June 12, 1934. C. S. REED 1,962,362

TWO PASS HEAT EXCHANGER

Filed Feb. 28, 1933

Fig. 1.

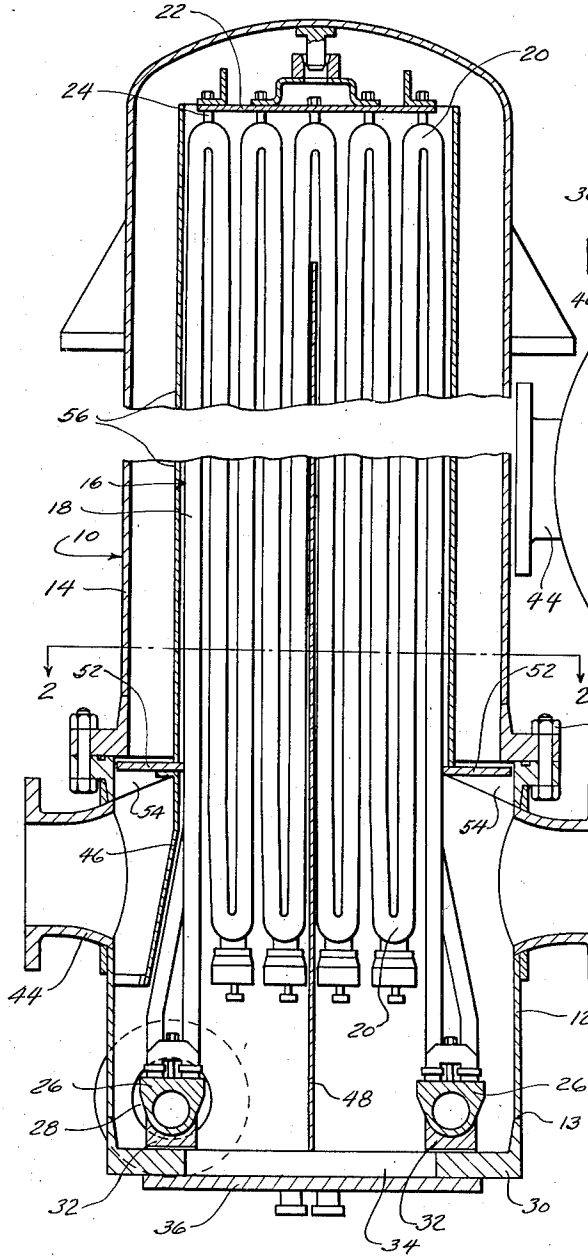
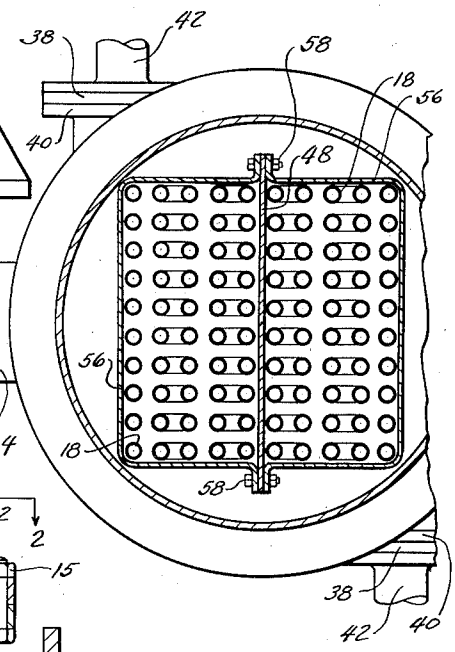


Fig. 2.



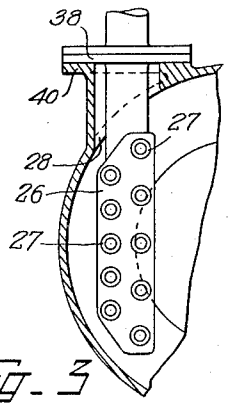


Fig. 3

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Patented June 12, 1934

1,962,362

UNITED STATES PATENT OFFICE

1,962,362

TWO PASS HEAT EXCHANGER

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Application February 28, 1933, Serial No. 658,914

12 Claims. (Cl. 257—223)

The present invention relates to heat exchangers and aims to provide a heat exchanger having good heat efficiency but which shall be economical to construct.

Heat exchangers have come into considerable use in several different industries, particularly in the petroleum distilling and cracking arts.

It is an object of my invention to provide a heat exchanger well adapted to the requirements of the petroleum industry.

In order that my invention may be readily and clearly understood, I will now describe in detail, and by way of example, a particular heat exchanger illustrated in the accompanying drawing and forming a preferred embodiment of my invention. In the drawing:

Fig. 1 is a longitudinal sectional view of a heat exchanger,

Fig. 2 is a section on the line 2—2 of Fig. 1 looking in the direction of the arrows, parts being broken away and parts being omitted for purposes of illustration.

Fig. 3 is a fragmentary sectional view showing the top plan of one of the headers appearing in Fig. 1, parts above such header being removed for purposes of illustration.

Referring to the drawing more in detail, the heat exchanger 10 includes a base ring 12. Ring 12 is shown as formed in two parts welded together along the line 13, but I do not limit myself to this. Exchanger 10 also includes removable shell portion 14 releasably connected to the ring 12 by bolts 15 or other means of attachment adapted to permit ready removal of shell portion 14. Within the exchanger 10 is a tube bank 16 having a cross section of rectangular outline as appears clearly in Fig. 2. The bank 16 is composed of individual units 18, 18 each of which includes a plurality of tube lengths substantially parallel to the central axis of the shell of the exchanger, the individual tube lengths being connected in alternate pairs at opposite ends by return bends 20, 20 to provide serpentine paths thru the units. As appears clearly in Fig. 1 each unit 18 has four such bends along one side, the bottom side as shown, and five such bends along its opposite side, the top as shown. Preferably the exchanger 10 has its central axis vertical when in use and the return bends 20 of each unit 18 at the top of such unit are connected together by a bar 22, bolted to projections 24, 24 so that the individual units are braced against sagging under their own weight. The outer pipe runs of the units 18 extend downwardly nearly to the lower end of the ring 12 where they make releasable connections with headers 26, 26. Each unit 18 is seen thus to lie in a plane parallel to the axis of the shell 14 and to extend from one header 26 to the other. As is clear from Fig. 2 also, there are ten such units lying in parallel planes. Headers 26 are introduced into the interior of the exchanger 10 through oppositely facing openings in the ring 12, one of which appears at 28. The units 18 connect to the top faces of the headers 26 and the weight of the units rest directly on the headers, the ends of the units contacting the conical seats 27, 27 which are ground into the top faces of headers 26. The weight of the tube bundle 16 and the headers 26 is shown as supported from an inwardly projecting flange 30 at the lower end of the ring 12, separable pillow blocks 32, 32 being conveniently interposed between the headers 26 and the flange 30 so that the headers may pass through openings 28 in ring 12 without requiring such openings to be inconveniently large. Of course, whenever desired, the parts 26 and 32 may be made in one piece and the size of openings 28 increased to permit insertion and removal of the resulting unitary structure therethrough. At their outer ends, the headers 26 preferably are provided with flanges 38, 38 which contact with the faces of flanges 40, 40 formed on nozzles 44 on the ring 12, such nozzles registering with openings 28. Flanged pipes 42, 42 serving as inlet and outlet for fluid for the units 18 may be bolted to the flanges 38 and 40 as shown in Fig. 2. The flange 30 can be considered as the head of the exchanger at its lower end, such head having a large access opening 34 therethru which is normally covered by a cover plate 36.

Vapors and gases for heating fluid in the units 18 are introduced into exchanger 10 thru the nozzle 44 in the ring 12, the inner end of nozzle 44 being covered by a slotted impingement baffle 46 to reduce the velocity of the fluids entering the shell of the exhanger before they impinge on the units 18. In the arrangement shown, a central baffle 48 extends upwardly from the flange 30 to a point near the top of the tube bank 16 so that heating fluids entering thru nozzle 44 must pass upwardly thru the pass of the tube bank and downwardly thru the other pass to the exit nozzle 50. In order that the heating fluids shall all contact with the units 18 the segmental spaces within the shell portion 14 which surround the tube bundle 16 must be shut off. In the arrangement illustrated for this purpose, the bottoms of such spaces are closed by plates 52, 52 which rest on brackets 54, 54 bolted to the inner faces of the ring 12. To further confine the heating fluids to the space occupied by the tube bundle 16, such bundle

is preferably closely surrounded by shroud plates 56, 56 which rest on the plates 52, and extend upwardly to the top of tube bundle 16. Plates 56 are bent to have a U shape in cross section and are placed together so as to surround the tube bundle 16 closely on all four sides. Preferably the central baffle plate 48 is wide enough to project between the edges of the plates 56 so that when the apparatus is in use the plates 56 and the baffle 48 can all be fastened together at their edges by bolts 53, 58.

In assembling the apparatus herein disclosed, the pads or pillow blocks 32, are first introduced into ring 12 through openings 28 and arranged on flange 30 in position to receive on their upper faces the headers 26. Such headers are then introduced through openings 28 and properly arranged for the reception of units 18. Baffle 48 is then put in place and such units are then arranged on the headers and connected thereto as shown in the drawing. Shroud plates 56 are then placed on plates 52 and bolted to baffle 48, whereupon the upper portion 14 of the shell may be placed on and coupled to ring 12 and the various pipes coupled to parts 40, 44 and 50.

The operation of the apparatus will be obvious from the foregoing.

When it is desired to remove the tube bundle 16 to clean the units 18, the shell portion 14 is first lifted off the ring 12, the bolts 58 then being removed and the surrounding plates 56 lifted out of the way, whereupon the plates 52 can be taken out and the units 18 disconnected from the headers 26.

Preferably the bundle 16 is lifted as a unit, but I do not limit myself to this.

It will be seen that I have provided a design of heat exchanger having marked simplicity and high efficiency together with great economy of manufacture.

Moreover, while I have disclosed my invention as applied to a two-pass structure, it is evident that many features thereof are equally applicable to single pass structures or to multiple pass structures.

What I claim is:

1. A heat exchanger having a casing including a base ring, an inwardly projecting flange fixed to said ring, headers supported from said flange, and a tube bundle connected to said headers.

2. A heat exchanger as set forth in claim 1 and in which the base ring has apertures therein adapted to permit the insertion and withdrawal of the headers.

3. A heat exchanger having a casing including a base ring, an inwardly projecting flange fixed to said ring, headers supported from said flange, said ring having apertures therethrough adapted to permit the insertion and withdrawal of said headers, and pillow blocks intermediate said headers and said ring.

4. The combination as set forth in claim 3 and in which the headers have rounded lower faces and the pillow blocks having recessed upper faces for receiving the lower faces of the headers.

5. A heat exchanger having a casing including a base ring, an inwardly projecting flange fixed to said ring, headers supported from said flange, said ring having apertures therethrough adapted to permit insertion and withdrawal of said headers, and flanges fixed to the outer ends of said headers and adapted to cover said apertures through the base ring.

6. A heat exchanger having a tube bundle of square outline in cross-section, a baffle extending into said bundle longitudinally and extending beyond the bundle at its lateral edges, a guide for fluid flowing against the outer surfaces of said bundle, said guide surrounding said bundle closely and having two separable portions normally engaging the edges of said baffle, and means releasably securing the portions of said guide to the edges of said baffle.

7. A heat exchanger having a shell comprising a base ring having inlet and outlet apertures therein and a cylindrical portion releasably secured to said ring, a tubular bundle in said shell having a cross section of rectangular form, a baffle in said bundle arranged to form two passes in the exchanger between said apertures, means surrounding said bundle and adapted to confine the fluid passing between said aperture to a path substantially within the space outlined by said bundle, means connecting said baffle to said first mentioned means, and a support for said first mentioned means on said ring.

8. A heat exchanger having a shell comprising a base ring and a portion releasably connected thereto, an inwardly projecting flange supported from the lower edge of said ring, headers close to and supported from said flange, said ring having apertures through which said headers may be introduced into and removed from the interior of the shell.

9. A heat exchanger as set forth in claim 8 together with a flat bottomed pad intermediate each header and the flange.

10. A heat exchanger having a base ring, flanged nozzles projecting outwardly from said ring, headers extending thru said nozzles into the interior of said ring and having flanges contacting with those of said nozzles, and a group of tubular units releasably connected to said headers.

11. A heat exchanger as set forth in claim 8 together with a tube bundle, and readily releasable connections between the tubes of said bundle and the headers.

12. A heat exchanger as set forth in claim 8 together with a separate pad between each of the headers and the base ring, a tube bundle, and readily releasable connections between the tubes of said bundle and the headers.

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