Aug. 19, 1924. 1,505,429

W. H. RIPLEY

HEAT EXCHANGE APPARATUS

Filed April 8, 1922

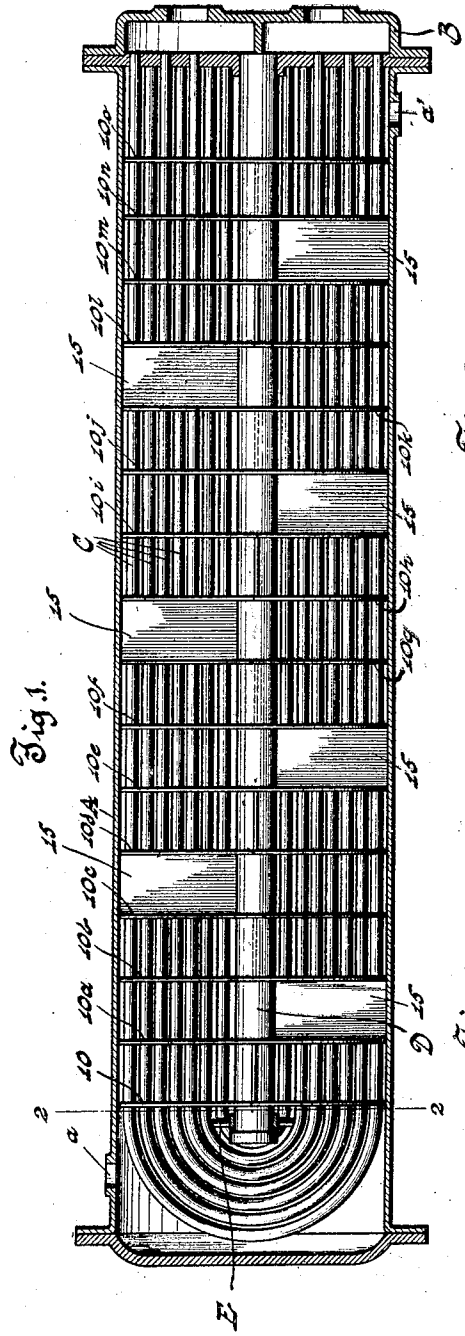


Fig. 1.

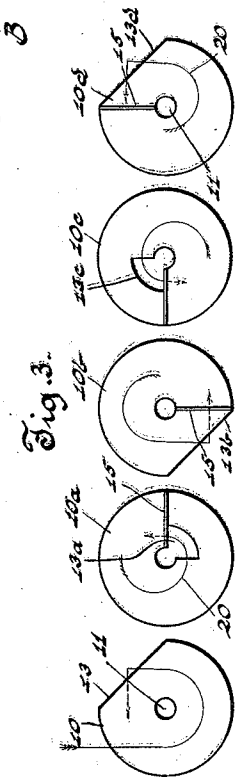


Fig. 3.

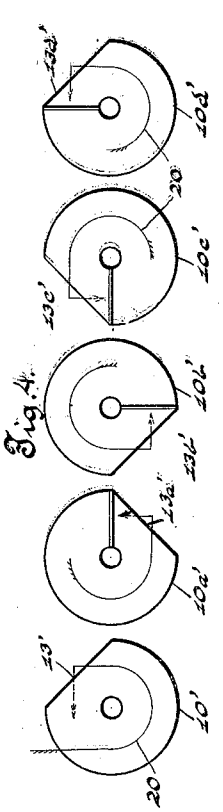


Fig. 4.

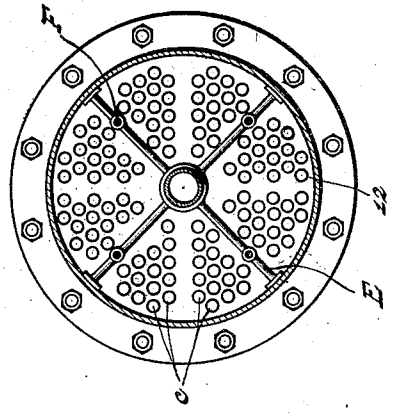


Fig. 2.

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UNITED STATES PATENT OFFICE.

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HEAT-EXCHANGE APPARATUS.

Application filed April 8, 1922. Serial No. 550,564.

To all whom it may concern:

Be it known that I, WILLIAM H. RIPLEY, a citizen of the United States, and resident of Hartford, county of Hartford, State of Connecticut, have invented certain new and useful Improvements in a Heat-Exchange Apparatus, of which the following is a specification.

This invention relates, generally, to apparatus wherein an exchange of heat is effected from one fluid to another by passing one fluid through a plurality of pipes and the other fluid about the pipes. The device may be used as a cooler or a heater or both, as desired, and has a wide application in that fluids of any sort, and whether in the liquid, gaseous or vaporous state can be heated or cooled. The device finds peculiar application as an oil heater or cooler, but it may be employed for other uses.

The aim of the invention is to provide an apparatus of this sort having various features of novelty and advantage, and, more particularly, to provide an improved arrangement wherein the fluid within the shell is so baffled and controlled in its flow that it is caused to take a maximum length of travel while, at the same time, the flow is so directed and broken up that stratification or the forming of stream lines of different temperatures is eliminated, thus insuring that all portions of the fluid will be brought into intimate contact with the heating (or cooling) surfaces afforded by the tubes and thereby obtaining the greatest efficiency in operation.

An apparatus constructed in accordance with the present invention is very effective in operation and is extremely simple and compact in construction and per unit of heating surface is of minimum weight with correspondingly low cost. Also, the arrangement is such that leakage of fluid through the openings in the baffles accommodating the tubes or between the edges of the baffles and the shell is effectively guarded against and the tendency for the fluid to follow a path adjacent the wall of the shell is counteracted, all of which results in increased efficiency.

In the accompanying drawing, wherein I have shown, for illustrative purposes, two embodiments which the invention may take,

Fig. 1 is a view taken longitudinally and centrally through my improved heat exchange apparatus;

Fig. 2 is a transverse sectional view taken on line 2—2 of Fig. 1;

Fig. 3 shows the baffle plates in the sequence in which they are assembled in Fig. 1, and

Fig. 4 is a view similar to Fig. 3, but showing the baffle plates of slightly different construction.

Referring to the drawing in detail, A denotes a shell or casing having an inlet a and an outlet a' at its opposite ends; B is a service header, and C tubes arranged within the casing and connected to the header as shown. In the present illustrative disclosure, the tubes are of the U-bend construction, but this is immaterial, as it is evident that the rear ends of the tubes may be connected to a floating head or to a fixed tube sheet; also, while the tubes are shown as being arranged to form two passes in series for the fluid flowing therethrough, the construction may be of the single pass type or any desired multi-pass arrangement, all of which constructions are old in the art. D is the usual core, the rear end of which, in the present instance, is shown for illustrative purposes as being supported by a spider E.

The present invention is directed more particularly to the means for controlling the flow of oil or other medium to be heated or cooled, as the case may be, through the shell or casing, this being brought about in such a manner that the oil is caused to take a maximum path of travel during which it repeatedly flows across the tubes constituting the heating or cooling elements in thin layers or films without stratification or the formation of stream lines or eddies. More particularly, I provide an arrangement of baffles which cause the oil or other fluid within the shell to flow in a generally circular or spiral path, the construction being such that it may be economically manufactured and in operation there being no leakage through the openings in the baffles which accommodate the tubes and the tendency for the oil or fluid to stratify being effectively counteracted.

Referring particularly to the drawing, it will be noted that the shell A is longitudinally divided into a plurality of chambers by means of spaced baffles 10, 10^a, 10^b, etc.,

which, by preference, are substantially flat and approximately at right angles to the length of the tubes. The baffles have a central hole 11 for accommodating the core D and a plurality of apertures or holes 12 for the reception of the tubes C, and it will be seen that the diameters of these holes may be practically the same as the diameters of the respective tubes which they receive, which means that there is a very close fit between the outside walls of the tubes and the edges of the holes which practically eliminates all leakage through these holes, thus assuring absolute control of the direction of flow of the oil. These baffle plates may be very cheaply manufactured, it being possible to stack one on top of the other and drill a number of them at a single operation. The baffles may be held in suitable spaced relation in any desired manner as, for instance, by spot-welding them to spacer rods F, the rear ends of which are supported in the spider E, as shown in Fig. 2.

The baffles, as will be seen most clearly from Figs. 3 and 4, are provided with cut-away portions which form openings through which the oil or medium within the shell flows from one chamber to another, and these openings are so arranged that they cause, in conjunction with vanes 15, the oil or other medium to take a generally spiral path. In the present instance, these cut-away portions are angularly spaced apart in sequence, so to speak, relative to the axis of the shell with the openings of adjacent baffles angularly adjacent each other. In one manner of speaking, these cut-away portions or openings are spirally arranged. In the embodiment illustrated in Figs. 1, 2 and 3, the openings in the successive baffles are indicated by the numerals 13, 13^a, 13^b, etc. In this embodiment, the openings in alternate baffles are provided by cutting away segments at the edges of the baffles, and the openings 13^a, 13^c in the intervening baffles are adjacent the center of the baffles. These openings are successively arranged at approximately 90° relative to one another but, of course, this showing is by way of illustration only, it being evident that the openings in adjacent baffles may be spaced other than at right angles to one another.

Provided in each chamber, and extending half way across the same, is a radially positioned vane or baffle 15 the purpose of which is to prevent the fluid from flowing directly from the opening in one baffle to the opening in the next one. These vanes are positioned between the openings of adjacent baffle plates and, therefore, these vanes are spirally arranged.

In the embodiment shown in Fig. 4, the edges of the baffles are cut-away as at 13′, $13^{a'}$, $13^{b'}$ in order to provide openings through which the fluid passes from one chamber to another. These openings are angularly arranged in a manner somewhat similar to the openings or cut-away portions of the baffles of the preceding embodiment.

In Figs. 3 and 4, I have indicated by lines 20 and arrows the course of travel which the oil or other medium passing through the shell is caused to take by the baffles. It will be seen that this path of travel is generally circular or spiral. In the embodiment shown in Figs. 1 to 3, the oil in some of the chambers, for instance in the chamber between the baffles 10 and 10^a, flows circularly and at the same time towards the center of the chamber so as to escape through the opening 13^a, and in the next chamber the tendency is for the oil to flow outwardly towards the periphery of the shell, so as to escape through the opening 13^b. In other words, the oil in each chamber takes an involute path, in one chamber the oil flowing towards the center and in the next chamber out towards the edge of the baffle. The advantage of this is that the tendency for the oil, owing to centrifugal force, to seek a path along the internal wall of the shell is counteracted, and thus stratification of the formation of stream lines is prevented, resulting in efficient operation.

In the embodiment shown in Fig. 4, the flow of oil in the several chambers is similar, as will be seen from the lines indicating the path of travel of the oil.

It is, of course, obvious that my invention is susceptible of various modifications and changes which are within the spirit of the invention without departing from the scope of the following claims, it being understood that the present disclosure of my invention is by way of illustration only and it is not to be taken as restrictive of my conception.

I claim as my invention:—

1. In an apparatus of the character described, a shell, a plurality of tubes therein, baffles spaced longitudinally of said shell and dividing the same into a plurality of intercommunicating chambers in which the fluid passing through the shell has a circular flow, and means arranged within each chamber for interrupting the circular flow of the fluid therein and directing it into the next chamber.

2. In an apparatus of the character described, a shell, tubes arranged therein, baffles spaced longitudinally of said shell and dividing the same into a plurality of chambers, and a vane extending part way across each chamber.

3. In an apparatus of the character described, a shell, a plurality of tubes arranged longitudinally therein, and means for causing the fluid within the shell to flow in a generally spiral path and including a plurality of substantially flat baffles spaced

apart longitudinally of the shell and arranged at right angles to the length of said tubes, and a longitudinally extending vane between adjacent baffles and extending part way across said shell.

4. In an apparatus of the character described, a shell, a plurality of tubes extending longitudinally thereof, baffle plates spaced longitudinally of the shell and positioned at right angles to the tubes whereby said shell is divided into a plurality of chambers, said baffle plates having openings spirally arranged, and vanes extending partly across each chamber and positioned between the openings of adjacent baffles.

5. In an apparatus of the character described, a shell, tubes arranged therein, and baffle plates spaced apart longitudinally of said shell whereby the latter is divided into a plurality of chambers, said baffles having angularly spaced apart openings at different distances from the center of said shell to cause the fluid passing through the shell to take a spiral path and cause the fluid in some of said chambers to flow towards the center of the shell.

6. In an apparatus of the character described, a shell, a plurality of tubes arranged longitudinally therein, a plurality of substantially flat baffles spaced longitudinally of the shell and extending transversely of said tubes, said baffles having openings spirally arranged with some of said openings positioned adjacent the center of the shell and others at the periphery of the shell.

7. In an apparatus of the character described, a shell, a plurality of tubes extending longitudinally thereof, baffle plates spaced longitudinally of the shell and positioned at right angles to the tubes whereby said shell is divided into a plurality of chambers, said baffles having openings spirally arranged with some of said openings adjacent the center of the shell and others adjacent the periphery of the shell, and vanes extending partly across each chamber and positioned between the openings of adjacent baffles.

8. In an apparatus of the character described, a shell, tubes arranged therein, baffle plates spaced longitudinally of said shell and extending transversely of said tubes, spacer rods in parallelism with said tubes and passing through said baffle plates, and a spider supporting the rear ends of said rods, said baffle plates being spot-welded to said rods.

9. In an apparatus of the character described, a shell, a plurality of longitudinally extending tubes therein, baffles spaced longitudinally of said shell and dividing the same into a plurality of chambers, each of said baffles having an opening, said openings being angularly disposed with respect to each other, and a vane extending part way across each chamber, said vanes being angularly disposed with each other in accordance with the openings in said baffles.

10. In an apparatus of the character decribed, a shell, a plurality of longitudinally extending tubes in said shell, transversely extending baffle plates longitudinally dividing said shell into a plurality of chambers, said baffles having spirally arranged openings, and spirally arranged longitudinally extending vanes between said baffle plates.

11. In an apparatus of the character described, a shell, a plurality of longitudinally extending tubes therein, and transversely extending baffle plates longitudinally dividing said shell into a series of chambers, said baffle plates having spirally arranged openings, said openings being alternately positioned adjacent the center and adjacent the wall of said shell.

WILLIAM H. RIPLEY.