Nov. 6, 1928. 1,691,012

G. T. JACOCKS

HEAT EXCHANGE APPARATUS

Filed Dec. 10, 1926

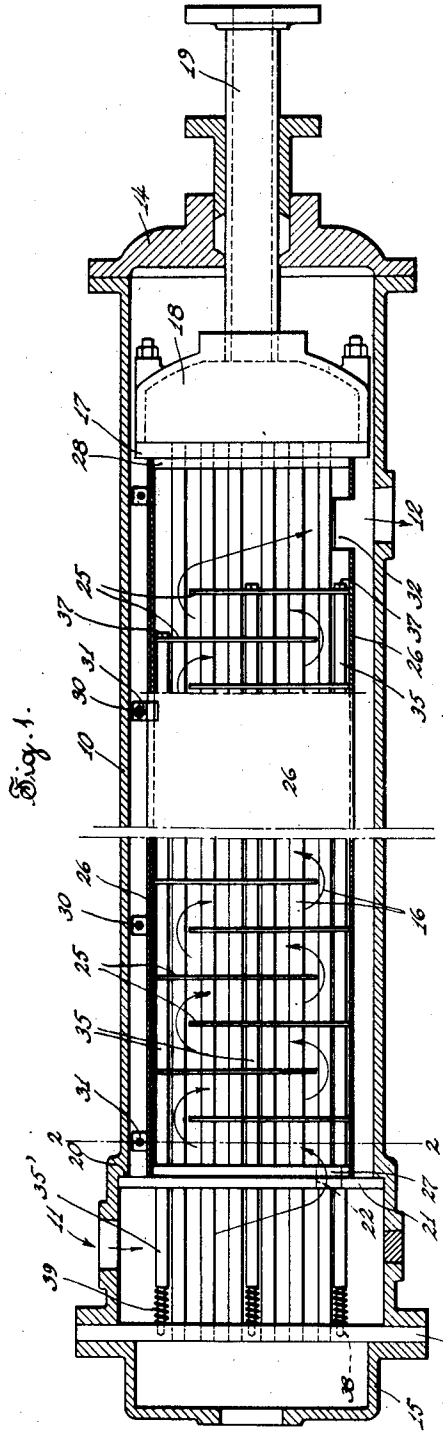


Fig. 1.

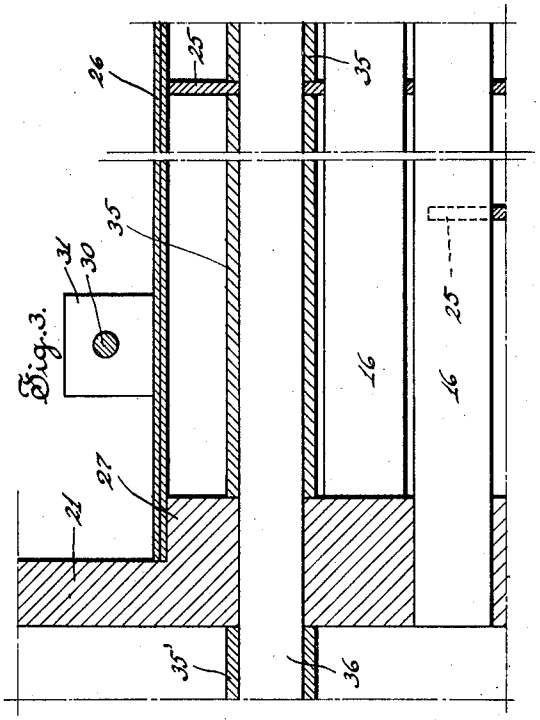


Fig. 3.

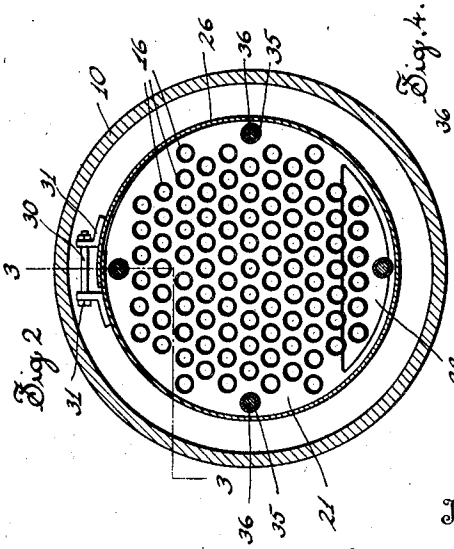


Fig. 2

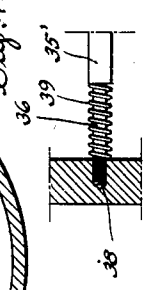


Fig. 4.

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UNITED STATES PATENT OFFICE.

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HEAT-EXCHANGE APPARATUS.

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This invention relates, generally, to apparatus wherein an exchange of heat is effected from one fluid to another by passing one of the fluids through a plurality of tubes and the other fluid about the tubes, the tubes being encased in a shell, and baffles being provided whereby the fluid which passes about the tubes is caused to repeatedly flow back and forth across the same. The device may be used either as a cooler or heater, 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, as stated, it may be employed for other purposes.

It has been the practice, in constructing heat exchange apparatus of this sort, to provide a cylindrical cast iron casing, assemble the tubes and the baffles as a unit (the baffles having substantially the same diameter as the internal diameter of the casing), and then slip the unit into position in the casing. This practice is open to various objections, among which may be mentioned that, if the edges of the baffles do not fit snugly against the internal periphery of the casing, the fluid, passing through the casing, is short-circuited (i. e. leaks through the cracks or openings between the baffles and the casing) and thus the efficiency of the apparatus is greatly impaired. It has been proposed, in order to overcome this objection, to bore out the casing to a uniform, smooth diameter and to make the baffles of an exact size so that they will properly fit the bored out casing, but this practice is an expensive one and is not entirely satisfactory as, owing to the required close fit between the baffles and the casing, considerable difficulty is experienced in slipping the built up unit into place.

An aim of the present invention is to provide a heat exchange apparatus of this type wherein the above and other disadvantages incident to structures, as heretofore manufactured, are eliminated and, more particularly, the aim of the invention is to provide an improved heat exchange apparatus which is characterized by its extreme simplicity in construction, the economy and facility with which the parts may be manufactured and assembled, and by its efficiency in that short-circuiting or leakage of the fluid between the edges of the baffle and the shell is substantially eliminated. By proceeding in accordance with the present invention, the baffle plates may be cheaply manufactured, it being unnecessary to finish the edges of the baffles to an exact diameter, and the shell may be made of sheet steel and require no finishing, boring or grinding operations to make the same of an exact diameter, while, at the same time, a very close, snug fit is had between the shell and the edges of the baffles so that there is no objectionable leakage between the shell and the baffles.

Other objects will be in part obvious and in part pointed out more in detail hereinafter.

The invention accordingly consists in the features of construction, combination of elements and arrangement of parts which will be exemplified in the construction hereinafter set forth, and the scope of the application of which will be indicated in the appended claims.

In the accompanying drawings, wherein I have shown, for illustrative purposes, one of the many embodiments which the present invention may take:

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

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

Fig. 3 is a detail view showing, in longitudinal section, a portion of the wrapper and tube unit, this view being taken substantially on line 3—3 of Fig. 2; and

Fig. 4 is a detail view showing the manner in which the rods for securing the baffles in position are connected to the front tube sheet.

Referring to the drawings in detail, 10 denotes a casing which, as usual, may comprise a cast iron cylindrical member having, adjacent one end, a fluid inlet 11 and, adjacent its opposite end, an outlet 12. One end of the casing is closed by a front tube sheet 13, and the other end may be closed by a head 14. The front tube sheet 13 forms a part of a service header 15. The tubes or pipes, designated by the numerals 16, 16, have their forward ends expanded into the tube sheet 13 and their rearward ends expanded into a tube sheet 17 of a floating header 18 which has an outlet in the pipe 19 extending through the head 14. The casing 10 has, rearwardly of its inlet 11, a shoulder 20 against which abuts the edge of a baffle sheet 21 through which the tubes extend, and this baffle sheet may

have, adjacent its lower end, an opening 22. While the tubes are shown as being arranged to form a single pass for the fluid flowing therethrough, the construction may be of any desired multi-pass arrangement, and the headers may be of any approved construction.

Between the baffle sheet 21 and the floating header 18 are a plurality of spaced apart baffle members 25 which may be of any suitable construction or arrangement, that shown in the drawings being by way of exemplification only. In the present illustrative disclosure, these baffle members are in the form of sheet metal plates extending transversely of the tubes and so arranged that the fluid, passing about the tubes, must repeatedly flow back and forth transversely thereof, and therefore have a relatively long path, as indicated by the arrows. In the present instance, these baffles are in the form of round disks or plates cut away at one side. These baffles are arranged in staggered relation, that is, with the cut away portions of adjacent baffles at opposite sides of the shell, so that the fluid will take a zig-zag path as it flows about the tubes.

In accordance with the present invention, instead of making the baffles fit snugly within the cast iron water-tight casing 10, these baffles are of somewhat less diameter than the internal diameter of the casing and are enclosed in an auxiliary shell which is in the form of a wrapper 26 preferably constructed of sheet steel rolled about the edges of the baffles and drawn by suitable means tightly against the peripheries thereof, whereby leakage between the wrapper and the edges of the baffles is effectively prevented. By preference, this shell fits about circular flanges or bosses 27 and 28 on the baffle sheet 21 and the tube sheet 17, respectively. By way of illustration, the edge of the wrapper is shown in overlapping condition, and the wrapper is drawn tightly against the baffles by bolts 30 carried by suitable brackets or clips 31 suitably secured, as by means of rivets, to the wrapper on opposite sides of the lap thereof. The wrapper has an outlet 32 immediately adjacent the outlet 12 of the casing.

The baffles are maintained in proper spaced relation by spacers 35 of tubular form and supported on rods 36, as shown most clearly in Fig. 3. The rear ends of these rods, which are preferably four in number, are threaded to receive nuts 37, and the forward ends of the rods are screwed into threaded recesses 38 in the front tube sheet. About the forward end of each rod, and positioned between the tube sheet 13 and the baffle sheet 21, is a spacer 35′ and a spring 39. These springs serve to urge the baffle sheet 21 against the shoulder 20 of the casing.

In the manufacture of my improved heat exchange apparatus, the following process may be employed. The baffles 25 are assembled on the rods 36 with the spacers 35 positioned between the baffles so as to space the latter in proper relation to one another. The tubes are then threaded through the assembled baffles 25, and the baffle 21 is slipped into place followed by the spacers 35′ and the springs 39. The rods are then turned so as to screw the forward ends thereof into the recesses 38 in the front tube sheet 13. The ends of the tubes are then expanded into the tube sheets 13 and 17 so that a unit is formed consisting of the tubes, the spacers, the rods, the tube sheets and the baffles. The sheet metal shell 26 is then rolled or wrapped about the baffles and is drawn tightly against the edges thereof by turning up on the bolts 30. The ends of the wrapper snugly engage the flanges on the baffle sheet 21 and the tube sheet 17 so that there is little or no leakage at these points. The assembly thus built up is then slipped into the casing 10, and the header 15 is bolted or otherwise secured in place.

It will be observed from the foregoing description, taken in connection with the accompanying drawings, that my improved heater may be very economically manufactured, particularly so since all operations requiring close or careful work, such as boring or grinding the parts to size, are eliminated. There is no necessity of finishing the internal diameter of the casing 10, the baffles may be made to approximate size, and the sheet metal wrapper may be cheaply made and very readily and quickly applied. The parts may be quickly and easily assembled.

My improved apparatus is very efficient, particularly so since the wrapper closely engages the peripheries of the baffles, thus eliminating the possibility of any substantial leakage or short-circuiting of the fluid which passes about the tubes. It will be observed that there is a space between the casing 10 and the sheet metal shell or wrapper 26 which will fill up with the fluid passing through the shell so that the pressure on the sheet metal shell is equalized, thus eliminating any excessive pressures thereon while, at the same time, the efficiency of the apparatus is not adversely affected thereby. Obviously, since there are no unequal pressures on the wrapper, and this wrapper is merely provided to confine the flow of the fluid passing about the pipes, the wrapper may be made of metal of relatively light gauge and easily applied, which means that the main object of the invention is accomplished, namely the provision of a very efficient structure at a relatively low cost. An absolutely close fit between the casing and the first baffle 21 is not necessary.

As many changes could be made in the above construction and many apparently widely different embodiments of this inven-

tion could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the language used in the following claims is intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

I claim as my invention:

1. In a heat exchange apparatus, a pair of spaced sheets having on their opposed faces circular flanges, tubes extending through said sheets, a plurality of baffles between said sheets and through which said tubes extend, the perimeters of said baffles being in alignment with one another and in alignment with said flanges, and a shell comprising a sheet of metal wound about said baffles and having its ends encircling said flanges, said shell being contracted tightly against the perimeters of said baffles and flanges.

2. In a heat exchange apparatus, a generally cylindrical casing having an inlet and an outlet spaced apart longitudinally thereof, a plurality of tubes in said casing and through which fluid is adapted to pass, a plurality of baffles through which said tubes extend and arranged to cause the fluid about the tubes to flow in a serpentine path, a sheet metal wrapper wound about said baffles and contracted into close engagement therewith, means for closing the opposite ends of said wrapper, the chamber within said wrapper having an inlet and an outlet respectively communicating with the inlet and outlet of said casing, and means for preventing communication between the inlet and the outlet of said casing except through the chamber within said wrapper.

3. In a heat exchange apparatus, a generally cylindrical casing having an inlet at one end and an outlet spaced apart longitudinally thereof; a plurality of tubes in said casing through which a fluid is adapted to pass, a pair of sheets through which said tubes extend, a plurality of baffles between said sheets and through which said tubes extend, and a wrapper engaging at its ends against said sheets and contracted closely about the peripheries of said baffles, the front one of said sheets having an inlet for the space within said wrapper, and said front sheet engaging said casing rearwardly of said inlet thereof, said wrapper having an outlet communicating with the outlet of said casing.

4. In a heat exchange apparatus, a generally cylindrical casing having an inlet at one end and an outlet spaced therefrom, said casing also having an internal shoulder rearwardly of said inlet, a plurality of tubes in the casing, a baffle sheet engaged against said shoulder and having an opening, a tube sheet at the rear ends of said tubes, a plurality of baffles between said sheets through which said tubes extend, and a wrapper comprising a sheet of metal contracted about and into close engagement with said baffles and engaging at its opposite ends against said sheets, said wrapper having an outlet communicating with the outlet of said casing.

5. In a heat exchange apparatus, a generally cylindrical casing having an inlet at one end, an outlet spaced therefrom, and a shoulder rearwardly of said inlet; a header on one end of said casing and having a tube sheet, a floating header within said casing, a plurality of tubes between said tube sheets, a baffle sheet through which the tubes extend engaging against said shoulder, a plurality of baffles between said baffle sheet and floating header, a wrapper between said baffle sheet and floating header comprising a sheet of metal contracted tightly against said baffles, said baffle sheet having an opening constituting an inlet for said wrapper and said wrapper having an outlet communicating with the outlet of said casing, and means for urging said baffle sheet against said shoulder.

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