Nov. 30, 1943. F. D. BERKELEY ET AL 2,335,479

BAFFLE

Filed Oct. 17, 1941

Fig. 1.

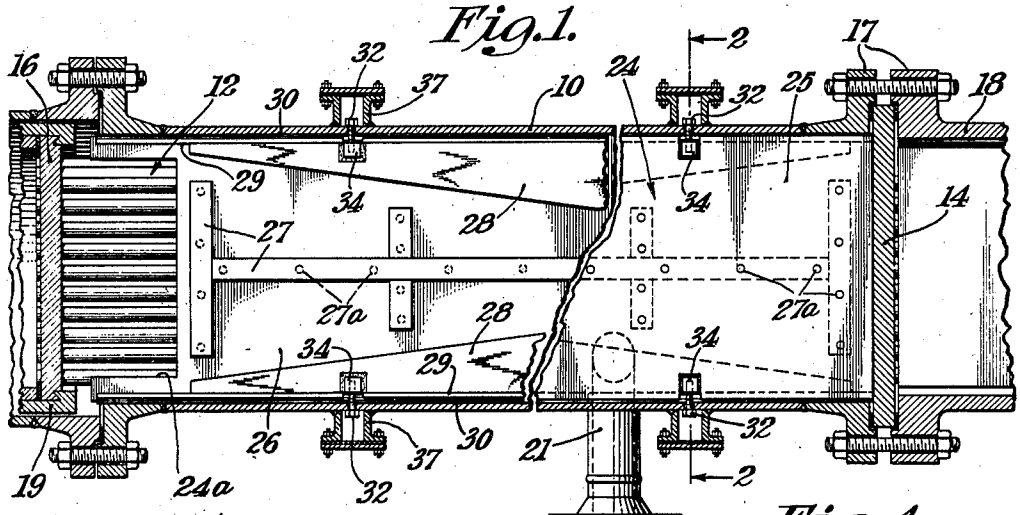


Fig. 5.

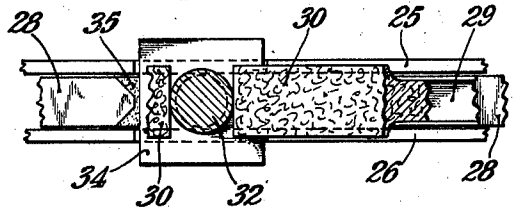


Fig. 4.

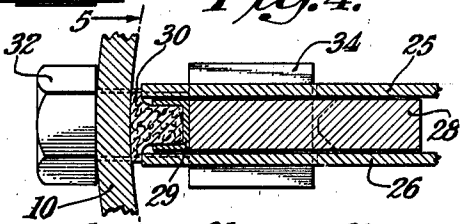


Fig. 3.

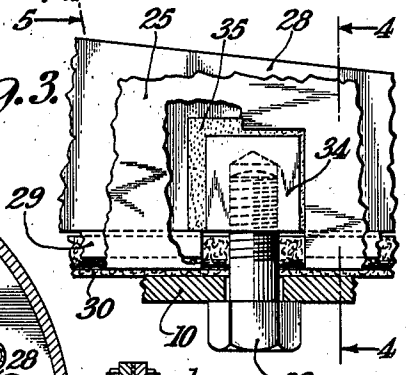
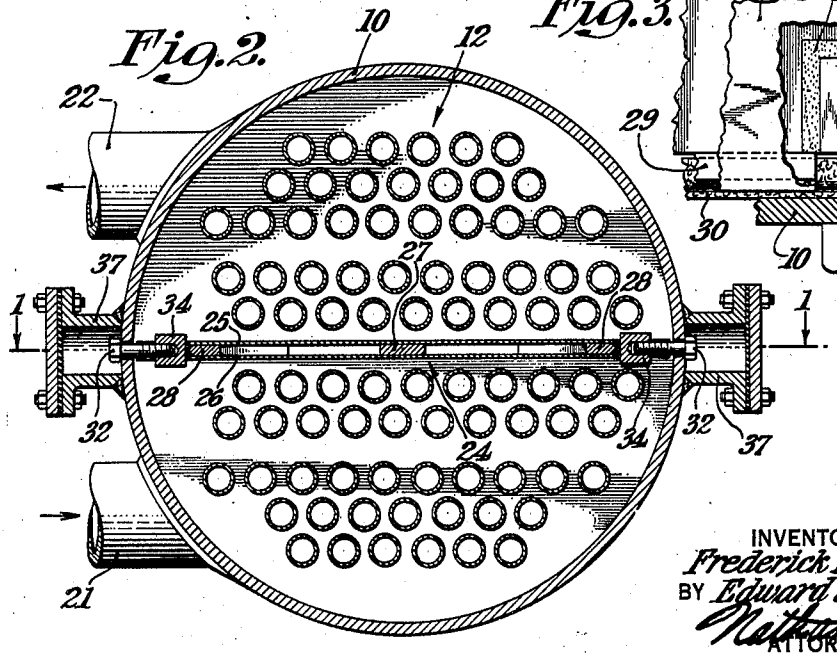


Fig. 2.



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BAFFLE

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Application October 17, 1941, Serial No. 415,368

8 Claims. (Cl. 257—239)

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

It is well known that heat exchangers of the shell and tube type are arranged for the interchange of heat between one fluid within the tubes and a second fluid external of the tubes but within the shell. Heretofore, various types of baffles extending longitudinally of the shell have been provided to more nearly obtain true countercurrent flow of the two fluids and to increase the distance of flow of the external fluid between the inlet and the outlet; and numerous patents have been granted for various types of mechanical devices for assisting in sealing the joint between the edges of the baffle and the wall of the shell. Many of these devices, however, are inefficient and permit objectionable by-passing of the external fluid from inlet to outlet, and all have proved to be complicated and expensive.

It is the principal object of our present invention to provide a simplified construction for assuring a leak-proof joint between a longitudinal baffle and the interior of the shell and tube heat exchanger, which construction is without mechanical complications and requires the minimum of shell modification.

More specifically, we provide simplified means for drawing a gasket carried by a longitudinal baffle in a shell and tube heat exchanger to the shell wall, which means are operated from the exterior of the shell but in such a positive manner that tightness can be obtained to the desired degree.

Another object of the invention is to provide a removable longitudinal baffle for a shell and tube type heat exchanger in which the body portion of the baffle extends substantially across the shell body and is provided with movable marginal sealing gaskets in sealed relation with the baffle and movable into sealed relation with the shell wall by external positively actuated members.

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

Fig. 1 is a substantially horizontal cross-section taken substantially along the line 1—1 of Fig. 2, with parts broken away, showing the internal construction of a heat exchanger provided with our improved baffle;

Fig. 2 is a substantially vertical cross-section taken on the line 2—2 of Fig. 1;

Fig. 3 is a plan view, with parts broken away, of a detail of the securing mechanism as would appear from an enlargement of a section taken at the left hand side of Fig. 1;

Fig. 4 is a cross-section taken substantially along the line 4—4 of Fig. 3; and

Fig. 5 is an end view, with parts broken away, taken substantially along the line 5—5 of Fig. 4 showing the arrangement of the packing.

In accordance with our invention, the heat exchanger shell 10 is generally a cylindrical member (although the construction will be equally as effective with any other closed shape) containing a tube bundle, generally indicated at 12, consisting of a plurality of tubes which at one end are suitably anchored in the fixed tube sheet 14 and at the other end are fixed to the floating tube sheet 16. As is well understood in the art, the fixed tube sheet 14 is generally secured between flanges 17 on the shell and on the channel 18, and the floating tube sheet 16 is provided with the floating tube sheet cover 19 secured in any suitable or preferred manner thereto.

Although the openings to the channel 18 are not shown, it is to be understood that a flow of liquid takes place through the tubes in the tube bundle 12 and that heat is exchanged with such liquid by the passage of a second fluid across the outside surface of the tubes. This object is accomplished by circulation of the second fluid through the inlet and outlet nozzles 21 and 22. It is the purpose of the longitudinal baffle, generally indicated at 24, to provide the desired flow of the external fluid and at the same time to prevent the by-pass of the external fluid between the nozzles 21 and 22 in the passage of such fluid from one end of the tube bundle to the other.

The baffle 24 is thus to be understood to be a longitudinally extending baffle which, for the purpose of our invention, is also removable in order that the tube bundle can be removed from the shell for cleaning and for repair. It is not necessary, however, that the baffle 24 be located at the major diameter or greatest width of the shell; for, if desired, more than one baffle may be used in the same manner, and they may readily be spaced from the plane of the greatest width of the shell.

In accordance with our invention, the baffle 24 preferably comprises two face plates 25 and 26 which are constructed of relatively thin gage sheet material and which are suitably spaced from each other by means of a central spacer bar 27 that is suitably welded or otherwise secured to the respective face plates as at 27a. The baffle 24 is arranged to engage the inside of the fixed

tube sheet 14 and is suitably cut away at 24a at the opposite end to provide for the flow of the external fluid.

Although the baffle 24 is normally the full width which can be permitted in the shell, it is necessary to have adequate clearance for the removal and insertion of the baffle in the shell. This clearance need not be very great although the larger it is, the easier and quicker the parts may be assembled. It has been found, however, that even a clearance of one-quarter of an inch along the length of the shell on each edge of the baffle is so great as to allow enough by-passing of fluid between inlet and outlet as to substantially nullify the effect of the baffle. A considerably higher heat exchange efficiency can be obtained if substantially all by-passing of the fluid is prevented.

We prevent this by-passing and effectively seal the baffle to the shell by providing on each side of the baffle along the length thereof a sealing bar or yoke 28 which abuts against a channel-shaped gasket-carrying element 29 as shown in Fig. 4. The yoke and channel extend between the respective plates 25 and 26 of the baffle 24, and a packing 30 secured in the channel 29 as by any suitable means extends outwardly thereof. As hereinafter described, the packing 30 is forced against the inner wall of the shell 10 for the desired seal.

The yoke 28 is preferably drawn toward the wall 10 of the shell in accordance with our invention by means of suitable studs 32 extending through suitable apertures in the shell wall. These studs engage in blocks 34 which are suitably welded or otherwise secured as at 35 to the yoke 28. At the respective locations of the studs 32, the plates 25 and 26 are cut away so that the block 34 may be of a sufficiently large size to permit tapping for the studs 32. The packing 30 extends up over the block 34, however, and nearly reaches the shank of the studs 32 so that there is little or no possible space through which the external fluid can by-pass.

Inasmuch as a similar yoke is provided on each of the respective sides of the baffle 24, by appropriate spacing of the studs 32, it is possible to apply an effective pressure on each of the channels 29 carrying the packing 30 to accomplish the desired seal. The yoke may be slightly triangular in shape to afford a good beam structure.

Both yoke 28 and channel member 29 are made relatively tightly fitting with respect to face plates 25 and 26. In this manner a substantially leak-proof construction is provided, and the channel member 29 is brought into substantially leak-proof relation with respect to the longitudinal edge of the baffle as pressure is applied to the yoke 28 through studs 32. At the same time the packing is brought into liquid-tight contact with shell 10 by reason of the outward movement of yoke 28.

We find it desirable to surround the stud openings in the shell with suitable nozzles generally indicated at 37 in order to prevent external leakage of the heat exchange fluid. These nozzles are provided with the usual caps or plates so that, after adjustment of the baffle is made, the nozzles can be hermetically closed to avoid any leaks. It will be understood that the studs 32 are inserted to the desired point in the heat exchanger shell; and then, by screwing down on the studs, the yoke is drawn outward until the seal has been completed.

With such a construction there are no parts that can be objectionably disturbed by changes of temperature within the shell, and there are no complicated mechanisms to become out of order; and effective sealing is readily accomplished and permanently retained. The baffle may be readily unsealed, however, by removing the studs, and then the baffle can be removed from the shell.

While we have shown and described a preferred form of embodiment of our invention, we are aware that modifications may be made therein; and we, therefore, desire a broad interpretation of our invention within the spirit of the description herein and of the claims appended hereinafter.

We claim:

1. In a heat exchanger having a longitudinal tube-containing shell, a longitudinal baffle dividing the interior of said shell, packing along the longitudinal edges of said baffle and engaging the inner longitudinal wall of the shell to form a seal between the baffle and said wall, backing bars for said packing borne by the baffle for shifting transversely relatively to the latter toward and from said wall, and draw devices anchored to said bars at points spaced along the latter, said wall having apertures spaced along said baffle edges for reach of said draw devices therethrough to the exterior of the shell and said draw devices being operable at the exterior of the exchanger for drawing and holding said backing bars outward to force and hold the packing against the shell wall, said draw devices being also operable from the exterior of the exchanger for disconnection from the backing bars and withdrawal outward through said apertures to thereby release the baffle for endwise withdrawal from the shell.

2. In a heat exchanger having a longitudinal tube-containing shell, a longitudinal baffle dividing the interior of said shell, packing along the longitudinal edges of said baffle and engaging the inner wall longitudinal of the shell to form a seal between the baffle and said wall, backing bars for said packing borne by the baffle for shifting transversely relatively to the latter toward and from said wall, draw devices anchored to said bars at points spaced along the latter, said wall having apertures spaced along said baffle edges for reach of said draw devices therethrough to the exterior of the shell and said draw devices being operable at the exterior of the exchanger for drawing and holding said backing bars outward to force and hold the packing against the shell wall, and releasable closure means at the exterior of the shell to cover said apertures and the outer portions of said draw devices and prevent leakage from the shell, said draw devices being also operable at the exterior of the exchanger for disconnection from the backing bars and withdrawal through said apertures to thereby release the baffle for endwise withdrawal from the shell.

3. In a heat exchanger having a shell, a baffle within said shell, packing to seal said baffle along an edge thereof to an opposed wall of the shell, a backing member for said packing borne by the baffle to shift relatively to the latter toward and from said wall, and a draw device anchored to said backing member, said shell wall having an aperture in direct opposition to said edge of the baffle for reach of said draw device therethrough to the exterior of the shell and the draw device being operable from the exterior of the exchanger to draw and hold said backing member outward

and thereby force and hold the packing against the shell wall.

4. In a heat exchanger having a shell, a baffle within said shell, packing to seal said baffle along an edge thereof to an opposed wall of the shell, a backing member for said packing borne by the baffle to shift relatively to the latter toward and from said wall and having a screw-threaded bore opening through said edge of the baffle and toward said wall, the wall having an aperture aligning with said bore, and a screw having a head outside of the shell to bear against an abutment at the exterior of the shell and a shank extending through said aperture and screw-engaged with said bore, whereby said backing member is advanceable outward to force and hold said packing against the shell wall by turning said screw from the exterior of the shell.

5. In a heat exchanger having a shell, a baffle within said shell, packing to seal said baffle along an edge thereof to an opposed wall of the shell, a backing member for said packing borne by the baffle to shift relatively to the latter toward and from said wall and having a screw-threaded bore opening through said edge and toward said wall, the wall having an aperture aligning with said bore, and a screw having a head outside of the shell to bear against an abutment at the exterior of the shell and a shank extending through said aperture and screw-engaged with said bore, whereby said backing member is advanceable outward to force and hold said packing against the shell wall by turning said screw from the exterior of the shell, a nozzle borne by said shell at the exterior thereof and surrounding said aperture and said screw head, and a releasable closure for said nozzle.

6. In a heat exchanger having a tubular shell, a longitudinal baffle within said shell and comprising a pair of parallel plates secured in spaced relation, channel members closely and shiftably fitted between said plates and extending along opposite longitudinal edges of the latter and opening laterally toward the inner longitudinal wall of the shell, packing fitted in said channel members and engaging said shell wall to effect seals between said baffle edges and wall, backing beams disposed between said plates and located back of said channel members respectively and each bodily and tiltably movable in the plane of the baffle, each of said beams having a pair of screw-threaded bores spaced therealong and opening through the respective one of said edges and toward the shell wall, and the wall having apertures aligning with said bores, and bolts having heads outside of the exchanger to engage an abutment at the exterior of the shell and shanks extending inward through said apertures and screw-engaged with said bores, whereby said packing is advanceable outward to force and hold it against the shell wall by turning said screws from the exterior of the exchanger and whereby said bolts are operable at the exterior of the exchanger for disconnection from the said beams and withdrawal outward through said apertures to free the baffle for endwise withdrawal from the shell.

7. In a heat exchanger unit including a longitudinal fluid-receiving shell, tubes within said shell and removable through an end of the latter and channel means for circulating fluid through said tubes, a longitudinal baffle in said shell, sealing means borne by said baffle along opposite longitudinal edges thereof for shifting into sealing engagement with the inner longitudinal wall of the shell, and adjusting means operatively connected to the said sealing means for forcing and holding the latter in sealing engagement with said shell wall, said shell wall being apertured to accommodate said adjusting means and the latter extending outward from the shell for operation from the exterior of the heat exchanger unit to effect said sealing engagement and for operation also from the exterior of the unit for disconnection from the sealing means and retraction from the shell to free the baffle for endwise withdrawal with the tubes.

8. In a heat exchanger having a tubular shell, a flat longitudinal baffle within said shell, sealing means extending along the opposite longitudinal edges of said baffle and borne thereby within the plane thereof for shifting transversely outward of said baffle edges and into contact with the opposed longitudinal side wall of the shell, backing means for the sealing means borne by the baffle within the plane thereof for shifting outwardly relatively to the baffle and transversely of said baffle edges to press said sealing means against said shell wall, said backing means having screw-threaded bores within the plane of the baffle and opening outward through said edges and toward said shell wall and the latter having apertures in alignment with said bores, respectively, and bolts having heads to engage an abutment at the exterior of the shell and shanks extending through said apertures and screw-engaged in said bores for drawing said backing means outwardly to compress and hold said sealing means against said shell wall, said bolts being retractable from the interior of the shell through said apertures after unscrewing from said bores, to permit endwise withdrawal of the baffle from the shell.

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EDWARD A. BERTRAM.

CERTIFICATE OF CORRECTION.

Patent No. 2,335,479. November 30, 1943.

FREDERICK D. BERKELEY, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, first column, line 24, after "shell" insert --of a shell--; page 2, second column, line 43, claim 2, for "inner wall longitudinal of the shell to form a seal" read --inner longitudinal wall of the shell to form a seal--; 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 1st day of February, A. D. 1944.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)