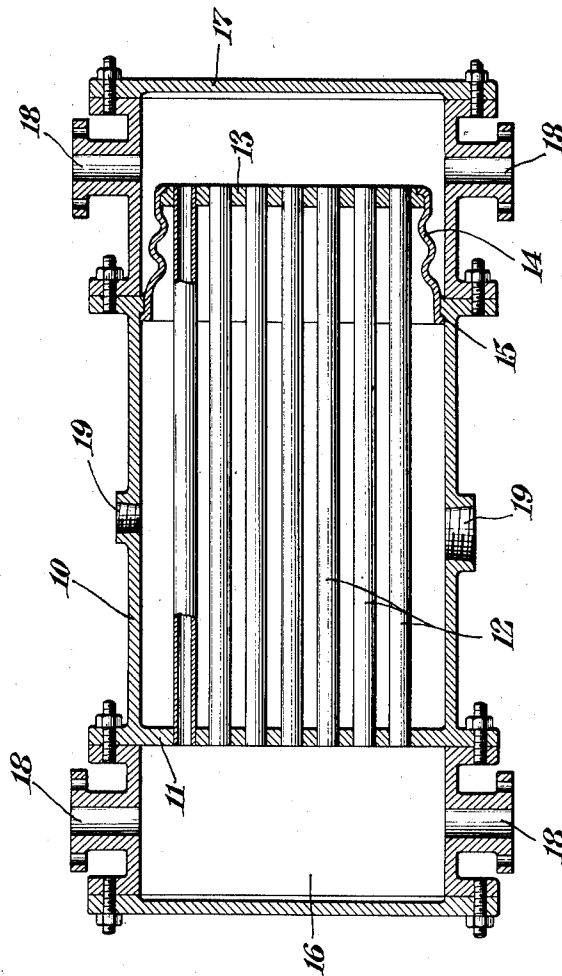


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HEAT EXCHANGE DEVICE

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HEAT EXCHANGE DEVICE

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6 Claims. (Cl. 257—236)

This invention relates to heat exchange devices and more especially to such devices consisting of a series of tubes surrounded by a shell provided with headers communicating with the tubes.

5 In such devices, linear expansion and contraction of the tubes must be provided for so that stresses in the tubes will not be effective to rupture joints and permit intermingling of the two fluids brought into heat exchange relationship in the devices. Usually one tube head is made 10 slidable and a packed joint is provided between the slidable tube head and the shell to permit expansion and contraction of the tubes and still prevent leakage of one fluid into the other. 15 Means usually are provided so that in case of failure of the packed joint there can be no intermingling of the two fluids which as in the case of fuel oil heated by steam would render the oil useless as fuel. Such devices have been complicated in structure, expensive to manufacture 20 and difficult to keep in proper operating order.

An object of this invention is a freely expansible and contractible tube-type heat exchange device having no packed joints separating the two fluids 25 between heat exchange relation and having permanent joints permitting free movement of one tube head.

In a heat exchange device constructed in accordance with the invention, a flexible apron has 30 one edge permanently joined to the surrounding shell and the other edge permanently joined to the floating tube head. Preferably, the apron is composed of the same material as the tubes, thereby having the same coefficient of expansion. 35 The apron may be connected to the floating tube head and to the shell in any permanent manner to insure a fluid-tight joint and preferably is welded at the joints. The flexibility of the apron permits free movement of the floating head by 40 reason of contraction and expansion of the tubes and fluid-tight connection is maintained at all times, thereby positively preventing intermingling of the fluids.

Other objects, novel features and advantages 45 of this invention will be apparent from the following specification and accompanying drawing wherein the single figure is a longitudinal section through a heat exchange device embodying the invention.

50 A metal cylindrical shell 10 is provided at one end with an integral head 11 in which are fastened ends of metal tubes 12 extending longitudinally of the shell. The tubes 12 extend through the open remaining end of the shell 10 and are 55 mounted in a floating metal tube head 13. A

metal flexible cylindrical apron 14 is permanently joined at one edge to the periphery of the tube head 13 and at its other edge to the shell 10 at 15, the apron preferably being welded both to the tube head 13 and the shell 10 to form permanent fluid-tight joints. Preferably, the apron 14 is of the same metal as the tubes 12 so that both have the same coefficient of expansion. A metal header 16 is connected to the shell 10 at the end 60 having fixed tube head 11 and a metal header 17 is connected to the shell 10 at the end having the floating tube head 13, the tube head 13 being received in the header 17. The headers 16 and 17 are provided with ports 18 by means of which fluid may be supplied to and discharged from the tubes 12. The shell 10 is provided with ports 19 70 by means of which fluid may be circulated through the shell around the tubes 12. The arrangement above described obviates packed joints separating the two fluids while permitting free expansion and contraction of the tubes 12 upon 75 change of temperature. The apron 14 preferably is provided with one or more peripheral crimps which permit free limited movement of the floating head 13 and prevents the development of strains in the tubes 12. As the tubes 12 are permanently sealed to the tube heads and the edges 80 of the apron 14 are permanently sealed to the shell 10 and the tube head 13, there is no possibility of leakage of one fluid into the other. There can be no failure of the joints by reason of failure of packing as there is no packing utilized.

The device above described is of particular utility in conditioning heavy crude oil for use in oil burning furnaces. Such oil must be heated 90 before it can be sufficiently atomized or vaporized and passed into the burners. The fuel oil is caused to pass through the tubes 12 from one header to the other and steam is circulated 95 through the shell 10 around the tubes 12, thereby heating the oil to the proper temperature for vaporization.

The tube head 13 is free to move with expansion and contraction of the pipes of the tubes 12 and in all conditions a fluid-tight joint is provided, thereby preventing leakage of steam into the oil. 100

It is of course understood that various modifications may be made in the device above described, without in any way departing from the spirit of the invention as defined in the appended claims. 105

I claim:

1. A heat exchange device comprising a tubular shell, a plurality of tubes extending longitudinally 110

of the shell, a fixed tube head closing one end of the shell, a floating tube head, a flexible cylindrical apron permanently joined to the floating head and to the corresponding end of said shell, and headers connected to the ends of said shell and communicating with said tubes.

2. A heat exchange device comprising a shell, a plurality of tubes extending longitudinally of said shell, and projecting beyond one end thereof, a fixed tube head closing one end of said shell, a floating tube head, a flexible cylindrical apron permanently connected to the floating tube head and corresponding end of the shell, and headers connected to the ends of said shell and communicating with said tubes, one of said headers having the floating tube head and cylindrical apron arranged therein.

3. A heat exchange device comprising a metal shell, a plurality of metal tubes extending longitudinally thereof, a tube head integral with and closing one end of said shell, a floating metal tube head, a flexible cylindrical metal apron welded to the floating tube head and the corresponding end of said shell, and headers connected to the ends of said shell and communicating with said tubes.

4. A heat exchange device comprising a metal shell, a plurality of metal tubes extending longitudinally thereof, a tube head integral with and closing one end of said shell, a floating metal tube head, a flexible cylindrical metal apron welded to

the floating tube head and the corresponding end of said shell, said apron being composed of the same metal as said tubes, and headers connected to the ends of said shell and communicating with said tubes.

5. A heat exchange device comprising a metal shell, a plurality of metal tubes extending longitudinally of said shell and projecting beyond one end thereof, a tube head integral with said shell and closing one end thereof, a floating metal tube head, a flexible cylindrical metal apron welded to the floating tube head and the corresponding end of said shell, and headers connected to the ends of said shell and communicating with said tubes, the floating tube head and flexible apron being arranged within one of said headers.

6. A heat exchange device comprising a metal shell, a plurality of metal tubes extending longitudinally of said shell and projecting beyond one end thereof, a tube head integral with said shell and closing one end thereof, a floating metal tube head, a flexible cylindrical metal apron welded to the floating tube head and the corresponding end of said shell, said cylindrical apron being composed of the same material as said tubes, and headers connected to the ends of said shell and communicating with said tubes, the floating tube head and flexible apron being arranged within one of said headers.

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