APPARATUS FOR CLEANING HEAT EXCHANGERS AND THE LIKE

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ATTORNEYS.
This invention relates to an improvement in apparatus for cleaning heat exchangers and will be found more particularly advantageous for use in cleaning the tubular elements of heat exchangers used in connection with the refining of petroleum.

As is well known, heat exchangers used in connection with the refining of petroleum, and especially the tube bundles thereof, become fouled with a heavy deposit which reduces their efficiency and as a consequence must be removed by some cleaning procedure. The fouling or deposit is in the nature of a tar or asphalt oil, coke, mud, scale, etc., and presents such difficulty in its removal that cleaning methods heretofore known, such as scraping, blowing with steam, dipping in a solvent, etc., have been recognized as inefficient and uneconomical.

Now in accordance with this invention there is provided an apparatus whereby heat interchangers, and more particularly the tube bundles thereof, may be efficiently cleaned in a minimum of time and at a great saving over the cost incident to the use of prior methods.

The apparatus in accordance with this invention will be designed for the direction of a high temperature, high pressure, flat stream of water on straight lines between the rows of tubes comprising the tube bundle of a heat exchanger. More particularly, the stream will have a pressure within the range 150–500 lbs. per square inch and more desirably within the narrower range 200–400 lbs. per square inch. The stream will desirably have a temperature within the range 160–190° F., or more specifically a temperature of about 175° F., and the stream will have a velocity of 90–200 ft. per second.

The apparatus embodying this invention will comprise essentially means for the development of the requisite temperature and pressure and a nozzle provided with an aperture or series of apertures capable of delivering a relatively thin, flat stream and with which will desirably be associated a guide arranged for the direction of the stream between rows of the tubes.

Having now indicated in a general way the nature and purpose of this invention, I will proceed to a detailed description thereof with reference to the accompanying drawings, in which:

Figure 1 is a view partly in section and partly broken away showing a form of apparatus in accordance with this invention.

Figure 2 is a view on line 2—2 Figure 1.

Figure 3 is a plan view of the form of apparatus.

Figure 4 is a sectional view showing a detail of the apparatus shown in Figure 3.

In the drawings, referring to the several figures, the tube bundle is provided with a plurality of banks of tubes 1, the banks being spaced from one another. A guide 2 is supported at its ends from the tube bundle by means of brackets 3 secured to the tube sheets of the bundle, as by plugs 4 driven into two or more tubes. The guide 2 is positioned outside of the bundle and extends longitudinally thereof and parallel to the tubes 1 adjacent to the space between a pair of the banks of tubes. Desirably, the guide 2 is supported intermediate its ends by means of a bracket comprising a member 4 embracing the guide 2 and bolted to a member 5 adapted to be engaged between adjacent rows of tubes of adjacent banks, as shown in Figure 4. The member 5, as shown, comprises a straight edge and a serrated edge and is so proportioned that it may be inserted between banks of tubes and then twisted to engage its straight edge against a row of tubes in one bank to engage its serrated edge with the other bank, the serrations projecting between tubes and acting to prevent its withdrawal. In assembling the bracket, the member 5 is first positioned between the banks of tubes and then secured to the member 4.

A carriage 6 provided with a saddle 7 is adapted to ride on the guide 2. The carriage is provided with a pair of handles 8, 8 whereby the carriage may be readily moved longitudinally of the guide 2. Extending transversely of the carriage is a nozzle guide 9 through which projects a nozzle 10 adapted for connection with a source of hot water under high pressure. The nozzle 10 is of greater width than height and is adapted for insertion between the banks of tubes, as shown in Figure 1. Adjacent the forward end of the nozzle narrow openings 11, or rows of holes, the walls of which extend at an angle corresponding to that of the alignment of the tubes 1, for example, 60°, are provided for the delivery of opposite streams from the nozzle. The body of the nozzle is provided with a series of notches 12, in diametrically opposite edges adapted to be engaged by a double spring catch 13 mounted on the carriage and the arms of which extend through notches 14 in the wall of the nozzle guide with which the notches 12 in edges of the nozzle may be brought into alignment. The notches 12 in the nozzle are spaced a distance equal to the distance between centers of the tubes, and those in one edge are staggered with respect to those in the opposite edge, so as to effect alignment of the openings 11.

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5 Claims. (Cl. 237—1)
in the nozzle and streams issuing therefrom with the spaces between the rows of tubes in adjacent banks, as shown in Figure 1.

In the operation of the apparatus shown in Figures 1-4, the bundle having been withdrawn from its shell the guide 2 is secured in place with respect to the space between two banks of tubes and the carriage carrying the nozzle mounted thereon. The nozzle is suitably connected with a source of hot water under pressure and is inserted between a pair of banks of tubes to a point such that the streams issuing therefrom will pass upwardly and downwardly between, for example, the first rows of tubes. In such position the nozzle is fixed by engagement of the spring catch 13 in a pair of the notches 12. The carriage is then moved longitudinally on the guide 2 causing the stream to move longitudinally of the tubes upon which they are acting. The nozzle is then moved inwardly a distance of one of the notches 12, which will position it for delivery of streams between the next row of tubes and the carriage again moved longitudinally on the guide 2. The inward adjustment and longitudinal movement is repeated until all the tubes have been subjected to the streams, then the nozzle is withdrawn from the nozzle guide, turned over and reinserted in the nozzle guide 9 and the process repeated with the result that the tubes will be subjected to the streams projected in different directions to the end that they will be thoroughly cleaned. Where an intermediate support for the guide 2, as shown, is provided, it will interfere with the longitudinal movement of the carriage and nozzle. However, the tubes may be cleaned in sections longitudinally and the nozzle and carriage passed by the support by removal from and replacement on the guide.

As will be appreciated, various modifications in detail over that involved in the above specific description with reference to a preferred embodiment of apparatus according to this invention may be made without departing from the scope of this invention.

What I claim and desire to protect by Letters Patent is:

1. Apparatus for cleaning tube bundles of heat exchangers comprising, in combination, a tube bundle, a guide positioned adjacent to the bundle and extending longitudinally thereof, a carriage mounted on said guide, a nozzle adjustably mounted on said carriage and means for the supply of heated fluid to said nozzle.

2. Apparatus for cleaning tube bundles of heat exchangers comprising, in combination, a tube bundle, a guide positioned adjacent to the bundle and extending longitudinally thereof, a carriage mounted for longitudinal movement on said guide, a nozzle mounted on said carriage and arranged for adjustment with respect thereto in a direction at right angles to that of its movement on said guide and means for the supply of heated fluid to said nozzle.

3. Apparatus for cleaning tube bundles of heat exchangers comprising, in combination, a tube bundle including a pair of spaced banks of tubes, a guide extending longitudinally of said bundle, a carriage mounted on said guide, a nozzle provided with a discharge opening adjacent its end adjustably mounted on said carriage and adapted to extend between said banks of tubes and means for the supply of heated fluid to said nozzle.

4. Apparatus for cleaning tube bundles of heat exchangers comprising, in combination, a tube bundle including a pair of spaced banks of tubes, a guide extending longitudinally of said bundle, a carriage mounted on said guide, a nozzle provided with a discharge opening adjacent its end adjustably mounted on said carriage and adapted to extend between said banks of tubes, means on said carriage adapted to cooperate with said nozzle and fix it in adjusted position.

5. Apparatus for cleaning tube bundles of heat exchangers comprising, in combination, a tube bundle including a pair of spaced banks of tubes, a guide extending longitudinally of said bundle, a carriage mounted on said guide, a nozzle provided with a discharge opening adjacent its end and having notches in its body portion adjustably mounted on said carriage and adapted to extend between said banks of tubes, means on said carriage adapted to cooperate with notches in the body portion of said nozzle and fix it in adjusted position.

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