No. 681,893. Patented Sept. 3, 1901.

E. R. STILWELL.

FEED WATER HEATER AND PURIFIER.

(Application filed Nov. 7, 1900.)

(No Model.)

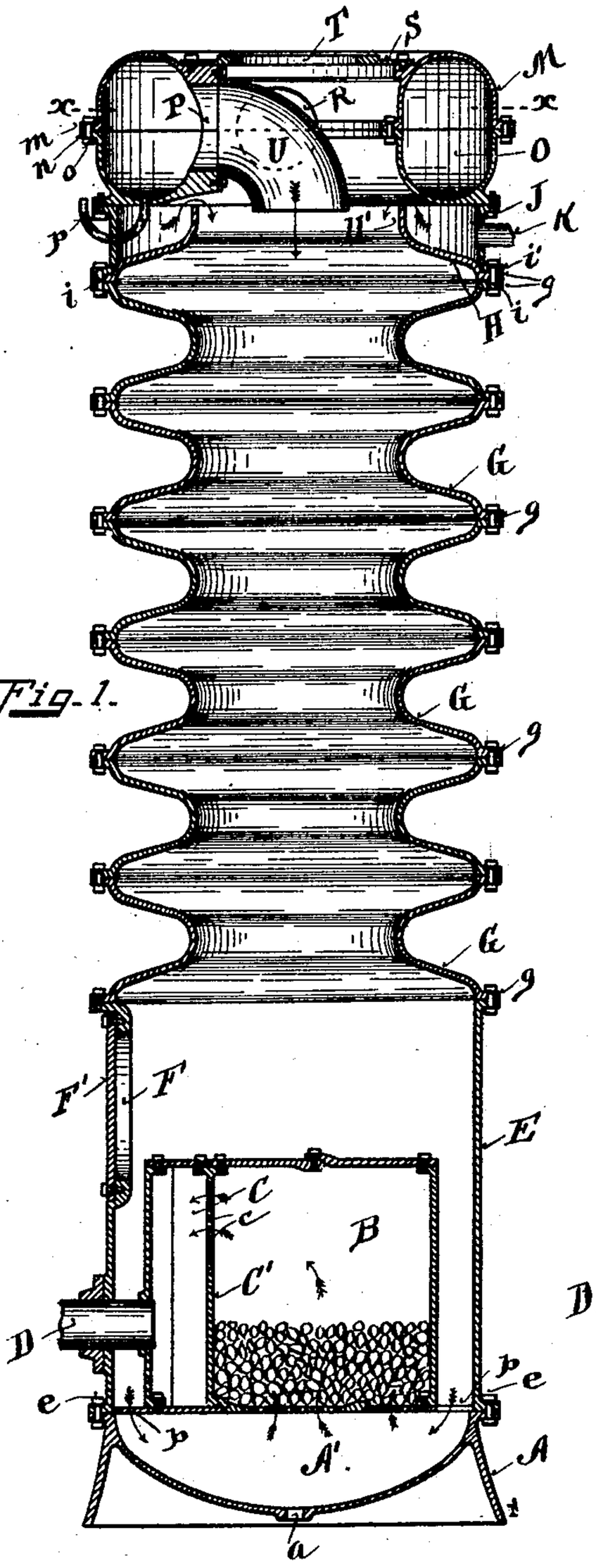

Fig. 1.

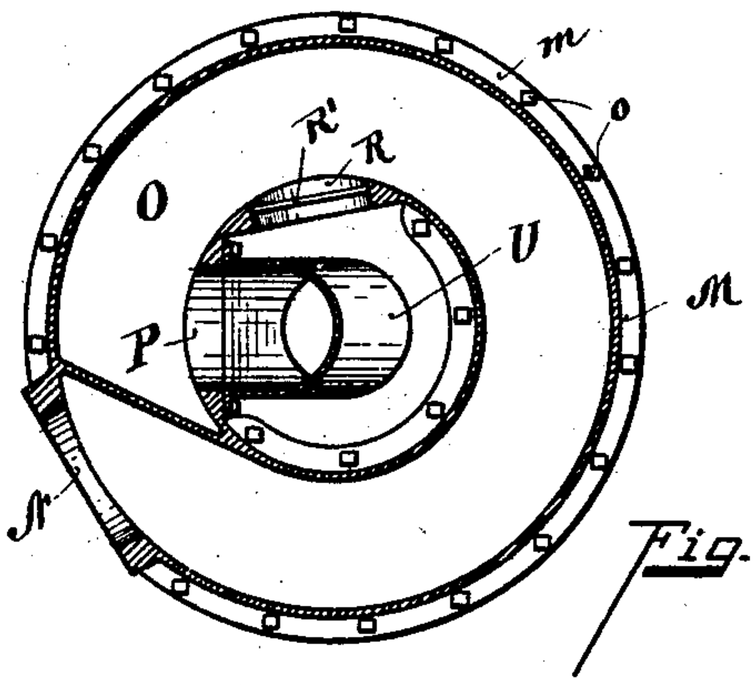

Fig. 2.

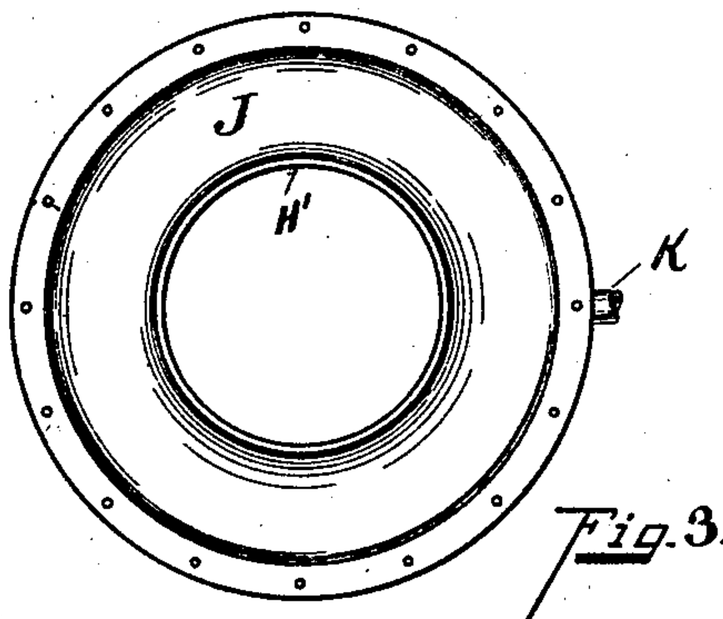

Fig. 3.

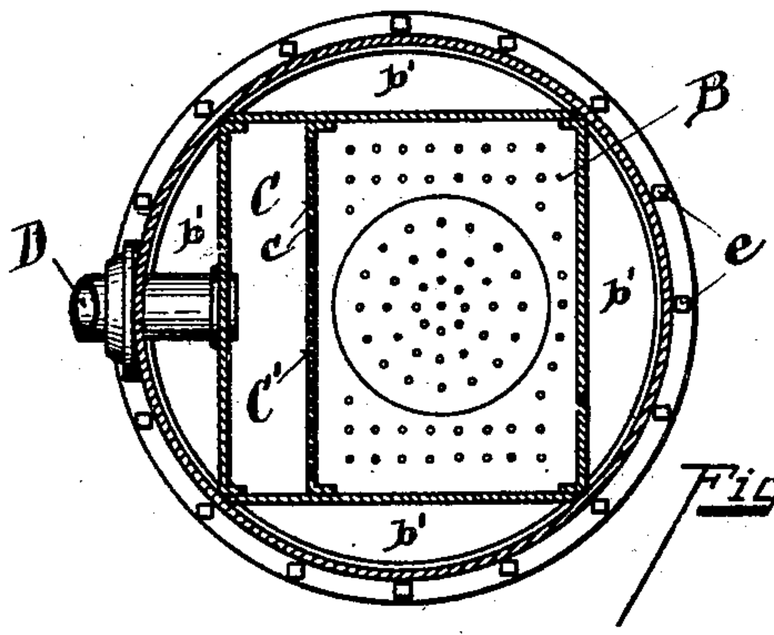

Fig. 4.

Witnesses
Oliver B. Kaiser
Pearl M. Michael

Inventor
Edwin R. Stilwell
By Wood & Wood
Attorneys

UNITED STATES PATENT OFFICE.

EDWIN R. STILWELL, OF DAYTON, OHIO.

FEED-WATER HEATER AND PURIFIER.

SPECIFICATION forming part of Letters Patent No. 681,893, dated September 3, 1901.

Application filed November 7, 1900. Serial No. 35,730. (No model.)

To all whom it may concern:

Be it known that I, EDWIN R. STILWELL, a citizen of the United States, residing at Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Feed-Water Heaters and Purifiers, of which the following is a specification.

One object of my invention is to provide a steam feed-water heater and purifier having an extended heating-surface over which the water is allowed to pass in a thin sheet, where it comes in contact with the steam, which it condenses and is mingled with, effecting both the economy in the cost of manufacture and in the effectiveness of the heater.

Another object of my invention is to provide a heater of such construction that the use of pans or shelves is not required to catch the deposit, and thereby avoiding the necessity of the frequent removal for cleaning.

Another object of my invention is to provide an efficient oil-separator in the steam-supply port of the heater.

The various features of my invention are more fully set forth in the description of the accompanying drawings, forming a part of my invention, in which—

Figure 1 is a central vertical section of my improvement. Fig. 2 is a section on line *x x*, Fig. 1. Fig. 3 is a top plan view of the water-reservoir. Fig. 4 is a sectional plan view of the filter-chamber.

A represents the base of the heater as shown in the preferred form. It is round and is provided with a convex bottom and provided with a blow-off hole *a* and serves as a mud-well for the filter.

B represents the filter-chamber supported upon brackets *b*. In the preferred form, as shown in Fig. 4, it is square, leaving segmental spaces *b'* around the sides thereof to allow a free passage of the water to the mud-well.

C represents the clear-water well, which is separated from the filter-chamber by a vertical plate C', the top portion of which is provided with perforations *c*, so as to allow the filtered water to pass from the upper portion of the filter-chamber into the clear-water well.

D represents the supply-pipe of the clear-water well leading to the boilers.

E represents the shell of the filter supported upon the base A, preferably in the manner shown in the drawings. It is provided with flanges or ears to rest upon corresponding projections of the base, to which it is secured by bolts *e*, the joints between these two projections being made water-tight by the use of suitable packing material.

F represents a manhole covered by a cap F' for allowing easy access into the interior of the heater. It will be observed that the plates of the filter-chamber may be made in sections, so that they may be taken out through this manhole, if desired. The top of the shell E is provided with an annular flange, upon which is seated the lower heating-section G. The heater-sections are duplicates of one another, and any number of these may be employed as desired. G represents said heating-sections. The preferred form of these sections is concavo-convex shaped or a double cone somewhat rounded in the central portion. When these sections are superimposed, they form a heater having scroll-like or undulating sides. The exact shape of these sides is of course immaterial. The several sections are provided with annular flanges *g* at the top and bottom thereof, so as to provide means for clamping them together to form a water-joint, suitable packing being employed for the purpose.

H represents the upper heating-section, H' representing the terminal end of the same, which forms a rim over which the water is introduced, as will now be explained.

J represents an annular shell secured to the base of the top section by bolts *i*, which pass through the flange *i'* of the water-chamber shell and the flanges *g* of the heater-sections. The outer section of the upper heating-section and the shell J form an annular water-supply or overflow chamber.

K represents a water-supply pipe. As the water rises in said chamber it flows over the rim H' in a thin stream or film, and capillary traction causes it to adhere to and trickle down and around the inner surface of the undulating walls of the heating-chamber.

Steam is supplied to the heater in the following manner:

M represents a steam-chamber, and N a steam-supply pipe. O represents an annular steam-passage around the top periphery of the heater. P represents the inlet from said steam-passage leading into the open top of the heater. The drawings show the preferred form of construction in which this shell is represented made of two sections, each provided with flanges *m n*, which are secured together by bolts *o*. I have shown two openings leading from the annular steam-passage into the open top of the heater. R represents a second opening, and R′ a gate for opening and closing the same. There may be any number of these openings and provided with gates, so as to regulate the amount of steam to be put into the heater.

S represents the top covering of the heater which forms a top boundary of the feed-chamber. This top is provided with an annular opening T, which is left open for the escape of steam when the device is used as an open heater. When the device is to be used for a live-steam heater and purifier, this top will be closed. In order to project the steam downward into the open heater, I provide a curved pipe U, which is connected to the inlet P. The advantage of this is that when the device is to be used for an open heater the steam is projected downwardly and effectually heats the lower portion of the heater. A very important function is performed by having the steam-admission shell contain a long tortuous passage. Escaped steam is usually impregnated with minute drops of oil, which it is very desirable to remove for the effectual purification of the water. By projecting the steam into the tortuous passage the oil and water of condensation are separated from the steam and adhere to the surfaces of the passage, trickling down said surfaces to the bottom of the chamber, where it can be readily drawn off by the ordinary trap-pipe *p*.

It will be observed that the interior surface of the heater is of varying diameters at different points. I have shown these variations to be of a wavy form and the sections circular; but this zigzag or wavy form and the circular form of the sections are employed simply for convenience of construction. Any other form having the zigzag or varying dimensions in cross-section would be within the scope of my invention.

Mode of operation: Water is introduced into the annular water-chamber J, steam being introduced at the same time into the interior of the chamber. The water condenses the steam as it passes over the surfaces of the heater and thence down into the mud-well A′. From thence it passes upwardly through the perforated bottom into the filter-chamber B, and thence it passes into clear well C, from whence it is drawn off by a supply-pipe. The impurities separated out from the water largely adhere to the shell of the heater; but impurities of a softer nature are sometimes carried down with the water and deposited into the mud-well, from whence the impurities may be removed by blowing off.

It will be observed that I employ no pans or shelves to catch the deposit separated out from the water. The crystallized material which adheres to the inner surfaces of the heater does not interfere in the least with the operation of the heater, and they may be used for a long time without cleaning without danger of the heater being choked up. By this construction I not only obtain a heater which is more efficient, but is of cheaper construction and can be used for a much longer time without stopping to open and clean the same. It will also be observed by the construction herein shown that all the water condensed by steam and all the water of condensation from the steam cannot flow back through the steam-supply pipe at the top of the heater.

It will be observed that both the water and steam are introduced at the top of the heater-chamber and flow downward in the same direction, the steam rising through the same chamber and escaping at the top. Thus the steam is held the longest possible time in thorough contact with the film of water flowing down the undulating sides. The results, of course, are greater efficiency in heating the water as well as steam condensation. Again, the steam being injected into the heater in the direction of the flow of the water has expended its greatest velocity by the time it rises for the upward escaping travel, so that it does not carry water with it upward and out of the heater. The steam being injected in the direction of the settling-tank assists instead of retards the proper flow of the water to that tank.

The particular means for admitting the steam which I preferably employ have special advantages. The steam-inlet chamber practically circumscribes the top periphery of the heater, leaving a central opening. The end of the steam-inlet chamber turns centrally into this open space and downward into the heater, the remaining open space constituting the steam-escape. Thus the entering steam flows in the periphery of a circle, and the water of condensation and oil are thrown by centrifugal force against the outer peripheral sides of this chamber, whence they are trapped into the bottom of this chamber and drawn off.

Another advantage of the undulating walls of the heater down which the film of water flows is that the water trickles continuously and unbrokenly down one single heated surface in most immediate contact with the steam, both flowing in the same direction from their joint entrance into the open top of the heater. Such a single continuous heated undulating surface forms the best possible base for the crystallization thereon of the solu-

ble impurities in the water. The sections can be removed and cleaned as desired.

The cheapness and efficiency of this heater I believe to be a material advance in the art, and I do not desire to limit myself to particular features not specifically incorporated into the claims.

Having described my invention, I claim—

1. In a feed-water heater and purifier, a heating-chamber having undulating sides the interior surface of which is adapted to pass water downwardly in a continuous stream, a water-supply surrounding the top of said chamber and adapted to pass water to the interior surface of said undulating sides, and means for passing steam through the interior of said chamber in direct contact with the film of water flowing down said undulating sides, substantially as described.

2. In a water heater and purifier, a heating-chamber having undulating sides the interior surface of which is adapted to pass water downwardly in a continuous stream, an overflow-basin surrounding the top of said chamber and adapted to pass water to the interior surface of said undulating sides, means for passing steam into the interior of said chamber from one end whereby it is caused to mingle with the flow of water from said basin, substantially as described.

3. In a water heater and purifier, a heating-chamber having undulating sides the interior surface of which is adapted to pass water downwardly in a continuous stream, said chamber being made up of superimposed sections, an overflow-water basin surrounding the top of said chamber adapted to overflow water onto the interior surface of said undulating sides, means for supplying steam into the interior of said chamber, substantially as described.

4. In a water heater and purifier, a heating-chamber having undulating sides the interior surface of which is adapted to pass water downwardly in a continuous stream, an overflow-water basin surrounding the top of said heater and adapted to overflow water onto the interior surface of said undulating sides, means for introducing steam and escaping steam at the top of said chamber intermediate of said basin, substantially as described.

5. In a water heater and purifier, a vertical heater open at the top and having undulating sides the interior surface of which is adapted to pass water downwardly in a continuous stream, a water-supply pipe around the open top and adapted to supply water to the inner surface of the undulating sides, and means for supplying steam through said open top, whereby it passes downward through said vertical heater in direct contact with the film of water upon its undulating sides, substantially as described.

6. In a water heater and purifier, a vertical heater substantially circumferential, the sides of said heater being undulating, the heater being open at the top, an overflow-water basin exteriorly surrounding the top of the heater, adapted to supply water over the edge of the heater to the inner surface of the undulating sides, and means for supplying steam into said heater through said open top, whereby the steam and water in direct contact pass downwardly through said heater, substantially as described.

7. In a water heater and purifier, a vertical heater composed of superimposed sections, the sides of which are undulating in a vertical plane, an overflow-water basin surrounding the upper peripheral edge of said heater and adapted to supply water to the inner surface of the undulating sides, a steam-supply pipe tapping interiorly into the upper open end of said heater, whereby the steam and water are passed in direct contact downwardly through the heater, and a steam-escape, substantially as described.

8. In a heater and purifier, a heater having undulating sides, means for supplying water to the inner surfaces of the top walls of the heater, a steam-supply chamber extended exteriorly around the top of the heater forming an intermediate opening constituting a steam-escape orifice, the discharge end of the heater opening into the top of the heater, substantially as described.

9. In a heater and purifier, an open heater, means for supplying water thereto, a steam-supply chamber at one end of the heater forming a curved passage, and opening into the heater, the sides of said curved passage serving to catch the water of condensation and oil deposited thereon by the centrifugal force evolved in the passage of the steam around said curved passage into the heater, and means for taking off said water and oil, substantially as described.

10. In a heater and purifier, a heater having undulating sides, a water-supply to the inner surfaces of the top walls of the heater, a steam-supply chamber at the top of the heater forming a curved passage, and opening downwardly into the said heater interior of the water-supply to the walls of the heater, and an opening at the top of the heater constituting a steam-escape, and means for taking off the water of condensation and oil deposited on the sides of said curved passage, substantially as described.

11. In combination with a vertical heater, a water-inlet adapted to discharge water into the top portion of the heater, a steam-supply passage extended circumferentially around the top of the heater, one end of said steam-passage being turned in radially and discharging concentrically into the heater, substantially as described.

12. In a vertical heater and purifier, a heating-chamber having undulating sides, a water-supply to the top thereof, adapted to pass

water to the interior surfaces of said undulating sides, means for supplying steam into the heater, a settling-compartment under the said heating-tank forming a continuation thereof, a filter-tank having a perforated bottom suspended in the settling-compartment, forming water-passages between the abutting faces of the settling-compartment and filter-tank for access to the bottom of the latter, substantially as described.

In testimony whereof I have hereunto set my hand.

EDWIN R. STILWELL.

Witnesses:

OLIVER B. KAISER,

PEARL MCMICHAEL.