

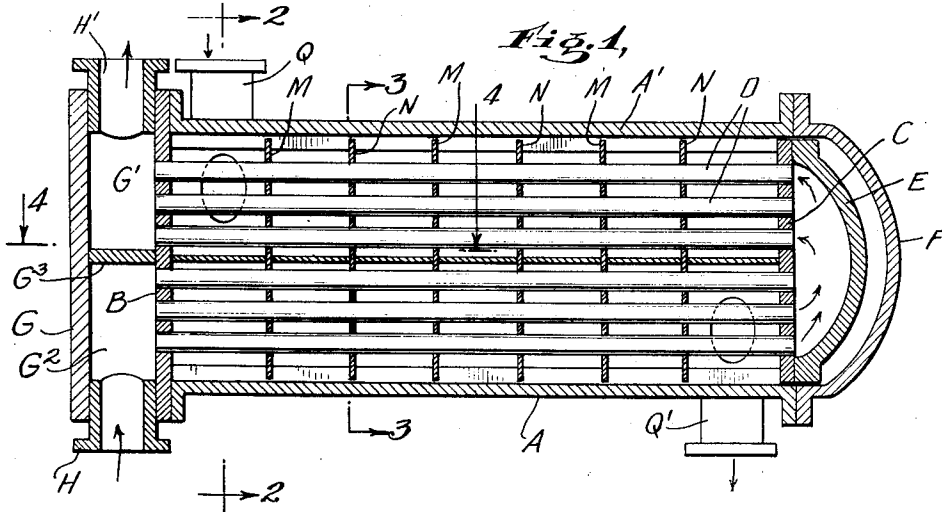
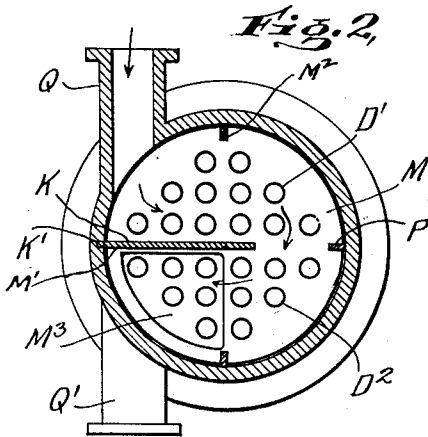
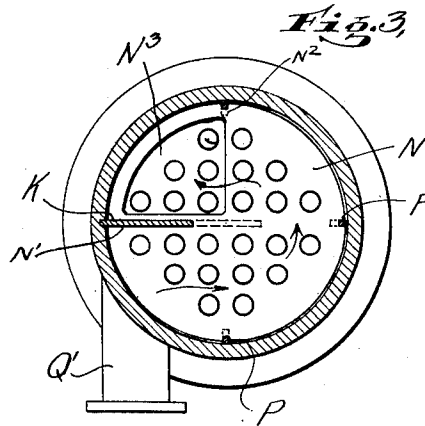
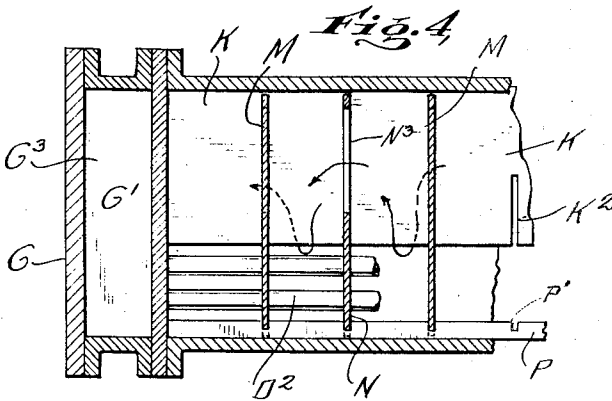
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D. K. DEAN

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HEAT EXCHANGER

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HEAT EXCHANGER

Application filed January 11, 1928. Serial No. 245,853.

My present invention relates to heat exchangers of the tubular type where heat is transferred between two fluids one flowing through the individual elements of a bank or banks of tubular elements and the other flowing around the individual tubular elements. The object of my present invention is to provide an improved construction of a heat exchanger of the tubular type and more specifically, an improved construction and arrangement of the baffle system for so directing and regulating the flow of the fluid externally of the tubular elements that the path of flow of said fluid is substantially normal to the tubular elements throughout its passage through the heat exchanger and the velocity of flow of said fluid is substantially increased.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention however and the advantages possessed by it reference should be had to the accompanying drawings and descriptive matter in which I have illustrated and described a preferred embodiment of the invention.

Of the drawings:

Fig. 1 is a sectional elevation of a preferred form of my invention;

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

Fig. 3 is a section on the line 3—3 of Fig. 1; and

Fig. 4 is a plan section on the line 4—4 of Fig. 1.

In the drawings I have illustrated a preferred embodiment of my invention in which a tubular heat exchanger A having a cylindrical shell A', a circular tube sheet B secured at one end to the shell A' and a circular floating tube sheet C mounted at the opposite end thereof. Each of the plates B and C is formed with a plurality of tube openings for tubular elements D, divided into upper and lower banks D' and D² respectively. A convex header E is secured to the floating tube sheet C and a similar header F closes that end of the shell A'. The opposite end of the heat exchanger is provided with a circular header G,

divided into upper and lower chambers G' and G², respectively, by a transverse diaphragm G³. A pipe connection H provides a fluid inlet opening to the chamber G² and a pipe connection H' provides a fluid outlet from the chamber G'.

With the construction described a fluid entering through the pipe H flows through the lower bank of tubes D², through the reversing chamber formed by the tube sheet C and header E, then through the upper bank of tubes D' and out through the chamber G' and pipe H'. It is immaterial in my invention whether or not the fluid flowing through the tubes D is the hot or cold fluid or whether the direction of flow is as described or the reverse. For the purpose of this description the flow is as described and the cooling fluid passes through the tubes D.

The interior of the shell A' between the tube sheets is provided with a baffle system for directing the flow of a heating fluid formed and in contact with the tubes carrying the cooling fluid. A longitudinal baffle K extends horizontally between the tube banks D' and D² with one side edge portion mounted in a longitudinal groove K' in the shell A' and with its ends secured to the tube sheets B and C. As shown in Fig. 2, the baffle K extends beyond the vertical center line but less than the inner diameter of the shell leaving a space between the edge of the baffle and the shell.

A series of circular baffles M and N arranged alternately are mounted in the shell A' transversely to the horizontal baffle K. Each baffle M and N is connected to the baffle K by a fluid tight joint. In the construction shown the joint is made by providing horizontal slots K², M' and N' in the baffles K, M and N, respectively, and fitting the baffles M and N in the corresponding slots in the baffle K with the slotted portions of the baffles M and N engaging the portions of the baffle K to the rear of and in alignment with the corresponding slots K².

Longitudinal tie baffles P are provided at spaced points on the inner surface of the shell A' for holding the transverse baffles M and N in position. The baffles P are connected to

the baffles M and N by fitting slots M² and N², formed in the baffles M and N, respectively, in corresponding slots P' cut in the baffles P at longitudinally spaced points. The type of connection is thus similar to the connection between the transverse baffles and the baffle K.

Each of the baffles M and N is provided with a set of circular openings for the tubular elements D. Each circular baffle M has its lower left or third quadrant substantially cut away to form an opening M³ as shown in Fig. 2. Each baffle N has its upper left or second quadrant cut away to form an opening N³ as shown in Fig. 3. The transverse baffles are thus formed with openings alternately on opposite sides of the baffle plate K.

The compartment formed by the tube sheet B and first baffle M is connected at its upper left side, as seen in Fig. 2, to a fluid inlet pipe Q and the compartment formed by the last baffle N and the tube sheet C is connected at its lower left side to a fluid outlet pipe Q'. In assembling the heat exchanger of my invention the tubular elements and the baffles are connected together as a unit and inserted into the shell A'. This mode of assembly is advantageous in that the unit may be bodily removed for cleaning or repairs.

With the baffle construction described the heating fluid enters through the pipe Q, through the upper side of the first chamber, through the passage between the edge of the baffle K and the shell A', down through lower half of the chamber and out through the opening M³ into the next chamber. In that chamber the flow is the reverse of the flow in the first chamber, the fluid entering in the third quadrant and passing out through the second quadrant of the second chamber. As shown in Fig. 4 the heating fluid follows the above described path of flow through each pair of compartments, finally passing out through the outlet pipe Q'. The baffles P restrict the flow to the portion of the chamber occupied by the tubes D.

The flow therefore between each pair of transverse baffles is normal to the tubes D for substantially the whole circular path. With this arrangement of baffles, the path of flow is substantially increased in length and decreased in cross-section for heat exchangers of given overall dimensions, with a resultant increase in fluid velocity and heat transfer coefficient.

While in accordance with the provisions of the statutes, I have illustrated and described the best form of embodiment of my invention now known to me, it will be apparent to those skilled in the art that changes may be made in the form of the apparatus disclosed without departing from the spirit of my invention as set forth in the appended claims and that in some cases certain features of my inven-

tion may be used to advantage without a corresponding use of other features.

Having now described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. A heat exchanger comprising a longitudinal bank of tubes through which a fluid is passed, a series of pairs of transverse baffles at spaced points along said tube bank, an opening in one sector of one of the baffles of each pair, an opening in an adjacent sector in the other baffle of each pair and a longitudinal baffle extending between said sectors, whereby a second fluid is passed through a substantially circular flow path between each pair of adjacent baffles.

2. A heat exchanger comprising a shell, a series of pairs of transverse baffles mounted at spaced points along said shell, a longitudinal bank of tubes extending through said baffles and containing a fluid, a pair of tube sheets connected to opposite ends of said tube bank, a fluid inlet connected to said shell between one of said tube sheets and one of said baffles, a fluid outlet connected to said shell between another of said baffles and the other of said tube sheets, a baffle extending longitudinally of said tube bank, and an opening in each of said transverse baffles, said openings being so arranged with respect to each other and said longitudinal baffle that a path of flow from said fluid inlet to said fluid outlet is provided substantially normal to said tubes through all quadrants between each pair of adjacent baffles.

3. A heat exchanger comprising a shell, a longitudinal tube bank in said shell, a series of transverse baffles at spaced points along said shell, a baffle extending longitudinally of said shell, and connections between said last mentioned baffle and each of said transverse baffles comprising interengaging slotted edge portions.

4. A heat exchanger comprising a bank of tubular elements, a series of transverse baffles spaced axially of said tubular elements and having apertures therein through which said tubular elements pass, and a plurality of tie baffles parallel with said tubular elements and in interlocking engagement with each of said transverse baffles.

5. A heat exchanger comprising a bank of tubular elements, a series of transverse baffles spaced axially of said tubular elements and having apertures therein for the passage of said tubular elements, a baffle extending axially of said tubular elements, interlocking connections between said last mentioned baffle and said transverse baffles, and a plurality of tie baffles parallel with said tubular elements and in interlocking engagement with each of said transverse baffles.

6. A heat exchanger comprising a shell, a longitudinally extending bank of tubes in said shell and through which a fluid is passed,

5 a plurality of longitudinally spaced smooth
faced baffles extending transversely of said
tubes, a fluid opening adjacent the periphery
of each of said transverse baffles, and separate
baffle means extending between adjacent
transverse baffles and arranged to direct a
second fluid through an arcuate flow path of
over 270° normal to said tubes.

10 7. A heat exchanger comprising a cylindri-
cal shell, a longitudinally extending bank of
tubes in said shell and through which a fluid
is passed, a plurality of smooth faced disc
shaped baffles extending transversely at lon-
15 gitudinally spaced points in said shell, a pe-
ripheral opening in one sector of each baffle,
the openings in adjacent baffles being ar-
ranged in adjacent sectors, and longitudinally
extending baffle means extending between said
20 transverse baffles and arranged to direct a sec-
ond fluid through an arcuate flow path nor-
mal to said tubes between the openings in
adjacent baffles.

25 Signed at New York city, in the county of
New York and State of New York, this 9th
day of January, A. D. 1928.

DION KANOUSE DEAN.

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