

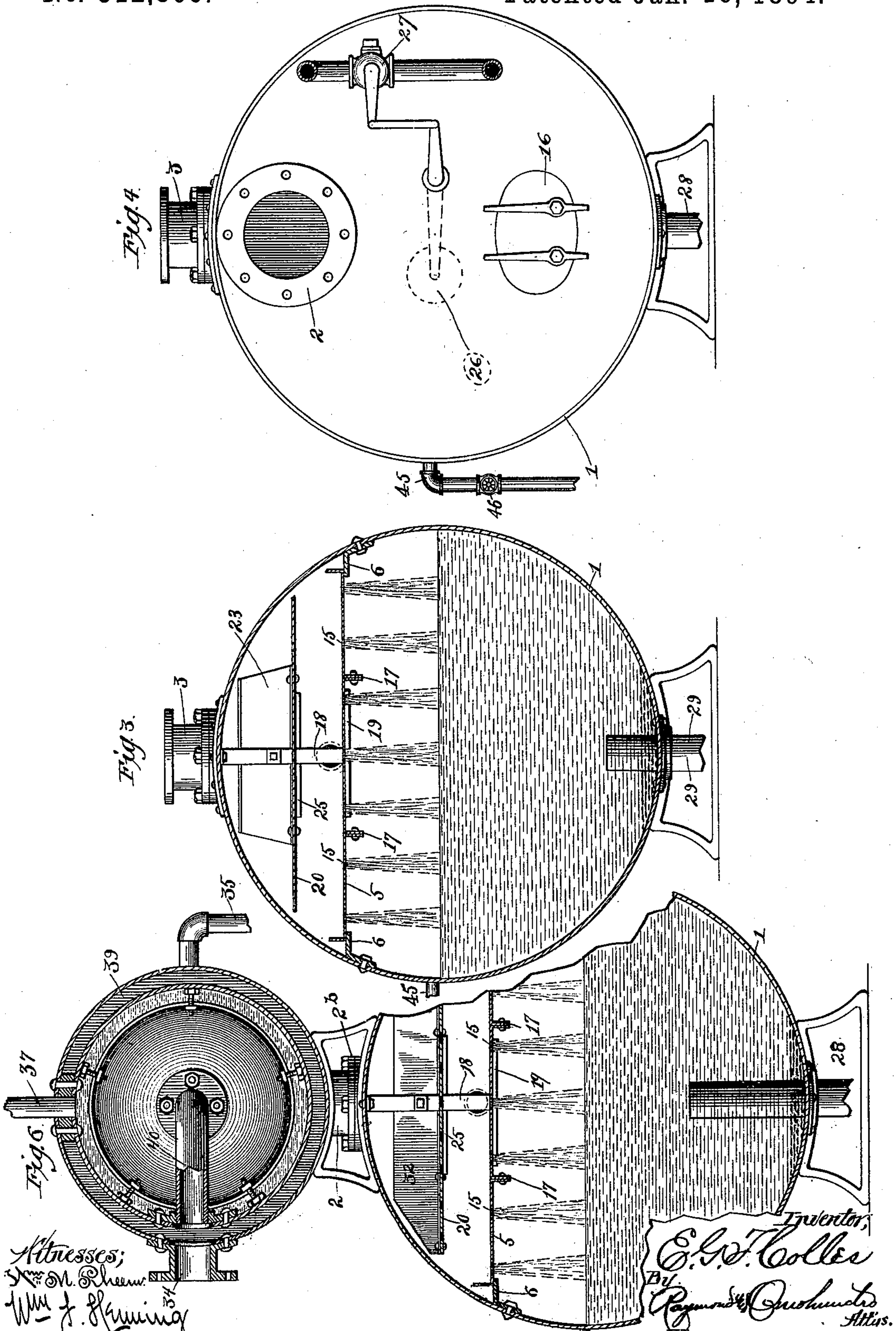
(No Model.)

3 Sheets—Sheet 2.

E. G. T. COLLES.
FEED WATER HEATER.

No. 512,806.

Patented Jan. 16, 1894.



Witnesses;
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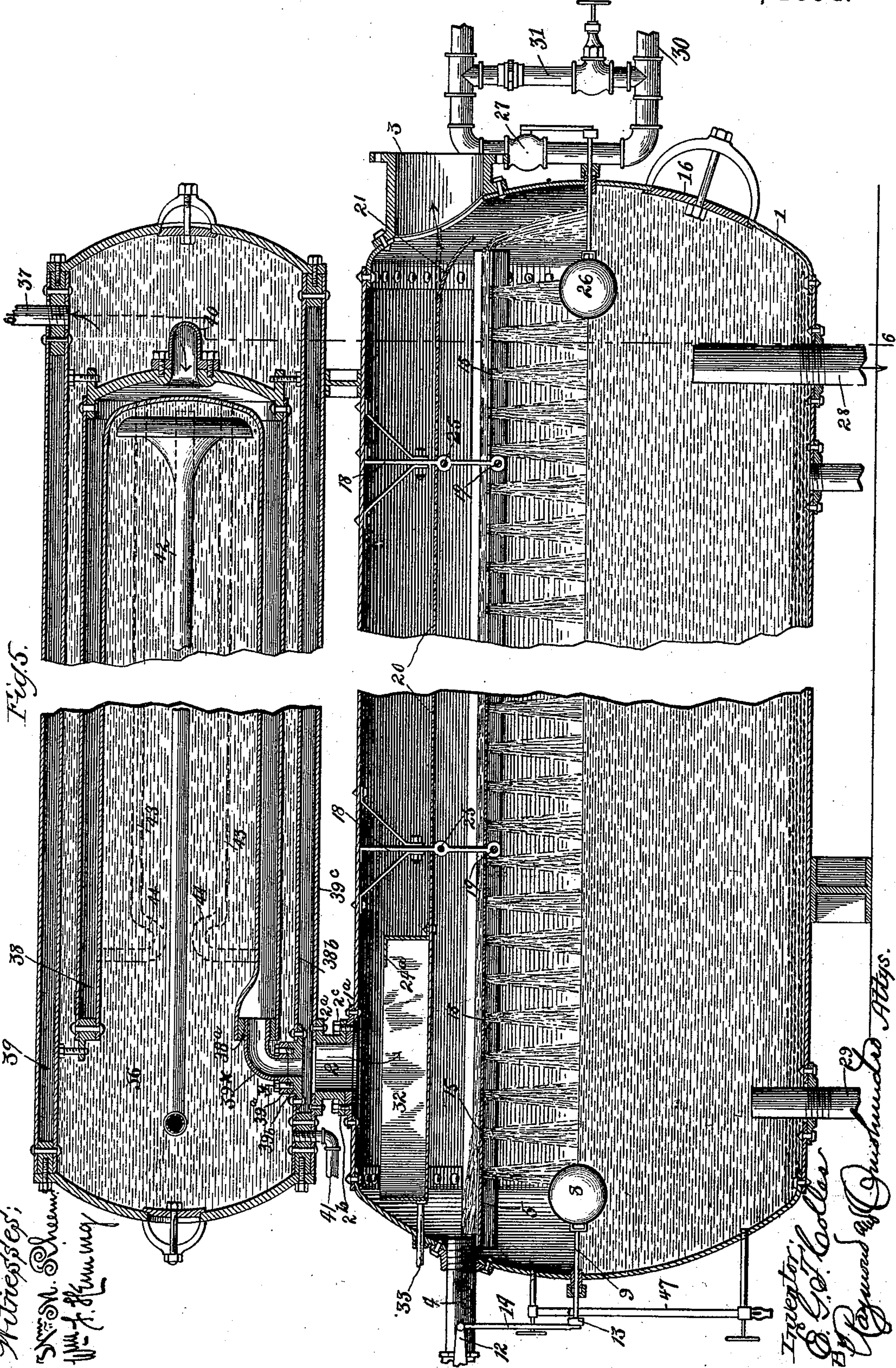
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UNITED STATES PATENT OFFICE.

EDWARD G. T. COLLES, OF CHICAGO, ILLINOIS.

FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 512,806, dated January 16, 1894.

Application filed February 15, 1893. Serial No. 462,491. (No model.)

To all whom it may concern:

Be it known that I, EDWARD G. T. COLLES, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Feed-Water Heaters, of which the following is a full, clear, and exact specification.

My invention relates to improvements in feed water heaters, and more particularly to that class known as "open heaters," *e. g.*, those in which the exhaust or other steam employed for heating the water is admitted into the tank of the heater in the presence of or directly in contact with the feed water; and of this class it has more especial reference to those heaters in which the water of condensation is returned thereto and utilized for raising the temperature of the new supply before it again enters the boiler.

One of the serious disadvantages heretofore experienced with heaters of this character, is that the steam in rushing through the tank of the heater has a tendency to carry along with it a portion of the water in the tank and also such water of condensation as forms in the pipes between the boiler and the heater; such action not only resulting in the formation of scale and deposits in the steam pipes leading from the heater, and in the depletion of the feed water, but also permitting the premature escape of the steam and thereby depriving the feed water of the full benefit of the heat thereof.

Hence, one of the objects of my invention is to provide improved means for preventing the premature escape of the steam from the heater and for arresting the escape of the water therewith.

Another object of my invention is to automatically regulate the discharge or withdrawal of the feed water from the heater in proportion to the supply of the water thereto.

Another object of my invention is to provide improved means for spraying the supply of cold water in the presence of the incoming steam.

Another object is to provide for the removal and replacement of the spraying pan without necessarily taking the tank apart.

A further object is to catch the grease and oil carried by the exhaust steam, before it

comes into contact with the water in the heater.

A still further object of my invention is to combine a closed heater with an open heater and to cause the feed water to pass first through one and then the other, but also to cause the steam to first enter the heater through which the water passes last; whereby the water will be first heated and then superheated by the steam at its highest point immediately before entering the boiler.

My invention consists in certain features of novelty in the construction, combination and arrangement of parts by which the said objects and certain other objects hereinafter described are attained, and which features are fully described hereinafter with reference to the accompanying drawings and particularly pointed out in the claims.

In the said drawings, Figure 1 is a vertical longitudinal sectional view of my improved open feed water heater, the middle portion being broken away. Fig. 2, is a detail plan view of one of the floats hereinafter described. Fig. 3, is a vertical transverse section taken on the line 3—3, Fig. 1. Fig. 4, is an end view thereof looking into the steam inlet port. Fig. 5 is a vertical longitudinal section of my improved combined open and closed feed water heater, and Fig. 6, is a transverse vertical section taken on the line 6—6, Fig. 5.

Like signs of reference indicate like parts throughout the several views.

In carrying out my invention, I employ any suitable tank 1, which is preferably arranged in a horizontal position and is provided at one end with an inlet port 2, for the admission of exhaust or any other steam employed for heating the feed water, and an outlet or exhaust port 3, for the escape of so much of the steam as is not condensed through contact with the water in the heater.

Arranged preferably at one extremity of the tank 1, and near the upper portion thereof is a water supply pipe 4, which may be connected with the city supply, an elevated tank or reservoir, a pump or any other suitable source. This supply pipe is arranged in a horizontal position and adapted to discharge lengthwise of an elongated spraying pan 5, which may extend substantially throughout the length of the tank and be supported there-

in in a substantially horizontal position on suitable brackets or supports 6, secured to opposite sides of the tank as more clearly shown in Fig. 3.

5 The pipe 4, is provided with a suitable valve or cock 7, which is adapted to be governed by a float 8 arranged within the tank and being so connected with the cock 7 as to open it and permit the ingress of water from the
10 pipe 4, when the water in the tank falls below a predetermined level. This connection between the float and the cock 7 may be any of the well known forms which will readily suggest themselves to the ordinary mechanic. I
15 have shown however, and I prefer to use a rocker shaft 9, passing through a suitable stuffing box 10 secured in the end of the tank and being connected to the float at one end by means of a crank arm 11, and to the
20 crank 12 of the cock, at its other end by means of a crank arm 13 and connecting rod 14.

The spraying pan 5 is provided at suitable intervals throughout its length and breadth with perforations or openings 15 through
25 which the water sprays or falls through the current of steam as it passes through the tank from the inlet 2, to the outlet 3; thus not only spreading the water out over a large area on the face of the pan immediately upon
30 its discharge from the supply pipe 4, but again breaking up the bulk of the water before it falls into the main body of water in the tank, from the spraying pan, thereby subjecting a given quantity of water to the maxi-
35 mum volume of steam.

As the spreading pan receives the water from the city supply it becomes coated with scale and dirt and it is often necessary therefore to remove it for cleaning and other purposes; and in order that this may be accomplished without taking the tank apart, I provide the tank in one end with a man-hole 16, which may be elongated in a horizontal direction as shown in Fig. 4, and I form the pan
45 of a number of sections having longitudinal flanges 17, preferably on their under sides, bolted or otherwise secured together as shown in Fig. 3; the entire arrangement being such that a man may enter the tank and unbolt or
50 disconnect the sections of the pan therein, and pass them out through the man-hole 16.

It being desirable to construct the pan of thin metal and in sections in the manner described, it becomes important to provide it
55 with a support throughout its center, and to this end I provide suitable hangers 18 which are secured to the top of the tank and at proper intervals throughout the length thereof, and pass through the pan and carry at
60 their lower ends cross bars or supports 19, which extend across the underside of the pan for a suitable distance and upon which the center of the pan rests. I have shown in the drawings but two of these hangers, but it will
65 of course be understood that those in the center are broken away and that any desired number may be employed, and as they are of

but slight width as shown more clearly in Fig. 3, it will be seen that they offer but little resistance or obstruction to the water flow-
70 ing over the surface of the pan.

In order that the steam as it rushes through the tank may not carry off particles of the feed water through the outlet 3, I locate above the spraying pan 5 and preferably parallel
75 therewith a broad plate 20 which is perforated throughout the greater portion of its length and breadth and has its end 21 preferably turned downward in front of the steam inlet
80 2, so as to prevent the incoming steam from rushing into the water running over and falling from the pan, and thereby opposing its onward flow from the supply pipe 4, and also carrying off a large percentage of it through
85 the outlet 3. This perforated plate 20 with its down-turned end 21 arranged as described, acts as a steam diffusing plate and shield or deflector, the perforations being for the purpose of permitting a gentle diffusion of steam
90 under the plate both above and below the pan 5, and the purpose of the down-turned end 21 being to prevent the violent rush of the steam under the plate from the inlet to the outlet. The end 22 of this diffusing plate
95 20 immediately under the outlet 3 is imperforate. The perforations are omitted at this point for the purpose of further breaking up or obstructing the straight course of the steam from the inlet to the outlet, and to still further obstruct this course, I provide the
100 plate 20 on its upper side between the inlet 2 and the outlet 3, preferably at the edge of the imperforate portion 22, with an upright baffle plate 23 which extends transversely of the plate 20, and is provided with a horizon-
105 tally projecting portion 24 turned toward the steam inlet. Thus it will be seen that the steam in its course from the inlet 2 over the plate 20 will be baffled by the plate 23, and forced downward by this horizontal projec-
110 tion 24, thereby causing considerable pressure above the plate 20 between the inlet 2 and the baffle plate 23, and compelling the steam to pass through the perforations in the plate 20 and diffuse itself throughout the
115 lower portion of the tank, the perforations in the plate 20 providing a short course for the steam above the said plate 20 in getting below the plate to fill the partial vacuum created between the pan and plate by the sudden con-
120 densation taking place there. This steam diffusing plate 20 may be supported within the tank in any convenient way, but I prefer to utilize the hangers 18 for the two-fold purpose of supporting the pan and this plate,
125 and I accomplish this by simply providing the hangers with additional cross-bars 25 immediately below the plate 20 and upon which hangers the plate rests.

It is important that the level of the water
130 in the tank 1 should be uniform, remaining, under all conditions, at substantially the same height, in order that there may be sufficient space between the spraying pan and

the level of the water below it, within which to scatter the water in the presence of the steam. If this were not done it is readily seen that at times the water would rise and defeat the purposes of the pan and its perforations. To the end therefore, that the water may be automatically drawn out as fast and only as fast as it runs in, I provide the interior of the tank 1 with a second float 26 which is connected to the steam cock or valve 27 that regulates the doctor pump not shown, by any suitable connections such as described with reference to the float 8 and valve 7. The connections, however, between the float 26 and valve 27 are so constructed and arranged, as will be understood, as to produce a movement of the valve 27 just the reverse of or opposite to the movement of the valve or cock 7 produced by the float 8—that is to say, both floats rise and fall with the level of the water but the falling of the float 8 opens the cock 7, while the falling of the float 26 closes the cock 27, shuts off the steam from the pump and consequently checks the withdrawal of the water from the tank 1 through the boiler supply pipe 28. With such an arrangement it will be seen that the water will flow through the heater continuously, and that it will flow in as fast as it flows out, and the level of the water in the tank will consequently remain at substantially the same point; for any abnormal increase of the volume of water in the tank will cause the steam valve to be thrown open to a wider degree and thereby accelerate the action of the pump, while at the same time the ingress through the pipe 4 is proportionately decreased. When the water falls in the tank the action of the pump becomes less violent until the ingress and egress reach an equilibrium.

When this heater is employed in a system where the exhaust or live steam is condensed and led back into the heater for being again utilized in the boiler, such water of condensation may be let into the heater by any suitable pipe, such as the pipe 29. When this is done, it will of course be understood that the purpose of the supply pipe is simply to provide for any loss of water which may take place through evaporation or escape of steam. It is also quite obvious that under ordinary circumstances the water of condensation cannot flow into the tank faster than it flows out, but it frequently happens through some local causes, that the inflow will be temporarily suspended from lack of condensation while at other times it will be abnormally profuse, and hence, under such circumstances, it becomes necessary to employ means for automatically regulating the egress.

The pipe 30 which supplies steam to the doctor pump not shown, may be provided with a by-pass 31 for supplying steam to the pump in the event the valve 27 should be out of order. In the form shown in Figs. 5 and 6, which is a combination of an open heater and a closed heater, the open heater if desired

may be of the form already described. I prefer, however, to reverse the order of the steam inlet and outlet ports 2 and 3 respectively, bringing the steam down through the port 2, at a point where it is discharged in the other form. I also prefer to arrange on the diffusing plate 20, immediately under the steam inlet port 2, a pan 32 which serves at once as a baffle plate for the steam, and as means for catching and retaining the oil and grease carried in the steam, which may be drained off continuously or from time to time through the discharge pipe 33. In this instance the edge of the pan 32 between the steam inlet and outlet is provided with a horizontally projecting portion 24^a which corresponds to and performs the same function as the portion indicated by 24 in Fig. 1, in this instance, however, it being turned in the opposite direction. The end of the plate is also turned downward at 21, and as in the other form, serves as a shield or deflector, but in this instance, to retard the too sudden exit of the steam through the outlet port 3, and to arrest any particles of water that may be carried in the steam rushing under the plate 20. But if desired, this plate may in either instance be perfectly flat as shown in dotted lines.

The steam space of the closed heater is connected to the steam inlet port 2 of the open heater, and the steam is admitted first to the closed heater through its steam inlet port 34, while the feed water is admitted first into the tank 1 in the manner described, and then forced by the pump or any other suitable means not shown, into the water space of the closed heater through its ingress pipe 35; thus bringing the water first into contact with the water of condensation which runs into the tank 1; through the pipe 29, and which raises the temperature of the fresh water to a considerable degree, and then carrying the water thus warmed into the closed heater where it is subjected to the action of the steam at a point where the steam is hottest, and at a point where the water leaves the heater immediately before entering the boiler, the steam after having passed through the closed heater, passing into the open heater and assisting in raising the temperature of the water therein. This arrangement is advantageous for it is seen that if the fresh water were admitted into the closed heater in the first instance without previous heating, the condensation of the steam entering that heater would be much greater than if the temperature of the water had first been raised by contact with the return water of condensation in the tank 1. And moreover, if the fresh water came in contact with the steam at its hottest point when it first entered the combined heater, its temperature would decrease before reaching the outlet of the heater; whereas, when the water is first warmed and then immediately before entering the boiler is subjected to the hottest portion of the incoming steam, this result does not take place.

The closed heater may be of any suitable construction, but preferably one substantially like that shown and described in United States Letters Patent No. 357,268, granted to myself February 8, 1887, 36 being the water space having a boiler supply pipe 37, 38 being the inner or second and 39 the outer or first steam space which are connected together by a pipe 40, and 41 being the blow-off.

The extremity of the inner or second steam space 38 is provided with an elbow pipe 39^x which may be connected in any suitable manner with the steam inlet port 2 of the open heater. I prefer, however, to effect this construction by the means shown in the drawings. The elbow pipe 39^x is threaded at one end in the annular head or ring 38^a and at its other end it is provided with a flange 39^a which is bolted to a second flange or ring 39^b. As clearly shown, this second flange 39^b is provided with an enlarged portion projecting up through the interior shell 38^b to afford metal for the engagement of the bolts or screws *y*, and it also has a lateral flange bolted or riveted to the under side of such shell 38^b. The purpose of this construction is to provide a sufficient thickness of metal for the attachment of the pipe 39^x to the shell 39^a. The pipe 39^x coincides with a short coupling constituting the port 2, which coupling is provided at its upper end with a flange 2^a riveted or secured to the shell 39^c, and at its lower end with a flange 2^b, it being necessary to arrange the flanges 2^a and 2^b close together as shown, because there is not sufficient room between them to rivet the lower end to the tank or drum 1, and consequently, screws or bolts 2^c are employed, but the drum 1 is too thin to hold the screws, and therefore a separate thick ring 1^a is riveted to the drum 1, and the bolts or screws 2^c are threaded in it.

If desired, one end of the steam space 38 may be connected with its other end by means of pipes 44 passing through the water space and being provided with bends for the purpose of taking up expansion and contraction, as shown in dotted lines; thus bringing the steam into more intimate relation with the water. In this event, the trumpet shaped mouth of the pipe 42 may be omitted.

The water tank or drum 1, of either form may be provided with an overflow or water line pipe 45 having a valve or cock 46, whereby any oil that might accumulate on the surface of the water in the drum may be drained off. This pipe will be of further advantage in controlling the level of the water in the tank or drum in case there should be a sudden influx causing the level to rise above the pan and diffusing plate. In this event, the cock 46 may be turned and the water quickly reduced to its normal level without waiting for the pump to draw it off, and also without necessitating the forcing of the surplus water which at such time is cold, into the boiler.

The level of the water may be indicated by a gage 47.

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

1. In a feed water heater the combination with the water drum or tank having a steam inlet and outlet, of a perforated steam diffusing plate located therein between the water and the said inlet and outlet, and a baffle plate interposed between said inlet and outlet, substantially as set forth.

2. In a feed water heater, the combination with the water drum or tank having inlets and outlets for steam and water, of a water pan arranged under the water inlet and a steam diffusing plate located between said pan and the steam inlet and outlet, substantially as set forth.

3. In a feed water heater, the combination with the water drum or tank, having inlets and outlets for the steam and water, of a perforated water pan and a steam diffusing plate arranged between said pan and the steam inlet and outlet, substantially as set forth.

4. In a feed water heater, the combination with the water drum or tank having inlets and outlets for the steam and water, of a perforated water spraying pan and a perforated steam diffusing plate arranged above said pan between the steam inlet and outlet, substantially as set forth.

5. In a feed water heater, the combination with the water drum or tank having inlets and outlets for the steam and water, of a perforated water spraying pan and a perforated steam diffusing plate arranged between said pan and the top of the drum or tank, and having a baffle plate, interposed between the steam inlet and outlet, substantially as set forth.

6. In a feed water heater, the combination with the water drum or tank having steam inlet and outlet ports, of a perforated steam diffusing plate arranged between the water and said steam ports and having a baffle plate interposed between the said steam ports, said diffusing plate being imperforate opposite one of said ports, substantially as set forth.

7. In a feed water heater, the combination with the water drum or tank having inlets and outlets for the steam and water, of a water pan arranged in said tank, a perforated steam diffusing plate arranged above said pan between said inlets and outlets and having one of its ends down-turned, substantially as set forth.

8. In a feed water heater, the combination with the water drum or tank, of a water pan arranged in said drum and composed of separate sections and hangers secured to the upper part of said drum and supporting the sections of said pan, substantially as set forth.

9. In a feed water heater, the combination with the water drum or tank, of a water pan arranged therein and composed of separate sections and hangers passing through said pan and having cross bars upon which the pan rests, substantially as set forth.

10. In a feed water heater, the combination

with the water drum or tank, and the water pan and steam diffusing plate arranged therein, and composed of separate sections of hangers secured to said drum and having upper and lower cross bars upon which said plate and pan rest respectively, substantially as set forth.

11. In a feed water heater, the combination with the water tank or drum having a steam port at or near each end, and a water pan located within the drum of a steam diffusing plate arranged over said pan and a water inlet arranged at one end of said pan, said diffusing plate having a down-turned end at the other end of said pan whereby it will be between the pan and one of said ports, substantially as set forth.

12. In a feed water heater, the combination of the water tank or drum having a supply and discharge and separate and independent means for respectively arresting automatically the discharge when the supply opens, substantially as set forth.

13. In a feed water heater, the combination with the water tank or drum having a water supply and discharge, and a spraying pan arranged therein, of separate and independent valves for respectively governing said supply and discharge and separate and independent floats arranged in said tank and connected with said valves and adapted to open and close said valves respectively as the water in the tank falls, substantially as set forth.

14. In a feed water heater, the combination of an open and a closed heater, the water discharge of one being connected to the water inlet of the other, and the steam discharge of said other being connected to the steam inlet of the first, substantially as set forth.

15. In a feed water heater, the combination of an open and a closed heater, the water discharge of the open heater being connected to the water inlet of the closed heater, and the steam discharge of the closed heater being connected to the steam inlet of the open

heater, and a steam diffusing plate arranged in said open heater between the steam inlet and the water line, substantially as set forth.

16. In a feed water heater, the combination of an open and a closed heater, the water discharge of one being connected to the water inlet of the other and the steam discharge of one being connected to the steam inlet of the other, a steam diffusing plate having perforations arranged within said open heater between the steam inlet and the water line, and an oil pan arranged under the steam inlet of the open heater, substantially as set forth.

17. In a feed water heater, the combination of the water tank or drum having steam inlet and outlet ports, of a perforated steam diffusing plate arranged in the upper part of said tank or drum and having an oil pan provided with a blow-off or drain, arranged under the steam inlet port, substantially as set forth.

18. In a feed water heater, the combination with the water tank or drum having steam inlet and outlet ports, of a steam diffusing plate arranged in the upper part of said drum and an oil pan arranged under said inlet port and having a lateral projection at one edge thereof, located between said inlet and outlet ports, substantially as set forth.

19. In a feed water heater, the combination with the shells 38^b—39^c, the head 38^a and the tank 1, of the elbow pipe secured at one end in the said head and having a flange at its other end, the flange 39^b secured to the shell 38^b and bolted to the flange on said elbow pipe, a flange 1^a secured to the drum 1, and a coupling coinciding with said elbow pipe and having the flange 2^a at one end secured to the shell 39^c and a flange 2^b at its other end bolted to the flange 1^a, substantially as set forth.

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Witnesses:

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