

Jan. 25, 1944.

L. H. MORRIS

2,340,138

HEAT EXCHANGER

Filed Dec. 31, 1941

Fig. 1.

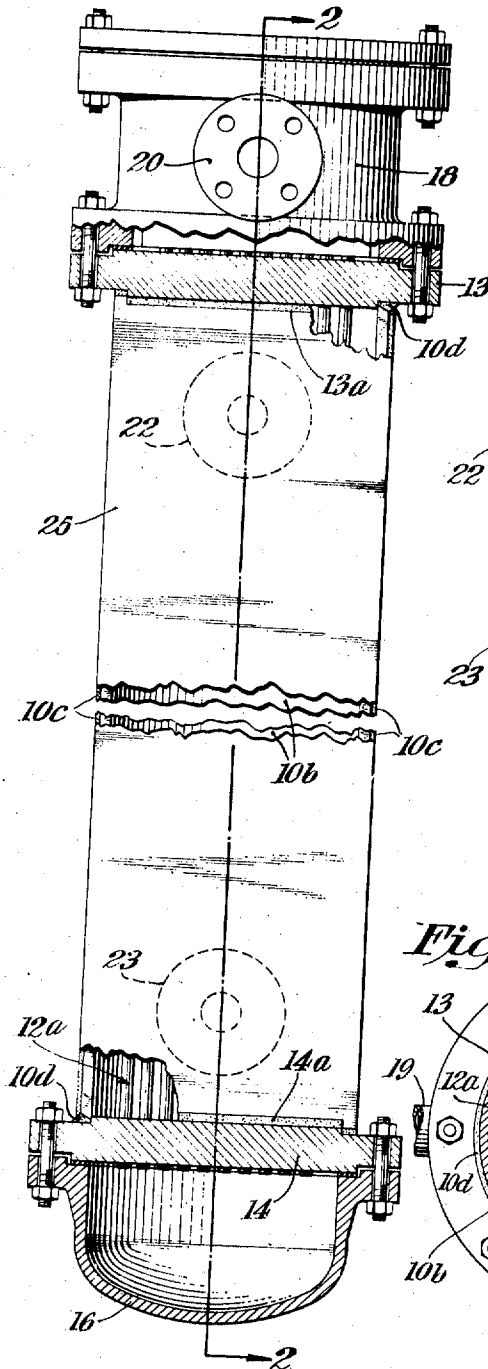


Fig. 2.

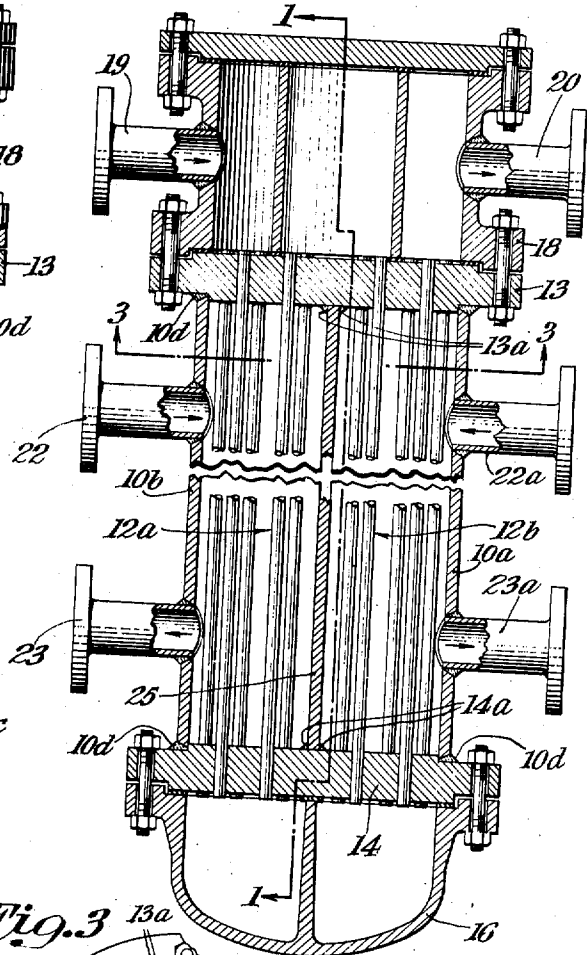
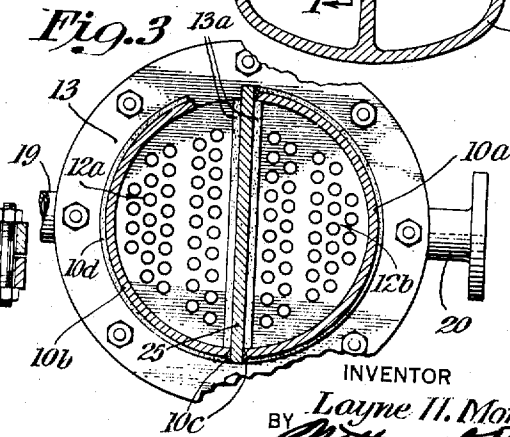


Fig. 3.



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HEAT EXCHANGER

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Application December 31, 1941, Serial No. 425,041

5 Claims. (Cl. 257-223)

This invention relates to improvements in heat exchangers of the shell and tube type and particularly to an improved internal baffle construction therefor.

The heat exchange efficiency of a shell and tube type heat exchanger can be substantially improved by providing more nearly true countercurrent flow between the fluid outside of the tubes and the fluid inside of the tubes and by preventing the undesired bypassing or leakage of the liquid around the baffle in order that high velocities can be obtained. It has been customary to use longitudinally extending transverse baffles to subdivide the tube bundle into groups of tubes so that the desired flow of fluid can be accomplished. The problem of sealing the baffle within the shell to prevent bypassing of the external fluid between its inlet and outlet presents considerable difficulty, however, and the many forms of mechanical expanding devices proposed to provide an effective seal between the edge of the baffle and the shell wall have proved to be very complicated and difficult to adjust because of the relatively great length and the relatively small diameter of the customary heat exchanger shell. On the other hand, internal welding of the baffle to the shell wall is limited to shells of relatively large diameter or relatively short length.

It is an object of my invention to provide a simplified internal baffle construction for a vessel such as a shell and tube type heat exchanger.

Another object of my invention is to provide a shell and tube type heat exchanger with a longitudinal baffle which extends entirely across the shell and through the wall thereof and which is sealed thereto as by welding from the exterior of the shell. The welding operation is thereby more easily accomplished, and the resulting weld is subject to a more thorough inspection.

It is a particular object of my invention to provide a shell and tube type heat exchanger having a bifurcated tube bundle and a longitudinal baffle extending between the two tube groups of the tube bundle and being integrally secured to the tube sheets, such baffle being externally secured to the shell, whereby a simplified, improved construction is obtained.

A still further object of my invention is to provide an improved method of welding or otherwise securing a longitudinal baffle in the shell of a shell and tube type heat exchanger wherein the baffle is first welded to the tube sheets to assure adequate strength and to provide adequate inspection, and thereafter semi-cylindrical

shell sections are welded both to the tube sheets and to the baffle to complete the unit.

Further objects and advantages of my invention will appear from the following description of a preferred form of embodiment thereof taken in connection with the attached drawing illustrative thereof, in which:

Fig. 1 is an elongated view, with parts in section and parts broken away, taken along the line 1-1 of Fig. 2 and showing one form of embodiment of my improved heat exchanger construction;

Fig. 2 is a vertical sectional view taken substantially along the line 2-2 of Fig. 1;

Fig. 3 is a horizontal sectional view taken substantially along the line 3-3 of Fig. 2.

The heat exchanger generally shown in the drawing includes a shell, in which is mounted a tube bundle. This shell is preferably a cylindrical member although my invention is equally applicable to heat exchanger shells of other shapes. In the form of embodiment shown, the tube bundle is bifurcated and consists of two groups of tubes generally indicated at 12a and 12b. These two groups of tubes are secured at their ends to the tube sheets 13 and 14. The tube sheet 14 is provided with the tube sheet cover 16, which is secured thereto in any manner well known to the art, and the other tube sheet 13 is suitably secured to the flanges of channel 18.

Channel 18 is provided with inlet and outlet nozzles 19 and 20, by means of which a fluid may be circulated through the tubes of the tube bundle. The shell is similarly provided with inlet and outlet nozzles 22 and 23 so that a second fluid can be passed over the outside surface of the tubes in heat exchange relation with the first fluid in a manner well known to the art. If desired, independent fluids may be circulated on each side of the baffle 25 by using the additional nozzles 22a and 23a.

My particular invention relates more specifically to the provision of a simplified longitudinal baffle, generally indicated at 25, and the manner in which such a baffle is secured to the shell. A baffle of this type is required if countercurrent flow or high velocity flow of the heat exchanging fluids is desired; but its construction must be such as to prevent the external fluid from bypassing. It is my particular desire to provide a construction that assures a tight joint between the edges of the baffle and the wall of the shell, yet is simple to construct, will require no maintenance, and is permanently tight.

In accordance with my invention, I first weld

the end edges of the baffle 25 to the respective tube sheets 13 and 14 along the lines 13a and 14a. Such welds can be completely inspected at the time they are made, and thereafter will be permanently tight. Such welding fixes the size of the tube bundle.

As a second operation, I preferably attach substantially semi-cylindrical shell members 10a and 10b to the longitudinal edges of the baffle 25 and to the peripheral edges of the tube sheets 13 and 14. The longitudinal welds are indicated at 10c and the circumferential welds at 10d. Each of these joints can be made from the outside with the desired penetration, and the shell becomes complete with a fully welded interior.

The resulting shell construction comprises a unit that is structurally stronger than one provided with the customary internal baffle, and it is considerably simpler and more economical to fabricate. Bypassing of the external fluid is completely avoided, although, if desired, a transverse flow can be provided by a suitable aperture in the baffle and the elimination of nozzles 23 and 23a.

It will be appreciated that more than one baffle may be inserted into a single heat exchanger shell in accordance with my invention. When a plurality of baffles is desired, one may be placed on a diameter of the shell and the others on chords thereof, or all may be placed on chords of the shell. Generally, any desired division of the tube bundle into groups is possible, and one or more baffles may be fixed in position in accord with the tube arrangement selected. Preferably, the baffle or baffles are arranged in planes at right angles to the axes of nozzles 22 and 23.

While I have shown and described a preferred form of embodiment of my invention, I am aware that modifications may be made thereto; and I, therefore, desire a broad interpretation of my invention within the scope and spirit of the description herein and of the claims appended hereinafter.

I claim:

1. A heat exchanger of the shell and tube type comprising a tube bundle including tube sheets spaced along the tubes, a channel member at the outer face of each of said tube sheets, a longitudinal baffle plate between said sheets and dividing the tubes of the bundle into groups and welded continuously along its opposite end edges to the inner faces of the respective tube sheets, and a straight tubular shell formed of transversely opposed approximately semi-cylindrical sections at the opposite faces of the baffle plate, with the longitudinal edges of the plate between the longitudinal edges of the different shell sections and with said shell edges welded continuously therealong to the margins of said longitudinal edges of the baffle plate from tube sheet to tube sheet and with the opposite end edges of the shell sections welded continuously therearound to the inner faces of the tube sheets respectively, said welding of the baffle plate along its longitudinal edges and its end edges forming a continuous seal for the plate entirely around the plate contour, the longitudinal edges of the plate being substantially flush with the periphery of the shell, and the tube sheets being larger than said periphery to provide them with projecting margins for attachment of said channel members thereto.

2. A heat exchanger of the shell and tube type comprising a tube bundle including tube sheets

spaced along the tube, a channel member at the outer face of each of said tube sheets, a longitudinal baffle plate between said sheets and dividing the tubes of the bundle into groups and welded continuously along its opposite end edges to the inner faces of the respective tube sheets, and a straight tubular shell formed of transversely opposed longitudinal sections at the opposite faces of the baffle plate, with the longitudinal edges of the latter between longitudinal edges of the different shell sections and with said shell edges welded continuously therealong to the margins of said longitudinal edges of the baffle plate from tube sheet to tube sheet and with the opposite end edges of the shell sections welded continuously therearound to the inner faces of the tube sheets respectively, said welding of the baffle plate along its longitudinal edges and its end edges forming a continuous seal for the plate entirely around the plate contour, and the tube sheets being larger than the periphery of the shell to provide them with projecting margins for attachment of said channel members thereto.

3. A heat exchanger of the shell and tube type comprising a tube bundle including a tube sheet, a channel member at the outer face of said tube sheet, a longitudinal baffle plate dividing the tubes of said bundle into groups and welded continuously along one of its end edges to the inner face of said tube sheet, and a straight tubular shell formed of transversely opposed approximately semi-cylindrical sections at the opposite faces of the baffle plate, with the longitudinal edges of the latter between the longitudinal edges of the different shell sections and with said shell edges welded continuously therealong to the margins of said longitudinal edges of the baffle plate, and with the edges of said sections at one end of the shell welded continuously therearound to the inner face of said tube sheet, said welding of the baffle plate along its longitudinal edges and along said end edge thereof forming a continuous seal, the longitudinal edges of the baffle plate being substantially flush with the periphery of the shell, and the tube sheet being larger than said periphery to provide the sheet with said projecting margin for attachment of a channel member thereto.

4. A heat exchanger of the shell and tube type comprising a tube bundle including tube sheets spaced along the tubes, a channel member at the outer face of each of said tube sheet, a solid longitudinal baffle plate between said sheets and dividing the tubes of the bundle into groups, welds extending continuously along the opposite end edges of said plate and securing and sealing said edges to the respective tube sheets, a straight tubular shell formed of transversely opposed approximately semi-cylindrical sections at the opposite faces of said plate and each having a fluid inlet nozzle and a fluid outlet nozzle, the longitudinal edges of said plate extending between the opposed longitudinal edges of the different shell sections, penetration welds extending continuously along the full length of said shell edges and substantially the full thickness of said edges and securing and sealing them to said plate, said welds along the longitudinal edges and the end edges of the plate forming a continuous seal between the plate and the shell sections and the plate and the tube sheets, and said seal extending entirely around the plate contour, and welds securing and sealing the end edges of the shell

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sections to the inner faces of the tube sheets entirely around the periphery of the shell, the tube sheets being larger than said periphery to provide them with projecting margins for attachment of said channel members thereto.

5. A heat exchanger of the shell and tube type comprising a tube bundle including a tube sheet, a channel member at the outer face of said tube sheet, a longitudinal baffle plate extending longitudinally into said bundle between tubes thereof and welded continuously along one of its end edges to the inner face of said tube sheet, a straight tubular shell formed of a pair of transversely opposed longitudinal sections at the opposite faces of the baffle plate, with the longitudinal edge margins of the latter between the longitudinal edges of said opposed shell sections,

penetration welds extending substantially the full thickness of said shell sections and extending continuously along said edge margins of the baffle plate and securing and sealing said edges of the shell sections to said plate margins at both faces of the plate, said welds along the longitudinal edges of the plate forming a continuous seal with the welding along said end edge of the plate, and welding securing and sealing the edges of said sections at one end of the shell continuously therearound to the inner face of said tube sheet, the tube sheet being larger than the periphery of the shell to provide the sheet with a projecting margin for attachment of said channel member thereto.

LAYNE H. MORRIS.

7- 223
CERTIFICATE OF CORRECTION.

Patent No. 2,340,138.

January 25, 1944.

LAYNE H. MORRIS.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, second column, line 8, for the word "elongated" read --elevational--; page 2, second column, line 1, claim 2, for "tube" read --tubes--; line 47, claim 3, for "said" after "with" read --a--; line 48, same claim, for "a channel" read --said channel--; line 53, claim 3, for "sheet" read --sheets--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 18th day of April, A. D. 1944.

Leslie Frazer

(Seal)

Acting Commissioner of Patents.

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sections to the inner faces of the tube sheets entirely around the periphery of the shell, the tube sheets being larger than said periphery to provide them with projecting margins for attachment of said channel members thereto.

5. A heat exchanger of the shell and tube type comprising a tube bundle including a tube sheet, a channel member at the outer face of said tube sheet, a longitudinal baffle plate extending longitudinally into said bundle between tubes thereof and welded continuously along one of its end edges to the inner face of said tube sheet, a straight tubular shell formed of a pair of transversely opposed longitudinal sections at the opposite faces of the baffle plate, with the longitudinal edge margins of the latter between the longitudinal edges of said opposed shell sections,

penetration welds extending substantially the full thickness of said shell sections and extending continuously along said edge margins of the baffle plate and securing and sealing said edges of the shell sections to said plate margins at both faces of the plate, said welds along the longitudinal edges of the plate forming a continuous seal with the welding along said end edge of the plate, and welding securing and sealing the edges of said sections at one end of the shell continuously therearound to the inner face of said tube sheet, the tube sheet being larger than the periphery of the shell to provide the sheet with a projecting margin for attachment of said channel member thereto.

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