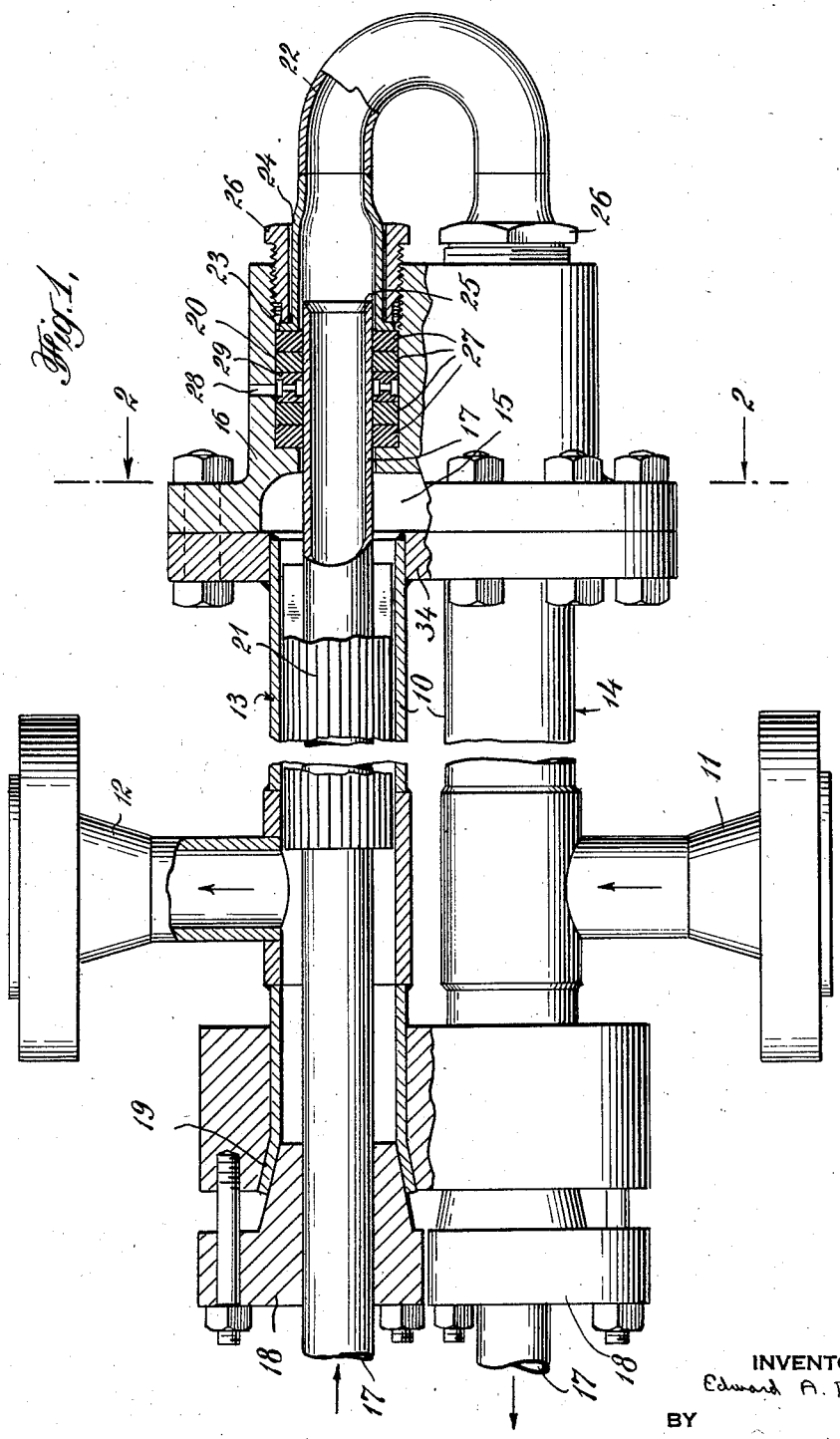
Feb. 24, 1942. E. A. DEWALD 2,274,233

HEAT EXCHANGER UNIT

Filed Feb. 29, 1940 2 Sheets-Sheet 1

Fig. 1.



INVENTOR
Edward A. Dewald

BY
Pennie, Davis, Marvin and Edmonds
ATTORNEYS

Feb. 24, 1942. E. A. DEWALD 2,274,233

HEAT EXCHANGER UNIT

Filed Feb. 29, 1940 2 Sheets-Sheet 2

Fig. 3.

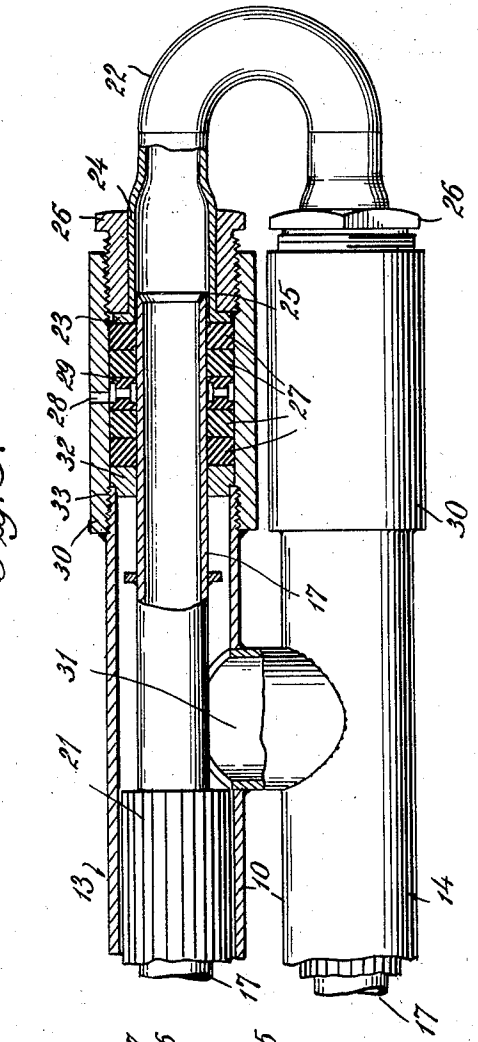
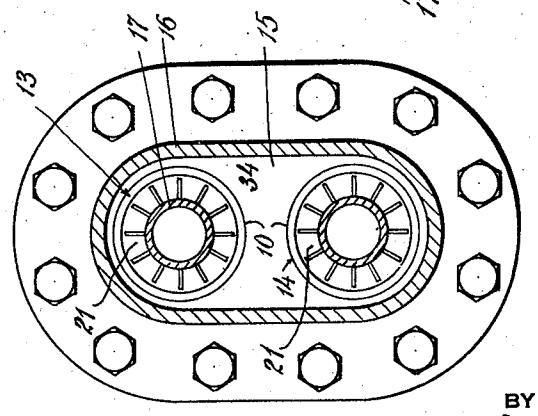


Fig. 2.



INVENTOR
Edmund A. Dewald
BY
Pennie, Davis, Marvin and Edmonds
ATTORNEYS

Patented Feb. 24, 1942 2,274,233

UNITED STATES PATENT OFFICE

2,274,233

HEAT EXCHANGER UNIT

Edward A. Dewald, Massillon, Ohio, assignor to The Griscom-Russell Company, New York, N. Y., a corporation of Delaware

Application February 29, 1940, Serial No. 321,364

6 Claims. (Cl. 285—20)

This invention relates to heat exchangers and particularly to heat exchangers built up of units of the tube within tube type.

The object of the invention is to provide a heat exchanger unit having two closed fluid circulating channels, one enclosed by the other, whereby heat is transferred from one fluid to the other, constructed so that the stress of differential expansion resulting from different temperatures of the two fluids is reduced to a minimum, so that the possibility of undetected cross leakage between the two fluids is eliminated and so that disassembly for clean-out purposes is easy. The advantage of this last characteristic is particularly apparent in the petroleum refining field in which the fluids circulated are generally of a dirty nature. Moreover, in this field temperatures and pressures used are constantly increasing making a combination of the advantages obtained by this invention highly desirable.

I propose to realize these objects and attain these advantages by an improved structure for the floating head end of such heat exchangers.

I have illustrated my invention in two embodiments shown in the accompanying drawings in which:

Fig. 1 is an elevation partly in cross section of a heat exchanger unit embodying my invention;

Fig. 2 is a transverse section taken on the line 2—2 of Fig. 1; and

Fig. 3 is an elevation partly in cross section of the floating head end of a modified form of the embodiment shown in Fig. 1.

In the embodiment of the invention shown in Fig. 1, the fluid passage for one fluid is formed by the twin shell units generally designated 10 having a flanged inlet connection 11 and a flanged outlet connection 12. Passage of the fluid from the upper tube 13 of the twin shell units 10 to the lower tube 14 is secured by means of the connecting chamber 15 in the header 16. The walls of the chamber 15 are formed by the header 16 and the tube sheet 34 into which the upper tube 13 and lower tube 14 of the twin shell 10 are sealed.

The passage for the other circulating fluid is composed of the tubes 17 coaxially placed within the upper and lower elements of the twin shell 10. These tubes extend through the sealing plugs 18 bolted into the expanded ends 19 of the twin shell 10. The tubes 17 extend through the twin shell 10 and the connecting chamber 15 in the header 16 into the cylindrical recesses 20 in the header 16. For that portion of the length of the tubes 17 extending within the twin shell 10 between the inlet and outlet connections 11 and 12 and the connecting chamber 15 they may be longitudinally finned as shown at 21 to promote the rate of heat transmittal between the fluids in the concentric passages.

The tubes 17 forming the inner fluid passage are interconnected by the return bend 22. This return bend is U-shaped, has flanges 23 at both ends and expanded portions 24 extending along its legs from the flanges 23. The purpose of the expanded portion 24 is to give expansion room to the floating end 25 of the tubes 17 which extend into the recesses 20 in the header 16. The purpose of the flanges 23 is to provide keying means by which the thrust of the screw collar 26 may be employed to seat the return bend 22 firmly against the packing rings 27 which surround the tubes 17 in the recesses 20.

The operation of the screw collar 26 is thus to render leakproof the sliding joint between the tubes 17 and the return bend 22 connecting them and at the same time to seal off that sliding joint effectively from the connecting chamber 15 carrying fluid between opposite legs of the twin shell 10.

Tell-tale holes 28 are provided in the header 16 leading into the recesses 20 therein. The packing rings 27 around the tubes 17 in the recesses 20 are so arranged on either side of a lantern ring 29 that it is positioned approximately directly under the tell-tale hole 28.

Thus, when in operation, a heat exchanger embodying my invention cannot acquire undetected cross leaks between the separate fluid passages since the only place where such a cross leak is possible is past the packing rings 27 at the sliding joint between floating ends 25 of the tubes 17 and the return bend 22. Any such cross leakage would relieve itself by drip through the tell-tale holes 28.

It is to be understood that the lower leg of the twin shell 10 is identical in these respects to the upper leg thereof.

In the modification of my invention illustrated in Fig. 3, the removable flanged header 16 shown in Figs. 1 and 2 has been eliminated and reinforced tubular extensions 30 of the upper and lower legs of the twin shell 10 substituted therefor. Since these reinforced extensions 30 are separate on each leg of the twin shell 10, a substitute for the connecting chamber 15 found in the flanged header 16, shown in Figs. 1 and 2, has been provided by the interconnecting passage 31. The reinforced extensions 30 of the legs of the twin shell 10, as shown in Fig. 3, serve to

replace the recesses 20 in the flanged header 16. Since the extensions 30 have no bottom therein against which the packing rings 27 can be seated, the annular key 32 is provided, which slips around the tubes 17 and seats on the shoulder formed by the end of the legs of the twin shell 10 inside the extensions 30. In other respects the embodiment of my invention as shown in Fig. 3 does not differ from that shown in Fig. 1.

The construction of my invention entirely obviates expansion stress on the finned tube elements 17, by reason of the free sliding joint formed in the expanded portions 24 of the return bends 22, while the joint itself is so constructed that any cross leakage is instantly detected by drip through the telltale holes 28 and stopped by tightening the screw collars 26. When inevitable fouling because of dirty circulating fluids makes cleaning necessary, instant and easy straight line access is provided to the tubes 17 simply by removing the return bends 22.

It is to be understood that my invention is not limited to the details of construction illustrated and described but includes all embodiments falling within the scope of the appended claims.

I claim:

1. A heat exchanger unit comprising a tube sheet, a pair of outer tubes affixed in said tube sheet, an inner tube within each of said outer tubes and coaxial therewith, said inner tubes having floating ends, a header affixed to said tube sheet having a space forming a connecting chamber between said outer tubes, cylindrical recesses in the outer face of said header coaxial with said outer tubes and substantially greater in diameter than said inner tubes, said recesses having apertures centered in their bottoms through which the floating ends of said inner tubes protrude a substantial distance into the recesses, packing within the recesses and around the floating ends of the inner tubes, a U-tube having the legs thereof extending over the floating ends of the inner tubes, the diameter of the legs of the U-tube, where they extend over the floating ends of the inner tubes, being sufficiently greater than the diameter of the floating ends of the inner tubes to permit free longitudinal movement of said floating ends, external flanges on the ends of said legs, and screw collars around said legs threaded into the outer ends of said recesses and bearing on the flanges and compressing the packing.

2. A heat exchanger unit comprising a tube sheet, a pair of outer tubes affixed in said tube sheet, an inner tube within each of said outer tubes and coaxial therewith, said inner tubes having floating ends, a header affixed to said tube sheet having a space forming a cannecting chamber between said outer tubes, cylindrical recesses in the outer face of said header coaxial with said outer tubes and substantially greater in diameter than said inner tubes, said recesses having apertures centered in their bottoms through which the floating ends of said inner tubes protrude a substantial distance into the recesses, packing within the recesses and around the floating ends of the inner tubes, lantern rings in said recesses around the floating ends of the inner tubes between layers of the packing, the header having apertures communicating with each of said recesses at the lantern rings, a U-tube having the legs thereof extending over the floating ends of the inner tubes, the diameter of the legs of the U-tube, where they extend over the floating ends of the inner tubes, being sufficiently greater than the diameter of the floating ends of the inner tubes to permit free longitudinal movement of said floating ends, external flanges on the ends of said legs, and screw collars around said legs threaded into the outer ends of said recesses and bearing on the flanges and compressing the packing.

3. In a heat exchanger unit of the type comprising a pair of outer tubes, an inner tube within each of said outer tubes and coaxial therewith and a header member mechanically connected to the end of each of said outer tubes and having a cylindrical recess extending inwardly from its outer face coaxial with each of said inner tubes, which recesses have centrally apertured bottoms through which said inner tubes protrude a substantial distance into said recesses and have an inside diameter substantially greater than the outside diameter of said inner tubes, a U-tube of substantially the same diameter as said inner tubes having expanded legs fitting over the ends of said inner tubes, external flanges on the ends of said legs of slightly less diameter than the inside diameter of said recesses, packing within said recesses and around said inner tubes, a lantern ring in each of said recesses and around each of said inner tubes between layers of said packing, said header member having apertures communicating with said recesses at said lantern rings, and screw collars around the legs of said U-tube threaded into the outer ends of each of said recesses and bearing on said flanges and compressing the packing.

4. A heat exchanger unit comprising a tube sheet, a pair of outer tubes affixed within said tube sheet, an inner tube within each of said outer tubes and coaxial therewith, a header affixed to said tube sheet having a single large depression in the inner face thereof forming a connecting chamber between said outer tubes, said header member having a cylindrical recess extending inwardly from its outer face coaxial with each of said inner tubes, which recesses have centrally apertured bottoms through which said inner tubes protrude a substantial distance into said recesses and have an inside diameter substantially greater than the outside diameter of said inner tubes, packing within said recesses and around said inner tubes, a lantern ring in each of said recesses and around each of said inner tubes between layers of said packing, said header having apertures communicating with each of said recesses at said lantern rings, a U-tube of substantially the same diameter as said inner tubes having expanded legs fitting over the ends of said inner tubes, external flanges on the ends of said legs of slightly less diameter than said recesses, and screw collars around said legs threaded into the outer ends of each of said recesses and bearing on said flanges and compressing the packing.

5. A heat exchanger unit comprising a pair of outer tubes, an inner tube within each of said outer tubes and coaxial therewith, a connecting tube between each of said pair of outer tubes slightly inwardly of one end thereof, cylindrical extensions on the ends of each of said outer tubes sealed around the outside thereof, an annular member within each of said extensions abutting on the end of the outer tube therein, one of said inner tubes protruding snugly through each of said annular members a substantial distance into each of said extensions, a U-tube of substantially the same diameter as said inner

tubes having expanded legs fitting over the ends of said inner tubes which protrude into said extensions, external flanges on the ends of said legs of slightly less diameter than the inside diameter of said cylindrical extensions, packing within said cylindrical extensions and around said inner tubes, a lantern ring in each of said extensions and around each of said inner tubes between layers of said packing, said extensions having apertures communicating with the interior thereof at said lantern rings, and screw collars around the legs of said U-tube threaded into the outer ends of each of said cylindrical extensions and bearing on said flanges and compressing the packing.

6. In a heat exchanger unit of the type comprising a pair of outer tubes, an inner tube within each of said outer tubes and coaxial therewith and a header member mechanically connected to the end of each of said outer tubes, said header member having a cylindrical recess extending inwardly from its outer face coaxial with each of said inner tubes, which recesses have centrally apertured bottoms through which said inner tubes protrude a substantial distance into said recesses and have an inside diameter substantially greater than the outside diameter of said inner tubes, a U-tube having its legs fitting over the ends of said inner tubes which protrude into said recesses, the portion of the legs which fit over said ends of the inner tubes having an inside diameter sufficiently larger than the outside diameter of said ends of the inner tubes to permit free longitudinal movement of said ends of the inner tubes within the legs of the U-tube, key means on the ends of said legs of slightly less overall diameter than the inside diameter of said recesses, packing within said recesses around said inner tubes, a lantern ring in each of said recesses around each of said inner tubes between layers of said packing, said header members having apertures communicating with said recesses at said lantern rings, and screw collars around the legs of the U-tubes threaded into the outer ends of said recesses and bearing on said key means and compressing the packing.

EDWARD A. DEWALD.