April 8, 1924. 1,489,932

S. J. DICKEY

HEAT INTERCHANGER

Filed Sept. 7, 1920

Fig. 1.

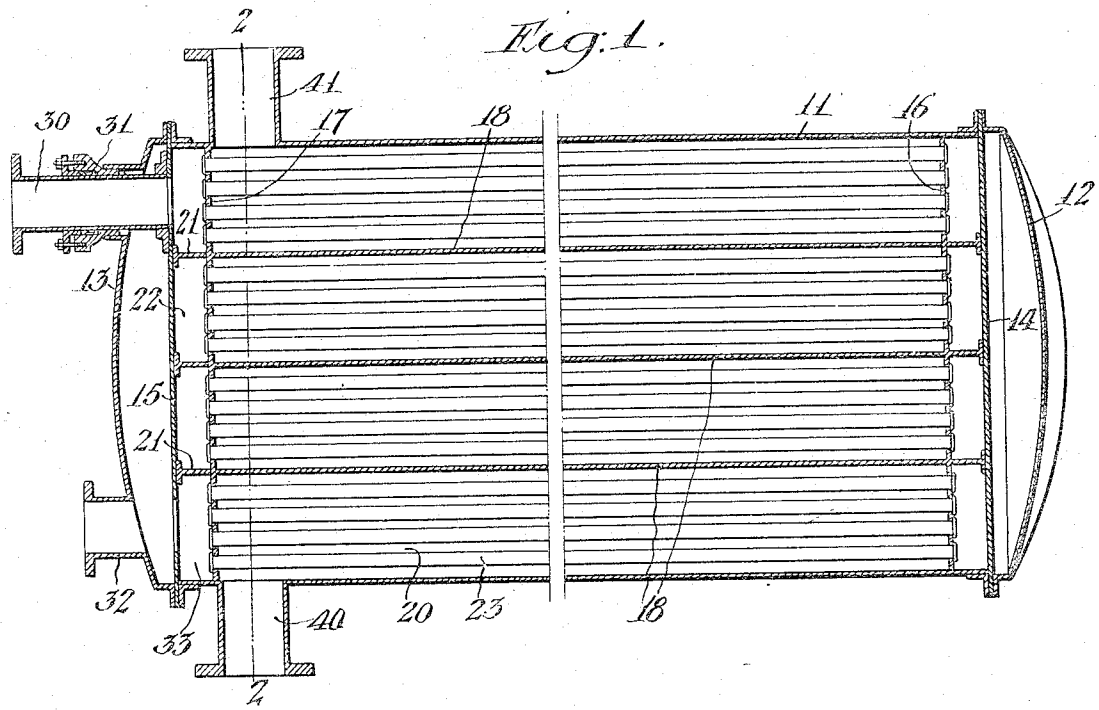


Fig. 2.

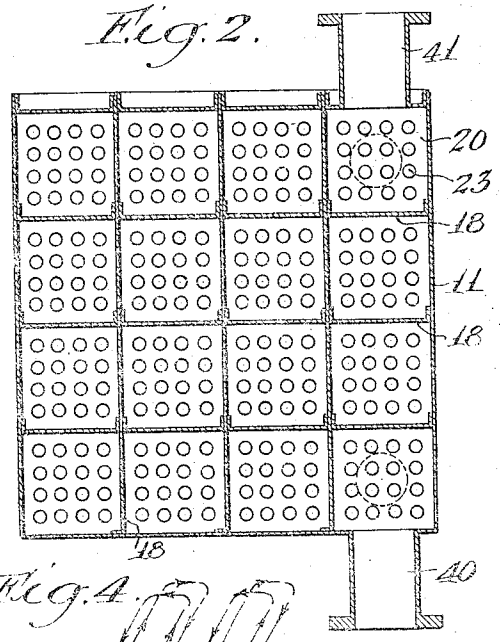


Fig. 3.

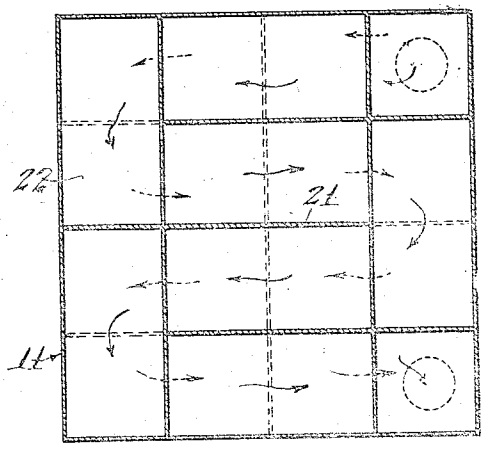
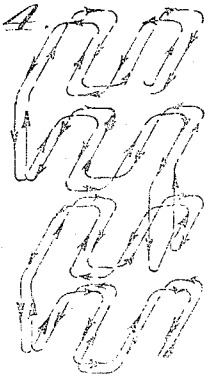


Fig. 4.



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UNITED STATES PATENT OFFICE.

SAMUEL J. DICKEY, OF LOS ANGELES, CALIFORNIA, ASSIGNOR TO GENERAL PETROLEUM CORPORATION, A CORPORATION OF CALIFORNIA.

HEAT INTERCHANGER.

Application filed September 7, 1920. Serial No. 408,671.

To all whom it may concern:

Be it known that I, SAMUEL J. DICKEY, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Heat Interchanger, of which the following is a specification.

My invention relates to those devices used in the arts for recovering waste heat from liquids or gases which it is desired to cool, this heat being absorbed in other liquids or gases which it is desired to raise in temperature.

The invention has a peculiar utility in the process of refining oil in which the gases or liquids after being treated or separated are passed through heat interchangers, giving up a portion of their heat to the crude oil and raising its temperature preliminary to its refining or treating, thus conserving this heat and increasing the economy of the process.

Further objects and advantages will be made evident hereinafter.

Referring to the drawing which is for illustrative purposes only,

Fig. 1 is a side sectional elevation through one embodiment of my invention.

Fig. 2 is a section on a plane represented by the line 2—2 in Fig. 1.

Fig. 3 is a diagram showing the course of one of the liquids.

Fig. 4 is a schematic diagram showing the course of both liquids.

In the embodiment of the invention shown, a shell 11 is provided, this shell being rectangular in cross section. Secured to either end of the shell are outer heads 12 and 13 and secured inside the heads 12 and 13 are false heads 14 and 15. Secured to the shell 11 inside the false heads 14 and 15 are tube sheets 16 and 17. Partitions 18 divide the space inside the tube sheets 16 and 17 into a series of chambers 20, the space between the false heads 14 and 15 and the tube sheets 16 and 17 being divided by partitions 21 into pockets 22. The members 18 may be secured in place by any convenient means such, for example, as welding them to the shell 11 and to each other. Tubes 23 are tightly secured in the tube sheets 16 and 17 extending longitudinally through the chambers 20. A primary liquid may be admitted to one of the pockets 22 through a pipe 30 which is provided with an expansion of joint 31 where it passes through the head 13, this liquid being withdrawn through a flange 32 which communicates with a space between the head 13 and the false head 15, this space being in open communication with one of the pockets 22 which may be conveniently numbered 33. A secondary liquid is admitted through a connection 40 into one of the chambers 20, being withdrawn from another chamber through a connection 41. The tubes 23 in the arrangement shown comprise sixteen sets, each of these sets being contained in one of the chambers 20. The pockets 22 are so arranged that the liquid passes from the pipe 30 successively through each of these series of tubes, being finally delivered to the pipe 32. In the same manner the partitions 18 are provided with openings so that the liquid entering through the connection 40 passes successively through all the chambers 20 around the tubes 23, being finally delivered to the connection 41. This is shown diagrammatically in Fig. 3 in which the solid arrows represent the course of the liquid at the end of the heat interchanger nearest the observer, the dotted arrows representing the course of this liquid at the end away from the observer. The effect of this arrangement is to pass the primary liquid through the apparatus in one direction and the secondary liquid through the apparatus in the opposite direction. One of these liquids at the point where it enters the heat interchanger is very much higher in temperature than the other liquid which enters the other end of the apparatus. In their passage through the apparatus, one of the liquids is reduced in temperature and the other liquid is raised in temperature which is the object of the apparatus.

I claim as my invention:

1. A heat interchanger comprising a shell; outer heads closing either end of said shell; false heads inside said outer heads; tube sheets inside said false heads; and tubes extending from one of said tube sheets to another, said false heads being perforated to equalize the pressure on either side thereof.

2. A heat interchanger comprising a shell; a first outer head closing one end of said shell; a first false head secured in said shell inside said outer head; a first tube sheet secured in said shell inside said false

head; a second tube sheet secured in said shell; a second outer head closing the other end of said shell; a second false head in said shell between said second outer head and said second tube sheet; tubes extending through the space between said tube sheets, each tube being secured at each end in fluid tight relationship with one of said tube sheets; partitions between said first false head and said first tube sheet dividing the space between said first false head and said first tube sheet into a series of first pockets; partitions between said second tube sheet and said second false head dividing the space between said second tube sheet and said second false head into a series of second pockets, said second pockets being so arranged with relation to said first pockets that liquid may be passed in a continuous path through all of said pockets and all of said tubes; means for introducing liquid into a pocket at one end of said path; and means for withdrawing liquid from a pocket at the other end of said path.

3. A heat interchanger comprising a shell; a first outer head closing one end of said shell; a first false head secured in said shell inside said outer head; a first tube sheet secured in said shell inside said false head; a second tube sheet secured in said shell; a second outer head closing the other end of said shell; a second false head in said shell between said second outer head and said second tube sheet; tubes extending through the space between said tube sheets, each tube being secured at each end in fluid tight relationship with one of said tube sheets; partitions extending parallel with said tubes between said tube sheets and forming a series of parallel chambers about said tubes, said partitions being pierced with openings so placed that liquid may be circulated through said chambers in a single path; a pipe delivering liquid to one end of said path; a second pipe delivering liquid to the other end of said path; partitions between said first false head and said first tube sheet dividing the space between said first false head and said first tube sheet into a series of first pockets; partitions between said second tube sheet and said second false head dividing the space between said second tube sheet and said second false head into a series of second pockets, said second pockets being so arranged with relation to said first pockets that liquid may be passed in a continuous path through all of said pockets and all of said tubes; means for introducing liquid into a pocket at one end of said path; and means for withdrawing liquid from a pocket at the other end of said path.

4. In a heat interchanger, the combination of a rectangular shell, tube sheets in said shell; tubes extending through the space between said tube sheets, each tube being secured in fluid tight relationship with one of said tube sheets at each end of said tube; and a series of partitions extending through said space parallel to said tubes, each partition being parallel with two sides of said shell and so secured to the walls forming the other two sides as to constitute a tension member preventing said sides being forced out by internal pressure on said space.

5. In a heat interchanger, the combination of a rectangular shell; tube sheets in said shell; tubes extending through the space between said tube sheets, each tube being secured in fluid tight relationship with one of said tube sheets at each end of said tube; and two series of partitions at right angles to each other extending through said space parallel to said tubes, each partition being parallel with two sides of said shell and so secured to the walls forming the other two sides as to constitute a tension member preventing said sides being forced out by internal pressure on said space.

6. In a heat interchanger, the combination of: a bottom wall; side walls extending upwardly therefrom substantially at right angles thereto; a series of vertical partitions secured at their lower edges to said bottom wall and extending upwardly substantially parallel to said side walls; and a series of intermediate partitions substantially parallel to said bottom wall secured at their edges between one of said side walls and an intermediate vertical partition or between two of said vertical partitions.

7. In a vessel having a plurality of longitudinally extending chambers; the combination of: a bottom wall; a plurality of members extending upwardly therefrom parallel to each other and substantially at right angles to said wall, said members being in the form of flat plates forming a tight joint at their lower edges with said bottom wall; and a series of inserts each secured at its edges between two of said members in a plane substantially parallel to said bottom wall.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 30th day of August, 1920.

SAMUEL J. DICKEY.