

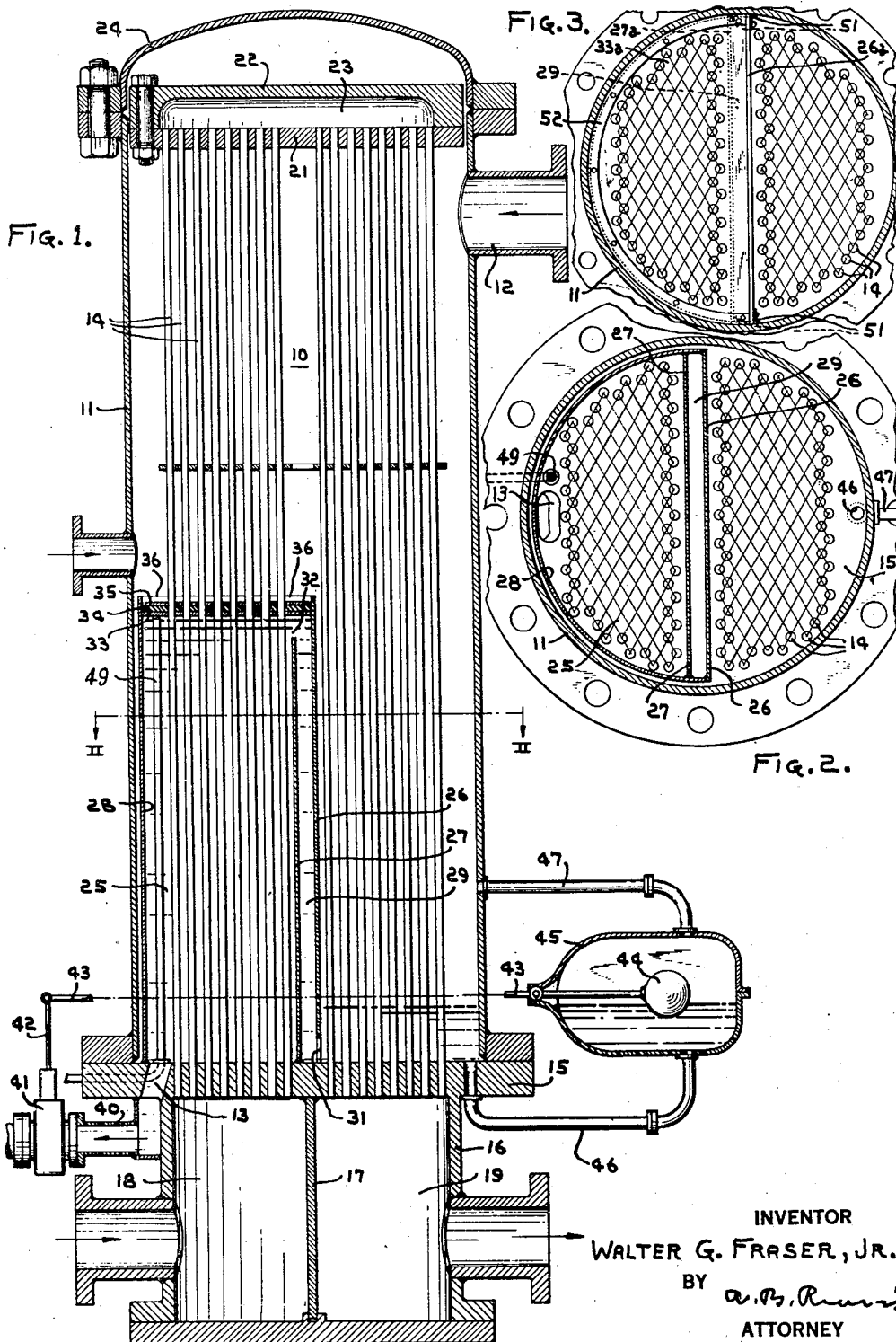
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HEAT EXCHANGE APPARATUS

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HEAT EXCHANGE APPARATUS

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This invention relates to heat exchangers, more particularly to heat exchangers wherein provision is made for subcooling the condensate, and it has for an object the provision of improved apparatus of this character.

The trend in high-pressure heater practice is to use a subcooling section for increasing the heat recovery from the bled steam and thus reduce the quantity of steam required. The subcooler should be confined to the first water pass, but the amount of surface required is normally very much less than the surface in this pass. While baffle structure may be provided to segregate as much of the first pass surface as is required for subcooling duty, generally this is not satisfactory, as only part of the feedwater is thus utilized for subcooling and the rise in temperature of the feedwater in the subcooler is thus increased, with a resultant penalty on the mean temperature difference between the cooling water and the condensate in this section. This, of course, increases the amount of surface required in both the subcooling and the condensing sections.

Hence, the most economical arrangement is to partition off the required part of the first pass nearest to the inlet tube plate for use as a subcooling section.

Where the feedwater heater is of the vertical type, it is proposed to partition off the coolest portion of the tubes of the first water pass (it being assumed that the water enters at the bottom of the heater) and to collect the condensate at the lowest portion of the condensing section and then to direct this condensate to the upper portion of the separated subcooling section by conduit means provided within the heat exchanger, thereby avoiding the necessity of providing the usual external hot well and piping heretofore relied upon for conveying condensate from the condensing section to the subcooler.

In order to obtain maximum heat transfer between the condensate and the tubes of the subcooler, it is necessary to maintain relatively rapid flow of condensate past the tube surfaces and such rate of flow can be obtained best by the presence of a sufficient pressure differential between the condensing section and the exit of the subcooling section. It will be apparent that leakage of steam from the condensing section to the subcooling section would result in decrease of this pressure differential, and any such leakage should be avoided. Therefore, it is an object of this invention to provide a suitable water seal between the condensing and subcooling sections, particularly at the point where the tubes pass

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from the subcooling section into the condensing section.

Yet another object of the invention is to provide a vertical heat exchanger with subcooler in which the usual external hot well and piping therefrom to the subcooler are eliminated.

These and other objects are effected by the invention as will be apparent from the following description and claims taken in connection with the accompanying drawing, forming a part of this application, in which:

Fig. 1 is a longitudinal sectional view of a heat exchanger embodying the present invention;

Fig. 2 is a transverse sectional view taken along the line II—II of Fig. 1, looking in the direction of the arrows; and,

Fig. 3 is a view similar to Fig. 2, but showing a modification of the invention.

Referring now to the drawing more in detail, there is shown, at 10, a heat exchanger of the vertical type comprising a shell 11 having an exhaust steam inlet 12 and a condensate outlet 13. A plurality of tubes 14 extend vertically within the shell 11 and have their lower terminal portions extending through and supported by a bottom tube plate 15 which serves to close the lower end of the shell. A waterbox 16 is associated with the tube plate 15 and it contains a transverse partition 17 dividing the space within the waterbox into an inlet chamber 18 and an outlet chamber 19. The upper terminal portions of the tubes extend through and are supported by an upper tube plate 21 having associated therewith a cover 22, the plate and cover providing a reversing chamber 23 which, in cooperation with the divided waterbox 16, provides for circulation of water through the tubes 14 in two passes. The upper end of the shell 11 may be closed in any suitable manner, as by the cover 24. The space surrounding the cold ends of the tubes of the first water pass is separated from the remaining space within the heat exchanger by a pair of vertical transversely-extending partitions 26 and 27 and a semi-cylindrical partition 28 cooperating therewith. The vertical partitions 26 and 27 are spaced apart to provide therebetween a conduit 29 communicating at the bottom, at 31, with the lowest portion of the condensing section of the heat exchanger and at the top, at 32, with the upper portion of the subcooling section 25.

The top of the subcooler is closed by a horizontal partition 33 upon which rests a sheet of packing material 34 held in place by a plate 35. It will be noted that the partition structure 33, 34 and 35 is positioned slightly below the upper

edge of the partitions 26 and 28 so that there is provided an upwardly projecting dam member 36 adapted to retain on the horizontal partition a layer of condensate falling thereon from the condensing portions of the tubes of the first water pass.

To maintain the subcooling section flooded at all times, the condensate discharge conduit 46 is provided with valve means 41 controlled through suitable linkage 42 and 43 to respond to change in position of a float member 44 disposed within the housing 45, the latter being in communication with the condensate collection space of the heat exchanger through conduits 46 and 47.

Any suitable vent means, such as the tube 49, serves to maintain the subcooler free from accumulations of gases.

In Fig. 3, which is a view similar to Fig. 2 but taken at a slightly higher plane and looking down upon the top of the subcooling section, there is shown a modification of the partition structure defining the subcooling section. In this arrangement, the vertically-disposed transverse baffles 26a and 27a extend the full width of the shell and are sealed in respect to the side walls of the latter by suitable means, such as the laminated metallic seals 51. Likewise, the horizontal baffle 33a extends to the side walls of the shell and is sealed with respect thereto by a similar seal 52, this arrangement permitting omission of the semi-cylindrical partition 28.

While the invention has been shown in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications without departing from the spirit thereof, and it is desired, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What is claimed is:

1. A heat exchanger comprising a vertically-disposed shell having a steam inlet and a condensate outlet, a plurality of tubes extending vertically of said shell, waterbox structure associated with said tubes and providing for circulation of water through the latter in a plurality of passes, and means segregating a section of the heat exchanger which includes the condensate outlet and the cold ends of the tubes of the first water pass from the remainder of the heat exchanger to define a subcooler, said means including a pair of vertical partitions arranged in spaced substantially parallel relation to define therebetween a vertical passageway communicating at the bottom with the lowest portion of the heat exchanger condensing space and communicating at the top with the interior of the subcooler for flow of condensate from the condensing space to the subcooler interiorly of the shell.

2. Structure as specified in claim 1, including valve means controlling discharge of condensate through the condensate outlet from the subcooler and including means for opening and closing the

valve when the level of condensate in the condensing space of the heat exchanger rises or falls, respectively, with respect to the point of communication of the vertical passageway with the condensing space.

3. A heat exchanger comprising a vertically-disposed shell having a steam inlet and a condensate outlet; a plurality of tubes extending longitudinally of said shell; a tube plate closing the lower end of the shell; waterbox structure associated with said tubes and tube plate and providing for circulation of water through the tubes in a plurality of passes; means dividing the space within the shell into a condensing section and a subcooling section, the latter including the condensate outlet and the cold ends of the tubes of the first water pass; said means comprising a vertical partition surrounding the subcooling section and having sealing engagement at its lower edge with the tube plate, and a horizontal partition having sealing engagement with the upper end of the vertical partition and closing the subcooling section; and means providing a conduit for flow of condensate from the lowermost portion of the condensing section to the uppermost portion of the subcooling section.

4. Structure as specified in claim 3, wherein the tubes of the first water pass extend through the horizontal partition, and the upper edge of the vertical partition extends above the horizontal partition to form a dam for maintaining the latter covered with condensate to provide a liquid seal thereon.

5. A heat exchanger comprising a vertically-disposed shell having a steam inlet and a condensate outlet; a plurality of tubes extending longitudinally of said shell; a tube plate closing the lower end of the shell; waterbox structure associated with said tubes and tube plate and providing for circulation of water through the tubes in a plurality of passes; means dividing the space within the shell into a condensing section and a subcooling section, the latter including the condensate outlet and the cold ends of the tubes of the first water pass; said means comprising a vertical partition structure having sealing engagement at its side edges and bottom edge with the shell and the tube plate, respectively, and a horizontal partition having sealing engagement with the shell and the upper end of the vertical partition structure; and means providing a passage for flow of condensate from the lowermost portion of the condensing section to the uppermost portion of the subcooling section.

6. Structure as specified in claim 5, wherein the tubes of the first water pass extend through the horizontal partition, and the upper edge of the vertical partition structure extends above the horizontal partition to provide a dam for maintaining the latter covered with condensate to form a liquid seal thereon.

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