Oct. 21, 1941. D. B. BANKS 2,259,604

HEAT EXCHANGER

Filed Sept. 21, 1939 3 Sheets-Sheet 1

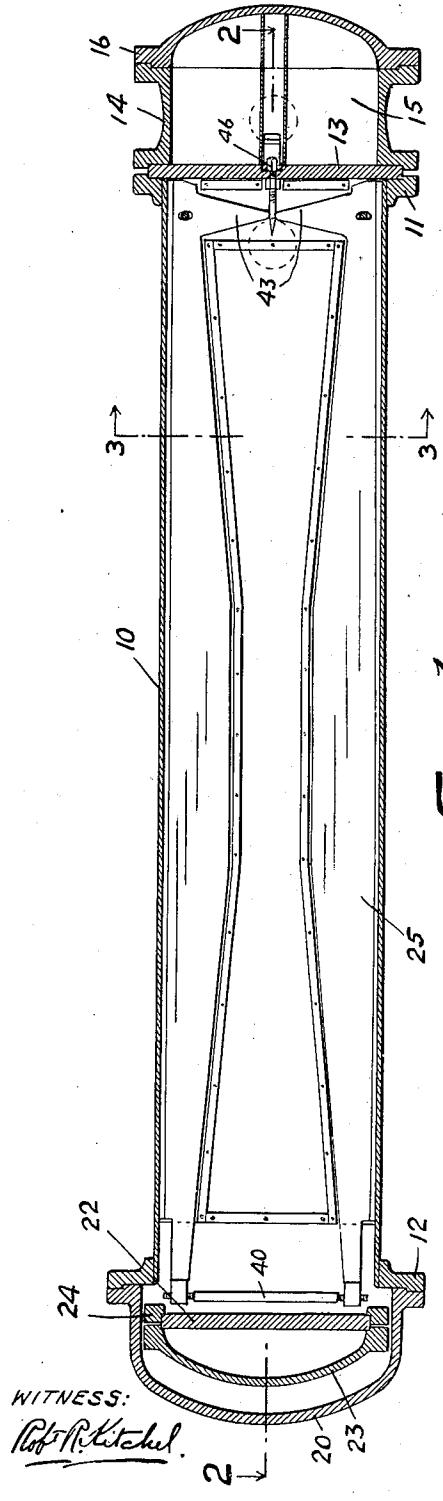


FIG. 1.

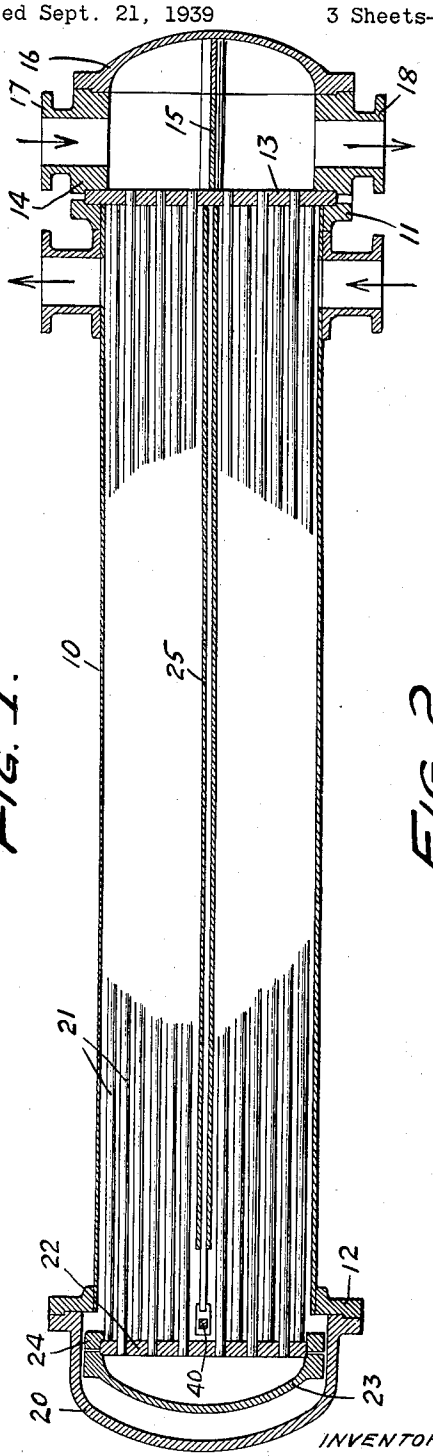


FIG. 2.

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HEAT EXCHANGER

Filed Sept. 21, 1939 3 Sheets-Sheet 2

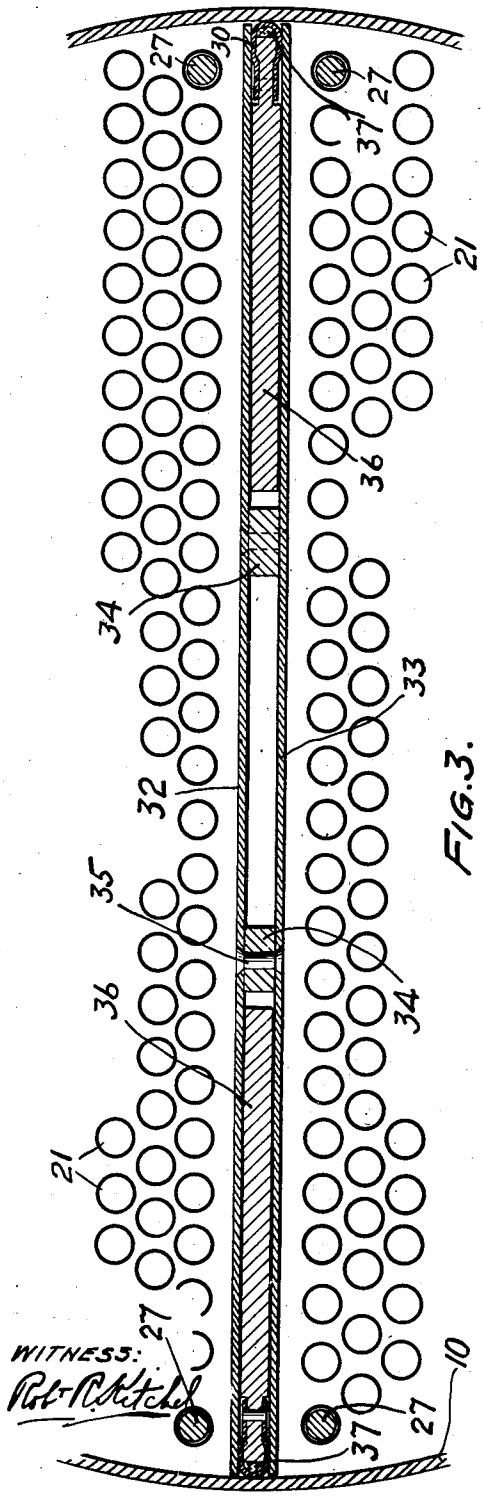


FIG. 3.

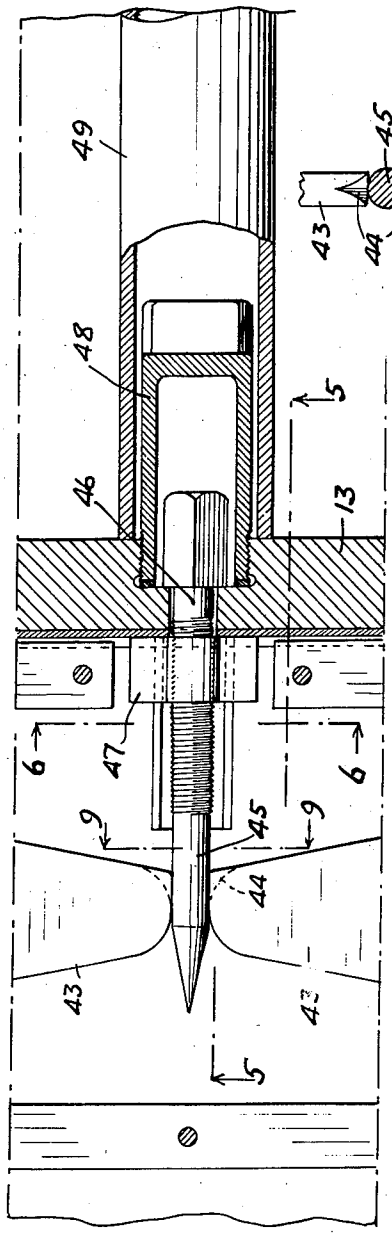


FIG. 4.

FIG. 9.

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Oct. 21, 1941. D. B. BANKS 2,259,604

HEAT EXCHANGER

Filed Sept. 21, 1939 3 Sheets-Sheet 3

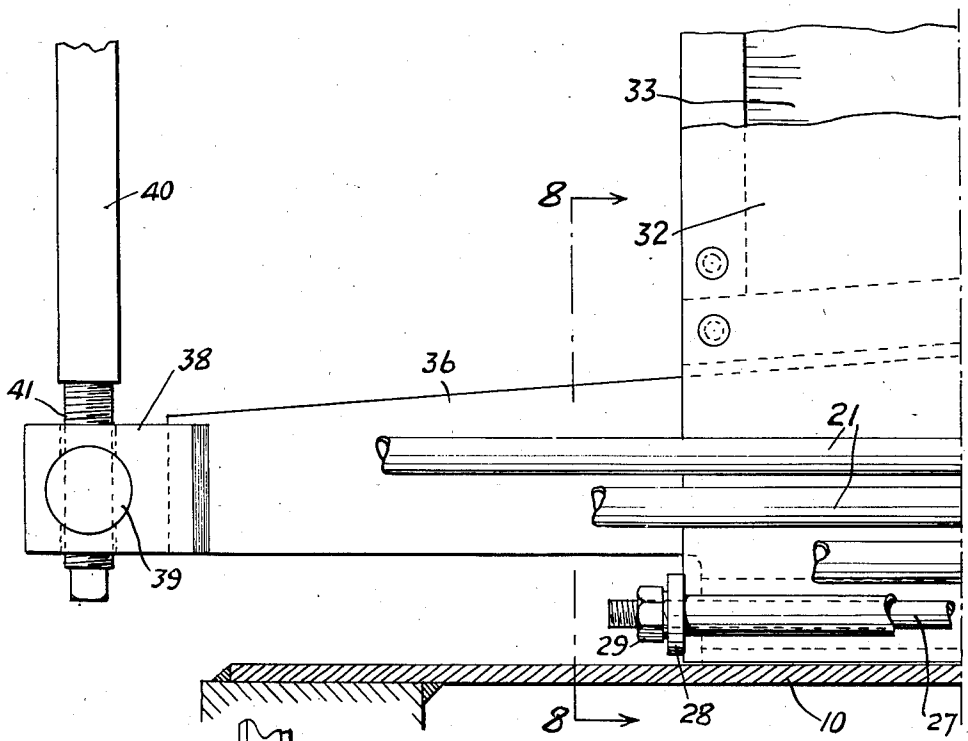


FIG. 7.

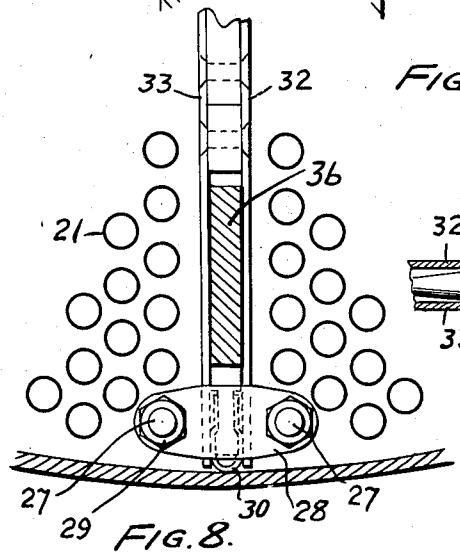


FIG. 8.

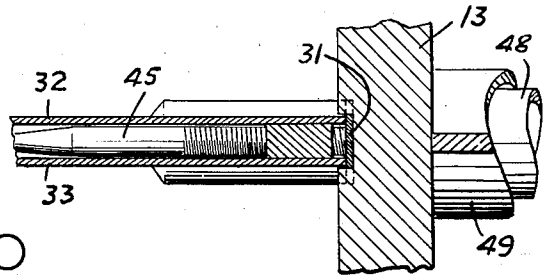


FIG. 5.

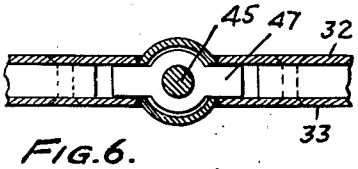


FIG. 6.

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Patented Oct. 21, 1941

2,259,604

UNITED STATES PATENT OFFICE

2,259,604

HEAT EXCHANGER

Daniel B. Banks, Drexel Hill, Pa., assignor to Sun Oil Company, Philadelphia, Pa., a corporation of New Jersey

Application September 21, 1939, Serial No. 295,928

5 Claims. (Cl. 257—239)

The present invention relates to a heat exchange apparatus of the shell and tube type and, more particularly, it relates to a removable baffle means for use in such apparatus.

It is an object of the present invention to provide heat exchange apparatus which may be readily assembled and dismantled for the purpose of cleaning and the like. It is a further object of the invention to provide a readily removable baffle plate which will provide a tight seal between the baffle and the walls of the exchanger. Other objects will be apparent as the description progresses.

For a better understanding of the present invention, reference should be made to the accompanying drawings in which—

Fig. 1 is a longitudinal sectional assembly drawing of the apparatus,

Fig. 2 is a section taken on the line 2—2 of Fig. 1,

Fig. 3 is a section taken on the line 3—3 of Fig. 1,

Fig. 4 is a detail of the end of the baffle at the manifold end of the exchanger showing the mechanism for spreading the baffle bars at that end,

Fig. 5 is a detail section taken on the line 5—5 of Fig. 4,

Fig. 6 is a detail section taken on the line 6—6 of Fig. 4,

Fig. 7 is a detail of the "free" end of the baffle,

Fig. 8 is a detail section taken on the line 8—8 of Fig. 7, and

Fig. 9 is a detail section taken on the line 9—9 of Fig. 4.

Referring now to the drawings, 10 designates the cylindrical body of the heat exchanger which is provided with flanges 11 and 12 at the ends thereof. A tube sheet 13 is held between the flange 11 and the cylindrical manifold 14 provided with a central web 15, and the end of the exchanger is closed by cover 16. Inlet and outlet lines 17 and 18 are provided in the manifold 14. The other end of the exchanger is closed by a cover 20 bolted to flange 12. Heat exchange tubes 21 are rolled into the tube sheet 13 and a tube sheet 22. A floating header is formed by tube sheet 22 and cover plate 23 bolted to a segmental ring 24, the tube sheet 22 being held between the cover plate 23 and split ring 24.

A central baffle 25 described hereinafter in detail is disposed within the cylindrical body 10 of the exchanger. The baffle 25 is held against the tube sheet 13 by means of tie rods 27 which pass through the tube sheet 13 and extend beyond the opposite end of the baffle 25. A clip 28 passes over the end of the baffle 25 and the ends of the tie rods 27 on the opposite sides of the baffle pass through the clip 28 and by tightening the nuts 29 on tie rods 27 the baffle may be pushed firmly against the packing 31 in a groove 26 provided in the tube sheet 13 to receive the end of the baffle 25.

Referring now more particularly to Figs. 3, et seq., the baffle 25 is formed of two plates 32 and 33 spaced from each other by spacers 34 and held together by rivets 35. A longitudinally extending bar 36 is disposed between the plates 32 and 33 at each edge thereof. Suitable packing material is provided at the outer edge of the bars 36. As shown in the drawings, this packing material may comprise a compressible packing material 37 which is held in place on the edges of the bars 36 by a retaining band of a suitable material 30 such as asbestos cloth. This retaining band 30 is stretched over the compressible material 37 and is itself secured to the sides of the bars 36 by any suitable means such as rivets. At the ends of the bars 36, nearest the floating head (Fig. 7), an enlarged plate 38 is welded to the end of the bar. A hole is drilled in the plate 38 and a round plug 39 is inserted therein having a threaded hole adapted to receive the spreader bar 40 provided with opposite threads at its opposite ends. An opening 41 is provided in each of the plates 38 through which the threaded ends of the spreader bar 40 may pass. A plate 43 is welded to the opposite ends of the bars 36, nearest the tube sheet 13. (Figs. 4, 5, 6 and 9.) These plates 43 extend toward the center of the baffle 25 and are provided with a V groove 44 at their ends. A pointed bolt 45 extends through a hole 46 in the tube sheet 13 and a collar or nut 47 is threaded on to the bolt 45 and is adapted to bear against the tube sheet 13. A cap 48 may be threaded to the tube sheet 13 to cover the end of the bolt 45 where it extends therethrough. A cylindrical well 49 may be provided in the central web 15 of the manifold 14 in the event that the exchanger is a two pass exchanger so that the manifold 14 may be drawn tightly against the tube sheet 13.

From the foregoing description, the method of assembling or disassembling the apparatus and the manner of its operation will be readily apparent. For example, when it is desired to disassemble the apparatus, the cover 20 may be removed from one end of the apparatus and the cylindrical manifold 14 removed from the other end of the apparatus. The cover 23 and the segmental ring 24 of the floating header may then

be removed and the baffle 25 may be loosened by turning the pointed bolt 45 so that it is withdrawn from the V groove 44 at the end of the plates 43 thereby releasing one end of the bars 36. The other end of the bars 36 may be released by turning the spreader bar 40 so that the ends of the bars 36 are drawn toward each other thereby moving the packing 37 away from the walls of the casing 10. The tube bundle with the baffle 25 therein may then be withdrawn from the body 10 of the exchanger by pulling out on the tube sheet 13. After the tube bundle has been removed from the exchanger, the baffle 25 may readily be removed therefrom by loosening the nuts 29 on tie rods 27 thereby permitting the clips 28 of the ends of the baffle 25 to be removed and permitting the baffle to be slipped out of the tube bundle.

In assembling the exchanger, the tube bundle, with the baffle 25 in place therein, is inserted into the body 10 of the exchanger, the bars 36 of course being in their contracted position during insertion with the pointed bolt 45 being withdrawn thereby permitting one end of bars 36 to be moved toward the center of the baffle and the other end of bars 36 being held in by spreader bar 40 so that the tube bundle may be inserted without damaging the packing on the baffle. When the tube bundle is in place in the exchanger, the pointed bolt 45 is inserted and its end forced into the V groove 44 thereby moving the plates 43 and the attached ends of bars 36 outwardly. Very little force is applied by bolt 45 to the bars 36, its object being merely to change the fulcrum point of these bars at one end of the baffle so that as the spreader bar 40 is turned forcing the other end of the bars 36 outwardly a tight seal will be made between the walls of the body of the exchanger 10 and the baffle. As the bars 36 are forced apart by turning the spreader bar 40, the packing 37 is compressed and the retaining band 30 of packing is forced against the side walls of the exchanger and also against the inside of plates 32 and 33 forming the baffle, so that a tight seal is made and practically all of the sealing is accomplished by turning the spreader bar 40. The heads of the exchanger may then be attached and it is ready for use.

What I claim and desire to protect by Letters Patent is as follows:

1. In a heat exchange apparatus, the combination with a casing and a tube bundle adapted to be inserted therein, of a longitudinal baffle comprising a pair of spaced apart parallel plates, a longitudinally extending bar inserted between said plates at each of the longitudinal edges thereof, a spreader bar at one end of said longitudinal bars, said spreader bar being provided with opposite threads on its opposite ends, a threaded opening in each of said longitudinal bars adapted to receive one end of said threaded spreader bar, and a wedge adapted to be inserted between the other end of said longitudinally extending bars to spread them apart while said tube bundle is within the casing.

2. In a heat exchange apparatus, the combination with a casing and a tube bundle adapted to be inserted therein, said tube bundle comprising a relatively small diameter tube sheet which is adapted to pass through said casing and a relatively large diameter tube sheet which is adapted to abut against one end of said casing and close the same and a multiplicity of tubes of greater length than said casing secured to said tube sheets and extending between the same, of a longitudinal baffle adapted to be inserted in said casing and comprising a pair of spaced apart parallel plates, a longitudinal bar inserted between said plates at each of the longitudinal edges thereof, said bars being of greater length than said casing and having a threaded opening in their ends nearest said smaller tube sheet, a spreader bar having opposite threads at its opposite ends engaging said threaded openings, tie rods passing through said larger tube sheet and extending to the far end of said baffle, means for attaching said tie rods to said baffle at its end nearest said smaller tube sheet to thereby press said baffle against said larger tube sheet, extensions on said longitudinal bars at their end nearest said larger tube sheet extending toward the center of said baffle, and a bolt having a pointed end extending through said larger tube sheet, and adapted to enter between said extensions on said longitudinal bars and force them apart.

3. In that type of heat exchange apparatus which comprises a cylindrical casing, tube sheets and a bundle of tubes extending between the tube sheets and removable with the tube sheets from the casing, a baffle comprising a pair of spaced apart parallel plates extending from one tube sheet toward, and terminating short of, the other tube sheet, longitudinally extending bars between said plates at opposite longitudinal edges thereof, sealing means between the longitudinal edges of said bars and the inner wall of said casing, and means to spread corresponding ends of the bars laterally toward the casing; the improvement which comprises wings extending inward from the other ends of said bars toward the longitudinal axis of the casing, and a pin extending along the axis of the casing from the tube sheet adjoining the last named ends of said bars and operable to be moved longitudinally between the inner ends of said wings and thereby spread the corresponding ends of the bars laterally to so position their fulcrums as to enable said bars to compress said sealing means and thereby make a tight seal between the longitudinal edges of the bars and said casing throughout the length of the bars.

4. In that type of heat exchange apparatus which comprises a cylindrical casing, tube sheets and a bundle of tubes extending between the tube sheets and removable with the tube sheets from the casing, a baffle comprising a pair of spaced apart parallel plates extending from one tube sheet toward, and terminating short of, the other tube sheet, longitudinally extending bars between said plates at opposite longitudinal edges thereof, and sealing means between the longitudinal edges of said bars and the inner wall of the casing; the improved means for securing the baffle in fluid-tight relation with the first named tube sheet and the inner walls of the casing, said means comprising two pairs of tie rods extending from the first named tube sheet longitudinally throughout the length of said baffle to beyond its end, said pair of tie rods extending near opposite walls of the casing and the tie rods of each pair extending on opposite sides of the baffle, a cross-piece carried by each pair of said tie rods and spanning said end of the baffle, means to press said cross-pieces against said end of the baffle and thereby force its other end against the first named tube sheet, a member extending through the first named tube sheet and operable to spread the corresponding ends of the said bars laterally against the casing wall

and fulcrum the same thereon, and independently operable means to spread the opposite ends of the bars, thereby compressing said sealing means to make a tight seal between the longitudinal edges of the bars and said casing throughout the length of the bars.

5. The construction defined in claim 4 in which the ends of the bars operable by the spreading member comprise inwardly extending wings and in which said spreading member extends along the axis of the casing and is movable longitudinally between said wings to effect the spreading action specified.

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