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3,262,489

HEAT EXCHANGER

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FIG. 1

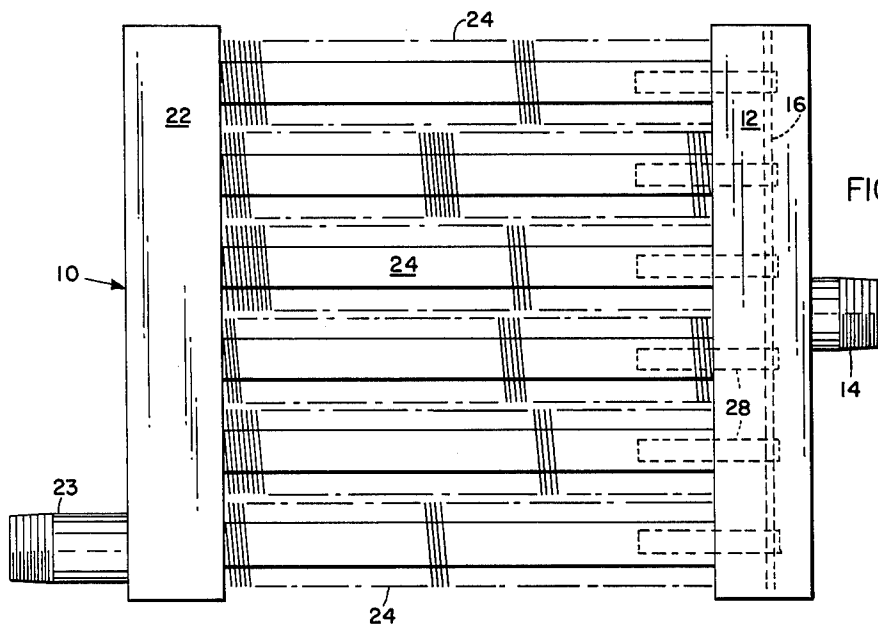
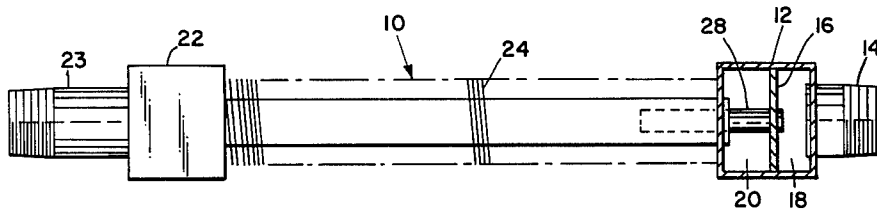


FIG. 2

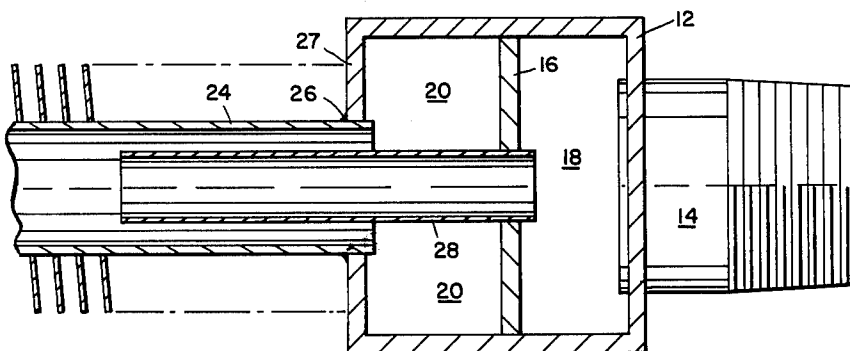


FIG. 3

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HEAT EXCHANGER

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2 Claims. (Cl. 165-1)

This invention relates broadly to heat transfer devices. More particularly this invention relates to heat transfer devices wherein a first fluid of relatively high temperature transfers heat to a second fluid.

Heat transfer devices of the kind under consideration are employed for the purpose of transferring heat between a superheated vapor, such as steam, and air or any other gaseous vapor for the purpose of elevating the temperature of the air or the gaseous vapor. The devices usually include a supply header in communication with a source of steam and a condensate or return header with the headers being connected by tubular members over which the air passes.

Economy of construction of a heat exchanger of the kind described is achieved by utilizing relatively inexpensive means such as brazing for connecting the parts forming the heat exchanger. A primary problem, however, with the use of brazed joints occurs when superheated steam of a temperature in excess of that considered to be safe for brazed joints is encountered. Under these circumstances it is necessary that the parts be united by welding, a more expensive process.

The chief object of this invention is the provision of a heat transfer device of the kind described constructed so as to enable high temperature steam to be employed in a structure containing brazed joints.

Another object of the invention is the provision of an improved heat exchanger wherein the supply of fluid to the heat exchanger is automatically distributed to the individual tubular members incorporated therein in accordance with the load on each tubular member in the interest of more efficient performance of the device. It will be appreciated that the air to be heated, as it passes over the heat exchanger, may vary in temperature throughout its path of flow in such a manner that one tube in the heat exchanger may encounter air of a different temperature or velocity than another tube in the device. The invention contemplated herein includes a construction that assures a supply of heat transfer fluid to a particular tube in accordance with the load on the tube.

Another object of the invention is the provision of an improved method of operating a heat transfer device of the kind described so that operation of the device may be achieved using steam or vapor having a temperature in excess of that considered safe for use with brazed joints.

A further object of the invention is the provision of an improved method of fabricating a heat transfer device of the kind contemplated.

In attaining the objects of this invention, there is provided a heat exchanger or heat transfer device including in combination a supply header provided with a partition dividing the supply header into two compartments, a condensate header remote from the supply header, together with a plurality of tubular members connecting the two headers, and a delivery tube projecting from the partition through one of the supply header compartments into each tube.

These and other objects of the invention will be apparent from a consideration of the ensuing specification and drawings in which:

FIGURE 1 is a side view, partly in section, of a heat transfer device incorporating this invention;

FIGURE 2 is a plan view of the device illustrated in FIGURE 1; and

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FIGURE 3 is a fragmentary view illustrating the arrangement of parts which permits the use of brazed joints in a construction of the kind contemplated.

Referring more particularly to the drawings for an illustration of a preferred embodiment of this invention, there is shown a heat exchanger 10 including a supply header 12. In order to supply superheated vapor such as steam to the supply header from a source of the fluid there is provided a connection 14. Disposed within the supply header 12 is a partition 16 dividing the header into a first compartment 18 communicating with the connection 14 and a second or inactive compartment 20.

A condensate or return header 22 is located remote from the supply header and serves to collect steam and steam condensate from the heat exchanger. A drain connection 23 permits the steam condensate or steam to be removed from the unit. Connecting the supply header 12 and the condensate header 22 are a plurality of finned tubes 24, it being understood that the fluid to which heat is to be imparted, such as air, is passed over the outer surface of the tubes 24.

Referring more particularly to FIGURE 3, it is to be noted that the end of the tube 24 connected to the supply header is brazed as at 26 to the portion of the supply header defining the forward wall 27 of the inactive compartment 20 for a purpose to be more fully explained. In order that the fluid supplied to the header 12 be transmitted to the tubes 24, there is provided a delivery tube 28 arranged at the entrance of the heat transfer tubes 24. Delivery tube 28 is connected to an opening in the partition member 16, so as to communicate with compartment 18, and extends forwardly through the inactive compartment for a relatively short distance into the tube 24. An important feature of the invention is the fact that the delivery tube 28 is maintained in spaced relation to the tube 24 and particularly the region of the tube that is connected to the inactive compartment 20.

Considering the operation of the device, it will be appreciated that the heat exchanger may be placed in a duct through which air to be heated flows in such a manner that the tubular members 24 are disposed in the path of air flow and that a first fluid such as superheated steam is supplied to the header 12 for flow through the individual tubes 24 via the delivery members 28. Condensate formed as heat is extracted from the fluid flowing in tubes 24, collects in header 22 and is drained therefrom through connection 23. With the construction shown, the connection 26 between the tube 24 and supply header 12 is not subject directly to the elevated temperature of the steam flowing in the compartment 18 and delivery tubes 28, being insulated therefrom by the compartment 20 and the spaced disposition of the tube 28. It may be considered to be thermally isolated by virtue of the resistance to conduction of the partition 16 and the walls forming the second compartment 20. Thus, it will be appreciated that superheated steam having a temperature on the order of 650° F. may be safely employed with the construction described. The temperature of the condensate will be less than 425° F., an acceptable brazed joint temperature. It will be appreciated that with the construction a more efficient heat transfer action can be achieved.

Another feature of the invention involves the particular construction of the second or inactive compartment 20. It will be appreciated that under certain circumstances the loading on the individual tubes 24 may vary over a substantial range. With the construction illustrated, should an individual tube, which is lightly loaded, receive more steam than necessary, the desuperheated steam or condensate will flow rearwardly to the second compartment for passage to another tube more heavily loaded. This is true because the individual tubes are

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in communication with a compartment to which there is no drain provided, the drainage being limited to connection 23. Thus, a self-balancing action is attained resulting in more efficient heat transfer action. To a certain extent the tubes 28 act as nozzles tending to entrain flow from the compartment 20 when the tubes 24 which they serve are heavily loaded.

With the construction shown, delivery tube 28 acts as a nozzle driving, at high velocity, any non-condensibles that might otherwise collect in the tube 24, served by the nozzle, into the header 22 from where they pass from the heat exchanger. The tube or nozzle 28 delivers the superheated vapor at a velocity tending to discourage reverse flow between the nozzle 28 and the tube 24. The fluid that may collect in the space between the two tubes for eventual drainage into compartment 20 is desuperheated to a temperature low enough so that the joint 26 is unaffected. The fins disposed about the tube 24 contribute to a rapid transfer of heat in the region of tube 24 adjacent the joint 26.

Other features of the invention will suggest themselves to those skilled in the art without departing from the scope of the invention as set forth in the following claims.

I claim:

1. The method of transferring heat from a first fluid to a second fluid wherein the first fluid is at a temperature in excess of that recommended for the joinder of metal parts by brazing, which comprises the steps of:

- (a) supplying the first fluid to a supply header having first and second compartments separated by an apertured partition;
- (b) delivering the first fluid to heat transfer tubes in communication with the second compartment through a brazed joint and a condensate header remote from the supply header, the delivery being accomplished through relatively short delivery tubes having a connection with the partition as its sole support, so that the brazed joint is isolated from the high temperature fluid and heat from the first fluid that flows by conduction to the brazed joint will pass through structure subject to temperatures below the temperature of the first fluid; and

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(c) supplying a source of fluid to be heated over the surface of the connected parts.

2. Heat transfer apparatus for transferring heat from a superheated vapor flowing within the apparatus to fluid flowing over the apparatus, comprising a first header for receiving the superheated vapor, a partition member arranged in said first header defining a first compartment in communication with a source of superheated vapor and a second compartment disposed adjacent thereto, a second header remote from the first header, a plurality of tubular members connecting the first and second headers with the ends of the tubular members connected to the first header in engagement with the part of the first header defined by the second compartment, the connection between the tubular members and the first header including a compound having a relatively low melting temperature, a delivery tube having a first end connected to an opening in the partition so as to be in communication with the first compartment of the first header, said delivery tube extending forwardly through said second compartment a predetermined distance into and in spaced relation to the tubular member, said distance being relatively small in comparison to the length of the tube so that heat flow to the connection by conduction through the parts will pass regions subject to temperatures less than the temperature of the vapor emanating from the delivery tube.

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