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3,008,693

HEAT TRANSFER APPARATUS

Filed Aug. 4, 1958

2 Sheets-Sheet 1

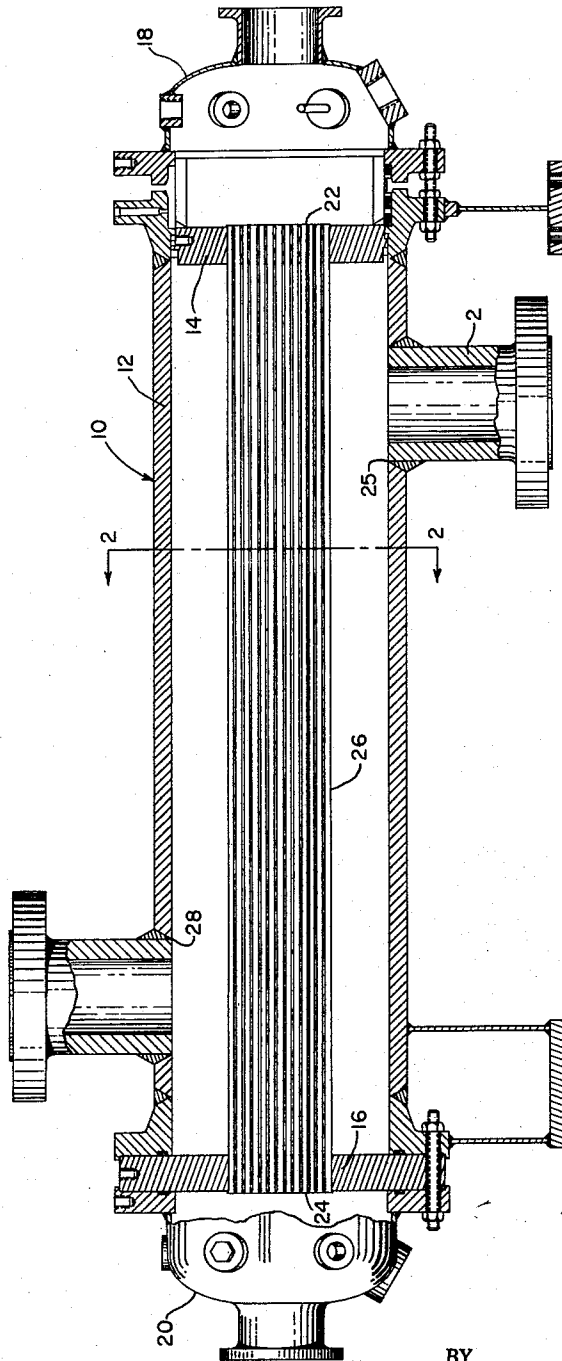


FIG. 1

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2 Sheets-Sheet 2

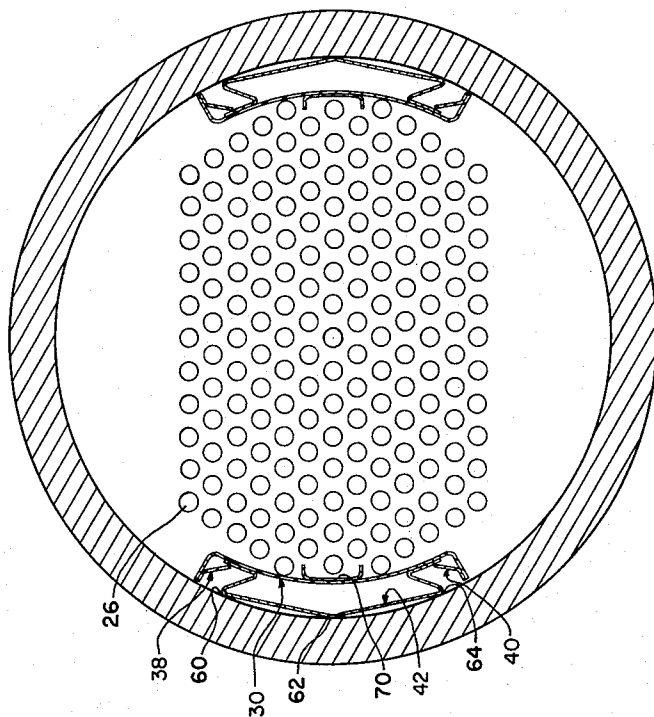
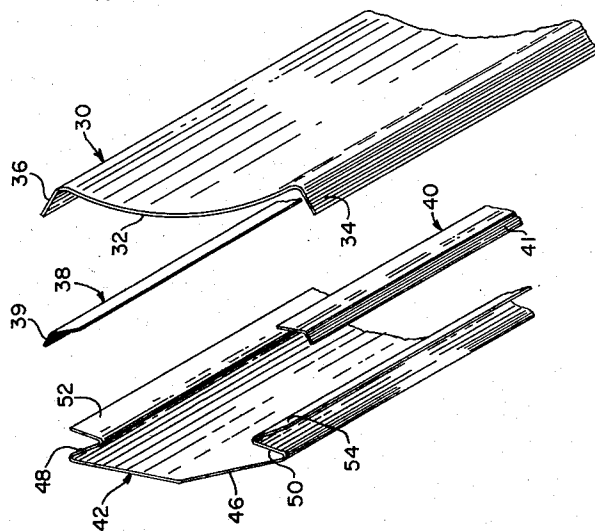


FIG. 2

FIG. 3



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3,008,693

HEAT TRANSFER APPARATUS

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6 Claims. (Cl. 257-236)

This invention relates broadly to heat transfer equipment. More particularly this invention relates to heat transfer equipment of the shell and tube type having arranged therein novel baffle members which control the path of gas flow through the equipment to obtain a high degree of efficient heat transfer action.

The chief object of this invention is the provision of an improved heat transfer unit of the kind described wherein baffle means are provided to function as a seal as well as a spacing element for maintaining the sides of the tube bundle in spaced relation to the sides of the shell.

Another object of this invention is the provision of a heat transfer unit of the kind described wherein baffle means of the type under consideration are arranged so as to be easily assembled in the shell and tube construction.

A further object of the invention is the provision of a heat transfer unit of the kind under consideration wherein the baffle means are provided with means for promoting turbulence in those areas of the tube bundle normally subject to rapid gas flow of the type which encourages bypassing of certain of the tubes in the tube bundle.

These and other objects of the invention are attained with a construction which includes means for providing a series of confined flow passages within a shell, and means serving to prevent the flow of a heat transfer medium in those areas located between the periphery of the means defining the confined flow paths and the sides of the shell which serves as a housing for the unit.

Other objects and features of the invention will be apparent from a consideration of the ensuing specification and drawings wherein:

FIGURE 1 is a side view of a heat transfer unit, partly in cross section, of the type to which the invention pertains;

FIGURE 2 is a view in section along lines 2-2 on FIGURE 1, showing the manner in which the baffle means are mounted in the heat transfer unit; and

FIGURE 3 is an exploded view of the baffle assembly illustrating the invention.

Referring to the drawings, for an illustration of a construction to which the invention may be applied, a shell and tube heat transfer unit 10, is shown comprising an outer shell member 12, having tube sheets 14 and 16 assembled therein adjacent the ends of the shell. The tube sheets 14 and 16 are provided with a plurality of spaced openings 22 and 24, for the purpose of securing and supporting the ends of tubular members 26.

Cover members 18 and 20 are adapted to be assembled to the ends of the shell through the abutting flange portions shown on FIGURE 1. Appropriate sealing means are assembled in those locations serving as connecting areas for the flanges.

The tubular members 26 define a series of confined passages for the flow of a first heat transfer medium introduced through the header 20 and which flows from the unit via the header 18. The shell member is provided with an opening 25 serving to mount a member providing an inlet to a central compartment of the heat transfer unit for a second medium which is in the gaseous state. The shell member is likewise provided with an opening 28, serving to mount a member providing for the exit of the second heat transfer medium. Under the circumstances the medium flowing within the tubes might be

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water while the medium flowing into the inlet 25, could be superheated steam. Thus the steam is cooled as it passes through the heat transfer unit for use in a facility not shown.

As shown in FIGURE 2, the tubes 26 are arranged so as to permit the passage of gas there-between. The sub-assembly of the tube sheets 14 and 16 and the tubular members 26, are often referred to as a tube bundle. In the interests of maintaining efficient heat transfer action, the tube bundle is so arranged that a space is located between the sides of the tube bundle and the inner surface of the shell. This space however, often serves as a passage for the flow of gas through the unit. Under these circumstances it will be obvious that flow through this passage represents a loss as far as heat transfer action is concerned. In order to prevent the flow through this passage and to maintain proper spacing of the tube bundle within the shell a construction of the type shown in FIGURE 3 is provided.

A combination sealing barrier and spacer assembly includes a support member 30, formed in the shape of a modified inverted U. It is contemplated that the support member 30 will engage the confronting surfaces of the tube sheets 14 and 16, so as to extend co-extensively with the tube bundle. The support member 30, includes a central arcuate portion 32, having a configuration generally similar to the configuration of the tube bundle in the area where it is to be mounted. Extending radially from the central arcuate portion 32 are end portions 34 and 36.

Retainer elements 38 and 40 are assembled with first portions 39 and 41 secured permanently to the portions 36 and 34 respectively of the support member. The other or free ends of the retainers 38 and 40 are inclined with respect to the portions 39 and 41 and arranged to overlie and engage the central portion of the support member 30. They are constructed with a degree of resiliency sufficient to permit the end portions of the sealing member, to be described in detail, to be slipped in between the free end and the support member as shown in FIGURE 2.

In addition to the structure described above, a resilient sealing member 42, having a central portion 46, and two intermediate portions 48 and 50 bent back upon the central portion 46 and two end portions 52 and 54, which are in turn bent back upon the portions 48 and 50, is shown assembled within the combined retainer and support member. The resilient sealing member is so arranged that when it is assembled in the manner described and as shown in FIGURE 2, three points 60, 62 and 64, yieldably engage the inner surface of the shell. Thus, a three line contact extending axially of the shell is assured.

Considering the operation of the heat transfer apparatus equipped with the invention described, once the tube bundle together with the combination sealing and spacer assembly is inserted within the shell, a substantial resistance to the passage of gaseous medium in those areas between the side of the shell and the side of the tube bundle is presented. Preferably the resilient sealing element is assembled within the retaining elements secured to the support member prior to assembly of the shell about the tube bundle. Under these circumstances the resilient sealing element 42, may extend outside the ends of the radial members 34 and 36 on the support element. However, when the sub-assembly including the tube bundle and the combination sealing and spacer member is inserted in the shell, engagement of the resilient member with the inner surface of the shell causes the resilient member to be compressed and to be maintained under compression during the assembly and at the completion of the assembly described.

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Channel shaped elements 70, may be secured to the surface of the support member confronting the tube bundle. The purpose of these members is to promote turbulence in those areas where there is an inclination for the vapor stream which passes into the unit through the inlet to bypass the tubes in the bundle adjacent the support 30.

While I have disclosed preferred embodiments of the present invention, I desire it to be understood that it is not limited thereto, but may be otherwise embodied within the scope of the following claims:

I claim:

1. In a heat transfer unit of the shell-and-tube type wherein a first fluid flows in a plurality of spaced tubular members mounted in a compartment of a shell member to define a plurality of confined flow paths and a second fluid is introduced into said compartment for flow over the surface of the tubular members and between the spaces thereof, barrier means arranged within the compartment for substantially preventing the flow of the second fluid between the portion of the compartment within which the tubular members are mounted and the inner surface of the compartment, said barrier means including oppositely disposed axially extending support members substantially coextensive with the tubular members, each of the support members adapted for engagement with at least one of the tubular members confronting the inner surface of the compartment, a resilient plate member disposed between the inner surface of the shell and each support member and being coextensive with each support member, said resilient plate members urging said support members into engagement with at least one of said tubular members and means for connecting the resilient plate members to the support members so that the resilient plate members yieldably engage the inner surface of the shell, said connecting means each including a retainer having a first end fixed to a support member and a second free end yieldably engaging said support member.

2. In a heat transfer unit of the shell-and-tube type the combination comprising spaced members for supporting in a central compartment within the shell the ends of a plurality of spaced tubes, means for introducing a first fluid into the unit for flow through the tubes, means for introducing a second fluid for flow through the central compartment and means for substantially preventing the flow of the second fluid between the portion of the central compartment occupied by the tubes and the inner surface of the shell, said last-mentioned means including a support member, a resilient element coextensive with said support member and retaining means for coupling said resilient element to the support member so that upon insertion of the support member and resilient element between a portion of the tube structure and the inner surface of the shell, the resilient element yieldably engages the confronting shell surface and urges the support member into engagement with at least one tube, said retaining means including a retainer having a first end fixed to the support member and a second free end yieldably engaging said support member wherein assembly of the resilient element and the support member is accomplished by insertion of a portion of the resilient element between the support member and the free end of the retainer.

3. A baffle assembly for preventing flow of fluid between a portion of a tube bundle and the confronting surface of a compartment in a shell-and-tube heat transfer unit comprising a support member adapted to engage with and extend coextensively with the portion of the tube bundle, a resilient plate element adapted to yieldably engage the surface of the shell and means for assembling the resilient plate element, said means including at least one retainer having a first end fixed to the support member and a second free end yieldably engaging said support

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member wherein assembly of the resilient plate element and the support member is accomplished by insertion of a portion of the resilient element between the support member and the free end of the retainer.

4. The invention set forth in claim 3 wherein said support member is provided with a surface having a configuration substantially complementary to the configuration of the portion of the tube bundle.

5. In a heat transfer unit of the shell-and-tube type the combination comprising spaced members for supporting in a central compartment within the shell the ends of a plurality of spaced tubes, means for introducing a first fluid into the unit for flow through the tubes, means for introducing a second fluid for flow through the central compartment and means for substantially preventing the flow of the second fluid between the portion of the central compartment occupied by the tubes and the inner surface of the shell, said last-mentioned means including an axially extending support member, a resilient member coextensive with said support member and disposed between the support member and the inner surface of the shell so that upon insertion of the support and resilient members between a portion of the tube structure and the inner surface of the shell the resilient member yieldably engages the confronting shell surface and urges the support member into engagement with at least one tube, means for assembling the resilient member to the support member comprising a retainer having a first end secured to one of the members and a second free end wherein assembly of the members is accomplished by inserting a portion of the other of the members between the first member and the free end of the retainer, and means secured to the support member adjacent said one tube for promoting turbulence in the tube area adjacent the engagement with the support member.

6. In a heat transfer unit of the shell and tube type wherein a first fluid flows in a plurality of spaced tubular members mounted in a compartment of a shell member to define a plurality of confined flow paths and a second fluid is introduced into said compartment for flow over the surface of the tubular members and between the spaces thereof, barrier means arranged within the compartment between the spaced tubular members and the inner surface of the shell member for preventing the flow of the second fluid between the portion of the compartment within which the tubular members are mounted and the inner surface of the compartment, said barrier means including an axially extending plate support member, a resilient plate member disposed between the inner surface of the compartment and the support member and being coextensive with said support member, and means for connecting the resilient plate member to the support member so that the resilient plate member yieldably engages the inner surface of the shell and urges the support member into engagement with at least one of the spaced tubular members, said means including at least one retainer having a first end fixed to the support member and a second free end yieldably engaging said support member wherein assembly of the resilient plate element and the support member is accomplished by insertion of a portion of the resilient plate element between the support member and the free end of the retainer.

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**UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION**

Patent No. 3,008,693

November 14, 1961

Edson H. Byrns

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 3, line 70, after "element" insert -- to the support member --.

Signed and sealed this 17th day of April 1962.

(SEAL)
Attest:

ESTON G. JOHNSON

Attesting Officer

DAVID L. LADD

Commissioner of Patents