J. K. TOLES.

WATER HEATER.

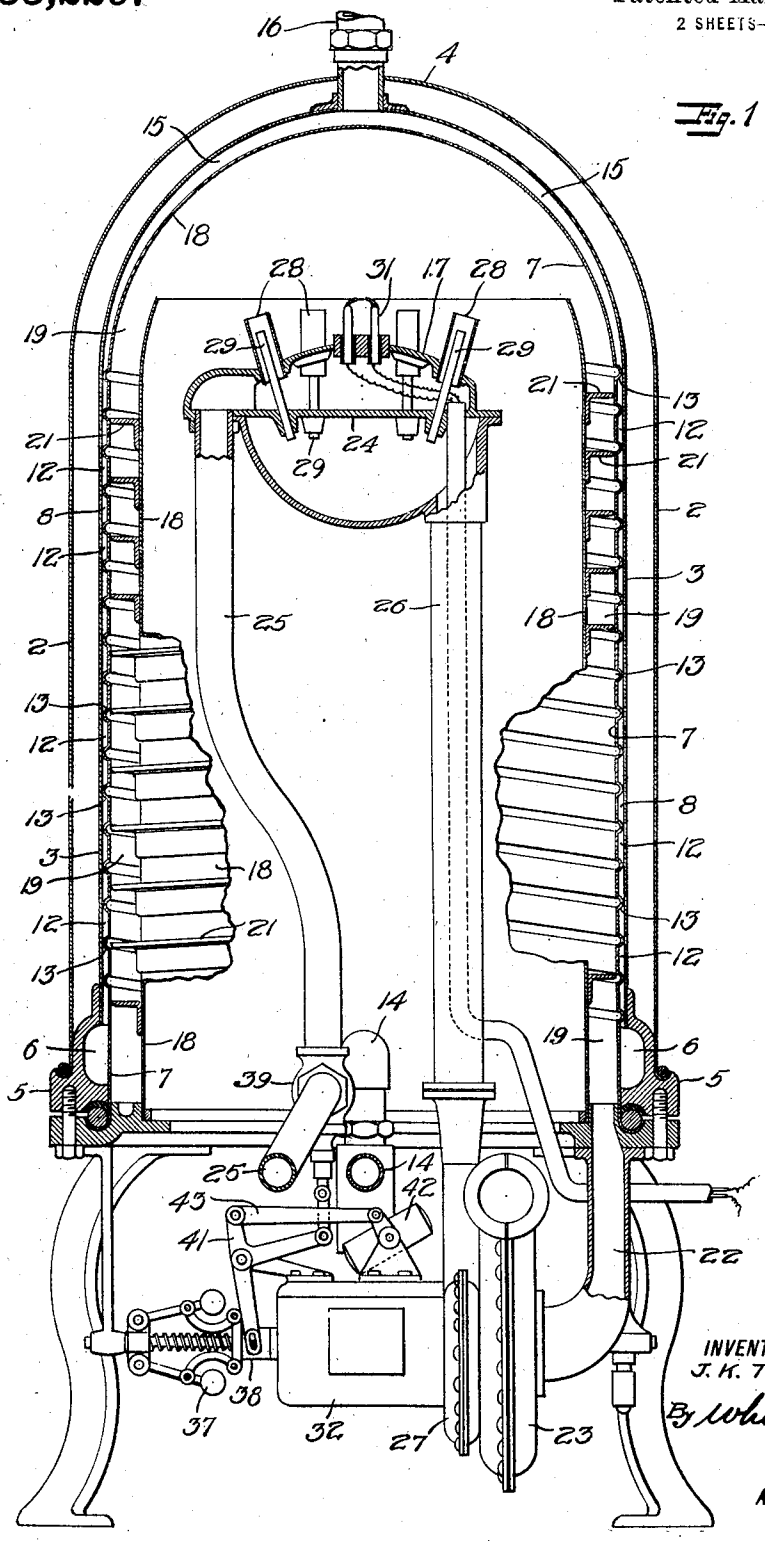
APPLICATION FILED OCT. 18, 1917.

1,333,229.

Patented Mar. 9, 1920.

2 SHEETS—SHEET 1.

Fig. 1



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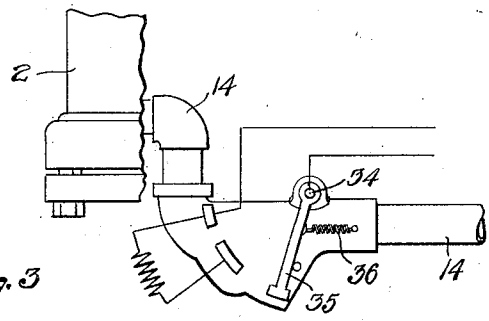


Fig. 3

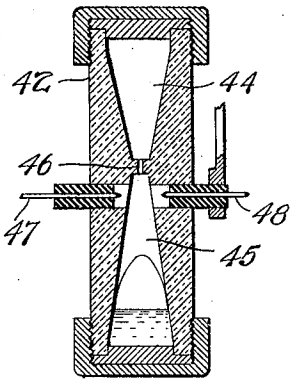
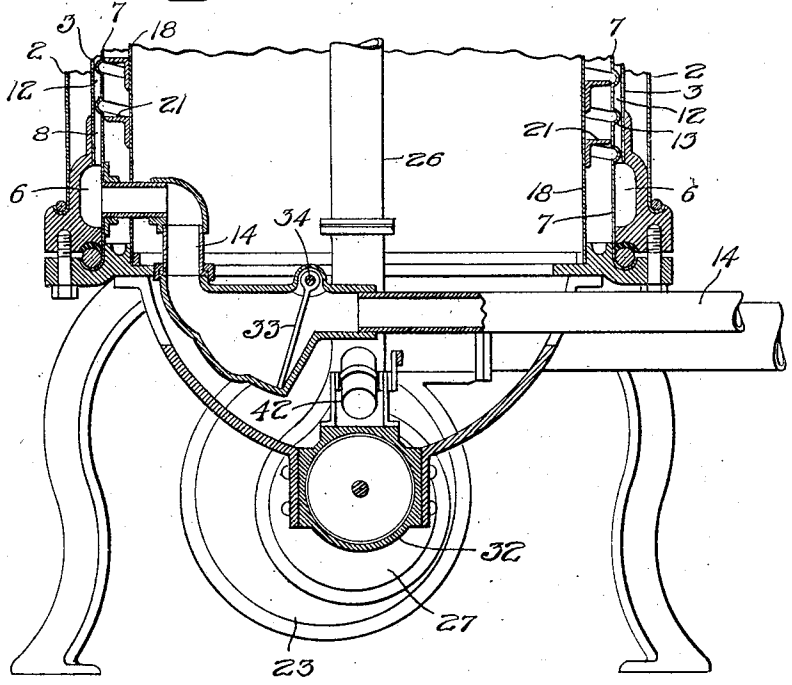


Fig. 4

Fig. 2



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WITNESS:

J. B. Gardner

UNITED STATES PATENT OFFICE.

JUSTIN KAY TOLES, OF SAN FRANCISCO, CALIFORNIA.

WATER-HEATER.

1,333,229. Specification of Letters Patent. Patented Mar. 9, 1920.

Application filed October 18, 1917. Serial No. 197,243.

To all whom it may concern:

Be it known that I, JUSTIN KAY TOLES, a citizen of the United States, and a resident of the city and county of San Francisco and State of California, have invented a certain new and useful Water-Heater, of which the following is a specification.

The invention relates to water heaters and particularly to that type of heater generally known as an instantaneous water heater.

An object of the invention is to provide a water heater having an increased efficiency, both in the burning of the fuel and the transfer of heat to the water.

Another object of the invention is to provide a water heater in which the gases of combustion and the water are in thermal contact with each other for relatively long times and in which the water travels in the opposite direction to the gases, so that the temperature of the exhaust gases is substantially the same as that of the inflowing cold water.

Another object of the invention is to provide a heater in which the gases of combustion and the water are in thermal communication over a large area, thereby facilitating the transfer of heat.

Another object of the invention is to provide a gas burner of the blower type which causes a combustion of the fuel at a much higher temperature than the familiar Bunsen burners.

A further object of the invention is to provide means for producing a rapid flow of the gases of combustion through the heater.

The invention possesses other advantageous features, some of which, with the foregoing, will be set forth at length in the following description, where I shall outline in full, that form of the invention which I have selected for illustration in the drawings accompanying and forming part of the present specification. In said drawings I have shown one specific form of my generic invention, but it is to be understood that I do not limit myself to such form, since the invention, as expressed in the claims, may be embodied in a plurality of forms.

Referring to said drawings:

Figure 1 is a vertical section of the water heater of my invention, parts thereof being broken away to show the construction.

Fig. 2 is a vertical section of the lower part of the heater taken at right angles to Fig. 1.

Fig. 3 is an elevation of the electric control switch.

Fig. 4 is a detail of the tumbler switch.

In the heater of my invention, the water travels in one or more broad, thin streams in thermal contact with the heat-carrying medium, which medium also travels in a long stream, so that it is in thermal contact with the water for a relatively long period. The heat-carrying medium travels through the heater in the opposite direction to the water, the cold water inlet being thermally adjacent the discharge of the gases of combustion, so that, in their travel through the heater, the gases are passed continuously into thermal contact with cooler water, thereby insuring a low temperature of the exhaust gases. The temperature of the exhaust gases is substantially the same as the temperature of the inflowing water. The water is gradually heated as it passes through the heater, the point of highest temperature of the exhaust gases being thermally adjacent the hot water outlet. By causing both the water and the gases to travel in thin streams in thermal contact over relatively long distances, the transfer of heat is greatly facilitated, producing a very efficient heater.

The heater of my invention comprises a heat-insulating outer shell, preferably composed of a double-walled shell, the walls 2—3 of which are spaced apart to inclose a dead air space of thermal insulating material. The outer shell is preferably cylindrical, merging into a dome 4 at the top. The lower ends of the walls are suitably secured to the base ring 5, which is provided on its inner face with an annular groove or passage 6. Arranged within the outer shell, and spaced closely to the inner wall 3 thereof, is an inner shell 7, which extends parallel to the inner wall 3 and has a dome-like top portion paralleling the dome of the outer shell. The space 8 between the wall 3 and the shell 7 is the water space and said space is divided into a plurality of spirally-arranged water passages 12, extending from the bottom to the top of the cylindrical portion of the shell 7. These spiral passages are formed by providing beads or corrugations 13 on the shell 7, which contact with the wall 3. Water passing

through the water space is caused to travel several times around the shell in a thin stream, which conditions are inducive to an efficient transfer of heat. These spiral passages open at the bottom into the annular passage 6 in the base ring 5, which constitutes the water inlet chamber, the water being introduced thereto through the pipe 14. The water after passing upward through the thin spiral passages, enters the narrow, dome-like chamber 15 at the top of the shell, whence it passes through the discharge pipe 16, which may lead to any places where it is desired to draw off hot water and is there provided with the customary faucets.

The space within the dome of the shell 7 is the combustion chamber and the burner 17 is arranged in this chamber and the hot gases of combustion from the burner strike the under side of the dome.

Means are provided for passing the hot gases of combustion in long and intimate contact with the shell 7 before they discharge from the heater. Arranged within and spaced from the shell 7, is a shell 18, forming between the shells 7 and 18 a chamber 19, which opens at its upper end into the combustion chamber. The gases of combustion from the combustion chamber pass down through the chamber 19, in thermal communication with the water in the water space and are caused to travel in a long path by a spirally-arranged plate 21, which consists preferably of an angle iron bent into spiral form and secured to the shell 18. The web of the angle iron extends into contact with the shell 7, thereby forming a long descending spiral passage for the gases of combustion. At the lower end, the spiral gas passage is connected by the conduit 22 with the intake side of the exhaust fan 23, which discharges into a suitable flue or other outlet. The gases of combustion are, therefore, drawn through the heater in a long thin path, in intimate contact with the water. The shell 18 is open at the top and bottom, so that the necessary air to complete the combustion of the fuel may readily pass into the combustion chamber.

The burner 17, in this instance illustrated as a gas burner, is arranged within the shell 18 and at the upper portion thereof, so that the zone of highest temperature occurs immediately below and in direct thermal contact with the water chamber 15, which occurs directly above the crown of the fire shell 17. The burner is a multiple blow-torch which produces a maximum of concentrated heat, which is distributed over the entire surface of the inner crown and is then drawn spirally downward through the spiral fire chamber. The interior of the burner casing 17 is divided into two chambers by the wall 24. Gas under normal pressure is introduced into the upper chamber through the pipe 25 and air under pressure is introduced into the lower chamber through the pipe 26 which is connected to the blower 27. Communicating with the upper chamber are a plurality of gas nozzles 28 and arranged in each gas nozzle is an air nozzle 29 communicating with the air chamber. This arrangement produces a blow-torch burner which causes the combustion of the gas at a high temperature. The ordinary gas burner of the Bunsen type produces a temperature of approximately 900° Fahrenheit, whereas the burner of my invention produces a temperature in excess of 2100° Fahrenheit without increasing the gas supply over that of the Bunsen type. The gas at the burner is ignited by the spark plug 31 preferably arranged on the burner.

The exhaust fan and the air blower are preferably mounted side-by-side on the shaft of the electric motor 32 and means are provided for closing the motor circuit when a faucet is opened to draw off hot water. Arranged in the water inlet pipe 14, is a pivoted vane 33 which is subjected to the direct velocity of the water, so that the position of the vane is varied with variations in the velocity of the water. Connected to the shaft 34 of the vane, on the outside of the pipe, is a rheostat arm or switch 35 which is moved in time with the vane to open and close the circuit of the motor. A spring 36 attached to the rheostat arm returns the arm to the open circuit position when the flow of water ceases. I prefer to employ a rheostat instead of a switch, so that the speed of the motor may be varied in accordance with the rate at which water is being drawn from the heater.

The amount of gas flowing to the burner is also controlled by the speed of the motor. Secured to the motor shaft is a centrifugal governor 37, the movable collar 38 of which is connected to a needle valve 39 in the gas lead by the lever 41, so that the opening of the valve is dependent upon the speed of the motor and consequently upon the rate of water flow through the heater.

The spark plug is arranged in parallel with the motor, so that as soon as the motor circuit is closed, ignition sparks are produced. In order to conserve the use of electricity, means are provided for opening the spark circuit as soon as or shortly after the burner is ignited. Arranged in the spark circuit is a delayed circuit breaker in the form of a tumbler switch 42 which is connected to the lever 41 by the link 43, so that the tumbler is moved as the motor starts. The tumbler switch is provided with two chambers 44—45 connected by a narrow neck 46 and one of the chambers is partly filled with mercury. Extending into said chamber adjacent the neck are two terminals 47—48 in the spark circuit. Normally the spark

circuit is open at these terminals, but when the tumbler is moved by the governor, the mercury flows into contact with the terminals and closes the circuit. Simultaneously the mercury passes slowly through the narrow neck into the other chamber and when all of the mercury has passed through, the circuit is opened. In practice, the spark circuit is closed for approximately twenty seconds after the water is turned on to insure the ignition of the gas. When the water is turned off, the motor stops, the gas supply is closed and the tumbler switch is rocked back to its initial position, causing the mercury to flow back through the neck.

I claim:

1. A water heater including two closely spaced shells inclosing a chamber through which the water to be heated passes, the inner shell forming a combustion chamber, a burner in said combustion chamber adjacent the upper end thereof, a third shell arranged within the inner shell and forming a heating chamber communicating with the combustion chamber, means dividing the heating chamber into a spiral passage for the products of combustion and means for flowing the products of combustion through said passageway.

2. A water heater including two closely spaced shells inclosing a chamber through which the water to be heated passes, the inner shell forming a combustion chamber, a burner in the upper part of said combustion chamber, a third shell arranged within the inner shell and forming a heating chamber communicating with the combustion chamber, means dividing the heating chamber into a spiral passage for the products of combustion and an exhaust fan connected to the discharge end of said passage.

3. A water heater including two closely spaced shells inclosing a chamber through which the water to be heated passes, the inner shell forming a combustion chamber, a burner in the upper part of said combustion chamber, a third shell arranged within the inner shell and forming a heating chamber communicating with the combustion chamber, a spiral plate secured to the third shell and contacting with the inner shell to form a spiral passage between said shells, and an exhaust fan connected to the discharge end of said passage.

4. A water heater including two closely spaced shells inclosing a chamber through which the water to be heated flows upwardly, the inner shell forming a combustion chamber, a burner in the upper part of said combustion chamber, a third shell arranged within the inner shell and forming a heating chamber communicating with the combustion chamber, means dividing the heating chamber into a spiral passage, and means for causing the products of combustion to travel downwardly in said passage, said two first named shells having closed spaced rounded upper ends extending over the third shell, and an outlet for the space between the rounded upper ends.

5. A water heater including two closely spaced shells, the thin space between the shells being divided into a plurality of spirally arranged thin water passageways through which the water flows upwardly, a third shell arranged adjacent one of said shells and forming a heating chamber, a burner located adjacent the upper end of the third shell, means dividing the heating chamber into a spiral passageway and means for causing the products of combustion to travel downwardly in said latter passageway.

6. A water heater comprising two closely spaced cylindrical shells having closed and rounded upper ends, closely spaced beads spirally arranged on the inner shell and engaging the outer shell to provide spiral water passages, a third shell within and spaced from the inner shell and being open at its top, a burner in the upper end of the last named shell, a spiral member between the inner and last named shells providing a spiral flue, and means to cause products of combustion to pass downwardly from the burner through the spiral flue.

In testimony whereof I have hereunto set my hand at San Francisco, California, this 27th day of September, 1917.

JUSTIN KAY TOLES.

In presence of—
H. G. PROST.