(No Model.)

2 Sheets—Sheet 1.

M. G. WILDER.

LIQUID HEATER.

No. 548,941. Patented Oct. 29, 1895.

Fig. 1.

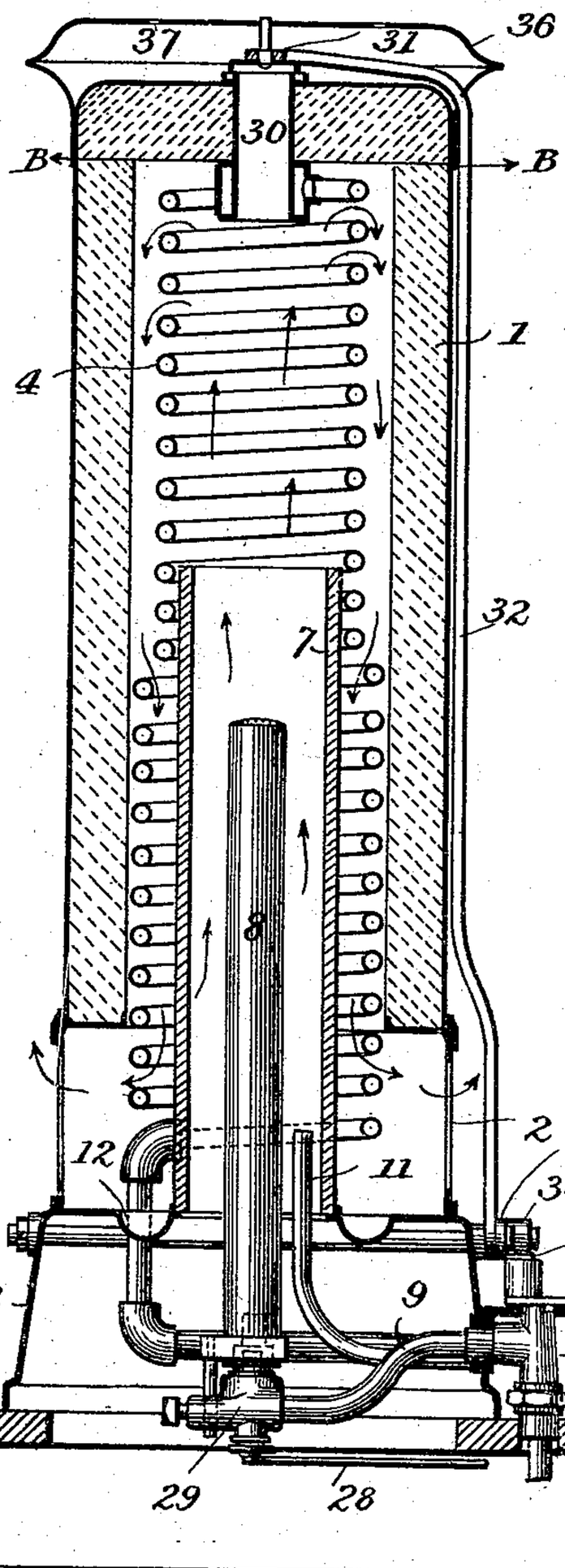
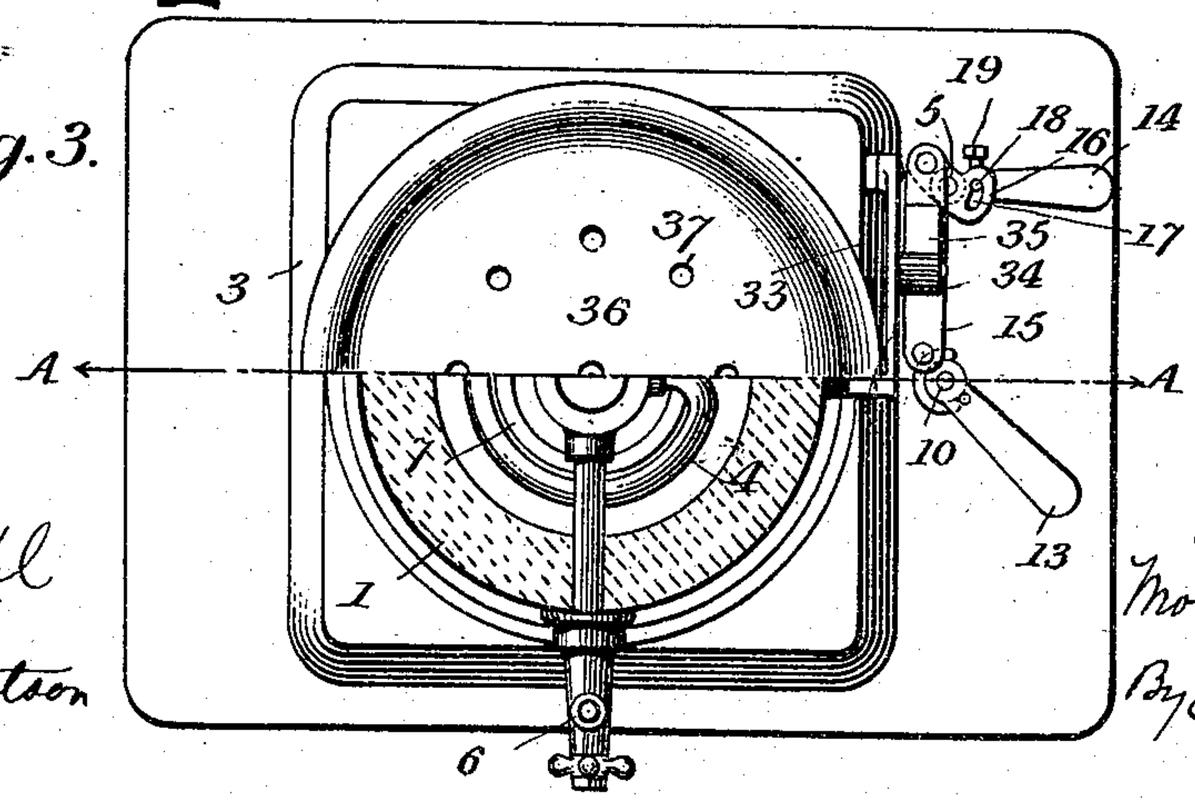


Fig. 3.



Witnesses
Jno. G. Hinkel
Robert C. Watson

Inventor
Moses G. Wilder
By F. C. Watson
Attorney

ANDREW B. GRAHAM, PHOTO-LITHO. WASHINGTON, D.C.

(No Model.) 2 Sheets—Sheet 2.

M. G. WILDER.

LIQUID HEATER.

No. 548,941. Patented Oct. 29, 1895.

Fig. 2.

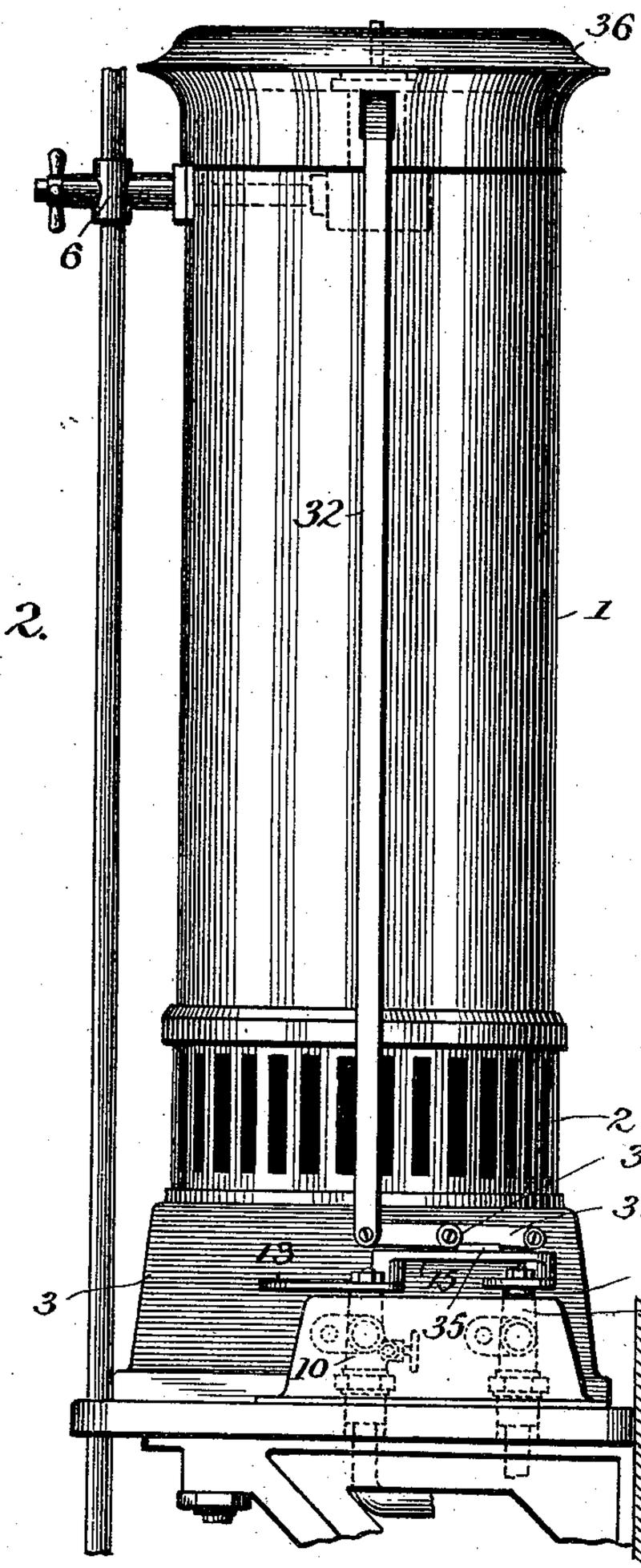


Fig. 4.

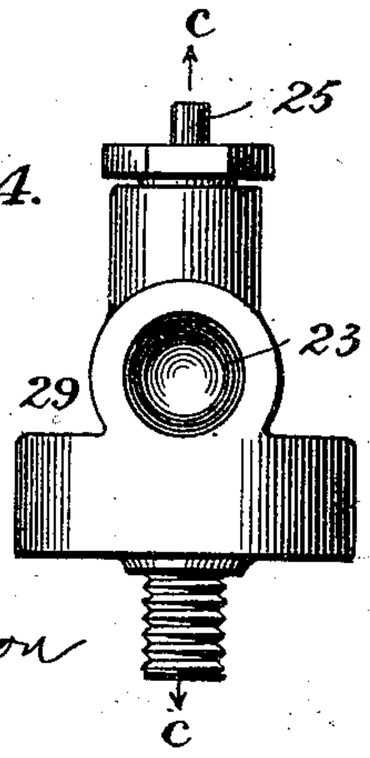
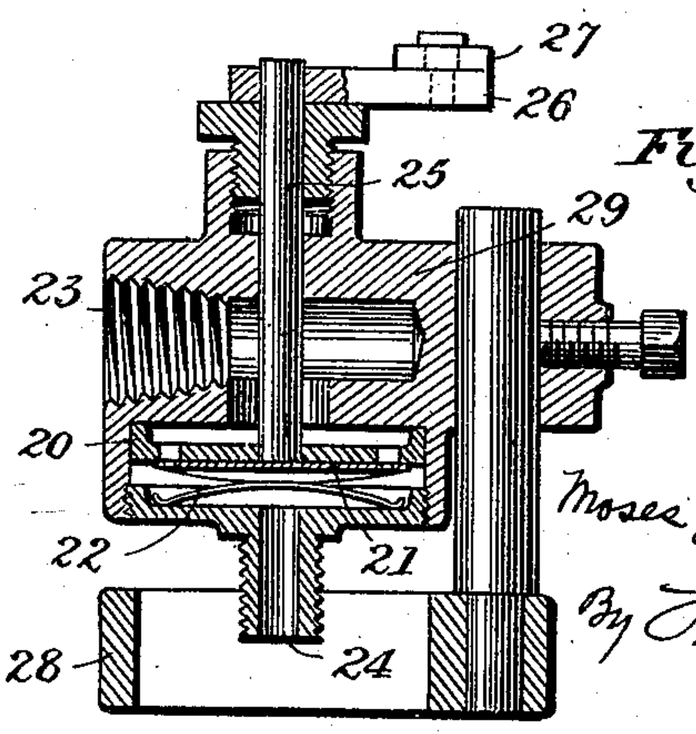


Fig. 5.



Witnesses
Jno. Hinkel
Robert Watson

Inventor
Moses G. Wilder
By J. H. Watson
Attorney

ANDREW B. GRAHAM, PHOTO-LITHO. WASHINGTON, D.C.

UNITED STATES PATENT OFFICE.

MOSES G. WILDER, OF PHILADELPHIA, PENNSYLVANIA.

LIQUID-HEATER.

SPECIFICATION forming part of Letters Patent No. 548,941, dated October 29, 1895.

Application filed June 11, 1895. Serial No. 552,465. (No model.)

To all whom it may concern:

Be it known that I, MOSES G. WILDER, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Liquid-Heaters, of which the following is a specification.

My invention relates to improvements in devices for heating water or other liquids by gas.

The object of the invention is to produce a practically instantaneous liquid-heater which is economical in the use of fuel and in which there is perfect combustion, thereby preventing the discharge from the apparatus of poisonous gases.

In my improved apparatus I arrange for the concentration of the flame of the burner within and upon the upper turns of a coil of pipe in which the water or other liquid circulates from the bottom upward to a discharge-outlet. The coil is surrounded and covered, excepting at its lower end, by an inverted cup-shaped heating-chamber. The chamber is preferably composed of or lined with a mineral non-conducting substance, which may become red-hot on its inner surface under the action of the burner without being injured. The burner is placed well up in the coil, so that the hottest part of the flame acts upon the upper end of the coil. The hot gases then pass through the interstices of the coil and thence downward and discharge at the lower end of the cup-shaped casing. A flue or chimney surrounds the burner within the coil, and the gases in passing downward are confined laterally between the chimney and the casing and compelled to circulate among the lower turns of the coil, which are kept cool by inflowing liquid. The effect of this is to transmit a very large proportion of the heat of the gases to the liquid circulating in the coil and the gases at the point of discharge below the casing are reduced to a comparatively low temperature. In actual practice I have attained a higher thermal efficiency with the present invention than is possible with any other apparatus of the kind of which I am aware.

My invention further consists in other details of constiuction, all of which will be fully described in connection with the accompanying drawings, in which—

Figure 1 is a vertical central sectional view on the line A of Fig. 3. Fig. 2 is a side elevation. Fig. 3 is a plan view, partly in section, on the line B of Fig. 1; and Figs. 4 and 5 are details of the valve at the bottom of the burner, Fig. 5 being a section on the line C of Fig. 4.

Referring to the drawings, 1 indicates an inverted cup-shaped casing open at the bottom and normally closed at the top. The casing consists of or is lined with some suitable refractory non-conducting material, and it rests upon a perforated or slotted ring 2, which, in turn, rests upon a base 3. Within the casing is a vertically-arranged coil 4, through which the liquid to be heated travels upward. The coil preferably extends from below the bottom of the casing 1 to the top of the chamber within the casing. As shown, the supply of liquid to the coil is controlled by a valve 5 and the hot liquid is delivered from the upper end of the coil through a valve 6. Within the coil, and extending upward from below the casing to a point somewhere near the middle thereof, is a flue or chimney 7, and within the chimney is arranged a burner 8, which, as shown, is an ordinary Bunsen burner.

The flue or chimney is so proportioned in diameter that only sufficient air to affect complete combustion of the gas can pass upward between the burner and flue. The chief purpose of the flue, however, is to separate the incoming air and gases from the lower part of the coil and direct the outgoing products of combustion onto the lower turns of the coil, so that the heat may be more completely absorbed by the coil and transmitted to the liquid within. The gas is supplied through a pipe 9, controlled by a valve 10. A pilot-light 11 is usually provided for convenience for igniting the burner.

The operation of the invention, so far as it has been described above, is as follows: The liquid being turned into the coil, so as to circulate upward therein, and the burner lighted, combustion will take place within the coil at or close to its upper end, and the heated gases will then pass laterally out through the inter-

stices of the coil at the upper end and thence downward and out through the openings in the supporting-ring 2. The burner is placed well up in the chamber of the casing, so that no direct heat from the flame is imparted to the lower part of the coil, the chimney serving to partly protect the coil from this direct heat, as well as to separate the incoming from the outflowing gases. The air-supply, which comes in around the burner, passes up around the flame and serves to complete the combustion of gases at the top of the chamber. Above the chimney 7 the current within the coil is upward, and between the coil and the casing there is a downward flow of the heated gases, but below the top of the chimney or flue the outflowing gases may pass down either inside or outside of the coil, or the coil may be placed in the middle of the space between the casing and the flue, thus compelling the gases to travel on both sides of it and to impinge upon all parts of the lower half of the coil. As shown in the drawings, the gases pass within the coil at the top of the chimney and flow downward between the coil and the chimney, passing out through the interstices of the coil at the bottom. Most of the heat of the gases is absorbed by the cool liquid entering the coil, and any heat which is imparted to the chimney is taken up by the cool air flowing to the burner. In this manner nearly all of the heat which tends to escape is conveyed back to the top of the coil upon which the hottest part of the flame plays. I have found that with this arrangement a moderately strong stream of hot liquid can be obtained from the heater in less than a minute, the temperature of the liquid and its amount of course depending somewhat upon the size of the burner. The escaping products of combustion I have found to be quite cool and free from deleterious gases. In fact the cooling effect upon the escaping spent gases is such that the moisture in them is largely condensed at the lower end of the coil, and I provide a trough 12 for carrying off the water of condensation. The force of the inflowing gas and the highly-heated gases within the upper end of the coil create an upward current which has sufficient force to drive the spent gases down through the annular space between the chimney and the casing and out at the bottom. The interior of the casing at the top becomes very highly heated, but if the casing be of suitable material heat is prevented from passing through it, and as it has no other avenue of escape except by traveling down the coil and over the cool lower portion of it, it will be evident that nearly all of the heat-units are eventually imparted to the liquid.

The gas-valve 10 is operated by a hand-lever 13 and the liquid-valve 5 is operated by a similar lever 14. In order to conveniently arrange for turning on the gas and liquid in proper proportions I connect the lever 13, by means of a link 15, with a lever 16, having a slot 17, into which projects a pin 18 upon the lever 14 of the liquid-valve. A set-screw 19 in the lever 16 projects into the slot and regulates the length thereof. It will be seen that when the lever 13 is moved to turn on the gas a certain amount of movement will be given to the lever 14 of the liquid-valve, the amount of movement thus imparted depending upon the position of the set-screw 19. If it be desired to increase the flow of liquid without increasing the gas-supply the lever 14 may be moved independently to further open the valve 5, the pin 18 being free to move in the slot 17 without disturbing the position of the gas-valve. The effect of this will be to give a larger supply of liquid at a lower temperature.

In Figs. 4 and 5 I have shown in side view and section a supplementary gas-valve which may be employed to regulate the flow of gas in connection with a thermostat. It consists of a casing 29, having an inlet 23 and an outlet 24, the valve proper consisting of a fixed disk 20 and a movable disk 21, arranged in a chamber of a casing, the disks being provided with perforations which register when the valve is open. The movable disk 21 is connected to a rocking stem 25, provided with a lever 26, which is connected by a link 27 to any suitable thermostatic regulator which is controlled by the temperature of the outflowing liquid. The burner 8 is supported upon a ring 28, which is attached to the casing 29 of the valve.

In order to ventilate the casing when the apparatus is not in operation, and to prevent the accumulation of gas which might leak from the burner and produce an explosive mixture, I provide an opening 30 in the top of the casing and a valve 31, which normally closes said opening. The valve, as shown, is operated by a rod 32, the lower end of which is connected to a lever 33, pivoted to the base. The lever 33 carries a roller 34, which rests upon the link 15. Upon the upper surface of the link is a cam 35, which, when the valves are thrown to shut off the gas and liquid, raises the lever 33 and lifts the valve 31, thereby opening the casing, so that the gases therein, may escape. As shown in the drawings, there is an ornamental cap 36 upon the casing, provided with perforations 37 for ventilation.

My invention is susceptible of various modifications in the matter of design and mechanical detail without departing from the spirit thereof, and I do not wish to be considered as limiting myself to the precise construction and arrangement of parts illustrated and described.

What I claim is—

1. In a liquid heater, the combination of an inverted cup-shaped casing normally closed at its upper end; a burner located within the chamber of the casing; a coil within the chamber, surrounding the burner, and ex-

tending from below the burner to the top of the chamber, said coil having its outlet at its upper end; and a flue or chimney within the coil and surrounding the burner, the course of the gases from the burner being first to the upper part of the chamber within the coil, thence through the interstices of the coil, and thence downward between the flue and casing and discharging at the lower end of the casing, the flue or chimney serving to separate the ascending currents of gas and air from the descending products of combustion in the lower part of the casing, substantially as described.

2. In a liquid heater, the combination of an inverted cup-shaped casing, composed of non-conducting material, and normally closed at its upper end; a burner located centrally within the chamber of the casing; a coil within the chamber, surrounding the burner, and extending from below the burner and casing to the top of the chamber, said coil having its outlet at its upper end; and a flue or chimney within the coil and surrounding the burner; the course of the gases from the burner being first to the upper part of the chamber within the coil, thence through the interstices of the coil, and thence downward between the flue and casing and discharging at the lower end of the casing, the flue or chimney serving to separate the ascending currents of gas and air from the descending products of combustion in the lower part of the casing, substantially as described.

3. The combination of the inverted heating chamber, a gas burner discharging its products upward into said chamber, a valve and valve seat in the top of said chamber, and means for opening said valve simultaneously with the shutting off of the gas from said burner and for closing it simultaneously with the turning on of the gas.

4. The combination in a liquid heater, of an inverted cup-shaped heating chamber, a coil of pipe within said chamber receiving liquid at the bottom and discharging it from the top, a flue or chimney within said coil, a burner within said flue, a gas cock, a safety valve in the top of said cup-shaped heating chamber, and means for automatically opening said valve when the gas cock is closed and for closing it when the gas cock is opened.

5. The combination in a liquid heater, of a vertical normally closed heating chamber, a coil of pipe within said chamber, a valve for controlling the flow of liquid to the lower part of said coil, a gas burner within said coil, a valve for controlling the flow of gas to said burner, a link connecting the operating handles of the gas and water supply valves, a cam on said link, a valve for closing the top of the heating chamber and means operated by the cam for opening the last named valve when the gas valve is closed, substantially as described.

In testimony whereof I affix my signature, in presence of two witnesses.

MOSES G. WILDER.

Witnesses:
SAML. SHAW,
JOHN S. MCCONNELL.