(No Model.)

A. D. GORDON.

WATER HEATER.

No. 545,199. Patented Aug. 27, 1895.

Fig. 1.

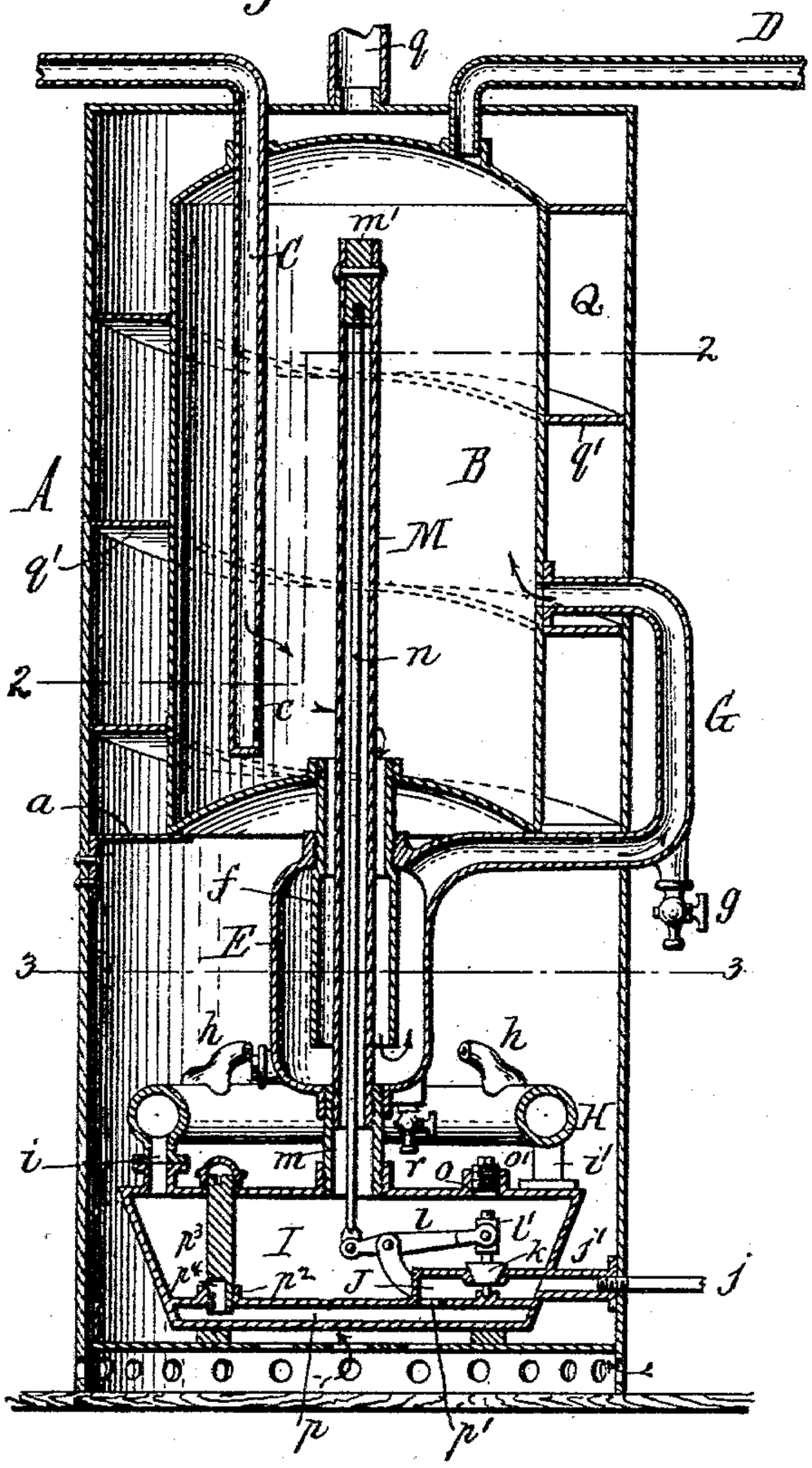


Fig. 2.

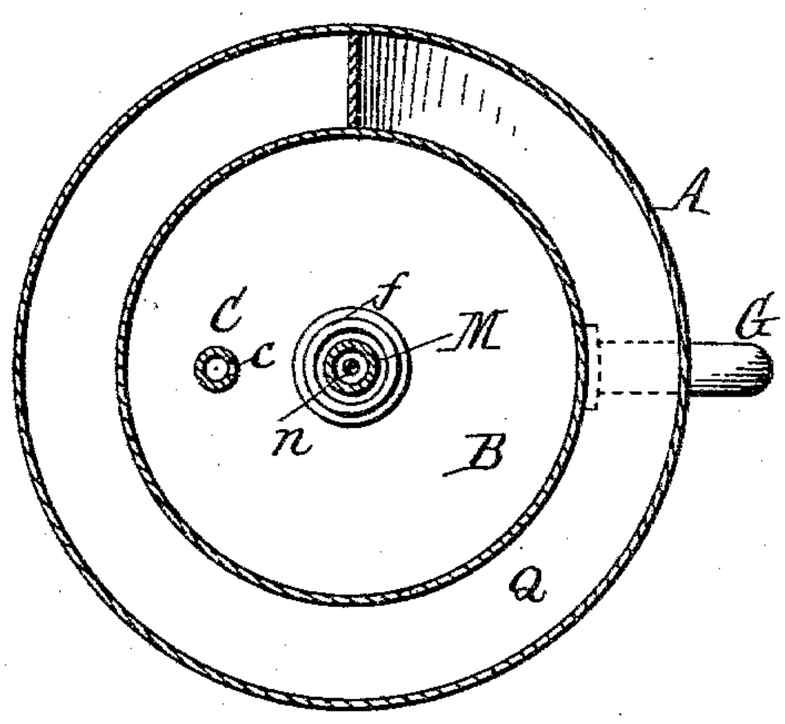


Fig. 3.

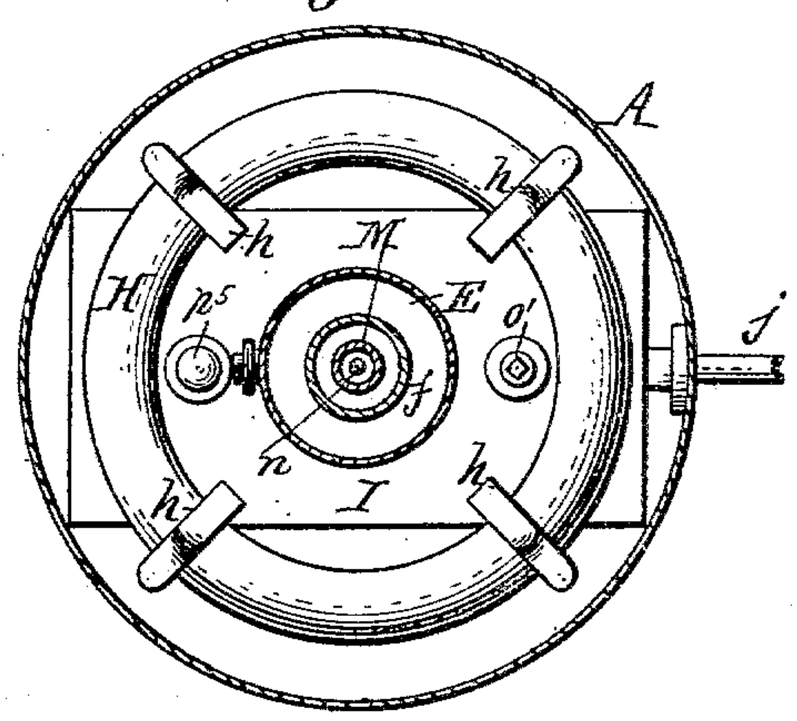


Fig. 4.

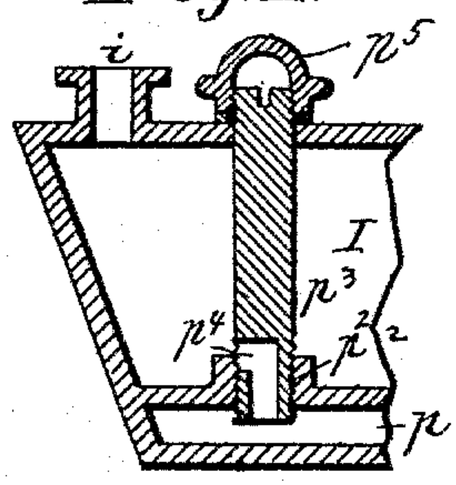


Fig. 5.

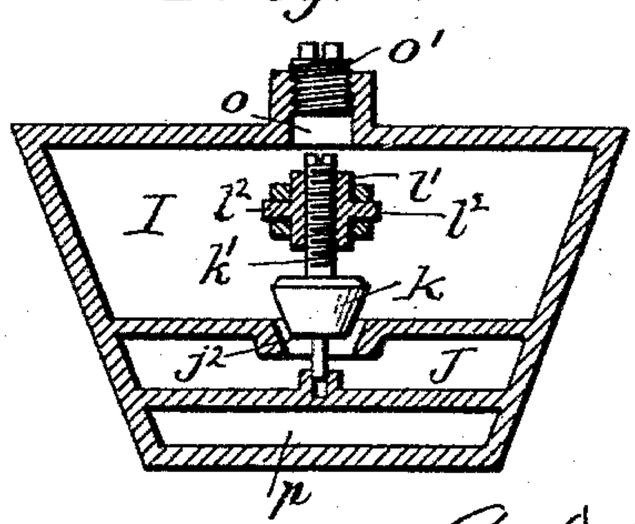
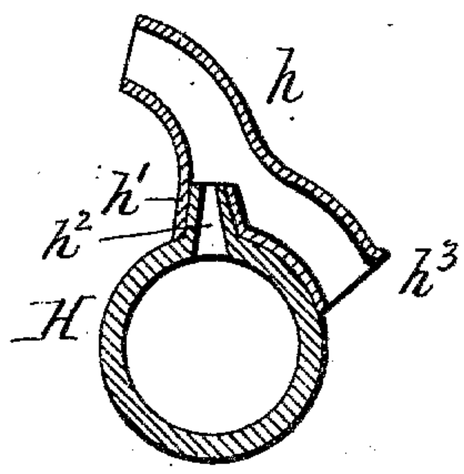


Fig. 6.



Witnesses:
Thos. L. Popp.
Chas. F. Burkhardt.

A. D. Gordon Inventor.
By Wilhelm & Bonner
Attorneys.

UNITED STATES PATENT OFFICE.

ALEXANDER D. GORDON, OF BUFFALO, NEW YORK.

WATER-HEATER.

SPECIFICATION forming part of Letters Patent No. 545,199, dated August 27, 1895.

Application filed January 14, 1895. Serial No. 534,765. (No model.)

To all whom it may concern:

Be it known that I, ALEXANDER D. GORDON, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented new and useful Improvements in Water-Heaters, of which the following is a specification.

This invention relates to that class of water-heaters which comprise, essentially, a boiler or reservoir, a gas-burner for heating the boiler, and a thermostat or automatic regulator which governs the supply of gas to the burner, and which is in turn controlled by the temperature of the water in the boiler.

One of the objects of my invention is to so organize the apparatus that the water is quickly heated and that the thermostat is quickly acted upon by the incoming cold water as well as by the heated water, so that both the opening and the shutting of the gas-valve are effected quickly and promptly in response to the changes taking place in the temperature of the water.

Other objects of my invention are to simplify the automatic gas-supply mechanism and to improve the construction of the apparatus in other respects.

In the accompanying drawings, Figure 1 is a sectional elevation of my improved water-heater. Figs. 2 and 3 are horizontal sections thereof in lines 2 2 and 3 3, Fig. 1. Fig. 4 is a fragmentary longitudinal section, on an enlarged scale, of the gas-delivery chamber arranged underneath the burner. Fig. 5 is a transverse section thereof, the plane of section being through the automatic gas-valve. Fig. 6 is a cross-section of the burner, taken through one of its nozzles.

Like letters of reference refer to like parts in the several figures.

A represents a jacket or casing which incloses the apparatus, and B is the main water boiler or reservoir arranged in the upper portion of the jacket and supported upon brackets *a* projecting from the inner side of the jacket.

C represents the inlet-pipe, through which the cold water enters the boiler and which terminates near the bottom of the boiler. This inlet-pipe is preferably closed at its lower end and provided on one side, near its lower end, with perforations *c*, through which the cold water issues laterally.

D is the outlet-pipe of the boiler, through which the hot water is discharged and which connects with the top of the boiler.

E is an auxiliary heating chamber or cylinder of comparatively small capacity, which is arranged below and in communication with the main boiler or reservoir and in which the water is heated in small volumes, whereby its temperature is raised more rapidly. This auxiliary heating-chamber is connected with the lower portion of the main boiler by a vertical tube *f* extending through the bottom of the main boiler and the top of the auxiliary heating-chamber.

G is a circulating pipe or passage which connects the upper portion of the auxiliary heating-chamber with the middle portion of the main boiler and whereby a circulation of the water is established through the main and auxiliary heaters, the water flowing from the main boiler downward through the tube *f* into the auxiliary heater and returning to the main boiler through the circulating-pipe G. The connecting-tube *f* preferably extends nearly to the bottom of the auxiliary heating-chamber to prevent the water from passing directly into the circulating-pipe upon entering said chamber. The circulating-pipe extends through the jacket A, and its external portion is provided with a cock or faucet *g*, through which the water may be drained in emptying and cleaning the main boiler.

H represents the burner, which is preferably annular in form and which surrounds the lower portion of the auxiliary heating-chamber, so that the flame envelops and highly heats said chamber.

h represents the nozzles of the burner, which, in the construction shown in the drawings, consist of upright tubes, each having at its base a socket *h'*, which fits over an upwardly-projecting nipple h^2 of the burner, and a lateral and downward extension h^3, which opens into the atmosphere, as shown in Fig. 6, whereby air is mixed with the gas. The burner is supplied from a gas-delivery chamber or casing I, arranged underneath the burner and communicating with the latter by a pipe *i*. The burner is supported on one side by this pipe and on its opposite side by a standard *i'*, secured to the gas-delivery chamber.

J is a transverse gas-receiving chamber or passage arranged in the lower portion of the

delivery-chamber I, and *j* is the supply-pipe which connects with the inlet-nipple *j'* of said gas-chamber. This gas-receiving chamber is provided in its upper side with a discharge-opening j^2, through which the gas passes into the delivery-chamber I and to which a conical or other suitable regulating-valve *k* is applied. The latter is connected with one arm of an actuating-lever *l* by means of a swiveling sleeve *l'*, having an internal screw-thread which engages with an external thread formed on the stem *k'* of the valve. The adjacent end of the actuating-lever is bifurcated and the sleeve *l'* is provided with horizontal pivots or trunnions l^2, which turn in openings formed in the jaws of the lever, as shown in Figs. 1 and 5. This swiveling connection permits the valve to fit closely in its seat. The actuating-lever is pivoted to an arm formed on the gas-receiving chamber, as shown in Fig. 1.

M represents an expansible tube or thermostatic member arranged centrally within the main boiler B and extending downward through the descending water-tube *f* and the lower portion of the auxiliary heating-chamber E. The lower end of this expansible tube is secured to a short tube or nipple *m*, which is secured at its upper end to a screw-nipple formed at the lower end of the auxiliary heating-chamber and at its lower end to a similar nipple formed on the top of the gas-delivery chamber I. The upper end of the expansible tube is closed by a plug *m'* and the same is free or detached, except at its lower end, so as to be capable of expanding and contracting lengthwise under the influence of the water by which it is surrounded.

n is a rod arranged within the expansible tube and secured at its upper end to the plug of the tube and at its lower end to the short arm of the valve-actuating lever *l*, whereby the movements of the expansible tube are transmitted to the gas-regulating valve. The movement of the valve can be regulated by screwing its stem up or down in the swiveling carrying-sleeve *l'*, the stem being formed in its projecting upper end with a notch for receiving a screwdriver. Access is obtained to the valve-stem through an opening *o*, formed in the top of the gas-delivery chamber above the stem, which opening is closed by a screw-plug *o'*. The expansion-tube, though communicating with the gas-delivery chamber, shuts off communication between said chamber and the auxiliary and main heating-chambers. The expansible tube is made of such a diameter that an annular water-passage is left between the outer surface of said tube and the connecting-tube *f*.

p is a by-pass or auxiliary gas-passage, which is adapted to connect the gas-receiving chamber J with the gas-delivery chamber at all times, so as to maintain a small gas-supply to the burner when the gas-valve is wholly closed, thereby preventing extinguishment of the burner when the automatic gas-valve is closed and avoiding undue cooling of the water. This by-pass is arranged below the gas-receiving chamber and communicates with the latter by an aperture *p'* and with the gas-delivery chamber by an internally screw-threaded nipple p^2.

p^3 is a valve arranged in the nipple p^2 for regulating the quantity of gas delivered by the by-pass. This valve consists of an upright stem, having its lower portion formed with an external screw-thread, which engages with the internal thread of the nipple p^2, and provided with a gas-port p^4, which extends upward from its lower end and thence laterally to the surface of the stem, where it opens into the gas-delivery chamber. By screwing the valve up or down in the nipple the outlet end of its port is covered more or less by the inner wall of the nipple, thereby regulating the gas-supply through the by-pass accordingly. This regulating-valve extends upward through an opening formed in the top of the gas-delivery chamber and is provided in its upper end with a notch for receiving a screwdriver. The projecting end of the valve is preferably inclosed by an externally screw-threaded cap or stuffing-box p^5, which bears against a packing-ring interposed between the box and the top of the gas-delivery chamber, as shown in Fig. 4. Upon removing this cap the valve can be turned. The main boiler or heater B is separated from the surrounding jacket by an annular flue Q, through which the products of combustion rise, such products escaping through a smoke-pipe *q* connected to the top of the jacket.

q' is a spiral baffle plate or flange arranged in the flue Q and serving to retard the escape of the products of combustion, thereby more effectually utilizing the heat.

In the use of the apparatus the water entering the main boiler through the inlet-pipe C descends through the tube *f* into the auxiliary heating-chamber, in which it is highly and rapidly heated, owing to the small capacity of the chamber and the direct exposure of the same to the flame. The water then rises through the circulating-pipe G and again enters the main boiler, a continuous circulation of the water taking place in this manner, whereby all portions of the boiler-contents are subjected to the heat of the auxiliary chamber. The main boiler is heated by the products of combustion passing upward through the annular flue which surrounds the boiler.

As the expansible or thermostatic tube is exposed to the water in the main and auxiliary heating-vessels, it is caused to expand and contract in accordance with the temperature of the boiler-contents. This movement of the expansible tube is transmitted by the rod *n* to the actuating-lever of the gas-valve *k*, which causes the valve to move toward or from its seat correspondingly, thereby regulating the supply of gas to the burner accordingly, the valve being opened to a greater ex-

tent as the temperature of the water is reduced by the incoming cold water and being closed more or less as the temperature rises. The extent of movement of the valve relatively to the movement of the expansible tube is readily adjusted by screwing the valve-stem up or down in the swiveling-sleeve *l'*. The water-inlet pipe is arranged adjacent to the expansible tube, and its discharge-apertures face the tube. By this arrangement the expansible tube is brought under the direct influence of the entering cold water, and the tube is thus controlled by the coldest portion of the heater-contents, thereby insuring the heating of the entire contents to a comparatively high temperature and avoiding a premature restriction or shutting off of the gas-supply, which occurs when the expansible rod is exposed principally to a portion of the boiler-contents, which are already partially heated. The extent of exposure of the expansible tube to the entering cold water is increased by the tube *f*, which, in addition to its function as a guard for preventing a too-ready escape of the water from the auxiliary heating-chamber, serves as a jacket which prevents direct contact of the surrounding hot water with the cold water descending through said tube. A considerable portion of the expansible tube is thus enveloped by the incoming cold water, and the necessary gas-supply to effectually heat all portions of the water is therefore insured at all times.

The auxiliary water-heater may be provided with a drain-cock *r*.

If desired, the connecting-rod *n*, which connects the expansible tube with the lever of the automatic gas-valve, may be covered or coated with a suitable non-conductor of heat.

As the rod which connects the thermostatic tube with the gas-regulating valve extends downward through the short tube *m* into the closed gas-delivery chamber I, no stuffing-box is required near the free end of this rod for preventing the escape of gas or water from the apparatus, thus guarding against leakage and saving the cost of stuffing-boxes.

The gas-delivery chamber contains the gas-regulating valve, the by-pass and its regulating valve, and it also carries the burner, and the chamber is independent of the heater shell or casing and is readily attached to the auxiliary heater by the short screw-threaded tube *m*, while the auxiliary heater is readily attached to the bottom of the main heater by means of the tube *f*. By thus constructing the gas-chamber and the parts carried by the same I am enabled to apply my improvement to any ordinary domestic boiler or reservoir, while at the same time inclosing the free end of the connecting-rod between the thermostatic tube and the gas-valve and avoiding the use of stuffing-boxes.

My improved water-heater is especially desirable for domestic purposes, but it is also applicable to the various other uses of such heaters.

I claim as my invention—

1. The combination with the main water heating chamber provided with an inlet for the cold water, of an auxiliary water heating chamber of less capacity arranged below the same and communicating with the main chamber by a descending cold water passage and by an ascending hot water passage, a gas burner arranged adjacent to said auxiliary chamber, a valve controlling the gas supply to said burner, and a thermostatic member exposed with its upper portion to the water in said main chamber and with its lower portion to the water in said auxiliary chamber, substantially as set forth.

2. The combination with the main water heating chamber, provided with an inlet for the cold water, of an auxiliary water heating chamber arranged below the same, a descending passage for cold water extending from the bottom of said main chamber to the lower portion of said auxiliary chamber, an ascending passage for the heated water extending from the upper portion of said auxiliary chamber, outside of said cold water passage, to the main chamber, a gas burner arranged adjacent to said auxiliary chamber, a valve controlling the gas supply to said burner and a thermostatic member controlling said valve and arranged in both chambers, substantially as set forth.

3. The combination with the main water heating chamber provided with an inlet for the cold water, of an auxiliary water heating chamber of less capacity arranged below the same and communicating therewith, a gas burner arranged adjacent to said auxiliary chamber, a valve controlling the gas supply to said burner, a thermostatic tube secured with its lower portion to said auxiliary chamber and extending upwardly through the same and into said main chamber, and a valve rod secured with its upper end to the upper end of said tube and extending downwardly through the same and connecting at its lower end with said valve, substantially as set forth.

4. The combination with a main boiler or heating chamber and an auxiliary heating chamber, of a tube connecting the bottom of the main heating chamber with the top of the auxiliary heating chamber and terminating near the bottom of the latter, a circulating pipe connecting the top of the auxiliary heating chamber with the lower portion of the main heating chamber, a thermostatic tube or member extending through said connecting tube and into the main heating chamber and separated from said connecting tube by a water passage, a gas burner arranged adjacent to the auxiliary heating chamber and having a gas supply, and a valve controlling the pas-

sage of the gas to the burner and connected with the thermostatic tube or member, substantially as set forth.

5. The combination with a main boiler or heating chamber and an auxiliary heating chamber arranged below the same and connected therewitb, of a circulating pipe connecting the auxiliary chamber with the main chamber, a gas burner arranged adjacent to the auxiliary chamber and having a gas supply, a regulating valve controlling the passage of gas to the burner, and a thermostatic tube arranged in said heating chambers and connected with said regulating valve, substantially as set forth.

6. The combination with a heating chamber, of a gas delivery chamber arranged underneath said heating chamber and provided with a gas inlet and in its top with an opening, a gas burner connected with said delivery chamber, a regulating valve applied to said gas inlet and arranged within the gas delivery chamber, a thermostatic tube arranged in said heating chamber and fixed at its lower end, whereby the tube is caused to expand upward, and a connecting rod extending through said thermostatic tube and the opening in the top of the gas delivery chamber and secured at its upper end to the thermostatic tube and having its lower end connected with said regulating valve, substantially as set forth.

7. The combination with a water heating chamber, of a gas delivery chamber arranged underneath said chamber, connected therewith by a tube or passage, and provided with a gas inlet, a burner connected with said delivery chamber, a regulating valve applied to said gas inlet, a thermostatic tube arranged in said heating chamber and having its lower end secured within said connecting tube or passage, whereby the thermostatic tube shuts off communication between the water heating chamber and the gas delivery chamber and a connecting rod secured at its upper end to the thermostatic tube, extending through the latter and said connecting tube or passage and having its lower end connected with said gas regulating valve, substantially as set forth.

Witness my hand this 12th day of January, 1895.

ALEXANDER D. GORDON.

Witnesses:

JNO. J. BONNER,

KATHRYN ELMORE.