(No Model.)

J. S. COE.

APPARATUS FOR HEATING WATER.

No. 555,675. Patented Mar. 3, 1896.

Fig. 1.

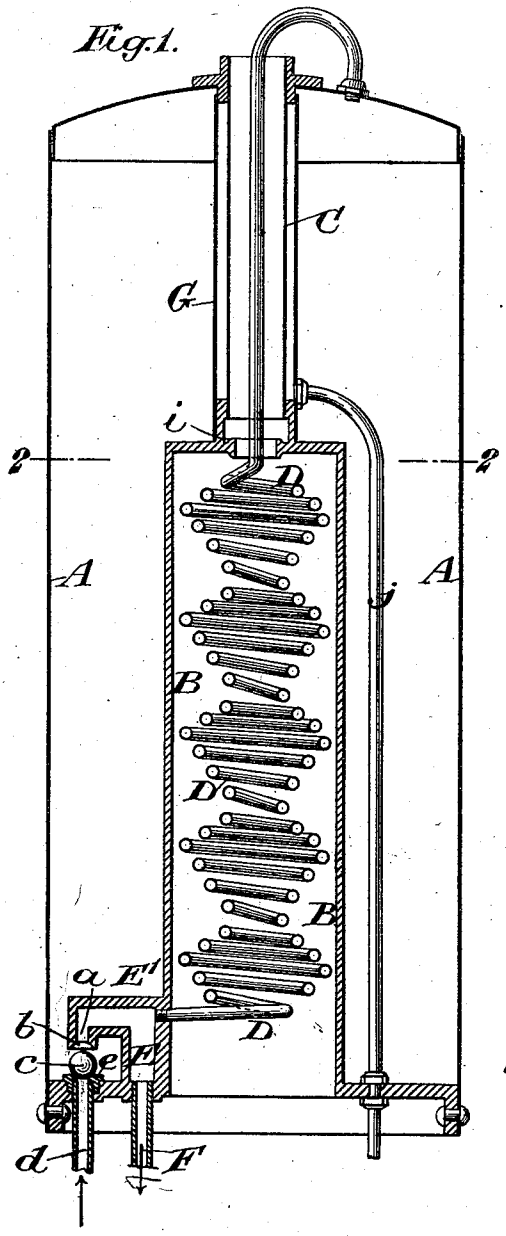


Fig. 2.

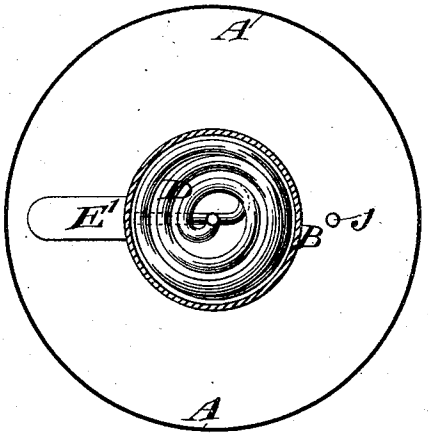
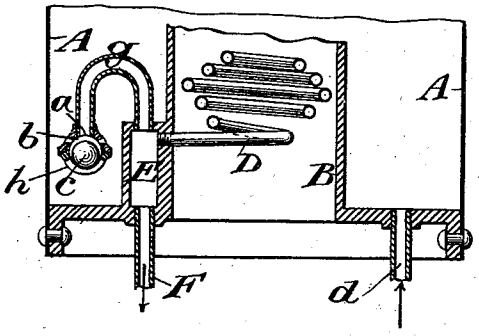


Fig. 3.



Witnesses:-
George Barry,
C. L. Sundgren

Inventor:-
John S. Coe.
by attorneys
Brown & Seward

UNITED STATES PATENT OFFICE.

JOHN S. COE, OF PATERSON, NEW JERSEY.

APPARATUS FOR HEATING WATER.

SPECIFICATION forming part of Letters Patent No. 555,675, dated March 3, 1896.

Application filed May 20, 1895. Serial No. 549,852. (No model.)

To all whom it may concern:

Be it known that I, JOHN S. COE, of Paterson, in the county of Passaic and State of New Jersey, have invented a new and useful Improvement in Apparatus for Heating Water, of which the following is a specification.

This invention relates to heating apparatus for heating water for domestic or other purposes, such apparatus consisting of a boiler or water-tank in the lower part of which is a heating-chamber containing a pipe which constitutes the principal or a considerable portion of the water-heating surface and through which an active circulation of water from the lower to the upper part of the boiler or tank is induced by the heat applied within said chamber at all times but while water is being drawn off.

The improvement consists in the combination, with the boiler or tank and its heating-pipe, of an automatic circulation-valve which at all times but while water is being drawn from the boiler permits the free circulation of the water from the lower to the upper part of the boiler through the said heating-pipe, but which while the water is being drawn off from the boiler for use shuts off the water in the lower part of the boiler from said pipe and causes the downward circulation of the water from the upper part of the boiler through said pipe to the outlet whence the water is drawn; thus causing the water to be always drawn from the upper part of the boiler downward through the heating-pipe, which is the hottest part of the apparatus.

The improvement further consists in certain details hereinafter described and claimed.

Figure 1 represents a central vertical section of a heating apparatus embodying my invention; Fig. 2, a horizontal section taken in the line 2 2 of Fig. 1; Fig. 3, a central vertical section of the lower part of an apparatus, illustrating a modification of the invention.

Similar letters of reference designate corresponding parts in all the figures.

I will first describe the example of the invention shown in Figs. 1 and 2.

A is a tank constituting the body of the boiler. This is represented as substantially like an ordinary kitchen-boiler except that it has in its lower part a heating-chamber B, (represented as of cylindrical form,) which is open at the bottom, and from the top of which a chimney or vent-pipe C passes out through the top of the tank.

Within the heating-chamber is a heating-pipe D, represented as consisting of an upright coil the convolutions of which are alternately contracted and enlarged so as to present an axial profile consisting of a series of alternately-reversed frustums of cones. The lower end of this heating-pipe D is connected with a water-box E provided in the bottom of the tank, and from the upper end of the coil the said pipe is prolonged upward through the chimney C and connected with the top of the tank. The chamber B and the pipe D are to be heated by any suitable means, as by gas-burners situated in the open bottom of the said chamber. A coil of this form heated from below has the lower half of every portion of the length of the coil exposed directly to the radiant heat from the burner and to contact with the upwardly-circulating hot gases of combustion without any interception from portions of the coil below.

The water-box E has in its upper part a lateral offset E′, in which is an inlet *a* from the lower part of the interior of the tank, and it has connected with it through the bottom of the tank a pipe F, through which the heated water is supplied from the boiler through the building or to any place where heated water is required. Around the inlet *a* is a seat *b* for the automatic circulation-valve *c*, (represented as a ball-valve,) which closes upward against the said seat for the purpose of shutting off the water in the lower part of the tank from the heating coil or pipe D.

The pipe *d*, through which the water enters to supply the boiler, is represented in Fig. 1 as situated directly under the valve-seat *b*, and the upper end of the said pipe is represented as furnished directly opposite the said valve-seat *b* with a seat *e*, which serves as a resting place for the valve *c* so long as no water is being drawn from the boiler through the delivery-pipe F. This valve is represented in Fig. 1 as resting on the said seat *e* and closing the supply-pipe *d*. Although it is preferable that the supply-pipe *d* should be so arranged under the valve-seat *b* and provided with the opposite valve-seat *e*, that ar-

rangement and provision are not absolutely necessary, as will be understood after the description of the modification shown in Fig. 3.

Referring to Fig. 1, the operation is as follows: The boiler being filled with water through the supply-pipe *d* and heat being applied at the bottom of the heating-chamber B, so long as there is no water drawn through the delivery-pipe F the automatic circulating-valve will be caused by its own weight to leave open the inlet *a* from the tank to the heating-pipe D, and there will be an active circulation of water from the lower part of the tank upward through the heating-pipe D into the upper part of the tank and a downward circulation through the tank to the lower opening of the heating-pipe. The water so circulating will be heated in part through the walls of the heating-chamber, but mainly in the heating-pipe D; but when water is drawn off from the pipe F the draft will cause the circulating-valve *c* to close the inlet *a* and shut off communication between the lower part of the coil and the lower part of the tank, and the circulation of water through the heating-coil D will then be reversed—that is to say, the water will pass from the upper part of the tank downward through the heating-pipe D into the box E, and thence through the delivery-pipe F, the water so drawn from the tank being replaced by the fresh water entering through the pipe *d* to the lower part of the tank. In this circulation the water is taken from the upper part of the tank where it is warmest, and in its passage thence to the outlet through the heating-pipe D will be exposed to the greatest heat. Hence in a very short time after lighting the burners or other supply of heat to the boiler a copious supply of hot water may be obtained. On the shutting off of the delivery-pipe F the automatic valve *c* will fall from its seat *b* and the normal circulation from the lower part of the tank through the heating-pipe D to the upper part of the tank will be resumed. Throughout the whole operation, whether the circulation-valve *c* is open or closed, there is always free communication between the heating-pipe D and the delivery-pipe F.

In the above-described operation the closing of the inlet *a* to the water-box E and coil and the reversal of the normal circulation through the coil will be rendered more prompt by the arrangement of the supply-pipe *d* and valve-seat *e* opposite the said inlet, as the valve will be directly operated upon by the pressure of the water in the supply-pipe.

The example of my invention illustrated in Fig. 3 only differs from that illustrated in Fig. 1 and hereinabove described in that the inlet-pipe *d* and the circulation-valve *c* are separated, the said inlet-pipe *d* being on the opposite side of the tank and the inlet *a* to the box E and heating-pipe D being at the end of a bent pipe *g*, which is attached to the upper part of the box. The valve *c* is in this case formed within a cage *h*, which retains the valve near the seat *b* when it is open.

In order to prevent the running back on the surface of the heating-pipe D of any water that may be condensed around the interior of the chimney or vent C from the products of combustion before the water in the tank becomes thoroughly heated, I provide around the base of the said pipe in the heating-chamber an annular drip-channel *i*, in which such water may be collected, and whence as the heat increases the said water may be evaporated by the heat of the chamber. For the purpose of further preventing any condensation on the interior of the chimney or vent I surround the latter with a tube G, which forms an air-jacket, in which the contained air forms a non-conductor to prevent the chilling of the chimney or vent as the boiler is filled with cold water. From the lower part of this air-jacket I have represented a pipe *j* as extending downward through the bottom of the tank for the escape of any water that may condense within said jacket.

The form of the heating-pipe D contributes greatly to the success of my invention. Its coils being arranged in alternately-reversed frustums of cones are so presented to the ascending heated products of combustion that every part of the pipe is effectively exposed to the heat.

It may be observed that in both the examples of my invention represented and described the automatic circulation-valve *c* is at the bottom of the coil or the end where the water enters to be heated, and that consequently when the delivery-pipe F is opened the cold water is shut off entirely from the heating-coil, which is then supplied only with the hotter water from the upper part of the boiler, while the boiler is supplied with cold water at the bottom.

What I claim as my invention is—

1. The combination with a boiler-tank, a heating-chamber within said tank, a heating-pipe within said chamber in communication with the upper and lower parts of the tank respectively and a delivery-pipe for heated water at the bottom of said tank in constant communication with the lower end of the heating-pipe, of a valve arranged at the communication between the heating-pipe and the lower portion of the tank for automatically closing said communication by the draft of water through the delivery-pipe, substantially as herein described.

2. The combination of a boiler-tank, a heating-chamber within said tank, a heating-pipe within said chamber in communication at one end with the tank, a delivery-pipe for heated water, a water-box through which the other end of the heating-pipe is in constant communication with the delivery-pipe and in which there is an opening to the tank, a valve-seat at said opening, a supply-pipe communicating with the tank through a valve-seat arranged opposite the first-mentioned valve-

seat, and a valve which works automatically between the two valve-seats to change the direction of the flow of water through the heating-pipe according as the delivery-pipe is open or closed, substantially as herein described.

3. The combination with the boiler-tank and the heating-chamber therein, of a heating-pipe arranged within said chamber and consisting of an upright coil the convolutions of which are alternately contracted and enlarged in the form of a series of alternately-reversed frustums of cones, substantially as herein described.

JOHN S. COE.

Witnesses:
FREDK. HAYNES,
GEORGE BARRY.