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A. HUET

1,938,700

INDIRECTLY HEATED BOILER

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FIG. 1.

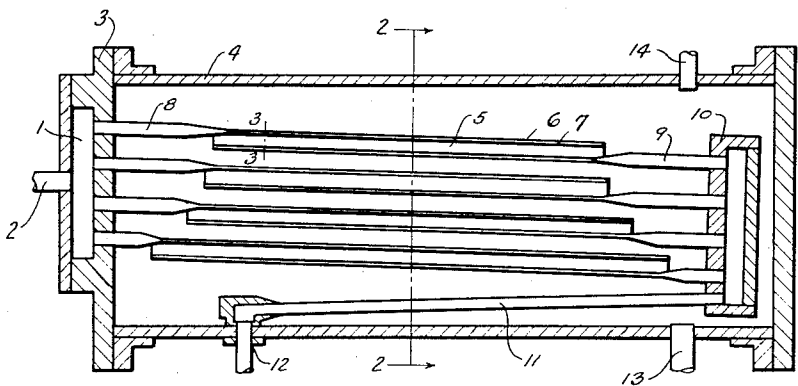


FIG. 2.

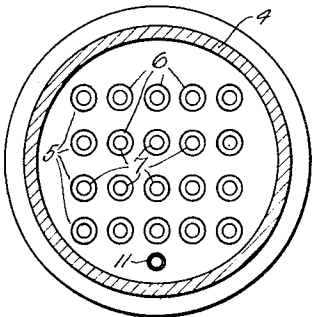
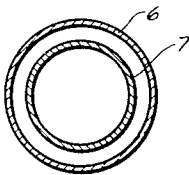


FIG. 3.



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INDIRECTLY HEATED BOILER

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and in France April 16, 1932

4 Claims. (Cl. 257—237)

The present invention has for its object to provide a vaporizing tube bundle particularly for use in boilers with primary closed circuits, that is, in boilers with indirect heating. The new feature in this vaporizer bundle resides in the fact that each of its elements is formed of two tubes placed one inside the other in such a manner that an annular space remains between them which is traversed by the heating or primary fluid, these elements being immersed in the fluid which is to be vaporized and with which they are therefore in contact both by their internal and by their external wall. Moreover these elements are so arranged as to impart to the secondary fluid, that is, the fluid which is to be vaporized, an active and turbulent circulation movement or at any rate to favor such a movement whereby new surfaces are continually presented to this medium for contact and for heat exchange.

Preferably this condition is obtained by having the annular portions of the ends of the elements arranged in stepped form, this arrangement being advantageously combined with an inclination of the said annular parts in the proper direction; this inclination, while enhancing the circulation of the secondary fluid, being at the same time helpful to the disengagement of the vapor produced.

The description which follows and which refers to the annexed drawing exemplifying the invention will make clear one way in which the invention may be put into practice.

In this drawing Fig. 1 is an axial longitudinal section of a cylindrical boiler drum with a primary closed circuit equipped with a vaporizing bundle according to the present invention;

Fig. 2 is a transverse section on line 2—2 of Fig. 1;

Fig. 3 is a transverse section on a larger scale of an annular element on line 3—3 of Fig. 1.

The auxiliary heating or primary fluid, which may be the vapor of water, is carried to the inlet header 1 by a connection 2. In the form shown in the drawing, the header 1 is formed in one of the ends 3 of the cylindrical drum 4 containing the fluid to be vaporized and the vaporizing bundle. But obviously some other provision may be adopted.

The vaporizing bundle comprises tubular elements 5 of annular cross-section, each being formed of two concentric tubes 6 and 7, the annular space between them being closed at either end, where the tubes are connected to each other.

Each element 5 is connected at one of its ends to the header 1 by a tube 8.

The other end of each element 5 is connected in a similar manner by means of a tube 9 to header 10 in which the primary fluid collects after being condensed.

A suitable pitch is given to the elements 5 so that the primary fluid which has condensed flows easily and rapidly toward the collector 10 from which it is then carried off by a pipe 11 communicating with the exterior of the drum 4 at 12. The inclination of the tubes 5 at the same time lets the vapor of the secondary fluid which is formed in the interior of the elements 5 escape easily at the upper end.

A particularly favorable arrangement is that shown in Figs. 1 and 2 wherein each horizontal row of elements 5 has an annular part shorter than that of the row below it and the ends of the annular parts of each row are both stepped back from the ends of the row next below it.

In this manner the available space between the upper ends of the elements and the end of the cylindrical drum 4 increases from the bottom toward the top so that as the volume of the vapor of the heated fluid delivered from the upper ends of the elements increases, the available space also increases. At the same time the free space at the opposite end between the tubes 9 also decreases from top toward bottom in the same ratio as the quantity of secondary liquid flowing toward the inlet ends of the tubes diminishes. This flow is induced by the ascending movement of the mixture of liquid and vapor in the center of the elements 5, the liquid flowing downward from the surface to begin again its circuit along the heating surfaces of the vaporizing bundle. Under these two combined actions of first the upward motion of the secondary mixture (liquid and vapor) in the center of the elements 5 and between the connecting tubes 8 and secondly the descending motion between the connecting tubes 9 of the fluid whose flow is induced by the heating and vaporizing action of the elements 5, a continual circulation is established in a definite direction which enhances the heat transfer and the efficiency of the device.

The secondary fluid which is to be vaporized is delivered into the drum by means of the connection 13.

The steam formed is preferably taken off above the connecting tubes 9 where the water level is lowest because of the energetic down-flow of the auxiliary liquid always occurring in this region. The driest possible steam is obtained in this way.

It is understood that modifications can be made in the manner of carrying out the inven-

tion just described without departing from its spirit.

What I claim is:

1. In apparatus of the class described wherein
5 one fluid flows in heat exchanging relation to but out of contact with another fluid, a bank of tubular elements slightly inclined to the horizontal, each of said tubular elements comprising two co-axially arranged tubes, the elements being progressively shorter toward the top, and inlet and outlet connections to and from the annular space between the two tubes of each tubular element.
2. In apparatus of the class described wherein
15 one fluid flows in heat exchanging relation to but out of contact with another fluid, a bank of tubular elements slightly inclined to the horizontal and arranged in a series of vertically spaced horizontal rows, each of said tubular elements comprising two co-axially arranged tubes, the elements of each row being shorter than those of the row next below it, and inlet and outlet connections to and from the annular space between the two tubes of each tubular element.
- 25 3. In apparatus of the class described wherein one fluid flows in heat exchanging relation to but out of contact with another fluid, a bank of

tubular elements slightly inclined to the horizontal and arranged in a series of vertically spaced horizontal rows, each of said tubular elements comprising two co-axially arranged tubes, the elements of each row being shorter than those of the row next below it, both ends of each row being stepped back with respect to the ends of the row next below it, and inlet and outlet connections to and from the annular space between the two tubes of each tubular element.

4. In apparatus of the class described, and in combination, a horizontal drum, a bank of tubular elements slightly inclined to the horizontal and arranged in a plurality of vertically spaced horizontal rows, each of said elements comprising two co-axially arranged tubes, the elements of each row being shorter than those of the row next below it, both ends of each row being stepped back with respect to those of the row next below it, headers opposite the ends of the tubular elements and at right angles to the axes of the tubes, inlet pipes for heating vapor connecting the header opposite the upper end of the bank to the annular spaces, and outlet pipes for condensate connecting the header opposite the lower end of the bank to the annular spaces.

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