

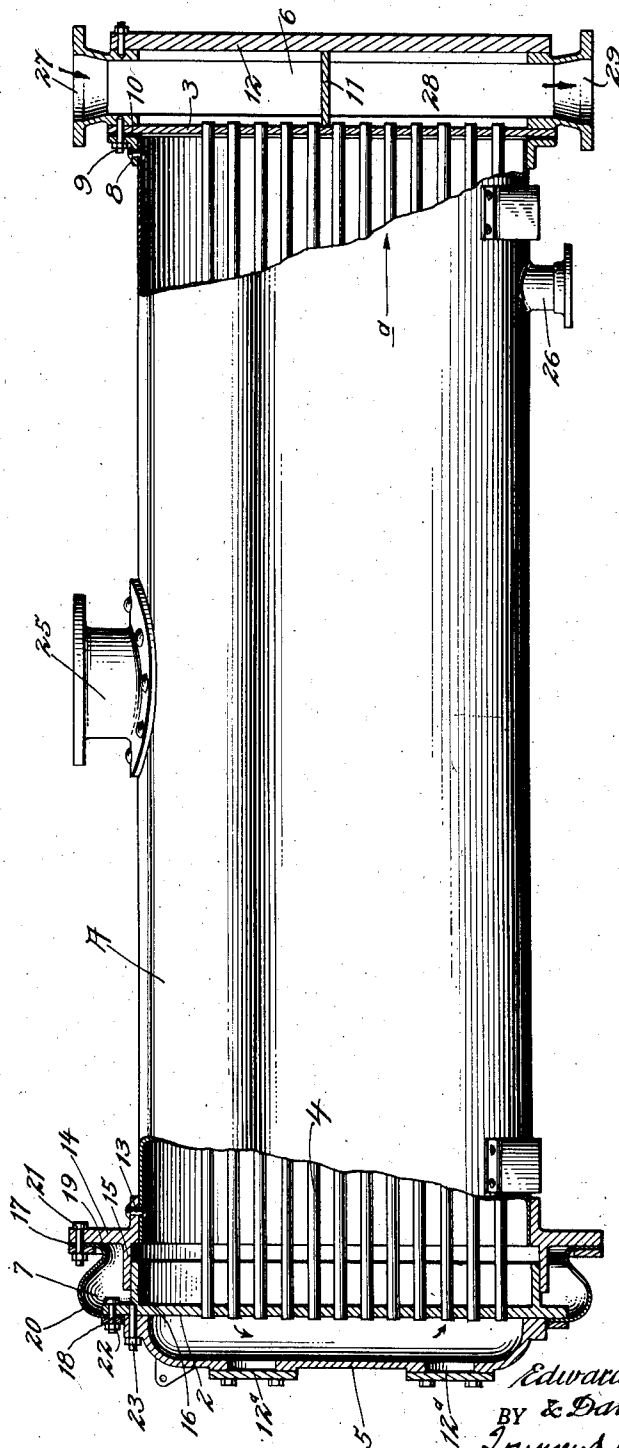
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EXPANSION JOINT FOR HEAT EXCHANGERS

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EXPANSION JOINT FOR HEAT EXCHANGERS.

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This invention relates to apparatus for heating or cooling fluids, in which the heat is transferred from one fluid to another and especially, to an expansion joint whereby the apparatus may freely expand or contract when subjected to different temperatures without imposing any stress on the heads, tube sheets, or other parts of the apparatus.

The heat exchanger forming the subject matter of the present application, comprises an elongated cylindrical shaped shell, a plurality of tubes interior thereof and extending from end to end, tube sheets at each end of the shell whereby the tubes are supported, means for introducing steam to heat the tubes, and a pair of end heads which directs the fluid to be heated through the tubes.

The object of the present invention is to generally improve and simplify the construction and operation of heat exchangers of this character, to provide means whereby one head and an adjacent tube sheet may be mounted for endwise or floating movement with relation to the shell, to provide means whereby both tube sheets and the tubes mounted therein may be moved in unison endwise of the shell, to provide an expansion joint to form a seal between the floating tube sheet and the shell and further, to provide an expansion joint which may be removed for replacement, annealing, packing, etc. without disturbing the floating tube sheet, the heads, or any other part of the apparatus.

One form which the invention may assume is exemplified in the accompanying drawings in which the figure is a side elevation of the heat exchanger, said side elevation being partly broken away and being also shown partially in section. Therefore, referring to the drawing in detail, A indicates an elongated cylindrical shaped shell constructed of steel or any other suitable metal. Disposed at each end of the shell are tube sheets such as indicated at 2 and 3 and mounted in the tube sheets and supported thereby is a plurality of tubes 4. Supported by each tube sheet or by the shell proper, are head members 5 and 6 and interposed between the tube sheet 2 and the shell proper is an expansion joint generally indicated at 7. The tubes 4 are secured in the respective tube sheets 2 and 3 in the usual manner. The tube sheet 3 is secured to one end of the shell by means of an annular flange 8 and

bolts 9 and a gasket 10 may be interposed between the tube sheet and the flange 8 to prevent leakage. The head member 6 is secured to the exterior face of the tube sheet in any suitable manner or as here illustrated by means of the bolts 9 and the head is provided with a horizontally extending partition member 11, the function of which will hereinafter be described. The head member is also provided with a removable end plate 12 which may be removed to permit cleaning of the head and the tubes when certain liquids or fluids are handled.

The tube sheet 3 will hereinafter be referred to as the stationary tube sheet and the tube sheet 2 as the floating tube sheet. The last named tube sheet is mounted and sealed with relation to the shell A in the following manner. Secured to the end of the shell as at 13 is an annular flange 14. This flange is provided with a second annular flange 15. The tube sheet 2 is also provided with an annular flange as indicated at 16 and this flange telescopes within the flange 15 and is guided and supported thereby. The tubes 4 are in most instances constructed of copper and as the exterior shell A is usually constructed of steel, it is obvious that a considerable difference in coefficient of expansion is encountered. It is for this reason that the floating tube sheet 2 is employed. In view of the floating tube sheet, it obviously becomes necessary to seal the telescoping joint formed by the flanges 15 and 16, and it is for this reason that the expansion joint 7 is employed. The joint is preferably made of copper or a like fairly flexible metal. The joint is ring-shaped or annular and is provided with two flanges, one indicated at 17 and the other at 18. A cross section of the expansion ring or joint shows that it is substantially S-shaped. This is of considerable importance, as it provides two bends or curls such as indicated at 19 and 20, which may give or flex during telescoping action of the tube sheet 2. The flange 17 of the expansion joint is secured to the outer peripheral edge of flange 14 by means of bolts or the like shown at 21. The second flange 18 of the expansion joint is secured by means of bolts 22 to the outer peripheral edge of the tube sheet. The head member 5 is secured to the exterior surface of the tube sheet 2 by means of bolts 23 and as such moves or floats with the tube sheet

during expanding or contracting action. In actual practice, steam or other heating medium is admitted to the shell through the connection indicated at 25. The steam entering surrounds the tubes 4 and the heat is transferred from the steam to the liquid or fluid circulating through the tubes 4. The condensate obtained after release of heat is collected in the bottom of the shell and may be removed or drained through the discharge connection indicated at 26.

In actual operation, the fluid or liquid to be heated enters the head member through the connection indicated at 27, then passes through the upper layer of tubes and flows through the same and thereby enters the head member 5. From there the liquid passes through the lower layer of tubes and discharges into the space 28 of the head member 6, from where it finally discharges through the connection 29. The partition member 11 serves the function of directing the incoming liquid into the upper series of tubes and similarly prevents the discharging warm liquid from mixing with the incoming cool liquid, or in other words, directs the discharging hot liquid through the connection 29. The heating medium such as steam or the like admitted, causes expansion or elongation of the heating tubes 4. Such elongation cannot set up any stress in the tube sheets or in the tube joints as tube sheet 2 is freely movable in an endwise direction. Leakage cannot take place around the floating tube sheet, as it is completely sealed or packed by means of the expansion joint 20.

The advantages of an arrangement and structure such as here shown are as follows. First, by providing the telescoping flanges 15 and 16 in connection with the floating tube sheet, the expansion joint 7 is entirely relieved of the weight of the tube sheet, the tubes, and the head member 5, and the tubes proper are also relieved of any bending stress. Secondly, by constructing the expansion joint as shown, it becomes possible to readily and quickly remove the same for renewal, annealing, packing, etc. by merely releasing the bolts 21 and 22 and without disturbing the float tube sheet, the head 5, or any other part of the apparatus, this being due to the fact that the inside diameter of the expansion joint at the point 19 is slightly larger than the exterior peripheral diameter of the tube sheet 2, thereby permitting the expansion joint to be slipped over the tube sheet and the head 5, while being removed or replaced. Third, the packing gasket 10 cooperating with the stationary tube sheet 3 may be replaced at any time by removing the bolts 9 and 22.

The removal of these bolts releases the floating tube sheet with relation to the expansion joint, and the stationary tube sheet with relation to the shell, thus permitting the tubes and the tube sheets to be moved endwise in the direction of arrow with relation to the shell, a sufficient distance to remove the old gasket and to replace it with a new. Fourth, the removable plate 12 and similar plates indicated at 12^a on the head 5 are also important as it permits ready access to the interior of the heads for cleaning the same and also for cleaning the interior of the tubes. This being of particular importance in handling liquids such as milk or the like. Fifth, an expansion ring or joint of S-shaped cross section is also an important feature, as it substantially doubles the flexibility of the joint and the life of the same.

While certain of the details of the present invention have been more or less specifically illustrated, we wish it understood that changes in form and proportion may be resorted to within the scope of the appended claims and we wish it understood that the materials and finish of the several parts employed may be made to suit varying conditions or to suit the dictates of the manufacturer.

Having thus described our invention, what we claim is:

1. In an apparatus of the character described, an elongated cylindrical shaped shell, a plurality of tubes interior thereof and extending from end to end of the shell, a stationary tube sheet at one end of the shell supporting one end of the tubes, a floating tube sheet at the other end of the shell supporting the opposite ends of the tubes, and an annular expansion member forming a seal between the floating tube sheet and the shell, and a head member supported by the floating tube sheet.

2. In an apparatus of the character described, an elongated cylindrical shaped shell, a plurality of tubes interior thereof and extending from end to end of the shell, a stationary tube sheet at one end of the shell supporting one end of the tubes, a floating tube sheet at the other end of the shell supporting the opposite ends of the tubes, and an annular expansion member forming a seal between the floating tube sheet and the shell, and means forming a guide and support for the floating tube sheet to relieve the expansion member of the weight of the floating tube sheet and the tubes, and a head member supported by the floating tube sheet.

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