No. 704,330. Patented July 8, 1902.

E. W. HIGBEE.

APPARATUS FOR HEATING WATER.

(Application filed Dec. 6, 1901.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

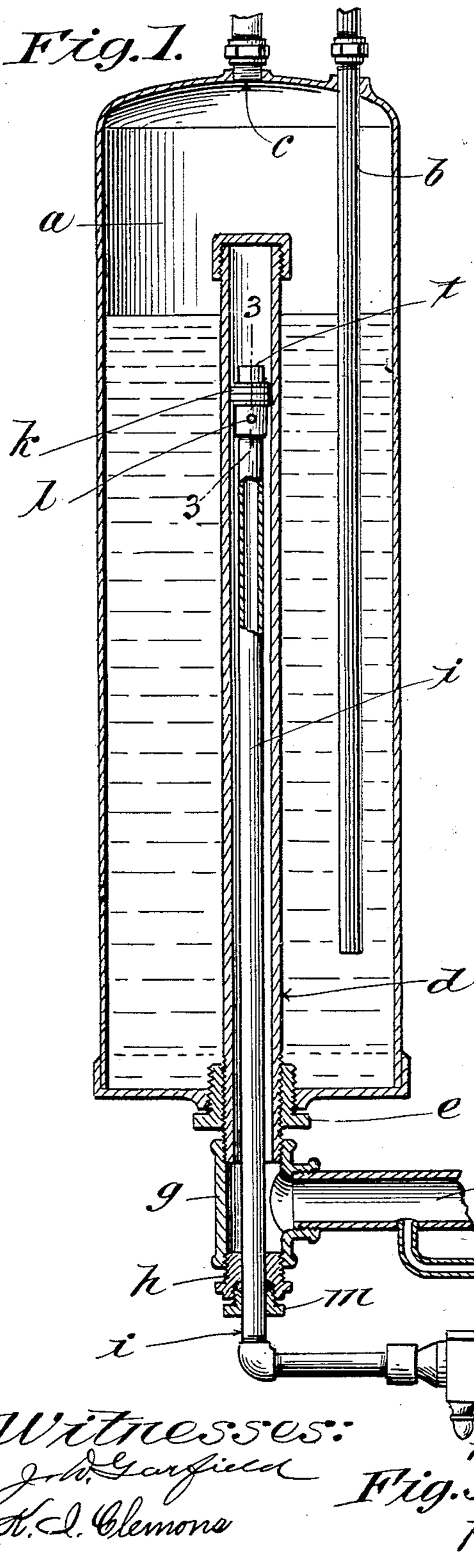

Fig. 2.

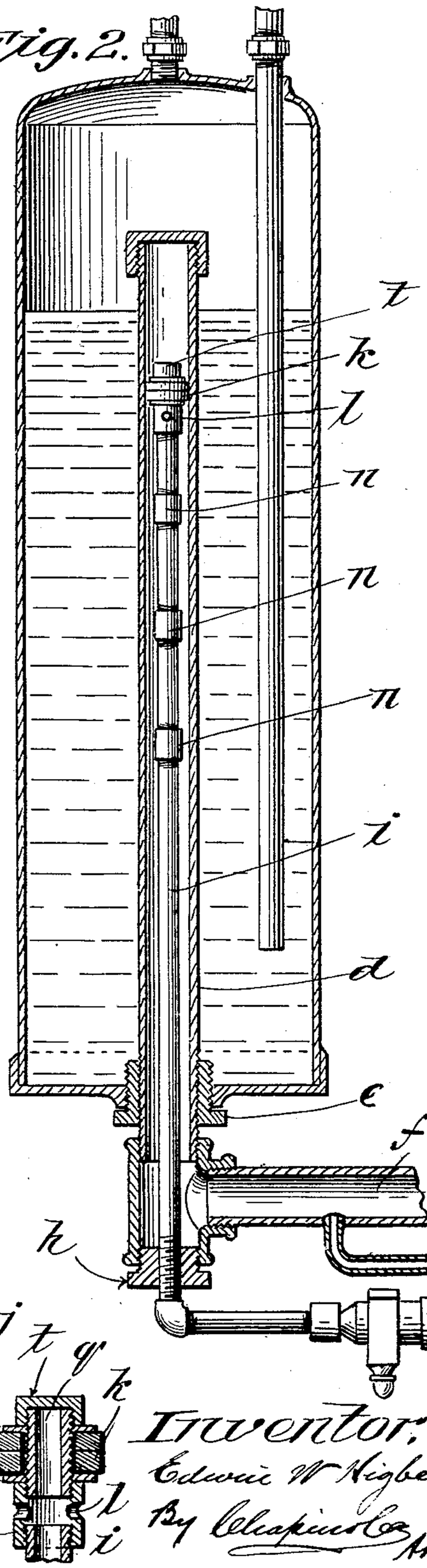

Fig. 3.

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Fig. 4.

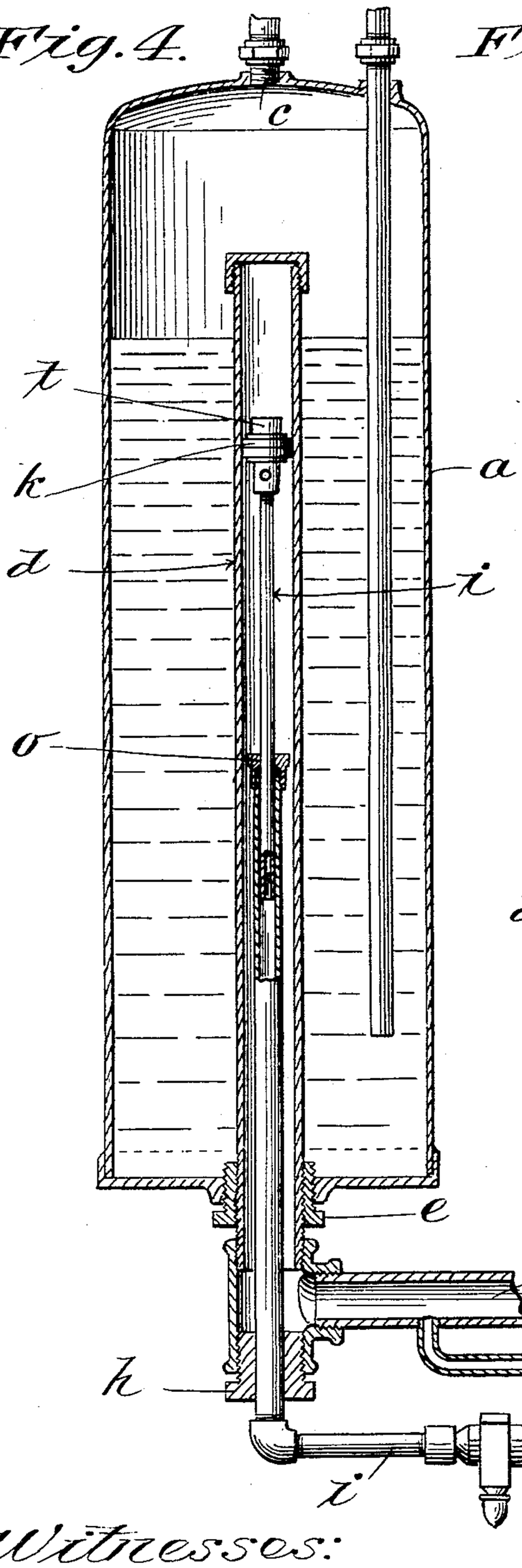
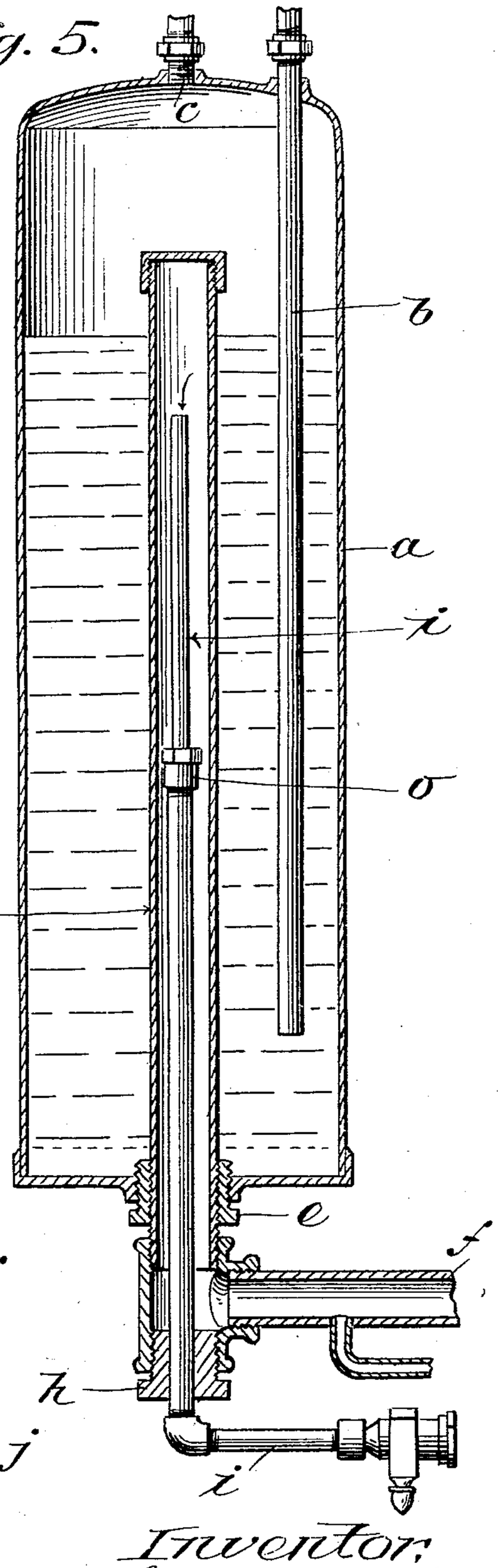


Fig. 5.



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR HEATING WATER.

SPECIFICATION forming part of Letters Patent No. 704,330, dated July 8, 1902.

Application filed December 6, 1901. Serial No. 84,909. (No model.)

To all whom it may concern:

Be it known that I, EDWIN W. HIGBEE, a citizen of the United States of America, residing at Northampton, in the county of Hampshire and State of Massachusetts, have invented new and useful Improvements in Apparatus for Heating Water, of which the following is a specification.

This invention relates to apparatus for heating water, and is in the nature of an improvement on my prior Letters Patent of the United States for "Apparatus for heating water," dated September 24, 1901, and numbered 683,278; and this invention is directed to the provision of means whereby the temperature to be imparted to the water may be regulated at will; and the invention consists in the construction whereby that end is attained, all as fully described in the following specification and clearly pointed out in the claims.

The apparatus shown and described in this application is like that illustrated in my said prior Letters Patent in that the said apparatus comprises a water-reservoir having suitable inlet and outlet pipes, a heating-pipe connected at some point outside of the reservoir with a suitable steam-generator, and a vent-pipe in said heating-pipe having on its outer end a thermostatic valve. The essence of this invention lies in the provision of means whereby the effective area of said heating-pipe may be varied, to the end that the degree of heat which may be imparted to the water may be controlled.

My improvements are clearly illustrated in the drawings, in which—

Figure 1 is a sectional elevation of a heating apparatus embodying my invention. Figs. 2, 4, and 5 are similar views showing modifications of the construction shown in Fig. 1; and Fig. 3 is a sectional view, somewhat enlarged, of the upper end of the drip or vent pipe within the heating-pipe.

Referring now to the drawings, in which like letters indicate the same parts in different figures, *a* indicates the water-reservoir, provided with suitable inlet and outlet pipes *b* and *c*.

d is a heating-pipe which enters the reservoir *a*, (through the bottom thereof, preferably,) the preferred manner of securing it therein being to screw it into a bushing *e* and then screw the bushing into a suitable boss on the bottom plate of the reservoir. The inner end of this heating-pipe is closed, the end thereof which extends outwardly from the bottom of the reservoir being connected with some suitable steam-generator (not shown) by means of the pipe *f*, which screws into a T *g*, as clearly shown in the drawings. In the lower end of this T there is secured a bushing *h*, through which the vent-pipe *i* passes. The outer end of this vent-pipe is provided with a thermostatic valve *j*, whereby by changes of temperature in the valve live steam is admitted to the heating-pipe *d* from the generators, all as fully set forth in my said prior patent.

Figs. 1, 2, 4, and 5 show various means whereby the height of the vent-pipe *i* within the heating-pipe *d* may be varied, and while the constructions shown in Figs. 1 and 2 are those which are most conveniently adapted to the various conditions under which these water-heaters can be used the constructions shown in Figs. 4 and 5 are also operative and are considered as falling within the scope of my invention.

It has been demonstrated in practice that the temperature of the water in the reservoir *a* can be absolutely controlled, so that its maximum will not exceed a given point, by varying the height of the vent-pipe *i* within the heating-pipe *d*, a given temperature of the steam or vapor of course being assumed.

I generally prefer to provide the upper end of the vent-pipe *i* with a piston-head *k*, which has a sliding fit in the heating-pipe, said pipe *i* having an outlet *l* below said head for the passage of steam, the upper end of the pipe being sealed, as shown in Fig. 3. By this means that portion of the heating-pipe above said head is absolutely cut off from the steam-space below it, and by varying the position of this head the heating area of the pipe *d*, between it and the bottom of the reservoir, may be varied in such a manner that it will be impossible for steam at a given temperature to impart to a given volume of water in the reservoir more than a certain number of degrees of temperature. It is not, however, essential that the upper end of the vent-pipe be provided with a head which shall abso-

lutely partition off a portion of the heating-pipe *d* from the rest, for by means of a construction such as is shown in Fig. 5 it is possible to control with fair accuracy the temperature of water to be heated by simply varying the height of the vent-pipe *i*, (assuming that the steam-passage *l* shall always be at or near the top of said pipe,) it having been found in practice that the "dead" end between the upper end of the vent-pipe and the upper end of the heating-pipe will receive practically no steam, as the latter will not rise much, if any, above the point at which it may escape through the vent-pipe. It is obvious, however, that while this construction (shown in Fig. 5) is operative within certain limits it is not capable of as accurate an adjustment as those illustrated in Figs. 1, 2, and 4, wherein the upper end of the vent-pipe is provided with a head which cuts off absolutely all of that part of the heating-pipe above it, the steam-passage in these three figures being located, of course, below said head.

In the four main figures of the drawings various ways have been shown for varying the length of the vent-pipe *i*, whereby variations in the temperature of the water in the reservoir may be effected. Those constructed as shown in Figs. 1 and 2 are, as has been stated above, of a construction which would be most generally used. In Fig. 1 the bushing *h*, through which the vent-pipe enters, is provided with a packing-nut *m*, which may serve the double purpose of making a tight joint around the vent-pipe and as means for holding the latter in any position to which it may be adjusted. By loosening this nut the pipe *i* may be moved endwise of the heating-pipe through the bushing *h* as far as may be required to regulate the heating area of the pipe *d* and then the nut *m* turned up to sufficiently compress the packing about the pipe to hold it in position.

In Fig. 2 the vent-pipe is screwed into the bushing *h* and its upper end is made up of a number of short sections screwed together by means of the couplings *n*. To vary the length of this vent-pipe, the bushing *h* must be unscrewed and the vent-pipe drawn entirely out of the heating-pipe *d* and a sufficient length thereof removed to provide for the location of the piston-heads *k* in the required position. The pipe may then be replaced in the heating-pipe.

In Fig. 4 the vent-pipe is made in two telescoping sections, the upper end of the lower section being provided with a packing-nut *o* for making a tight joint between its two sections. In order to regulate the length of the vent-pipe in this construction, the bushing *h* is unscrewed and the vent-pipe drawn out from the heating-pipe. The upper end may then be pushed into the lower until the proper adjustment has been reached, and the packing-nut *o* may then be screwed up tight enough to secure these two sections in the vent-pipe together with sufficient rigidity to permit the head *k* to be pushed back into the heating-pipe without varying the adjustment.

The construction shown in Fig. 5 is similar in all respects to that shown in Fig. 4, except that there is no head on the upper end of the vent-pipe. The adjustment of this last-named construction is effected in the same manner also, and its operation is the same in all respects, except that it will not operate within quite as narrow a range of temperatures as the construction shown in the other figures.

In Fig. 3 there has been shown in sectional elevation the preferred mode of securing the head to the top of the vent-pipe, which consists in screwing the straight coupling *p* onto the upper end of the pipe *i*, then screwing a nipple *q* into the upper end of the coupling. A metal washer *r* is then slipped over the nipple and the piston-heads *k* and another washer *s* also slipped onto the nipple, with a cap *t* then being screwed onto the upper end of it, which serves not only to close the open end of the nipple, and consequently the pipe *i*, but also to bind the piston-heads *k* securely between the washers *r* and *s*. The steam-passages *l* are drilled straight through the coupling. This is only one manner, however, of constructing the head *k*. Any other method whereby the same result is attained would answer every purpose. This is a detail not forming part of the invention.

Having thus described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. A water-heating apparatus comprising a reservoir, a heating-pipe extending through the wall of the reservoir, the inner end of which pipe is closed, and the outer end of which is in communication with a steam-generator; a vent-pipe extending into the heating-pipe, means for adjusting the position of the open end of said vent-pipe longitudinally in the heating-pipe relative to the end of the latter, and a thermostatic valve on said vent-pipe outside of the reservoir.

2. A water-heating apparatus comprising a reservoir, a heating-pipe extending through the wall of the reservoir, the inner end of which pipe is closed, and the outer end of which is in communication with a steam-generator; a vent-pipe extending into the heating-pipe, a head on the vent-pipe adapted to provide a partition between the ends of the heating-pipe, said head being slidable in the latter, a thermostatic valve on the outlet end of said vent-pipe, there being a passage for steam through the latter from a point under said head, and thence through said valve to the atmosphere.

3. In a water-heating apparatus, a reservoir, a heating-pipe in said reservoir adapted to be placed in communication with a source of steam-supply, a vent-pipe in said heating-pipe, means for adjusting the position of the end of said vent-pipe longitudinally in the

heating-pipe, and a valve on said vent-pipe, substantially as described.

4. In a water-heating apparatus, a reservoir, a heating-pipe in said reservoir adapted to be placed in communication with a source of steam-supply, a vent-pipe extending into said heating-pipe, means for adjusting the position of the end of said vent-pipe longitudinally in the heating-pipe, and a valve on said vent-pipe outside the reservoir, substantially as described.

5. In a water-heating apparatus, a reservoir, a heating-pipe in said reservoir adapted to be placed in communication with a source of steam-supply, a vent-pipe extending into said heating-pipe, means for adjusting the position of the end of said vent-pipe longitudinally in the heating-pipe, and a thermostatic valve on said vent-pipe outside of the reservoir, substantially as described.

6. In a water-heating apparatus, an adjustable vent-pipe comprising a pipe-section *i*, coupling *p* on the vent-pipe having passages *l*, nipple *q*, supported by the coupling means for closing the end of the nipple, a piston-head on the nipple, means for securing the piston-head on the nipple, and a valve on the outer end of the vent-pipe, substantially as described.

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