April 3, 1945. W. F. KEENAN, JR., ET AL 2,372,675

HEAT EXCHANGE DEVICE

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Fig. 1.

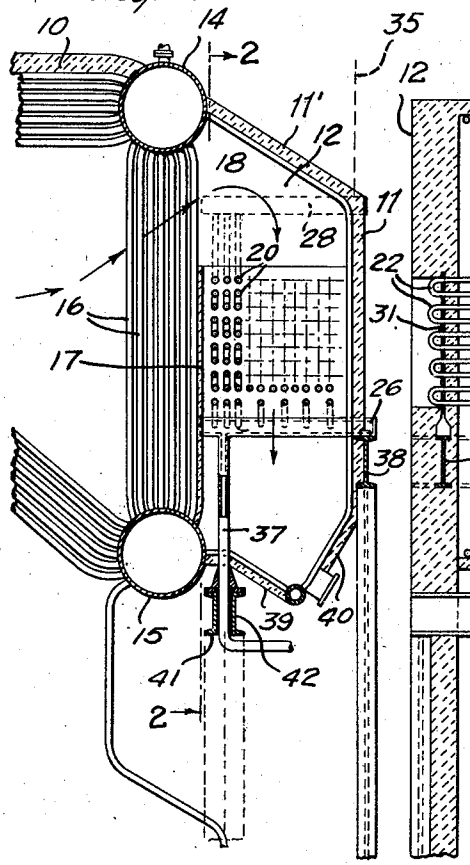


Fig. 2.

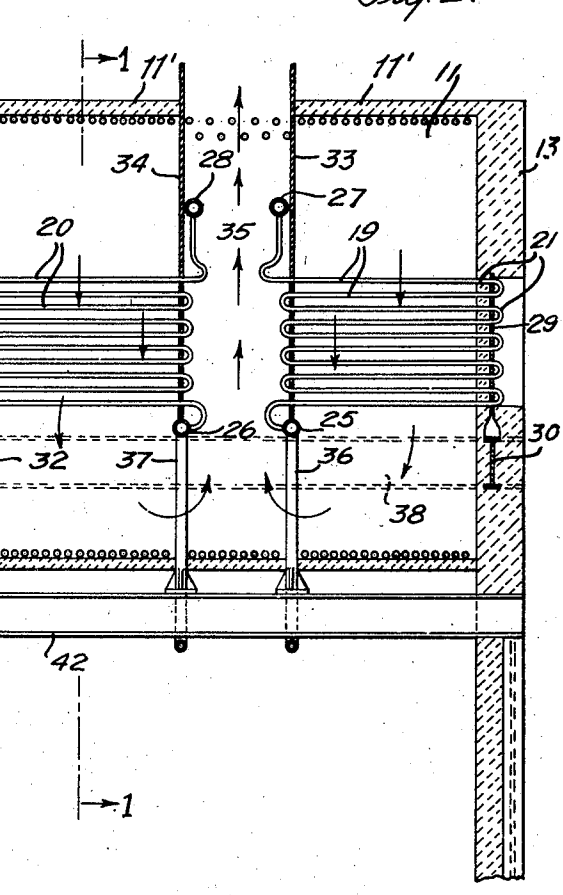
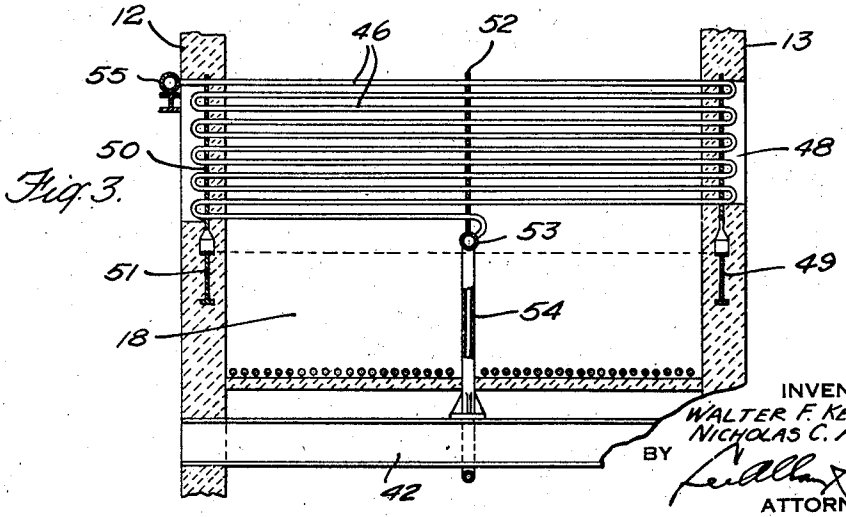


Fig. 3.



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HEAT EXCHANGE DEVICE

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7 Claims. (Cl. 257—230)

This invention relates to heat exchange devices used for the recovery of heat from furnace gases or the like, and more particularly pertains to economizers for steam boilers, although the invention is capable of more general application in the heating of vapors or liquids.

In high pressure steam generators of modern design in which the exit temperature of the furnace gases leaving the boiler may be as high as 1100° or 1200° F., the economizer is a much more important factor than it is in units operating at lower pressures and temperatures, and from a more or less auxiliary heat recovery device, the economizer has become a major part of high pressure steam generating units. Consequently its weight and size have increased materially, and owing to space limitations, it is often housed within the boiler setting. Due to various considerations which enter into the proportioning and arrangement of a high pressure unit, economizers now operate at much higher average gas temperatures than formerly. This frequently involves difficulties in the support of the economizer in a compactly designed unit. Since it is not practical to attempt to distribute the weight of an economizer on the boiler tubes on account of excessive stresses on the tube joints, independent means of support must be provided, which under present conditions would ordinarily require the use of special alloy steel, or artificially air-cooled girders or beams suitable for withstanding the prevailing high temperatures. Both of these supporting means are costly or otherwise undesirable.

It is the object of this invention to provide a suitable and inexpensive supporting means for economizers or other heat exchange devices operating under the conditions described.

The invention will be understood from the following description considered in connection with the accompanying drawing forming a part thereof, and in which:

Fig. 1 is a transverse vertical sectional view illustrating more or less diagrammatically, an embodiment of the invention;

Fig. 2 is a longitudinal vertical sectional view taken on line 2—2 of Fig. 1, and

Fig. 3 is a longitudinal vertical sectional view illustrating more or less diagrammatically, another form of the invention.

Like characters of reference refer to the same or to like parts in the several views.

Referring to the drawing, particularly to Figs. 1 and 2, reference character 10 designates generally the setting of a steam generator having a rear wall 11 and side walls 12 and 13. The generator has an upper drum 14 and a lower drum 15, the drums being connected by a bank of vertically disposed steam generating tubes 16. A vertical baffle 17 extends upwardly from the lower drum 15 along the outermost row of the tubes 16 to a point short of the upper drum. A horizontally inclined roof portion 11' extends from the upper drum 14 to the rear wall 11, and forms with the walls 11, 12 and 13, a chamber or duct 18. Within this chamber are spaced economizer sections 19 and 20, comprising respectively, banks of horizontally disposed return bend tubes 21 and 22. The lowermost row of tubes of each of the economizer sections 19 and 20 is connected respectively, to horizontal feed water inlet headers 25 and 26, while the uppermost row of tubes of each section is connected respectively to horizontal outlet headers 27 and 28. The ends of tubes 21, which are adjacent the side wall 13 are supported by a plate 29 which in turn is supported on a steel girder 30 in the wall 13. The ends of the tubes 22 adjacent the side wall 12 are similarly supported by a plate 31 which rests upon a steel girder 32 in the wall. The inner ends of the tubes of each section 21 and 22 are supported by plates 33 and 34 respectively which define the side walls of a gas outlet duct or flue 35 between the economizer sections. Plate 33 rests upon and is supported by the inlet header 25, and the plate 34 rests upon and is supported by the inlet header 26. The inner end of each of the headers 25 and 26 is supported by a vertical feed water inlet pipe 36 and 37 respectively, while the outer end of each of these headers is supported on a steel girder 38 in wall 11. Chamber 18 has a hopper bottom formed by the inclined floor portions 39 and 40, through which the feed pipes 36 and 37 extend and beneath which they are supported by steel girders 41 and 42 extending between the setting walls 12 and 13.

In operation, gases from the furnace of the boiler are directed upwardly by the baffle 17, enter the upper portion of the chamber or duct 18, and flow downwardly in two parallel streams over the tubes of the economizer sections. In the lower portion of chamber 18 the gas streams turn inwardly from the side walls and flow upwardly through the outlet flue 35 to other heat recovery devices, or to a stack, neither of which is shown. Although the inlet feed pipes 36 and 37, which carry a substantial part of the weight of the economizer sections, are exposed to high temperature gases, due to the fact that they are part of the water circuit, they are cooled adequately and

thus are enabled to withstand the high temperature operating conditions to which they may be subjected. The structural steel supporting the outer ends of the economizer sections is not directly exposed to the furnace gases.

In the form of the invention shown in Fig. 3, the economizer comprises a single section of relatively long horizontal return bend tubes 46, which extend entirely across the duct 18 between the walls 12 and 13. A plate 48 which is supported by steel girder 49 in wall 13 supports the tubes 46 at one end, while at the other end the tubes are supported by plate 50 carried by the girder 51 in wall 12. The intermediate portions of the tubes of the economizer are supported by a plate 52 which rests on horizontal inlet header 53 carried by vertical feed water inlet pipe 54 which is supported by outside steel girders 41 and 42. The top row of tubes is connected to an outlet header 55. As in the form disclosed, the supporting member which carries a substantial portion of the weight of the economizer and is directly exposed to the heat of the furnace gases passing over the tubes, is a part of the water circuit of the unit, and therefore is cooled adequately.

Since changes may be made in the form, location and arrangement of the several parts of the apparatus illustrated without departing from the principles of the invention, it will be understood that the invention is not to be limited excepting by the scope of the appended claims.

What is claimed is:

1. Heat exchange apparatus comprising a fluid conduct, a heat exchange device having surface thereof disposed in the conduit, a substantially vertically disposed tubular column positioned below the device providing support therefor and for supplying fluid thereto, said column passing through a wall of the conduit, and means outside of the conduit for supporting the column.

2. Heat exchange apparatus comprising a fluid conduit, a heat exchange device having a plurality of tubes, a header below the device, to which the tubes are connected, means for supporting the tubes, said tube supporting means being supported by the header, a substantially vertically disposed tubular column below the header connected thereto for providing support for the header and for supplying fluid thereto, said tubular column passing through a wall of the conduit, and means outside of the conduit for supporting the tubular column.

3. Heat exchange apparatus comprising a fluid conduit, a heat exchange device having a plurality of tubes, a header below the device, to which the tubes are connected, means for supporting the tubes adjacent one end portion thereof, said tube supporting means being supported by the header, a substantially vertically disposed tubular column below the header connected thereto for providing support for the header and for supplying fluid thereto, said tubular column passing through a wall of the conduit, and means outside of the conduit for supporting the tubular column.

4. Heat exchange apparatus comprising a fluid conduit, a heat exchange device having a group of tubes constructed and arranged for flow of fluid therethrough, a header to which the group is connected, means for supporting the group of tubes adjacent the opposite end portions thereof, supporting means for supporting said tube group intermediate the end portions thereof, said intermediate tube supporting means being supported by the header, a substantially vertically disposed tubular column below the header connected thereto for providing support for the header and for supplying fluid thereto, said tubular column passing through a wall of the conduit, and means outside of the conduit for supporting the tubular column.

5. Heat exchange apparatus comprising walls forming a fluid conduit, a heat exchange device having plurality of tubes, means for supporting one end portion of the tubes on one of said walls, a header below the device to which the tubes are connected, a plate through which another portion of the tubes extends, said plate being supported by the header, a substantially vertically disposed tubular column below the header connected thereto for providing support for the header and for supplying fluid thereto, said tubular column passing through a wall of the conduit, and means outside of the conduit for supporting the tubular column.

6. An economizer for a vapor generator having a combustion gas conduit through which gases flow subsequent to their passage over the vapor generating surface of said generator, said economizer comprising a bank of substantially horizontally extending tubes disposed in the conduit and constructed and arranged for flow of fluid therethrough, a header for the economizer below the bank of tubes to which the tubes of the bank are connected, a substantially vertically extending plate through which the tubes extend for supporting the tubes, said plate being supported by the header, a substantially vertically disposed tubular column communicating with the interior of the header and extending downwardly therefrom for providing a support for the header and for supplying feed water to the header and to the economizer, said tubular column passing through a wall of the gas conduit, and means outside of the conduit for supporting the tubular column.

7. An economizer for a vapor generator having a combustion gas conduit through which gases flow subsequent to their passage over the vapor generating surface of said generator, said economizer comprising a bank of substantially horizontally extending tubes disposed in the conduit and constructed and arranged for flow of fluid therethrough, a substantially horizontally extending header for the economizer below the bank of tubes to which the tubes of the bank are connected, the axes of the tubes and the header being substantially at right angles to each other, one end of the header extending through a wall of the conduit, means outside the conduit for supporting said one end of the header, a substantially vertically disposed tubular column communicating with the interior of the header and extending downwardly therefrom for providing a support for the header within the gas conduit and for supplying feed water to the header and to the economizer, said tubular column passing through a wall of the conduit, means for supporting the tubes, said tube supporting means being supported by the header, and means outside the conduit for supporting the tubular column.

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