive the gaseous products of combustion from the burning of said flame therein, and means for mixing, in said second chamber, said gaseous products of combustion with finely divided particles of the water to be heated, said means defining said second heat exchange chamber including means for maintaining a bath of the water to be heated substantially at a predetermined level, at which level the surface of said bath of water cooperates to define the lower boundary of said second heat exchange chamber, said mixing means including a plurality of nozzles for spraying the water to

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be heated into said second heat exchange chamber.

3. A water heater comprising means defining an elongated vertically disposed cylindrical wall providing a heat exchange chamber, means for providing a cylindrical layer of water flowing down and completely covering said wall, means for providing an elongated flame substantially filling the space within and separated from said wall by said cylindrical layer of water, means defining a second heat exchange chamber disposed below said first heat exchange chamber and communicating therewith at the lower end thereof, and means for directing a jet of water to be heated horizontally within said second heat exchange chamber and transversely of the lower end of said cylindrical wall to provide a thorough mixture of finely divided particles of water to be heated with the gaseous products of combustion produced by said flame and to facilitate the provision of a down draft in said first heat exchange chamber and the proper disposition of said flame.

4. A water heater as defined in claim 3 wherein said first heat exchange chamber communicates with said second heat exchange chamber through the upper wall of said second heat exchange

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chamber and adjacent one side thereof and wherein said second heat exchange chamber is provided with a restricted outlet adjacent the opposite side thereof, said means for directing a jet of water being disposed adjacent said one side and adapted to direct said jet of water toward the opposite side of said heat exchange chamber.

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