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DEVICE FOR IMPROVING THE CIRCULATION OF WATER TUBE BOILERS

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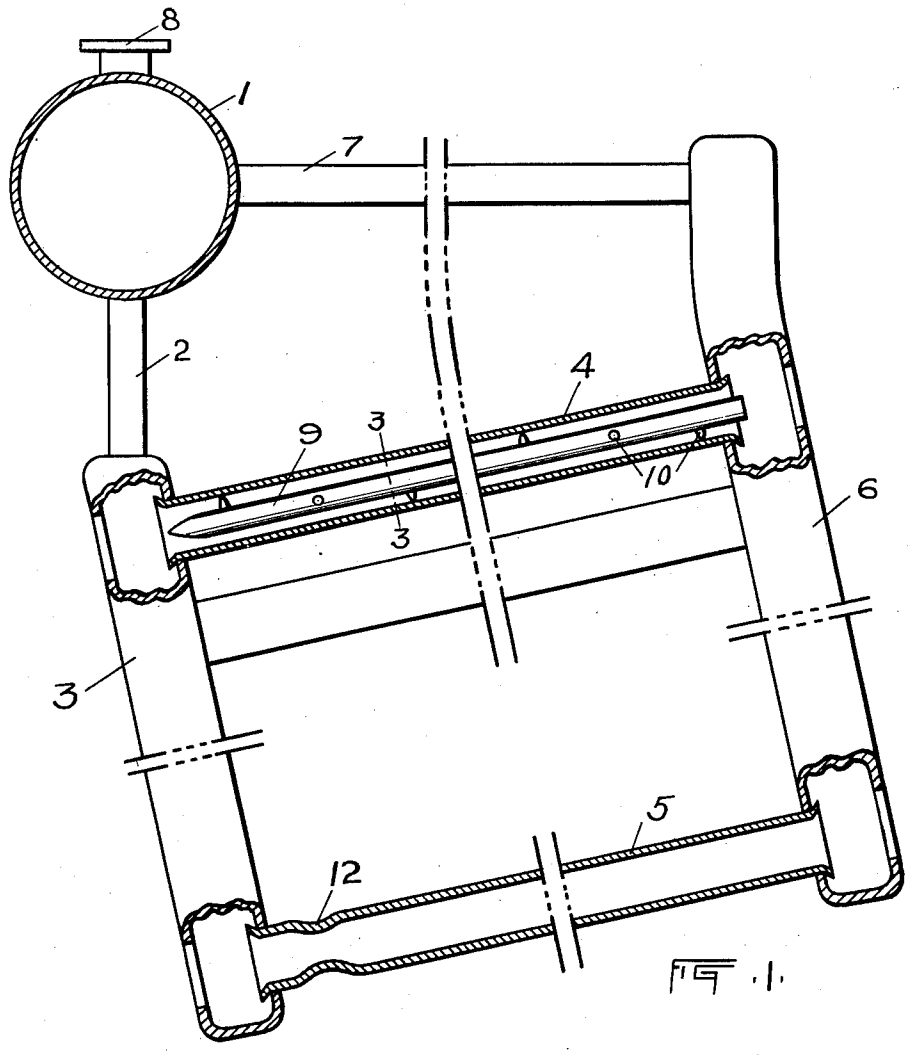


FIG. 1.

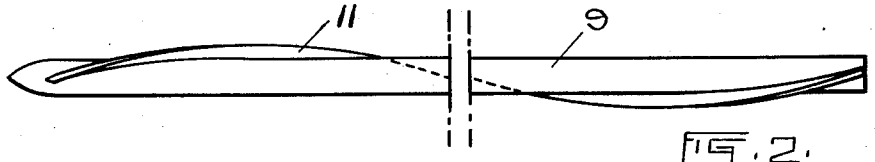


FIG. 2.

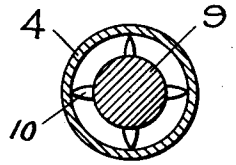


FIG. 3.

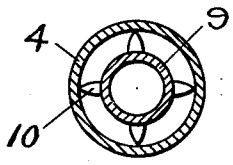


FIG. 4.

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DEVICE FOR IMPROVING THE CIRCULATION OF WATER TUBE BOILERS

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3 Claims. (Cl. 122—501)

Our invention relates to an improvement in a device for improving the circulation of water tube boilers and has for its principal object the provision of simple and efficient means for increasing the velocity of the circulating water in those steam generating tubes where, under the present system, the circulation is sluggish. A further object is to direct the flow of the circulating water so as to sweep the inner walls of the steam generating tubes clear of accumulated steam, solids or stagnant water film and thus greatly increase the thermal efficiency of the boiler. Other objects and advantages will appear in the following specification and are shown in the accompanying drawing in which similar reference numerals refer to similar parts in all of the views.

Fig. 1 is a partial side elevation of a water tube boiler of common design, showing the embodiment of our invention.

Fig. 2 is a side view of the core showing a modification in the method of keeping it central when placed within a steam generating tube.

Fig. 3 is a cross sectional view of a steam generating tube and core and is taken on a line 3—3 of Fig. 1. In this view the core is shown solid.

Fig. 4 is a cross sectional view of a steam generating tube and core and is also taken on a line 3—3 of Fig. 1. In this view the core is of tubular construction instead of solid as in Fig. 3.

In the drawing, Fig. 1 shows a common type of straight, inclined tube, horizontal cross-drum boiler in which 1 is the steam drum with nipples 2 joining it to header 3. An upper series of steam generating tubes 4 and a lower series of steam generating tubes 5 connect header 3 to header 6 and cross tube 7 connects header 6 to steam drum 1. The steam outlet from the drum 1 is shown at 8.

In one of the upper series of water tubes 4 in Fig. 1, is shown a solid core 9 approximately the full length of the tube 4 and provided with distance lugs 10 which position it centrally within the tube 4. These distance lugs 10 are also clearly shown in Figs. 3 and 4. The end of each solid core 9 toward header 3 where the circulating water enters the tubes 4, is pointed in order to offer as little resistance to the entering water as possible. We have just referred to the core 9 as being solid as shown in Fig. 3 but it may be of tubular construction if desired as shown in Fig. 4 but the forward end should be closed and pointed as in Figs. 1 and 2, since the function of the core 9 is to compel the water to pass through the comparatively restricted annular space between the core 9 and the inner wall of the tube 4. In Fig. 2 we show a modification in the manner of centering the core 9 within a water tube. In this view a fin 11 is integral with the core or attached to it in any approved manner and extends spirally throughout its entire length. The advantage of this construction is that, in addition to centering the core 9 within a water tube, it also directs the water in a slightly spiral course through the annular space between the core and inner wall of the water tube in which it is placed.

In Fig. 1, the lower series of water tubes 5 are shown contracted at 12 to retard the flow of water through these tubes but retarders may consist of separate elements such as nipples, loosely fitting plugs or any other effective means for retarding the flow of water through the tubes.

In practice one or more of the upper rows will be equipped with cores 9 and one or more of the bottom rows will have retarders. The correct number of tubes so equipped will depend upon boiler conditions and will generally be determined by experiment. However, it might be beneficial under certain conditions to put cores 9 in all of the tubes of the boiler. The cores in the lower series of tubes would then act as retarders and the resulting increase in velocity of the water would sweep away the stagnant water film which tends to adhere to the walls of the tubes and thus increase the rate of heat transfer, giving greater boiler capacity and thermal efficiency.

In operation, the circulation of water is downward from the drum 1 through nipples 2, into header 3, through tubes 4 and 5 into header 6 and thence back to drum 1 through tube 7. It is well known that when the rating of a boiler is forced, the circulation in the upper tubes becomes sluggish and sometimes even reverses in direction. As a result steam tends to accumulate in these upper tubes because the circulating water has insufficient velocity to sweep it away. The accumulated steam occupies the upper part of the tubes and prevents the water from contacting and cooling that portion of the wall of the tubes which often results in burning, embrittling or blistering. Furthermore, accumulated steam often contains chemicals released from the water which cause the tubes to corrode from chemical action.

Our invention prevents this deteriorating action on the inner walls of the water tubes by presenting only a restricted annular space next to the wall of the tubes through which the circulating water must pass at relatively high veloci-

ties thus positively carrying with it the accumulated steam. This scavenging action also sweeps out the loose solids and is very effective in preventing accumulations on the inner walls of the tubes.

In practice our invention has proven to be very effective in increasing the efficiency of the boiler to a marked degree but it was also observed that a series of retarders in the tubes in the lower part of the boiler very materially increased the circulation in the upper tubes with the cores 9 in place. We therefore consider that these retarders have definite functions, not previously contemplated, when used in combination with the cores 9 in the upper tubes of the boiler.

Having thus described our invention we claim as new and desire to secure by Letters Patent:

1. In a water tube boiler, a steam generating tube in the upper section of said boiler and a steam generating tube in the lower section of said boiler, in combination with a solid core concentrically located in said steam generating tube in the upper section and water retarding means for the said steam generating tube in the lower section whereby the water flow in the said steam generating tube in the upper section is increased.

2. In a water tube boiler the combination with a plurality of steam generating tubes in the upper section of said boiler and a plurality of steam generating tubes in the lower section of said boiler, of solid cores concentrically located in the said steam generating tubes in the upper section and water retarding means in the steam generating tubes in the lower section, said water retarding means co-acting with the said solid cores to increase the velocity of the circulating water in the steam generating tubes in which said solid cores are located.

3. In a water tube boiler, the combination with a plurality of steam generating tubes in the upper section of said boiler said steam generating tubes having solid cores extending full length thereof and concentric therewith, of a plurality of steam generating tubes in the lower section of said boiler said steam generating tubes having water retarding means whereby the water flow in the first mentioned steam generating tubes with cores is accelerated.

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