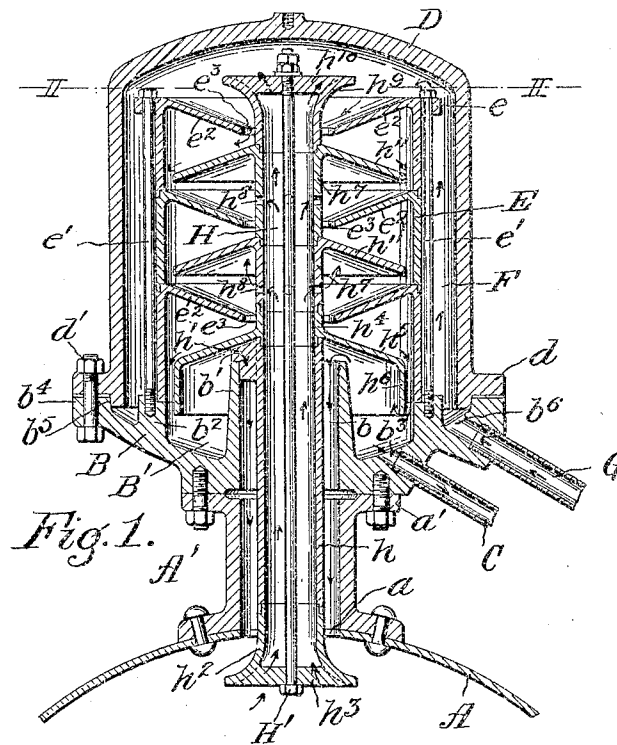
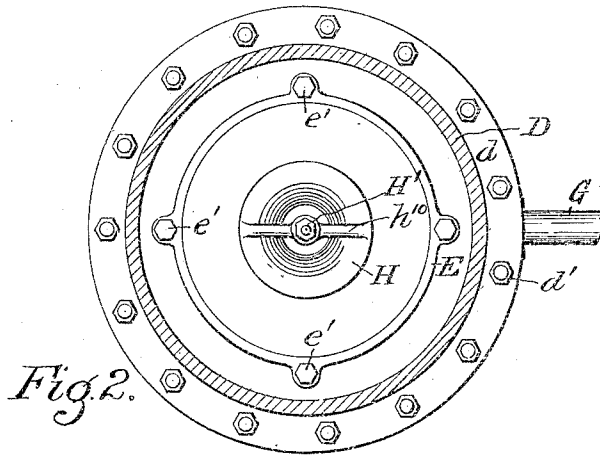


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WATER HEATER AND PURIFIER.  
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958,845.

Patented May 24, 1910.



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# UNITED STATES PATENT OFFICE.

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WATER HEATER AND PURIFIER.

958,845.

Specification of Letters Patent.

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*To all whom it may concern:*

Be it known that I, HENRY WHITE, a citizen of the United States, resident of Cleveland, county of Cuyahoga, and State of Ohio, have invented a new and useful Improvement in Water Heaters and Purifiers, of which the following is a specification, the principle of the invention being herein explained, and the best mode in which I have contemplated applying that principle, so as to distinguish it from other inventions.

My invention relates to combined feed water heaters and purifiers, its object being to provide a simple and efficient structure of this character which may be readily applied to a boiler and which will serve to properly heat the feed water and deliver same to the boiler at a high temperature, removing therefrom the sediment-forming material and delivering the water in a condition such as to prevent foaming and incrustation.

My invention is adapted for use either in connection with locomotive or stationary boilers, and consists of means hereinafter fully described and particularly set forth in the claims.

The annexed drawing and the following description set forth in detail certain means embodying my invention, the disclosed means, however, constituting but one of various mechanical forms in which the principle of the invention may be applied.

In said annexed drawings:—Figure 1 is a vertical axial section of a device embodying my invention, as particularly applied to a stationary boiler, a fragmentary section of the latter being shown. Fig. 2 is a transverse section taken upon the plane indicated by line II—II of Fig. 1.

The boiler A is provided with an opening *a* in its top and hence above the water level therein, and around this opening is riveted a hollow casting A' forming a connecting member between the heater and purifier proper and the boiler. The upper end of the casting A' is formed with a flange *a'* upon which is bolted a bottom member B of general cup shape form. In the middle of said bottom member is formed an opening *b* which is surrounded by an upright tubular wall *b'*, thereby bringing the point of discharge of the opening in a plane above the interior of the bottom of the member B.

The opening *b* is made preferably of the same diameter as the opening in the casting A'. Surrounding the tubular wall *b'* is an annular wall *b<sup>2</sup>* concentric with the wall *b'*. This latter wall and wall *b'* form an annular settling chamber B'. An opening *b<sup>3</sup>* is formed through the member B, by means of which a blow-off pipe C may communicate with the settling chamber. The member B is further provided with an outer annular wall *b<sup>4</sup>* which is also concentric with the wall *b'*. Upon this latter wall is seated the flange *d* of an outer bell shaped shell D, said flange being secured to the wall by means of suitable bolts *d'*. The wall *b<sup>4</sup>* is formed with a conical seat *b<sup>5</sup>* and the lower end of the shell D formed with a similar conical face, whereby a gas-tight joint may be secured, as will be readily understood. Seated upon the inner wall *b<sup>2</sup>* is an inner hollow cylindrical shell E which is made in sections, as will be further described. The upper end of shell E is formed with a flange *e* through which bolts *e'* pass, the lower ends of such bolts being screwed into the wall *b<sup>2</sup>*, as shown. As will be noted, the outer diameter of the shell E is such as to form an interior annular water space F. The height of the shell E is such that the said space F may communicate with the interior of said shell at the top, all communication other than that at such top being cut off. An opening *b<sup>6</sup>* is formed in the member B which communicates with the water space F, whereby water may be introduced in the latter by means of a feed pipe G.

Passing from the upper part of the boiler and above the water line, upwardly through the casting A' and the opening *b* is a tubular duct H. This duct is composed of a plurality of sections. A main section *h* is located in the opening *b* and passes downwardly into the casting A'. The upper end of this section is provided with lateral lugs *h'*, usually three in number and spaced 120 degrees from each other, which rest upon the tubular wall *b'* as shown. To the bottom of this section is fitted a section *h<sup>2</sup>* whose lower end is outwardly flared and formed with a spider *h<sup>3</sup>*. Upon the section *h* rests a section *h<sup>4</sup>*. This latter section is provided with an outwardly and downwardly projecting flange *h<sup>5</sup>*, and the outer end of this flange is

provided with a rim  $a^6$ , which projects into the settling chamber B'. Upon the section  $h^4$  rests a plurality of sections  $h^7$  of duplicate form and which may vary in number in accordance with specific requirements. Each of these sections  $h^7$  is provided with lateral openings  $h^8$ , whereby communication is afforded directly from the interior of the duct H to the interior of the shell E. The top-most section  $h^7$  is capped by a section  $h^9$  whose upper extremity is outwardly flared as shown, and formed with a spider  $h^{10}$ . The superimposed sections are formed with complementary counterbored seats and reduced ends and are held together by means of a tie bolt H'. Each of the sections  $h^7$  is formed with a downwardly inclined and outwardly projecting flange  $h^{11}$ , and the outer diameters of all the flanges  $h^5$  and  $h^{11}$  are less than the interior diameter of the shell E.

As before mentioned, this shell E is formed of a plurality of cylindrical sections as shown, each section being provided with complementary counterbored and reduced portions for retaining them in their relative positions, as will be readily understood. Each section of the shell E is formed with an inwardly and downwardly projecting web  $e^2$ , and the inner extremities of these webs form passages  $e^3$  between them and the vertical walls of the tubular duct H. As shown, the web  $e^2$  and flanges of the duct H alternate with each other in the direction of the duct's axis, and therefore provide a duct of tortuous form leading from the interior of the device to the bottom thereof, the lower end communicating with the opening  $b$  and hence with the boiler, and the upper end communicating with the water space F.

In operation, the steam from the boiler A rises up through the duct H, and discharges into the upper part of the shell or dome D, the length of the duct H being such as to effect this discharge at a plane above the top of the shell E. The steam so ascending also finds an outlet through the lateral opening  $h^8$ , whereby it enters directly into the interior of the shell E. Water being forced through the pipe G into the water space F, rises in the latter until it flows over the top of the shell E and downwardly on the uppermost web  $e^2$ . Continuing, the water passes through the openings  $e^3$  and falls alternately upon the flanges  $h^4$  and webs  $e^2$ , finally reaching the settling chamber B'. The steam in the meantime heats the webs and flanges and the walls of the duct H and shell E to a high degree of temperature, and imparts such heat to the water. Such water becoming so highly heated, all acids contained therein are rendered soluble, and all the lime, magnesia, etc., which form incrusting agents are acted upon in a manner such that they lose their deleterious incrusting character. This heating operation is further augmented by

the direct contact of the water with the steam which reaches it through the opening  $h^8$ , the temperature of this steam being higher toward the lower end of the water's downward course than it is at the upper end thereof, as will be readily understood.

The rim  $h^6$  of the lowermost flange  $h^5$  forms a trap in the settling chamber, and around it all of the water must flow, thereby causing a change in the direction of the flow of the water from downward to upward. This arrangement permits of and promotes the settling of all precipitating material such as is ordinarily found in feed water, and such precipitants are deposited in the bottom of the settling chamber as shown. These precipitants may be removed by opening up the blow-off pipe C, a suitable blow-off cock or valve (not shown) being provided for this purpose, as will be readily understood. The water now rising in the settling chamber and rendered innocuous in so far as concerns the action of acids or incrusting agents contained therein, overflows the top of the wall  $b'$ , passes into the opening  $b$  and thence downwardly into the boiler. The upper end of the duct H is preferably flared as shown, so as to distribute the steam rising upwardly through the interior of the shell E evenly and laterally, and the lower end of said duct is flared as shown for distributing the water which passes down through the opening  $b$  in a similar manner. In this manner, the steam and water are brought into intimate contact and the chemical action required for effecting the purifying action thereby effected.

Having fully described my invention, what I claim and desire to secure by Letters Patent is:—

1. The combination with a steam generator; of a combined water heater and purifier comprising the following elements; an outer shell formed with an opening for a feed water connection; an inner shell forming in conjunction with said outer shell and within same, a water space closed at the bottom and open at the top, said inner shell being furthermore provided with a bottom opening affording communication between its interior and said generator; a duct passing through the latter leading upwardly through, and discharging near the closed top of, the heater; and a second duct of tortuous form surrounding said first named duct and leading from the upper portion of the heater downwardly, the lower end of said tortuous duct communicating with said bottom opening.

2. The combination with a steam generator; of a combined water heater and purifier comprising the following elements; an outer shell formed with an opening for a feed water connection; an inner shell forming in conjunction with said outer shell and within

same a water space closed at the bottom and open at the top, said inner shell formed with a bottom opening affording communication between its interior and said generator; a duct passing upwardly from the said generator directly through said bottom opening and discharging near the top of said heater; and a second duct of tortuous form surrounding said first named duct and leading from the upper portion of the heater downwardly; the bottom of said tortuous duct communicating with said bottom opening; said first named duct having lateral communication with said tortuous duct.

3. The combination with a steam generator; of a combined water heater and purifier comprising the following elements; an outer shell formed with an opening for a feed water connection; an inner shell forming in conjunction with said outer shell and within same a water space closed at the bottom and open at the top, said inner shell provided with a bottom opening affording communication between its interior and said generator; a duct leading from said generator upwardly through, and discharging at the top of, said water space; a second duct of tortuous form surrounding said first named duct and leading downwardly from the upper portion of the heater from a plane below the point of upper discharge of said first named duct, the bottom of said tortuous duct communicating with said bottom opening; the first named duct being provided with lateral openings communicating with said tortuous duct.

4. In a combined feed water heater and purifier, means for bringing feed water and steam into intimate contact, comprising the combination of a shell having a central bottom opening having its point of discharge in a plane above the bottom of the interior of said shell; a duct passing through said opening and discharging near the upper part of said shell; outwardly projecting flanges on said duct and of an outer diameter less than the interior diameter of said shell; and inwardly projecting annular webs on said shell having an interior diameter greater than the exterior diameter of said duct.

5. In a combined feed water heater and purifier, means for bringing the feed water and steam into intimate contact, comprising a shell provided with a central bottom opening having its point of discharge in a plane above the bottom of the interior thereof; a duct passing through said opening and discharging near the top of the shell; flanges projecting outwardly from said duct and having an outer diameter less than the interior diameter of said shell; annular webs projecting inwardly from the interior of said shell and having an inner diameter greater than the exterior diameter of said

duct; said webs and flanges alternating with each other in position in the direction of the axis of said duct.

6. In a combined feed water heater and purifier, means for bringing the feed water and steam into intimate contact, comprising the combination of a shell provided with a central bottom opening having its point of discharge in a plane above the bottom of the interior of said shell; a duct passing upwardly through said opening and discharging near the top of said shell; flanges projecting from the sides of said duct and having an exterior diameter less than the interior diameter of said shell; annular webs projecting from the interior of the shell and having an inner diameter greater than the exterior diameter of said duct; said webs and flanges alternating in position with each other in the direction of the axis of said duct; the lowermost flange terminating in a plane below the plane of discharge of said bottom opening; said shell formed with a second opening in its bottom independent of said first named opening.

7. A combined feed water heater and purifier comprising the combination of an outer shell formed with an opening for a feed water connection; an inner shell forming in conjunction with said outer shell and within same, an annular water space communicating at its top only with the interior of the inner shell; the lower part of the latter being provided with an opening discharging in a plane above the bottom of such inner shell, together with an opening for a blow-off connection; a steam duct passing through said bottom opening and discharging near the top of the heater; circular flanges projecting outwardly from said duct, and of a diameter less than the interior diameter of said inner shell; annular webs projecting from the interior of said inner shell, and forming passages between their inner extremities and said duct; the lowermost of said flanges projecting below the plane of discharge of said steam opening.

8. A combined feed water heater and purifier comprising the combination of a bottom member provided with a central opening surrounded by an upwardly projecting tubular wall, an inner annular wall surrounding said opening and forming in conjunction with said tubular wall an annular settling chamber, an outer annular wall, and an opening into said annular settling chamber; a bell shaped outer shell secured to said outer annular wall; a tubular shell seated upon and secured to said inner annular wall and forming in conjunction with said outer shell an annular water space communicating at its upper end with the interior of said inner shell, said water space being provided with an opening for a feed water connection; and a tubular duct passing through

the central opening in the bottom member; said duct and inner shell forming a duct of tortuous form communicating at its upper end with the said annular water space and  
5 at its lower end with said opening.

9. In a combined feed water heater and purifier, a bottom member formed with a central opening and formed with an annular wall surrounding said opening; a cylindrical shell open at its top and seated on  
10 and secured to said annular wall; and a duct passing through said central opening and upwardly through said shell, discharging near the top of the latter; said cylindrical shell formed of a plurality of cylindrical sections each provided with an in-

wardly projecting annular web; said tubular member comprising in its structure a plurality of superimposed sections, each section formed with an outwardly projecting  
20 annular flange; said flanges and webs alternating in position with each other and forming a tortuous duct communicating at its lower end with said central opening; said bottom member being provided with an  
25 opening for a blow-off connection.

Signed by me, this 27th day of July, 1909.

HENRY WHITE.

Attested by:

A. E. MERKEL,  
CURT B. MUELLER.