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TUBE BUNDLE ASSEMBLY FOR HEAT EXCHANGERS AND THE LIKE

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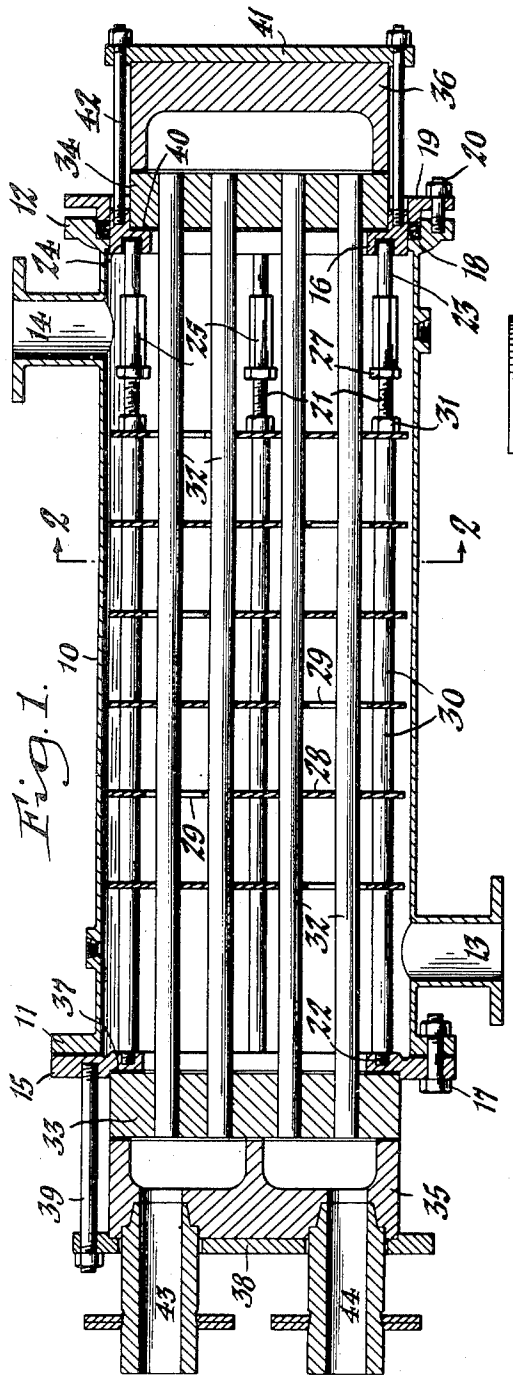


Fig. 1.

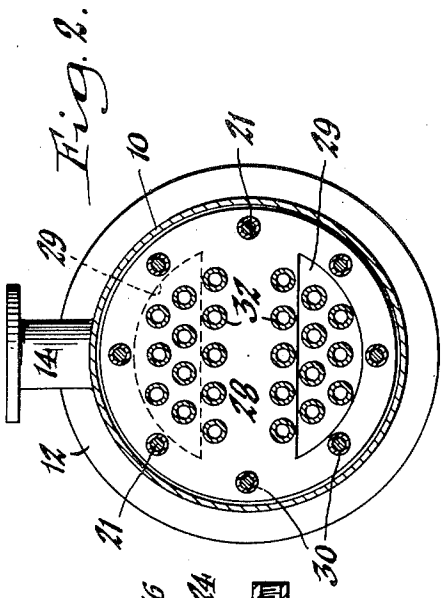


Fig. 2.

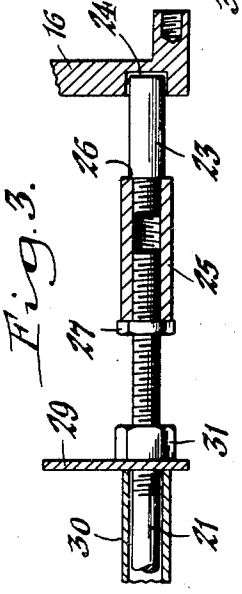


Fig. 3.

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## TUBE BUNDLE ASSEMBLY FOR HEAT EXCHANGERS AND THE LIKE

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3 Claims. (Cl. 257—239)

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This invention relates generally to heat exchangers but more particularly to certain new and useful improvements in the tube-supporting frame or tube bundle assembly for such exchangers.

It has for one of its objects to provide a tube assembly frame of this character which is so designed and constructed as to permit the ready assemblage of its parts and its handling, interchanging and installation in the shell of the heat exchanger, and which is adjustable and provides for the thermal expansion and contraction of its parts when the exchanger is in operation.

Another object of the invention is to provide a removable and adjustable tube nest assembly frame which has been primarily designed for use in connection with carbon or other non-metallic tubes and tube sheets and wherein maximum protection is afforded such parts against breakage during interchanging, handling and shipment.

Other features of the invention reside in the construction and arrangement of parts hereinafter described and particularly pointed out in the appended claims.

In the accompanying drawings:

Figure 1 is a longitudinal section of a heat exchanger in which my improved tube bundle assembly frame is installed. Figure 2 is a cross section taken on line 2—2, Figure 1. Figure 3 is an enlarged sectional detail view showing the adjustable tie rod construction.

Similar characters of reference indicate corresponding parts throughout the several views.

Referring now to the drawings, 10 indicates the shell or cylinder of a heat exchanger which is provided at one end with an annular attaching flange 11 and at its opposite end with a similar flange 12. Adjacent its ends the shell has a fluid inlet 13 and an outlet 14. The improved tube nest or bundle assembly frame which is adapted to be removably and adjustably arranged within the shell is preferably constructed as follows:

The numerals 15, 16 indicate tube head retaining or supporting rings or members which are applied to the opposite ends of the shell 10, the ring 15 being adapted to be rigidly connected to the shell-flange 11 by bolts 17, while the retaining ring 16 has a slide or floating fit with the corresponding end of the shell and a stuffing box 18 is provided including a gland ring 19 secured to the shell-flange 12 by bolts 20. Disposed between and connecting these supporting rings and in protective relation about the tube bundle are longitudinal tie rods 21 which are secured by

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screw connections 22 or the like at one end with the ring 15 while their opposite ends terminate in adjustable rod-sections 23 removably seated at their outer or free ends in companion seats or sockets 24 formed in the inner face of such ring 15. The opposing ends of each tie rod and its adjustable rod section are threaded and in coupling engagement therewith is an internally-threaded sleeve or nut 25 abutting at its outer end against a shoulder 26 formed on the rod-section 23. A locking nut 27 applied to the tie rod and engaging the inner end of the adjustable sleeve serves to retain the rod-sections in their adjusted position. By this construction, the assembly frame can be readily adjusted to allow for thermal expansion and contraction of its parts and the separation of the frame at this point, when required, is facilitated for replacement of parts.

Mounted on the tie rods 21 in suitably spaced relation lengthwise thereof are a plurality of baffles 28 in the form of disks which are provided with alternate openings 29. Spacing sleeves 30 are applied to the rods between the baffles to retain them in their proper spaced relation and against endwise relative displacement. The outermost baffle at that end of the assembly frame adjoining the adjustable tie rod sections is held against outward displacement by retaining nuts 31 applied to the threaded portions of the tie rods 21.

This frame structure has been more particularly designed for use as a protective assembly for carbon or other non-metallic tubes and tube sheets, but is not limited to such use, and in the drawings the tubes are indicated at 32, the tube heads or sheets at 33 and 34, and the head covers at 35 and 36, respectively. The tubes are cemented or otherwise secured at their ends to the tube sheets, the tube sheet 33 being seated in an annular groove 37 in the fixed retaining ring 15 and together with its head cover 35 is securely fastened to such ring by a steel head plate 38 and tie bolts 39. The companion tube head or sheet 34 is seated in an annular groove 40 in the sliding or floating retaining ring 16 and together with its head cover 36 is securely fastened to such ring by a steel head plate 41 and tie bolts 42. In the drawings, the fixed head cover is shown having inlet and outlet nozzles at 43, 44 connected thereto and enabling the fluid undergoing treatment to have a multi-pass circulation through the heater, although it is understood that such nozzles may be applied to both head covers.

While manifestly simple, compact and rugged in construction, this tube nest or bundle assembly frame affords maximum protection to the tubes during handling and shipment, and can be readily assembled in a minimum period of time. Furthermore, the device is so designed that it can be readily adjusted, as desired, to permit the expansion and contraction of the parts in response to varying thermal conditions existing in the heat exchanger. The sectional and adjustable tie rod construction also facilitates the separation of the floating retainer ring 16 from the floating tube head 34 for renewing the gasket between these parts. The whole tube nest or bundle assembly frame also permits quick easy and safe removal or separation of the tube bundle from the heat exchanger shell 10 for repairing or replacing any of its parts or interchanging it with another bundle of the same size.

In assembling the tubes 32 and in turn the protective frame about the same, prior to installation in the shell 10, the tubes are first secured at one end to the tube sheet 33, after which the retaining ring 15 together with the tie rods 21, baffles 28 and spacing sleeves 30 are properly positioned in the manner shown in Figure 1, with the outermost baffle held against displacement by the nuts 31. The rod-sections 23 and their adjusting sleeves 25 are then connected to the tie rods, the floating tube sheet retaining ring 16 is then brought into socket-registering relation with the ends of such rod-sections, and finally the tube sheet 34 is secured in place on the adjoining ends of the tubes 32, suitable packing being provided between the tube sheets 33, 34 and the opposing grooved faces of the companion rings 15, 19. This tie rod and baffle arrangement together with the fixed and floating tube sheet retaining rings form a complete protective cage or enclosure and effective mechanical support for the carbon tubes 32, and in the handling of this tube bundle assembly for insertion or removal from the heat exchanger shell the weight and strain is placed on the steel parts, such as the rings, tie rods, baffles, etc., thereby effectually eliminating any danger of breakage of the tubes, as well as the tube sheets.

The installation of the tube bundle assembly into the shell 10 of the heat exchanger, after making the proper adjustment of the sectional tie rods 21, 23 to the predetermined length desired to take care of the difference in thermal expansion in a given installation, is accomplished by inserting the assembly into the shell, bolting the fixed ring 15 thereof to the shell-flange 11 and mounting the gland ring 19 in sealing relation to the floating ring 16 and bolting it to the shell-flange 12. Thereafter, the head covers 35, 36 and head plates 38, 41 are mounted in place and securely held by the tie bolts 39, 42 to the respective retaining rings 15, 16. The removal of the tube bundle assembly from the shell is accomplished by the reversal of the steps for installation and in this connection, while the head cover 36 and its head plate 41 are detached from the retaining ring 16, it is not necessary to detach the head cover 35 and its head plate 38 from the companion retaining ring 15. It should be pointed out here that this assembly affords a freedom and flexibility of baffle arrangement depending on the purpose to which the exchanger is to be used.



I claim as my invention:

1. A tube bundle assembly for heat exchangers and the like, comprising a pair of retaining rings adapted to support and protect the companion tube heads of a tube bundle and between which the tubes of such bundle extend, longitudinal tie members arranged between the inner faces of the rings and disposed in protective relation about the tubes of the bundle, and means applied to the outer faces of the rings for fastening the heads of the tube bundle thereto, said means including portions disposed in protective relation about said heads.

2. A tube bundle assembly for heat exchangers and the like, comprising a pair of retaining rings adapted to support and protect the companion tube heads of a tube bundle and between which the tubes of such bundle extend, longitudinal tie members arranged between the inner faces of the rings and disposed in protective relation about the tubes of the bundle, and means applied to the outer faces of the rings for fastening the heads of the tube bundle thereto, each of said means including a supporting plate extending over the outer face of the companion head of the tube bundle and tie bolts disposed in protective relation about such head and connecting said plate with its companion ring.

3. A tube bundle assembly for installation into the shell of heat exchangers and the like, comprising a pair of retaining end rings to which the companion tube heads of the tube bundle are adapted to be connected, longitudinally-adjustable tie rods between said rings in alinement and disposed in protective relation about the tubes of the tube bundle, one end of said rods being fixedly connected to one of the retaining rings and the other ring having sockets therein for freely receiving the opposite ends of said rods, that ring to which the tie rods are fixed being fixedly fastened to one end of the shell and the companion ring having a floating sliding connection with the opposite end of the shell, and means connected to said end rings for fastening the heads of the tube bundle thereto, said means including cover plates adapted to extend over the outer ends of said heads and tie bolts disposed in protective relation about such heads.

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