Oct. 27, 1931. R. V. S. THÉRY 1,829,119

WATER TUBE BOILER

Filed Dec. 13, 1928

Fig.1.

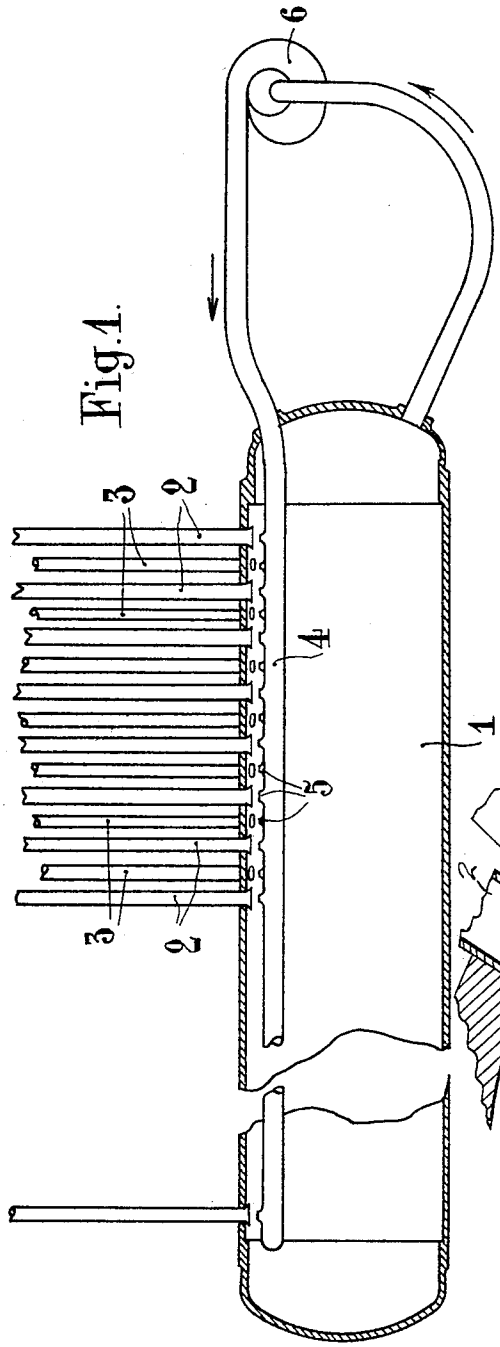
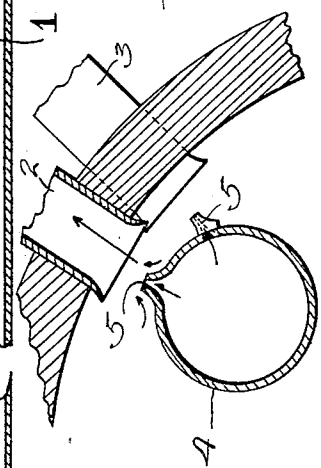


Fig.2



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UNITED STATES PATENT OFFICE

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WATER TUBE BOILER

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This invention has reference to activating an exchange of calories between liquid contained in a tube and the tube-surrounding medium; and it relates more particularly to water-tube boilers and especially those of the tubes therein that are directly exposed to fire-box radiation.

As persons skilled in the art are aware, such tubes take up a relatively considerable portion of the heat from the fire-box. Vaporization is intensive therein, and scales show a marked tendency to deposit in these parts, resulting in rapid wear. On the other hand their heat absorbing capacity is frequently limited by the formation of an insulating film of steam on their walls.

My invention has for its purpose to do away with the above set forth drawbacks.

The invention consists essentially, on the one hand, in accelerating circulation through the tubes concerned by applying an extra impulse to their water contents, and, on the other hand, in applying said impulse under pulsatory form so as to impart to the water within the tubes a jerky motion the mean velocity of which is other than zero, thereby reproducing the well known advantages that accrue to locomotives from the rail-track jolts.

In order to make my invention more clearly understood I have illustrated, as an example, an embodiment thereof and by drawings appended hereto and wherein:

Figure 1 is a view in longitudinal section of a boiler header fitted with the device according to my invention;

Figure 2 is an enlarged cross section of the same.

From the lower header 1 of the boiler starts the nest of tubes composed, in the case shown, of two rows 2 and 3 of tubes arranged respectively in quincunx fashion.

Opposite the outlet of said tubes 2 and 3, a pipe 4 is arranged within the header parallel to the axis of header 1, said pipe 4 being fitted with a multiplicity of small nipples or jets 5, each of them located in line with the axis of one of the tubes 2 or 3.

Pipe 4 is connected with the delivery side of a pump 6, the suction side of which is connected with header 1 itself (Figure 1). Said pump 6 is so designed that it will have a pulsatory forcing pressure the mean value of which is other than zero. Such pulsations may be obtained with sufficient frequency by using a rotary pump driven at suitable speed, owing to the separating action that takes place on the suction side between the pump blades and the sucked-in water loaded with steam bubbles. In fact, the velocity of the moving fluid sometimes becomes less than the speed of the pump wheel because of the viscosity or because of the resistance of the intake pipe. A plunger pump may also be used having a reduced number of cylinders and devoid of the usual pulsation-damping air reservoir.

In operation, the nipples or jets 5 do duty as injectors. The water circulation velocity through the tubes is considerably increased beyond normal circulation velocity, and this high velocity already fosters rapid steam exhaust, while increasing the absorption power of the tubes. At the same time, the pulsations caused by pump 6 maintain within the tubes of vibratory condition calculated to prevent the formation of deposits and to oppose any film formation effect (that is to say the occurence of a stagnant water or steam layer along the walls of the tube, which layer hinders heat transmission).

It may be found desirable or advantageous to control the pulsating apparatus in such manner as to further insure consonance between the pulsations thereof and those of the tubes themselves, that is, to attune the vibrations artificially produced with those inherent in the corresponding tubes.

It should be noted that the above described device in no way hinders ordinary circulation, thereby permitting the pump to be thrown out of operation at slow speeds and, on the other hand, constituting an important advantage as to safety in the event of the pump happening to be accidentally thrown out of commission in the course of operation.

I wish it to be clearly understood that my invention is not limited to the above described embodiment of a pulsatory circulation, although said embodiment has proven

advantageous on account of its simplicity and of its safety. It might, however, be replaced by any other device calculated to ensure equivalent results, or also, circulation might just be activated without any pulsations being produced.

Furthermore, although I have described my invention as applied to a water-tube boiler and more specially as applied to tubes so called "over-heating", that is to say directly exposed to fire-box radiation, it may be advantageously applied to any heat exchanger comprising tubes traversed by a liquid.

Having now particularly ascertained and described the nature of my said invention as well as the manner in which the same is to be performed, I declare that what I claim is:

1. A method of preventing scale formation and improving the operation of a water-tube boiler or like heat-exchanging apparatus, consisting in injecting jet pulsations of water into the tubes of the boiler to impart a pulsating motion to the water already in the tubes in the direction of normal circulation, such motion having a mean velocity other than zero, and the pulsations imparted to the water in the tubes being in consonance with the vibration of the tubes.

2. In a water-tube boiler or like apparatus comprising upper and lower headers, and a nest of water tubes connecting the headers and opening into the same at opposite ends; a water delivery pipe having its major portion disposed within the lower header adjacent the points where the lower ends of the tubes open thereinto, said pipe being provided with a multiplicity of nipples arranged in axial alinement with said tube ends to inject directly into them jet pulsations of water; a pump external to said header and to the delivery side of which said pipe is connected; and a supply pipe opening at one end into the header and having its other end connected to the suction side of the pump to draw water into the latter from the header when the pump is in operation, the frequency of pulsation of the pump corresponding with the natural period of vibration of the tubes to prevent the formation of scale deposit within the tubes.

In testimony whereof I affix my signature.

RENÉ VICTOR STANISLAS THÉRY.