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W. H. SMITH.

FEED WATER HEATER AND PURIFIER.

(Application filed Nov. 15, 1897.)

(No Model.)

Fig. 1.

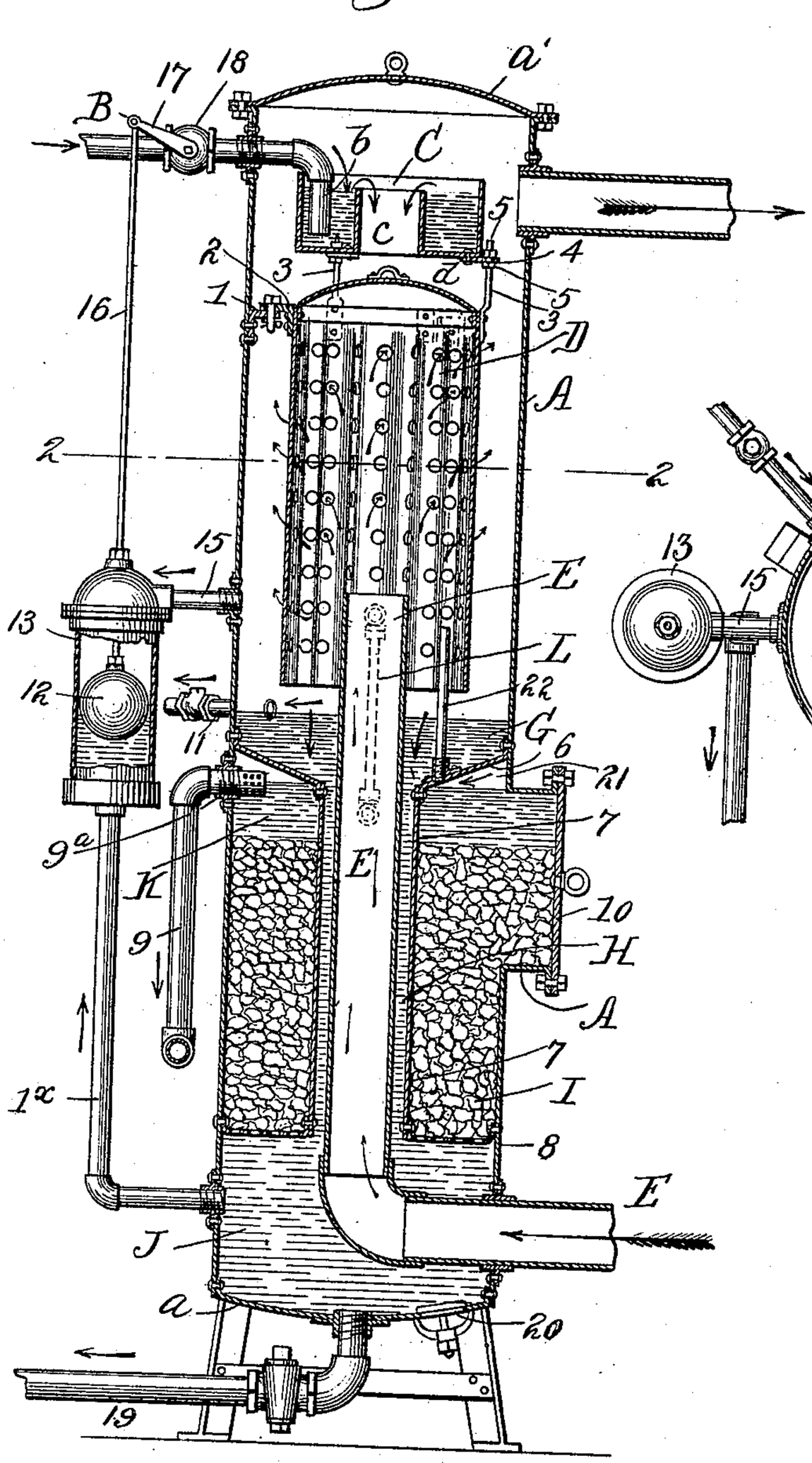
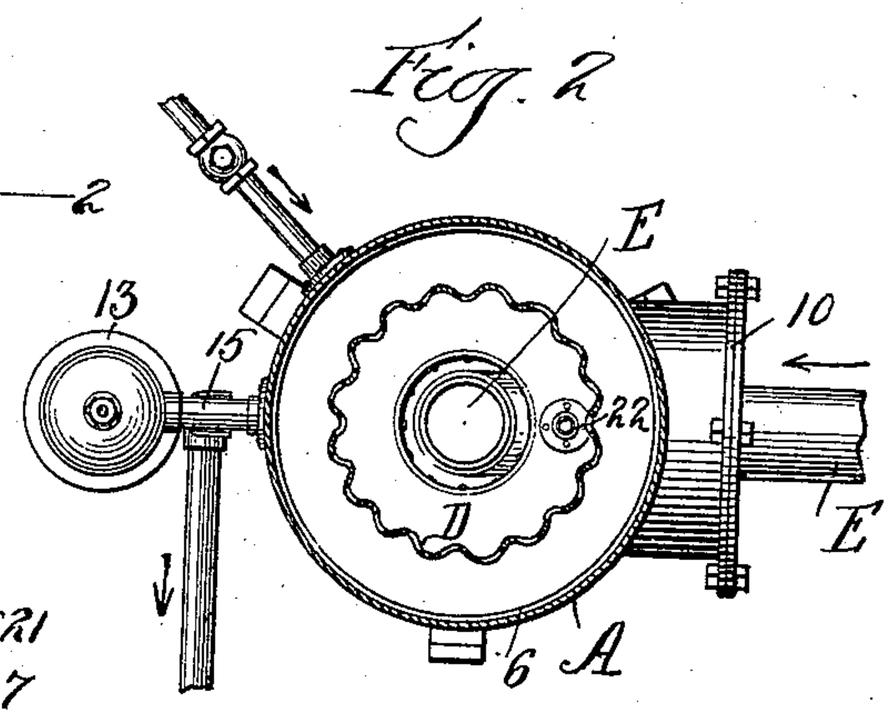


Fig. 2.



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FEED-WATER HEATER AND PURIFIER.

SPECIFICATION forming part of Letters Patent No. 619,513, dated February 14, 1899.

Application filed November 15, 1897. Serial No. 658,532. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM H. SMITH, a citizen of the United States, residing at Aurora, in the county of Kane and State of Illinois, have invented certain new and useful Improvements in Feed-Water Heaters and Purifiers, of which the following is a full, clear, and exact specification.

My invention relates to feed-water heaters and purifiers in which exhaust-steam is condensed by the direct discharge of the steam into a cooling-chamber and in which in efforts to remove the impurities the water has been conducted to another chamber in the apparatus, in which the removal of the impurities is effected by precipitation alone.

The object of my invention, generally stated, is to substantially quicken the condensation of exhaust-steam in a feed-water heater and thoroughly remove all impurities, and particularly oil, from the waters of condensation during their passage through said heater and at the same time utilize as far as possible the heat of the exhaust-steam for raising the temperature of the feed-water and maintaining it in a highly-heated condition while in the heater and during its passage therefrom.

More specifically stated, one of the objects of my invention is to remove the oil from the waters of condensation as fast as it accumulates and before the supply-water is filtrated for the removal therefrom of scale-forming substances and other sediment.

A further object is to so conduct the water through a feed-water heater that the heat from the exhaust-steam pipe may be fully utilized to promote and maintain a high degree of heat in said water during its circulation through the heater.

Another object is to provide for the removal of the oil from the waters of condensation before filtration, and then raise the temperature of the supply-water in such manner that the natural tendency of cold water to descend and hot water to rise in a circulating system may be utilized for conducting said water through a filter and promote its onward and upward flow to the feed-water-discharge pipe of the heater.

A still further object is to expose the supply-water to the exhaust-steam in the best possible manner, promoting the circulation of the steam through the condensing-chamber and quick condensation of the steam and the raising of the temperature of the supply-water to a maximum degree by said steam, and that the supply-water may have its temperature raised by the heat of the steam prior to its direct contact therewith, and finally to secure certain other advantages of operation in feed-water heaters and purifiers by details of construction hereinafter described, claimed, and illustrated in the accompanying drawings, in which—

Figure 1 illustrates a central vertical section of a feed-water heater embodying my invention; and Fig. 2, a transverse section of the same, taken on the line 2 2, Fig. 1.

Similar letters and numerals of reference indicate the same parts in both figures of the drawings.

A indicates the usual form of tubular shell for a feed-water heater, which shell is closed at its bottom by a head *a*, bolted or otherwise tightly secured thereto, and at its top by a cap or cover *a'*, removably bolted to an annular flange of the shell, as is common in heaters of this class. Entering this shell, near its top, is a water-supply pipe B, the inner end of which is bent downwardly, as shown at *b*, and discharges just above the bottom of an annular tank C, from which the water rising therein discharges through its central opening *c* upon the closed cap or cover *d* of a perforated drum D, open at its lower end and suspended in the shell by means of a bracket 1, bolted to the shell, and a bracket 2, bolted to said drum, the tank C being supported from the drum D by a number of posts 3, passing through lugs 4 on the tank, secured to the posts by nuts 5, threaded on the posts next above and below said lugs, which nuts are preferably adjustable for the purpose of leveling the tank, so that there will be a uniform flow of water over the edges of the annulus forming the central opening of the tank, and therefore a uniform distribution of water over the top and down the sides of the perforated drum.

The perforated drum may have plain sides, but is preferably corrugated for the purpose

of securing an extended surface correspondingly increasing the rapidity of the condensation of the steam by the supply-water discharged from the tank upon the perforated drum, as will hereinafter be more clearly explained.

Entering the side of the shell A, at a point near to its bottom end, is an exhaust-steam pipe E, which, after passing to about the diametrical center of the shell, is extended upwardly for about half the height of the shell and until it projects well into the perforated drum, into which it discharges exhaust-steam, the uncondensed portions of which after escaping through the perforations in the drum and through the supply-water rise above the drum and after imparting heat to the water in the tank, both by conduction through the walls of the tank and direct contact with the surface of the water therein and the water discharging upon the cover of the drum, escapes through the pipe F to the open air or elsewhere, as may be desired.

By the construction and arrangement so far described it will be observed that the drum not only affords a very large condensing-surface for the steam, but that it serves to hold the steam for a time against that surface, and that its perforations break up the steam to the best possible advantage for promoting further condensation after it escapes from the drum and comes in contact with the water upon the outer surface of the drum and the more or less spray produced by the fall of the water upon the head of the drum, and that the circulation of the steam is rendered desirably rapid both for these purposes and for imparting their heat to the supply-water by reason of the arrangement and close proximity of its discharge-pipes F. In other words, there is such a rapidity of the circulation of the exhaust-steam after discharging from the supply-pipe E, both inside and outside of the drum and over and against the tank, that its condensation, as far as may be, is very rapid and the heat of its uncondensed portions utilized to the very best advantage for raising the temperature of the supply-water both while in the tank and not only during its discharge therefrom, but throughout its flow for the entire height of the drum.

Next below and in open communication with the perforated drum and its surrounding chamber is an oil-separating chamber G, the bottom of which is formed by an annular diaphragm 6, bolted at its outer edges to the shell A and converging toward the center, where it is provided with a central opening somewhat larger than the exhaust-pipe E, which passes through it, and having riveted or otherwise secured to its inner edges a pipe 7, surrounding the exhaust-pipe E and forming a water-heating chamber H for a considerable length of the exhaust-pipe. The pipe 7 forms the inner wall of a filtering-chamber I, the outer walls of which are formed by the casing A, the top closed by the diaphragm 6 and the bottom by a screen 8, and below this bottom is a settling-chamber J, through which a horizontal and vertical portion of the exhaust-pipe E passes.

The filtering-chamber is partially filled with coke or other suitable filtering material, so as to leave space above the filtering material to form a reservoir K for supply-water, which discharges therefrom through a pipe 9, access being had to the filtering-chamber by means of a manhole 10, formed by a lateral projection of the casing A, closed by a suitable cover.

In operation supply-water discharging into the tank C through the pipe D overflows through the central opening in the tank in a thin sheet and striking the cover of the perforated drum splashes out over its sides and flows down over its sides and the perforations therein, while at the same time steam discharging from exhaust-pipe E into the drum is condensed against the sides thereof, and passing out through the perforations is further condensed by the falling water, and passing upwardly imparts its heat to the tank-water and then discharges from the heater through the pipe F. The condensations and the supply-water accumulate in the heater until they rise to the level of the pipe 11 in the oil-separating chamber, which discharges oil rising to and accumulating upon the surface of the water at that point. This level of water in the heater is automatically maintained at all times by means of a float-valve 12 in a chamber 13, the lower end of which chamber is in open communication with the settling-chamber J by means of a pipe 14 and the upper end of said chamber in similar communication with the condensing-chamber, in which the perforated drum is located, by means of a pipe 15 and a float-rod 16, connected with a crank-arm 17, attached to a valve or cock, (not shown, but indicated at 18,) and of any ordinary construction and in such a manner that when there is a tendency of the water to rise substantially above the oil-discharge pipe 11 the float-valve will be lifted by the water and shut off or partially shut off, as the case may be, the flow of water into the tank C, and thus maintain the water at such a level in the heater that the oil may be drawn off as fast as it accumulates by its specific gravity in the oil-separating chamber with an absence of any substantial amount of water or more than is necessary to facilitate the flow of the oil from the chamber and through the oil-discharge pipe.

It will be understood, of course, that the pressure of water in the float-chamber is equalized by the pressure of steam in the pipe 15, and also that the settling-chamber is provided with the usual blow-off pipe 19 for discharging sediment collecting in the settling-chamber, and also with a manhole and cover 20 for access to said chamber, and also that the feed-water-discharge pipe 9 may have a

perforated cap or other strainer 9^a on its inner end to insure against the possibility of any foreign substance entering into that pipe.

In order to prevent any possible accumulation of steam in the angular annular chamber 21 between the level of the water in the feed-water chamber K and the bottom of the oil-chamber, I have provided a pipe 22, opening in the top of said chamber and projecting up into the perforated drum.

For the purpose of ascertaining at all times whether or not there is a proper level of the water in the heater, or, in other words, whether or not its several parts for automatically maintaining that level are in perfect working condition, a water-gage glass, (indicated at L by dotted lines,) may be employed.

Among other advantages resulting from the construction shown and described are that the oil is removed from the condensations before the water enters the heating-chamber or reaches the filtering material; that in the passage of the supply-water to and before reaching the settling-chamber its temperature is raised to the maximum degree, thus promoting precipitation before the water is subjected to filtration, and, further, that the tendency of the heated water to rise is utilized for promoting its flow through the filtering material and thence to the boiler to be supplied or to any other destination, and that as a whole my construction is compact and simple to the highest degree possible consistent with rapid condensation, thorough purification of the water, and this capacity of steam for producing a high degree of heat for the twofold purpose of precipitating the impurities and heating the supply-water.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A feed-water heater and purifier having in combination a shell, a perforated drum having its upper end closed, a water-distributer arranged above said drum in the path of the steam entering and discharging from the heater and constructed to discharge water in a sheet upon the closed end of said drum, a water-chamber below said drum, a filter-chamber surrounding said water-chamber, and a steam-supply pipe passing upwardly through said water-chamber and having its steam-discharging end projected upwardly into the perforated drum, substantially as described.

2. The combination in a feed-water heater and purifier, of a shell, a perforated drum having its upper end closed, a water-chamber below said drum, a steam-supply pipe projecting upwardly through said water-chamber into the drum and an annular water-distributer having its inner wall below the plane of the outer wall thereof and discharging water in a thin sheet upon the top of said drum, said distributer being arranged in the path of the steam entering and discharging from the heater, substantially as described.

3. A feed-water heater and purifier having in combination a shell, a perforated drum supported in said shell and having its upper end closed, the annular water-chamber supported over said shell, means for supplying said chamber with water, a receptacle arranged below said drum for catching the water to be purified as it falls from said drum, an oil-drain leading from said receptacle, a filter arranged below said receptacle and at a distance above the bottom of said drum so as to form a space under said filter, a pipe extending downwardly from said receptacle through said filter and connecting said receptacle with said space, a float-chamber connected with said space below the filter and also with the shell above said oil-drain, a float in said chamber connected with and controlling the means for supplying water to said annular chamber, a steam-pipe leading into said shell below said filter and extending upwardly through said pipe and into said drum at a point above said oil-drain, the feed-water pipe leading from said filter, a steam-escape pipe leading from the upper part of said shell and the vent-pipe leading from the upper part of said filter up into said drum to a point above said oil-drain, substantially as described.

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