March 20, 1934. E. A. DOERR 1,951,752

BOILER ECONOMIZER

Filed June 3, 1933 2 Sheets-Sheet 1

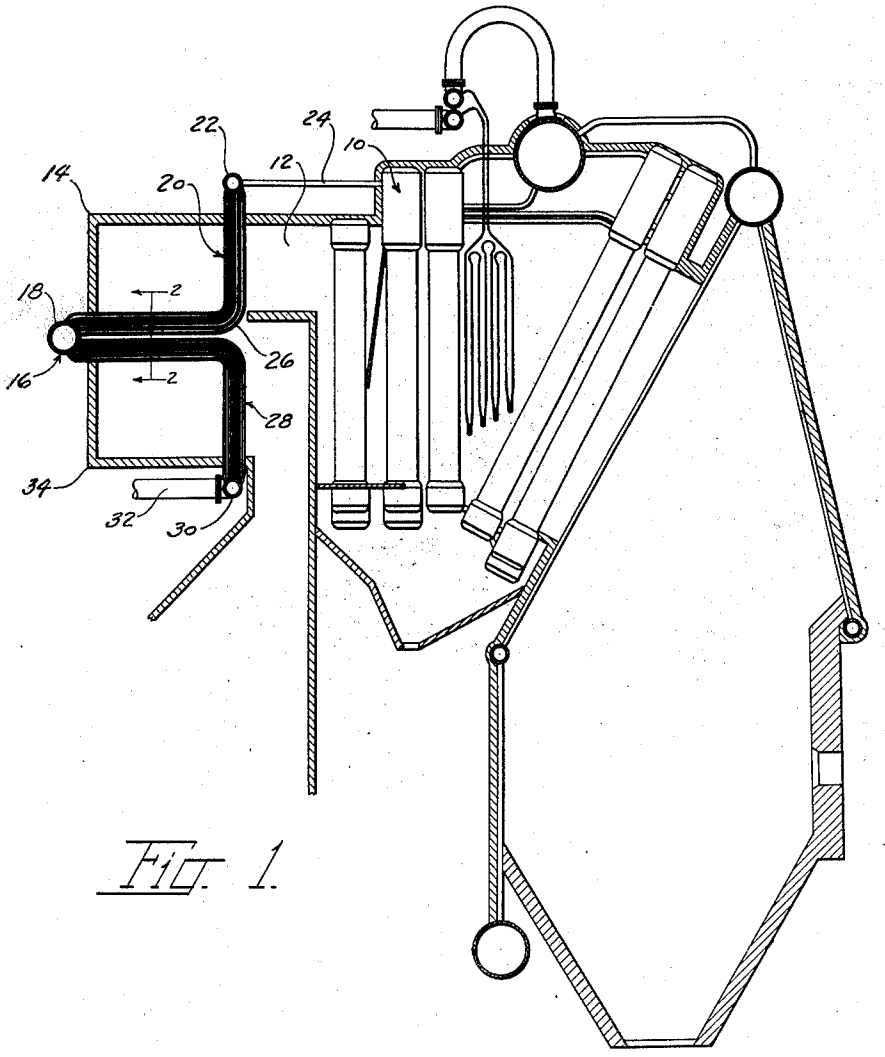


Fig. 1.

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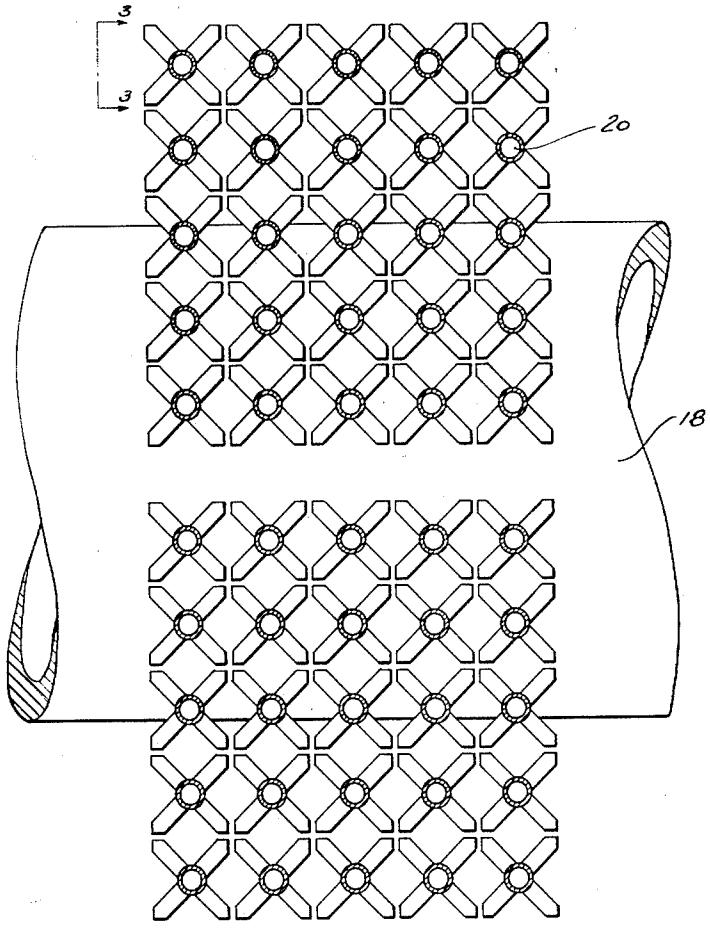


Fig. 2.

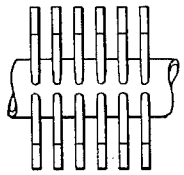


Fig. 3.

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BOILER ECONOMIZER

Edward A. Doerr, Toledo, Ohio

Application June 3, 1933, Serial No. 674,179

3 Claims. (Cl. 257—220)

My invention relates to fluid heaters.

Heaters or economizers are in common use for preheating feed water for boilers. It is the principal object of my invention to provide a type of heater well adapted for this purpose and possessing a variety of advantages over the ordinary form of economizer. However, I do not limit the use of my invention to the field of economizers.

In order that my invention, together with its objects and advantages, may be fully and readily understood, I will now describe in detail and in connection with the accompanying drawings, an economizer arrangement within my invention. In the drawings,

Fig. 1 is a sectional elevation through a boiler having an economizer connected thereto.

Fig. 2 is a section of a tube bundle along the line 2—2 of Fig. 1 looking in the direction of the arrows.

Fig. 3 is a fragmentary view of a portion of one of the tubes shown in Fig. 2.

The arrangement illustrated in Fig. 1 comprises a boiler 10 of known type having an outlet or offtake flue 12 for furnace gases which have passed the boiler surface. The offtake flue 12 is shown as having a portion leading off in a horizontal direction and then turning at right angles to its initial direction to form a vertical portion. The angle in the flue 12 is indicated at 14. For preheating feed water and for further abstracting heat from the gases, I have provided an economizer 16 which includes a header 18 and an L-shaped tube bundle 20 which connects the header 18 with the header 22. A pipe 24 is provided also for conducting fluid from header 22 into the boiler proper. The tubes of bundle 20 are shown as parallel and of small diameter so that the fluid passing therethrough is divided into a large number of small streams. Each of the tubes in bundle 20 has a horizontal portion and a vertical portion so that the bundle as a whole has an angle at 26 diagonally across the flue 12 from the angle 14 in the wall of the flue. Fluid to be heated therefore flows into the horizontal portion of bundle 20 from header 18 and out of the vertical portion of the bundle 20 to header 22. Further, as will be seen, the bundle 20 is so arranged that its vertical portion lies substantially at right angles to the horizontal portion of flue 12 and its horizontal portion lies substantially at right angles to the vertical portion of flue 12, the gases flowing first across the outlet leg and then across the inlet leg of the bundle. The bend in the offtake flue 12 therefore lies within the tube bundle 20 so as to economize space and head room, an angle such as that shown at 14 being a common feature in offtake flues to connect the flue up to either an economizer or an air heater.

It is a common practice at present to provide the tubes of economizers with means increasing or extending their outer surfaces as compared to their inner surfaces. In Figs. 2 and 3, I have illustrated portions of the economizer shown in Fig. 1 on an enlarged scale so as to show the adaptability of my arrangement to the use of extended surfaces. However, I do not limit myself to tubes having extended surfaces, the particular arrangement of extended surfaces illustrated being merely that now preferred by me but forming no part of my invention.

In the arrangement shown in Fig. 1, moreover, I have illustrated a second tube bundle 28 having an inlet header 30 and an inlet pipe 32 for conducting fluid to the header 30. Tube bundle 28 is arranged so as to conduct the fluid from header 30 into header 18. Tube bundle 28 is similar to tube bundle 20, the tubes in the bundle 28 merely being inverted as compared to those in bundle 20, so that header 30 lies directly beneath header 22. Tube bundle 28 likewise has a horizontal portion and a vertical portion, the horizontal portion of tube bundle 28 lying across the vertical portion of the flue 12 adjacent the horizontal portion of tube bundle 20. If tube bundle 28 is employed, however, it necessitates the use of a second angle 34 in the casing of the flue 12 so as to provide a second horizontal portion of such flue in which the gases travel at right angles to the vertical portion of tube bundle 28. I do not, however, limit myself to employing two tube bundles of the type illustrated, as I may use either one tube bundle or more than two as desired. Moreover, I may employ one or more tube bundles such as those employed in the economizer 16 in connection with an economizer having units of ordinary form or in connection with an air heater.

An economizer having the L-shaped tube bundle illustrated and described herein possesses a number of advantages as compared to the ordinary economizer arrangement. The tube bundle of such shape cannot become steam bound and therefore it is adapted for use as part of a steaming economizer and can supply water to the boiler at any desired temperature. Moreover, the L-shaped tube bundle provides a maximum of flexibility and expansion, a small depth of section allowing easy cleaning and inspection,

and is adaptable to low headroom. By using tubes of small diameter the L-shaped tube bundle results in a low construction weight, provides more contact surface for water and therefore less dead center water, and reduces the difficulty of maintaining tight joints because of less change in diameter of the tubes with changes in temperature caused by changing temperatures of water and gases. Furthermore, one leg of the L-shaped bundle may be made longer than the other thereby providing a gas channel whose cross section converges in the direction of gas flow to remain the gas velocities constant through the economizer.

What I claim is:

1. A heater having a tube bundle two portions of which form a pronounced angle, and means for directing a stream of heating gases first across one portion of said bundle and then across the other and approximately at right angles to the lengths of the two tubes of such portions.

2. The combination of a gas flue having a pronounced angle therein and a fluid heater having a tube bundle extending twice across such flue and forming a pronounced angle lying diagonally opposite said angle of the flue.

3. An economizer having a substantially L-shaped tube bundle arranged with one leg horizontal and the other vertical, means for passing feed water into the said horizontal leg and out of said vertical leg, and means for conducting heating gases first across the vertical leg of said bundle and then across the horizontal leg thereof.

EDWARD A. DOERR.