July 1, 1930. J. A. POTTER 1,768,786

HEAT EXCHANGER

Filed Aug. 8, 1927

Fig. 1.

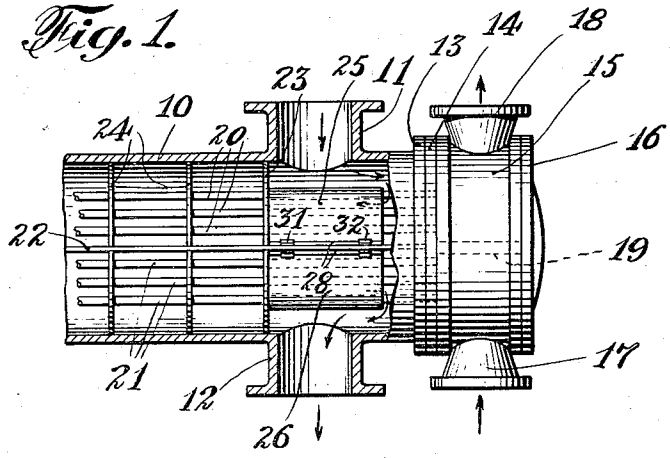


Fig. 2.

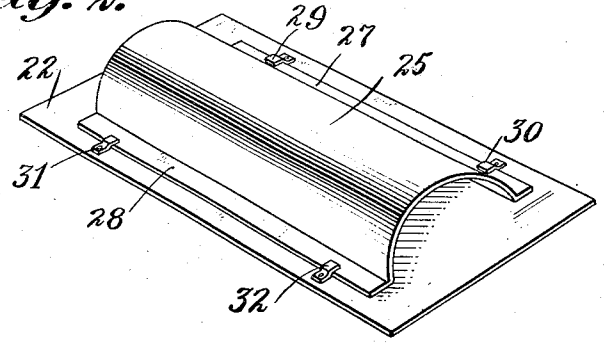
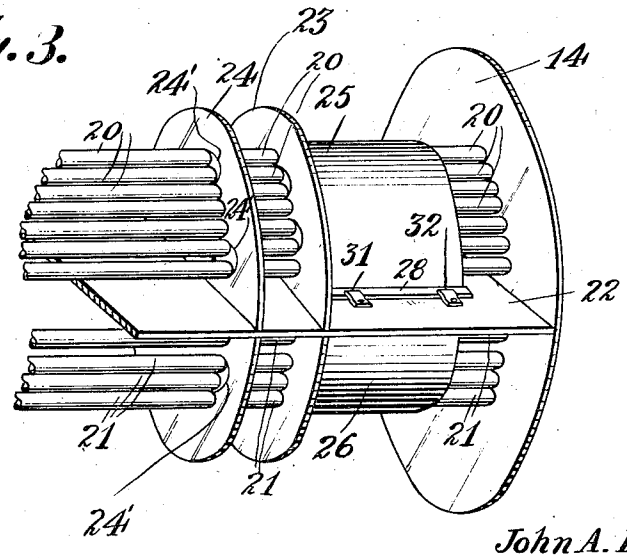


Fig. 3.



INVENTOR
John A. Potter
BY
His ATTORNEYS

Patented July 1, 1930 1,768,786

UNITED STATES PATENT OFFICE

JOHN A. POTTER, OF ROSELLE, NEW JERSEY, ASSIGNOR TO FOSTER WHEELER CORPORATION, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

HEAT EXCHANGER

Application filed August 8, 1927. Serial No. 211,315.

My present invention relates to a heat exchanger in any one of the various forms in which such devices are commonly employed in the art, for example by including a shell, bundles of tubes within the shell, and means for directing a medium to the space within the shell so as to surround the tubes, together with means for directing a second medium through the tubes to effect an exchange of heat between these mediums. This type of apparatus is commonly employed for example in the oil industry as an auxiliary in refining petroleum, or for example in power plants for condensers, feed-water heaters and the like.

In this type of apparatus as I am aware, it has been more or less customary to employ a baffle plate within the shell and adjacent the inlet opening for the incoming fluid. These baffle plates, however, have merely been employed to separate or spread the fluid rather than to shield the adjacent portions of the tubes and to direct the flow of the fluid so that the incoming fluid in the use of baffle plates as ordinarily employed is not so directed to the tubes as to obtain the greatest efficiency in effecting the transfer of the heat from one medium to another. The apparatus made in accordance with the present invention while particularly adapted for use in the petroleum industry, is, of course, not limited to such a use, and is designed to protect the tubes at the point at which the medium admitted to the interior of the shell enters the same, and to cause this medium to pass to one end of the space within the shell and to then be deflected and directed to the beginning of its path of flow through the space in the shell. To this end the invention more particularly relates to a shield and deflector which is employed in conjunction with a baffle plate in such a manner that the medium passing into the shell of the exchanger is directed toward the tube plate at one end thereof and then deflected so as to change its course and to pass between and among the tubes in starting its flow through the apparatus, whereby substantially all the tube surface is effectively utilized in the exchange of heat between the medium passing through the tubes and the medium passing through the shell, as will be hereinafter more particularly described.

In the drawing Figure 1 is a partial elevation and central longitudinal section illustrating a heat exchanger made in accordance with this invention.

Fig. 2 is a perspective view of a part of the tube shield and flow director to which the invention particularly relates, and

Fig. 3 is a perspective view on an enlarged scale showing the use of the tube shield and flow director.

Referring to the drawing the heat exchanger as therein illustrated embodying the present invention includes a shell 10 constructed in a customary manner to include a nozzle 11 for the admission of a fluid or other medium to the interior of the shell and a nozzle 12 for the discharge of a circulating medium from the shell, and suitable flanges at the end of the shell one of the end flanges being indicated at 13. The nozzles 11 and 12 forming the admission and discharge or inlet and outlet connections for the fluid or other medium are preferably in oppositely disposed positions and adjacent one end of the shell. Connected to this end of the shell there is a tube plate 14 and a box 15 for another fluid or other medium, together with a cover or bonnet 16. These parts are connected to each other and to the shell by any suitable means. The box 15 provided with a suitable nozzles 17 and 18 preferably in oppositely disposed positions to form inlet and outlet connections for the said second medium as the same is admitted to and discharged from the box which interiorly, as illustrated, is provided with a transverse partition wall 19.

Lying within the shell there are bundles of tubes indicated at 20 and 21. The number of groups into which the tubes are divided forms no part of the present invention, as the tubes may be segregated to any number of groups depending primarily upon the number of passes in the apparatus. Interiorly the shell is provided with a longi-

tudinally disposed baffle 22 placed in a central position and extending from the tube plate 13 to a point adjacent the oppositely disposed tube plate, it being understood that the ends of the tubes at the opposite end of the apparatus are fixed in a floating head or tube plate whereby the tubes as a bundle or a plurality of bundles may be removed as a unit from the shell. Adjacent the inlet and outlet connections the shell is also provided with a transverse baffle 23 and in suitably spaced positions with other transverse baffles as indicated at 24 for the purpose of directing the flow of the medium which passes through the space in the shell of the apparatus.

The baffles 24 are provided with apertures 24' through which certain tubes pass. The apertures 24' are preferably staggered in adjacent baffles to prevent a direct flow of the fluid through one baffle to the next.

The invention in the present case relates more particularly to a shield and medium flow director which as illustrated in these figures of the drawing may comprise oppositely disposed semi-cylindrical members 25 and 26. The member 25 for example is provided with side flanges 27 and 28 adapted to rest upon the adjacent surface of the longitudinal baffle 22 and to be secured thereto by means of clamps or cleats 29, 30 engaging the flange 27, and similar clamps or cleats 31, 32 engaging the flange 28. This semi-cylindrical member extends across the admission or inlet opening and at one end is adapted to make a tight joint with the adjacent surface of the transverse baffle 23, while at the opposite end it terminates an appreciable distance from the end of the shell and the inner face of the tube plate 14. The cylindrical member 26 is similarly constructed and is secured to the opposite face of the longitudinal baffle 22 in a similar manner so as to extend across the outlet or discharge opening and at one end to make a relatively tight joint with the adjacent surface of the transverse baffle 23 while at the other end it terminates an appreciable distance from the end of the shell and the adjacent inner face of the tube plate.

As will now be understood, one fluid or other medium is caused to flow to and through the tubes by being admitted for example to the box 15, through the inlet connection 17, passing thence to the tubes 21 to the box at the other end of the apparatus, and then in the opposite direction through the tubes 20 to the box 15 and out of the same by way of the discharge or outlet connection 18. The other fluid or medium to or from which heat is to be exchanged passes into the shell by the inlet or admission nozzle 11 and then is deflected by the semi-cylindrical member toward the adjacent tube plate when its course is directed to the space between the tubes. Similarly, after this medium has been caused to travel through a tortuous path by means of the transverse baffles 24 through the upper and then through the lower sections of the shell, as illustrated in Fig. 1, it is caused to flow through the semi-cylindrical member 26 toward the adjacent inner surface of the tube plate and thence as its course is changed is caused to flow from the shell by way of the outlet or discharge connection 12. It will thus be understood that a maximum contact between the medium flowing through the shell and the tubes is effected to obtain a maximum heat transfer between this medium and that passing through the tubes.

I claim as my invention:

1. In a heat exchanger, a shell, a tube plate, a plurality of tubes each connected at one end in the said tube plate, a centrally disposed longitudinal baffle, a plurality of transverse baffles extending across the shell, admission and discharge connections in corresponding positions on opposite sides at the same end of the said shell and between the tube plate and the transverse baffle next adjacent the same, and a tube shield and fluid flow director lying entirely within the shell and extending across the admission connection and from the said transverse baffle next adjacent the tube plate toward the tube plate, the said tube shield and fluid flow director also surrounding the said tubes on the inlet side of the longitudinal baffle and being connected to the longitudinal baffle whereby the flow of an incoming fluid is directed first toward the tube plate and then through the shield and between the tubes therein.

2. In a heat exchanger, a shell, a tube plate, a plurality of tubes each connected at one end in the said tube plate, a centrally disposed longitudinal baffle within the shell, a plurality of transverse baffles extending across the shell, admission and discharge connections in corresponding positions on the opposite sides at the same end of the shell and lying between the tube plate and the nearest transverse baffle thereto, a tube shield and fluid flow director lying entirely within the sheel and extending across the admission connection and from the transverse baffle nearest the tube plate toward the tube plate, and a second tube shield and flow director extending across the discharge connection and from the said transverse baffle nearest the tube plate toward the tube plate, the said tube shield and fluid flow directors being connected to the said longitudinal baffle whereby the flow of an incoming fluid is directed toward the tube plate and then through the first aforesaid shield and the outgoing fluid is directed toward the tube plate and thence to the discharge connection.

3. In a heat exchanger, a shell, a tube

plate, a plurality of tubes each connected at one end in the said tube plate, a series of transverse baffles, a longitudinal baffle, admission and discharge connections in oppositely disposed positions on the shell and lying between the tube plate and the said transverse baffle next adjacent thereto, and a tube shield and fluid flow director lying wholly within the shell extending across the admission and discharge connections and associated with the said longitudinal baffle for directing an incoming fluid toward the tube plate and then to the space between the tubes and directing the outgoing fluid toward the tube plate and thence to the discharge connection.

Signed by me this 28th day of July, 1927.

JOHN A. POTTER.