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A. HUET

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WATER TUBE BOILER

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Fig. 1.

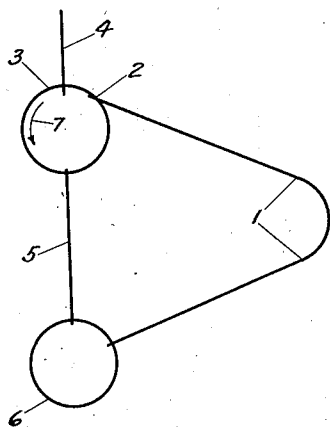


Fig. 2.

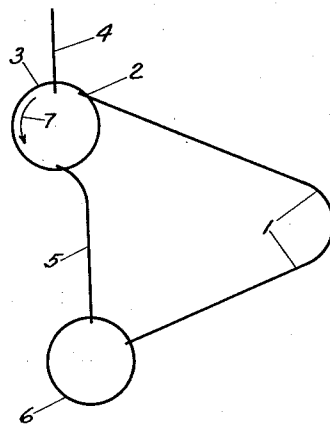
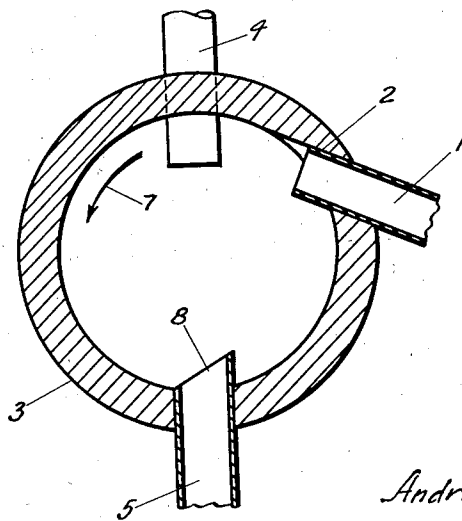


Fig. 3.



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WATER TUBE BOILER

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4 Claims. (Cl. 122-488)

The present invention has for its object an improvement in water tube boilers either directly heated or indirectly heated by a primary closed circuit and comprising separator headers into which the evaporation tubes open discharging into it a mixture of steam and water.

In boilers of this type it is important that the steam and water should be separated from each other as quickly as possible after they leave the vaporizing tubes, the steam, as dry as possible, following its normal path while the water re-enters the evaporation circuit.

This rapid and complete separation is necessary for two reasons. On the one hand it is desirable to have the steam as dry as possible whether it is to be utilized directly or whether, as in the case of the boiler with a primary closed circuit, it is to be condensed in a condenser bundle giving up its latent heat of vaporization to produce the steam for use. On the other hand the fact that the water in the return tubes is free from steam bubbles gives to the descending column a maximum density which is favorable to the greatest velocity of circulation of the water in the evaporating bundle in accordance with the principle of Archimedes.

The improvement according to the present invention consists essentially in giving to the separating drums a circular or approximately circular section, in having the evaporating tubes open into the upper part of the section approximately in a direction tangential to the inner wall of these drums, in arranging the tubes by which the steam leaves at about the highest point of the drums but so that their inlets are below the jet of mixed steam and water entering from the vaporizing tubes, and finally in arranging the return tubes for the water at the lower part of the drum and in shaping them so that the water after having followed the inner wall of the drum by a circular movement shall have the tendency to enter the return tubes in the most direct manner and so to re-enter the evaporating circuit.

This improvement has not only the desirable features mentioned above but further has the result of conserving as far as possible in the water leaving the vaporizing tube the speed and kinetic energy which it has acquired, thereby increasing the velocity of circulation and enhancing vaporization.

These advantages of the invention are particularly noticeable in the case of boilers heated by a primary closed circuit in which the volume of steam is small compared with the volume of

water and in which the circulation is due only to a thermosiphon effect.

The description which will now be given and which will refer to the attached drawing exemplifying the invention will make clear how the invention can be practically carried out.

Fig. 1 is a diagrammatic representation of a portion of a steam generator embodying the invention. Fig. 2 is a similar view of a variation. Fig. 3 shows on an enlarged scale a transverse section of drum or header 3 of Fig. 1.

In Fig. 1 the evaporating bank of tubes is made up of one or more rows of tubes 1 opening at 2 into the separator header 3, whence the steam leaves by one or more tubes 4 while the water which has been separated out from the steam in the header 3 flows downward through the tube or tubes 5 and, either through a drum 6 or directly, re-enters the evaporating bank made up of the tubes 1.

As will be best seen in Fig. 3 the evaporating tubes 1 open at 2 into the drum 3 tangentially to the upper part of the inner wall of the header. As a result the steam escaping from the tubes and the water carried with it, arriving with a certain speed, are thrown into a circulatory movement along the wall in the direction indicated by the arrow 7. The water being denser follows the wall due to its surface tension and to centrifugal force. The steam, being less dense, tends to separate from the water and to collect in the central part of the header.

The tubes 4 through which the steam is to escape are arranged vertically or approximately so and extend through the highest portion of the drum. They open into the drum at a point such that neither the jet of mixed steam and water nor the layer of water circulating along the drum wall can enter them. As a result, pure steam is collected by the tubes 4.

The return tubes 5 for the water, vertical or approximately so are arranged in the lower part of the drum. Their ends 8 may have a straight section on a level with the internal wall of the drum but preferably are cut off diagonally, the sloping openings being so placed that the water arriving in the direction indicated by the arrow 7 impinges on this sloping side and immediately enters the tubes 5 which therefore will contain nothing but water without steam.

In Fig. 2, which shows a variation of the invention, the return water tube 5 is curved adjacent to the drum 3 in such a way as to open tangentially to the inner lower wall of the drum so that the water whirling in the drum enters directly

and without shock into the tube 5. In this case the end of the tube 5 may be less oblique or may even be cut off square.

Preferably the ends of the tubes 1 and 5 shown in the drawing will be in the same vertical plane while the ends of the tubes 4 will be in other planes, for example, midway between the vertical planes containing the several ends 1 and 5.

The sloping end shown at 8 of Fig. 3 for the extremity of tube 5 may be extended and completed in such a way as to increase the tendency of the water separated from the steam to enter most directly into the tube 5. For example, the lips of the sloping end 8 may be spread to form a crescent and the spread portions of one tube may even extend to contact with those from the adjacent tubes so that the water will be directed positively into the tubes 5.

Obviously, modifications in detail may be made in the invention without departing from its spirit. For example, invention may be applied to the case where a boiler has several headers 3 and these may be arranged in any fashion.

What I claim is:

1. In apparatus of the class described the combination of a horizontal drum, a set of alined spaced tubes opening into the drum at one side adjacent to the top tangentially to the drum to discharge a mixture of steam and water into the drum, a plurality of tubes extending into the drum at its highest point and opening at points removed from the wall of the drum, said last named tubes being out of alinement with the tubes of the first-named set, and a plurality of tubes opening into the lower part of the drum at points in alinement with the tubes of the first-named set of tubes, their openings being

directed to face the current of the mixture discharged from the first-named set of tubes.

2. In a water tube boiler, the combination of a steam and water drum forming part of a closed boiler circulation system, steam generating tubes arranged to discharge a steam and water mixture tangentially into the drum thereby causing a rotary motion of the drum contents, return water tubes opening from the drum and having their ends cut off at an angle to their axes with the opening thus formed facing the rotating water, and tubes extending into the drum to a point away from the walls to convey steam away from the drum.

3. In a vapor generator, a vapor generating section, a substantially cylindrical separation chamber, said chamber having a tangential inlet opening and a tangential outlet opening, said inlet and outlet openings entering the chamber at opposite directions with respect to the flow of fluid in said chamber, an uptake connection for conveying a liquid and vapor mixture from the generating section to said inlet opening, and a downtake connection for returning the separated liquid to the generating section.

4. In a water tube boiler the combination of a horizontal steam and water drum forming part of a closed boiler circulation system, steam generating tubes arranged to discharge a steam and water mixture tangentially into the drum near its top thereby causing a rotary motion of the drum contents, return water tubes opening from the drum near its lower side, and tubes extending into the drum to a point removed from the walls to convey steam from the drum.

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