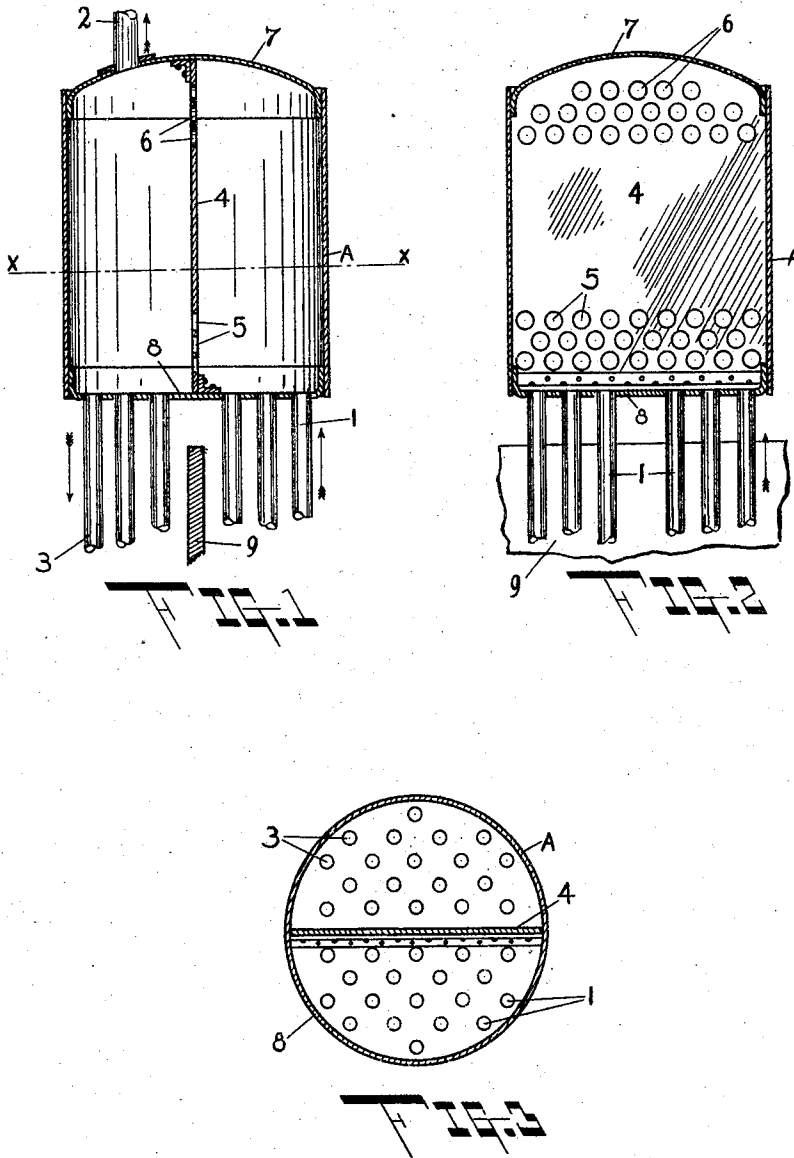


E. C. FISHER.
 VERTICAL WATER TUBE BOILER.
 APPLICATION FILED JULY 27, 1908.

933,541.

Patented Sept. 7, 1909.



WITNESSES:

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VERTICAL WATER-TUBE BOILER.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, ELBERT CURTISS FISHER, a citizen of the United States, residing at Saginaw, in the county of Saginaw and State of Michigan, have invented certain new and useful Improvements in Vertical Water-Tube Boilers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to vertical water tube boilers comprising a mud drum, a water and steam drum located above the mud drum, and vertical water tubes connecting the drums.

The main objects attained by my invention are: First, the setting up of an ascending and descending circulation of water. Second, the novel separation of the steam and water in the steam drum, and third, the transfer of the water elevated by the ascending current from the ascending to the descending side of the drum without loss by friction, thereby maintaining a water level constant on both sides of the drum. Fourth, the provision of a partition within the steam drum which operates as a separator for the steam and water and also acts as a strong and powerful brace for the drum.

In my invention, the entire boiler is divided into what I may term ascending and descending sides, both as regards the gas and water and steam. This is attained by the provision of a division wall extending vertically upward from the mud drum and separating the tubes into two sets. These sets I shall designate as the riser tubes and the descending tubes respectively. This divisional wall conducts the gases upward directly from the furnace, the gases impinging against the bottom of the steam drum and being led downward on the opposite side of the divisional wall to the stack. In their passage upward, the gases are hottest and envelop the riser tubes which absorb nearly one-half of the heat from the gas. Obviously, this materially lowers the temperature of the products of combustion passing downward on the opposite side of the divisional wall and enveloping the descending tubes, so that a less degree of heat is imparted to the latter. The divisional wall divides the boiler into ascending and de-

scending sides so far as the gas is concerned. Coöperating with the division wall is a baffle extending approximately vertically upward within the steam drum and in substantial alinement with the division wall. This baffle converts the single drum into a double steam drum and separates the riser tubes discharging ebullient water into the drum from the descending tubes which lead the water from the steam drum. It further separates the water from the steam liberated by the water on the ascending side of the drum, (with which side the riser tubes communicate) from the dry steam in the steam storage chamber (with which chamber the descending tubes communicate). The baffle prevents the ebullient water from disturbing the entire area of water in the steam drum by confining such ebullition to the ascending side of the drum.

Another object of my invention is to produce a baffle plate which shall prevent the discharge of water or flying spray into the steam leaving the boiler nozzle.

To these and other ends, therefore, my invention consists of certain novel features and combinations such as will be more fully described hereinafter and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a vertical sectional view through a steam drum equipped with my invention. Fig. 2 is a similar view taken at right angles to Fig. 1, and Fig. 3 is a horizontal cross sectional view on line $x-x$ of Fig. 1.

At the tube liberating point of steam and water in the steam drum of any water tube boiler, a powerful ebullition is set up. This tends to raise the level of the water over the riser tubes high above the level of the water over the descending tubes and also disturbs the entire body of water in the steam drum where the liberating tubes discharge. Such ebullition also interferes with the circulation of the water in the boiler and induces priming in the steam drum. To avoid these disadvantages, baffle plates of different forms have been provided. Also others have attempted to overcome these disadvantages by providing separate drums with which the riser tubes and the descending tubes respectively communicate, such drums being connected by cross tubes. This construction is faulty because the cross tubes

throttle the delivery of water from one drum to the other, and fail to equalize the water level in the two drums.

In my invention, I provide a baffle consisting of a partition 4 arranged vertically in and extending diametrically across the steam drum A from top to bottom. This partition lies between the riser tubes 1, and the descending tubes 3, and serves to confine the ebullition from the riser tubes to the inlet side of the drum.

Heretofore, no attempt has been made to utilize the baffle as a strengthening means and brace for the steam drum. I have discovered however, that the baffle may be caused to materially strengthen the steam drum and afford a powerful brace for the tube sheet, to which end I preferably secure the lower and upper edges of the partition to the dished head 7 and tube sheet 8 respectively of the drum. The partition may be secured to the tube sheet and dished head in any suitable manner as by riveting. The partition separates the steam drum into two chambers or compartments which I will call the liberating chamber and the steam storage chamber communicating with each other through a series of apertures 5 in the partition near its lower end, the combined area of which series of apertures is equal to or greater than the area of the riser tubes 1 or the descending tubes 3. This affords a perfect freedom of circulation of water from the ascending to the descending side of the steam drum and prevents strangulation. The upper end of the partition is apertured as at 6 for the escape of steam from the liberating chamber into the steam storage chamber. The steam discharge pipe 2 is preferably located above the descending tubes 3. The partition operates to separate the steam mingled with the water that is projected up through the riser tubes in the liberating chamber and before it passes to the storage chamber or to the discharge pipe. The height in drum A from the water level to the apertures 6 in the partition, as above described, further acts as a separator to remove the spray from the steam because the steam, when liberated on the ascending side rises vertically to the upper end of the liberating chamber; then changing its direction, passes horizontally through the apertures 6 in the partition into the steam storage chamber, and the spray, if any, is precipitated by the diaphragms around apertures 6 into the liberating chamber. To enter the outlet pipe 2, the steam changes its course from horizontal to vertical again.

It will be understood that the steam near the surface of the water carries with it a considerable portion of water on the ascending side of the drum. If ample height is given the steam in which to rise before passing through the apertures 6, this entrained

water will be separated from the steam in the liberating chamber by gravity and before the steam passes through apertures 6 to the steam storage chamber. This results in increasing its velocity so that only the light steam passes through the apertures 6, the heavier water and spray being precipitated into the liberating chamber. Thus I provide a high steam chamber in which the steam liberated by the water from the riser tubes ascends, such steam carrying with it entrained water in the form of spray. By reason of the comparatively great height to which the steam must ascend before attaining the outlet apertures 6, a separation of the spray from the steam occurs as it rises in the liberating chamber. If the drum A is inclosed in brick work, forming a gas chamber around the drum, as is usually the case, the steam carries with it a small degree of superheat. By reason of the large area of apertures 5, permitting communication between the two compartments, the water level is equalized in both chambers of the drum, which equalization is never obtained in the two-drum construction, owing to the throttled area of delivery from the front drum to the middle drum.

Many boilers are very sensitive, the direction of the wind being sufficient to reverse the circulation in the tubes. In a boiler constructed in accordance with my invention, the circulation is fixed or constant. The water is caused to ascend through the riser tubes and descend through the down-comer tubes, by reason of the wall 9, preferably of tile, which divides the vertically extending tubes into two sets. This division wall operates to lead the products of combustion when at their highest temperature upward around the riser tubes 1, to the steam drum and thence downward around the tubes 3 thereby setting up a difference in temperature. Because of such higher temperature on the ascending side of the boiler, the water in the riser tubes is caused to ascend into the liberating chamber, the water in the steam storage chamber being permitted to descend through the relatively cooler down-comer tubes on the opposite side of the division wall 9. It is obvious that without the division wall, no effective predetermined circulation could be obtained as the tubes and contents would all be of equal temperature. Furthermore the combination of the baffle with the division wall separates the boiler into ascending and descending sides respectively, for the gas and the steam and water.

Having thus fully disclosed my invention, what I claim as new is:—

1. In combination with a vertical water tube boiler having a steam drum, a vertical partition separating the drum into two chambers, riser tubes communicating with one chamber and down-comer tubes communicat-

ing with the other chamber, said partition being provided with a series of apertures near its lower edge for equalizing the level of the water in the two chambers, the partition also provided with a second series of apertures near its upper edge, said second series being separated from the lower series of apertures by an unperforated portion of the partition, whereby said partition operates as a baffle to cause the precipitation of mechanically suspended water.

2. The combination with a vertical water tube boiler having a steam drum, a plurality of tubes communicating with the drum, a wall interposed between and dividing the tubes into riser and down-comer tubes respectively, and a partition in the drum arranged in alinement with the division wall, the partition separating the drum into two chambers, the riser tubes communicating with one chamber, the down-comer tubes communicating with the other chamber, the partition being provided with a series of apertures near its lower edge for equalizing the level of the water in the two chambers, the partition also provided with a second series of apertures near its upper edge, said second series being separated from the lower series of apertures by an unperforated portion of the partition, whereby said partition

operates as a baffle to cause the precipitation of mechanically suspended water.

3. A steam drum for boilers having riser and down-comer tubes communicating therewith, a partition constituting a combined brace and baffle extending from top to bottom of the drum and dividing the drum into two chambers with which the riser and down-comer tubes respectively communicate, the partition being provided with a series of apertures near its lower edge for equalizing the level of water in the two chambers, the partition also provided with a second series of apertures near its upper edge, said second series being separated from the lower series of apertures by an unperforated portion of the partition, whereby said partition operates as a baffle to cause the precipitation of mechanically suspended water, and means fastened to the top and bottom of the drum and to the upper and lower ends of the partition respectively, to maintain it in position as a brace for the drum.

In testimony whereof, I affix my signature in presence of two witnesses.

ELBERT CURTISS FISHER.

Witnesses:

LOUIS SMITH,
FRANK H. PAYNE.