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SPRING SEAL FOR TUBE AND SHELL HEAT EXCHANGERS

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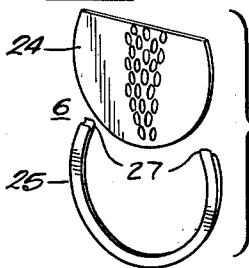
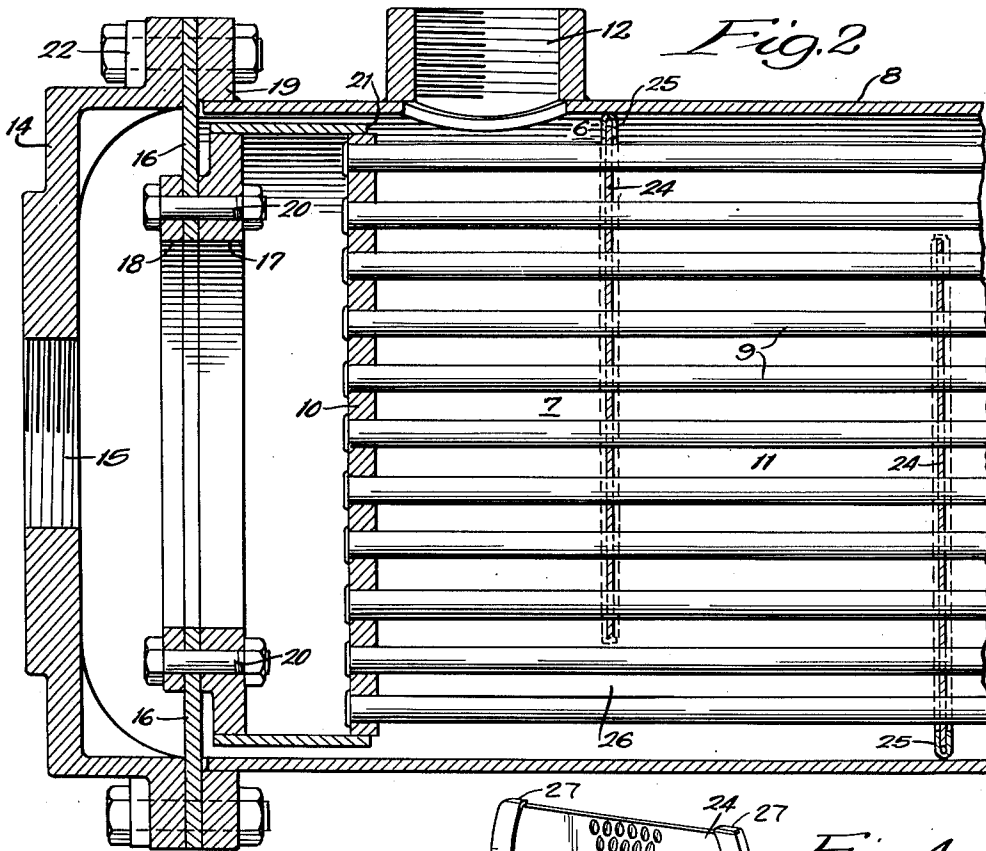
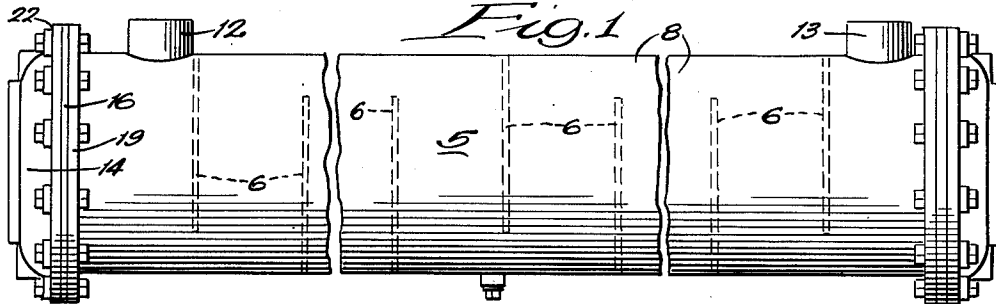


Fig. 3

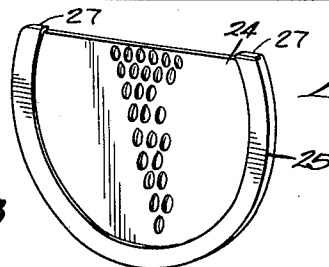


Fig. 4

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SPRING SEAL FOR TUBE AND SHELL
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In the manufacture of tube and shell heat-exchangers, of the type wherewith this invention is adaptable, as they have heretofore been constructed, one of the problems has been to insure a satisfactory fluid-tight contact of the baffles of the tube assembly with the shell. Obviously, this is essential in order to preclude the fluid by-passing its normal flow around the cut-off section of the baffle, and thereby reduce the efficiency of the heat-exchanger. The core unit of tubes, headers, and baffles, is first assembled and then slid into the shell. Of necessity this must be a press-fit operation for the baffles. If, perchance, a baffle is slightly over-size, or under-size, and/or not truly concentric with the shell axis, a gap between a baffle and the shell or a distortion or displacement of the baffle might result in a failure to have the desired fluid-tight contact of the baffle with the shell throughout its entire periphery.

The main objects of this invention, therefore, are to provide an improved form of baffle construction for use with tube and shell heat-exchangers; to provide an improved peripheral formation of baffles of this kind which facilitates the insertion of the tube and baffle assembly, with its header supports, into the shell so as to secure a practically fluid-tight seal between the baffles and the shell; to provide an improved, yielding, peripheral seal for baffles in structures of this kind which can be placed on the baffles either before or after assembly with the tubes, and which will yield sufficiently to allow the tube and baffle assembly to slide into the shell with the application of very little pressure and be completely free from the danger of distorting or displacing any of the baffles, or leaving gaps between the baffles and shell; and to provide a yielding peripheral seal of this kind which is economical to manufacture and assemble and which eliminates practically all possibility of by-pass leaks around the baffles.

In the accompanying drawings:

Fig. 1 is a side elevation of a tube and shell heat-exchanger of the type wherewith baffles constructed in accordance with this invention are particularly adapted for use;

Fig. 2 is an enlarged, fragmentary, cross-sectional, elevation of one end of a tube and shell heat-exchanger equipped with baffles embodying this invention and showing the manner of mounting one end of the tube and baffle assembly on the shell;

Fig. 3 is an exploded perspective view of one of the disks and spring seal which constitute this improved form of baffle; and

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Fig. 4 is an enlarged view of the same showing the spring seal in place on the disk.

A tube and shell heat-exchanger 5, wherewith spring-sealed baffles 6 embodying this invention are adapted for use, comprises a core unit 7 telescoped into a shell 8 to provide for the exchange of heat between two fluids of differing temperatures flowing through and around the core unit 7.

The core unit 7 comprises a bundle of tubes 9 arranged in parallel, radially-spaced relationship and bonded at their ends to header-plates 10, thereby forming a labyrinth 11 around the tubes 9 intermediate the header-plates 10 and within the shell 8.

The shell 8 is a cylindrical casting provided with a fluid inlet 12 and a fluid outlet 13 communicating with the core-labyrinth 11 and having the open ends of the shell closed with end plates 14 wherein are formed ports 15 communicating with the tubes 9.

Yielding support for one end of the core unit 7 within the shell is provided to allow for the expansion and contraction of the core unit 7. In the present embodiment this involves a diaphragm 16 clamped between a pair of rings 17 and 18, and between a shell-flange 19 and the ported plate 14. As clearly shown in Fig. 2, the rings 17 and 18 are secured together by suitable bolts and nuts 20, with the inner ring 17 bonded to the adjacent header-plate 10 by a sleeve 21. The ported plate 14 is secured to the shell flange 19 by suitable bolts and nuts 22.

A spring-sealed baffle 6, constructed in accordance with this invention, comprises a truncated, apertured disk or plate 24 and a truncated ring 25 of channel-shaped cross-section embracing the peripheral portion of said disk 24.

As will be noted from Fig. 3, the truncated ring 25 is formed with one end of each of the parallel sections extended beyond the other to provide shoulders 27. After the disk 24 and ring 25 are assembled, these shoulders are struck down, as shown in Fig. 4, to insure the retention of the truncated ring 25 on the truncated disk 24.

A plurality of such baffles 6 are assembled on the bundle of tubes 9, being spaced apart axially so that when in the shell 8 they divide the labyrinth 11 into a plurality of compartments communicating through the spaces 26 between the cut-off part of each disk 24 and the shell 8. Adjacent baffles are oppositely disposed so as to direct a normal fluid flow axially through said shell in a constantly-reversing radial direction.

The truncated ring 25 is formed of spring material with the internal diameter of the channel

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slightly greater than the diameter of the disk 24, and the channel so formed that it fits the disk 24 snugly and forms a practically fluid-tight contact therewith. (See Fig. 2.) Thus, when the truncated rings 25 are in place on the disks 24, as shown in Figs. 2 and 4, and the core unit 7 is slid into the shell 8, the truncated rings 25 compress slightly to accommodate the external circumference of the ring 24 to that of the interior wall of the shell 8, and provide a practically fluid-tight seal around the peripheral part of the ring 25.

To assemble a truncated ring 25 on a truncated disk 24 they are placed in parallel axial alignment and the ring is sprung sufficiently to allow the sidewise insertion of the disk into the ring. The truncated rings 25 may be assembled on the truncated disks 24 before or after the disks have been assembled on the tubes 11.

A secondary advantage of this form of spring-seal baffle is that the core unit 7 may be easily removed for repair or cleaning.

Although but one specific embodiment of this invention has been herein shown and described, it will be understood that details of the construction shown may be altered without departing from the spirit of the invention as defined by the following claims.

I claim:

1. A baffle for tube and shell heat-exchangers comprising, a plate apertured for assembly on a bundle of parallel radially-spaced tubes bonded to headers and thereafter insertable into a shell whereby said plate divides the interior of said shell around said tubes into separate compartments on opposite sides of said plate, and an arcuate-shaped spring metal element embracing a major peripheral portion of said plate and circumferentially contractible in the plane of said plate to permit the sliding insertion of said tube-supported plate into said shell and thereby form a practically fluid-tight seal between said compartments around said major peripheral portion of said plate but allowing communication between said compartments around that peripheral portion of the plate not embraced by said element.

2. A baffle for tube and shell heat-exchangers comprising, a truncated disk apertured for assembly on a bundle of parallel radially-spaced tubes bonded to supporting headers and thereafter insertable into a shell whereby said disk divides the interior of said shell around said tubes into separate compartments on opposite sides of said disk, a truncated spring metal ring of channel-shaped cross-section embracing the circumferential peripheral portion of said disk and contractible in the plane of said disk to permit the sliding insertion of said tube-supported disk into said shell to form a practically fluid-tight seal between said compartments around said peripheral portion of said disk.

3. A heat-exchanger core of the class described for assembly with a supporting shell comprising, a bundle of parallel radially-spaced tubes spanning and bonded at their ends to header plates, a plurality of apertured truncated disks assembled on said tubes in axially-spaced relationship with the truncated portions of adjacent disks oppositely disposed to form baffles dividing said shell into communicating compartments and directing a

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fluid flow axially through said shell in a constantly-reversing radial direction, and an arcuate-shaped spring metal element of channel-shaped cross-section embracing the circumferential peripheral portions of each of the respective disks and each independently circumferentially contractible in the plane of the respective disks to permit a sliding insertion of said core into a shell, whereby said yielding elements form a practically fluid-tight seal between said compartments and said shell and the peripheral portions of said disks.

4. In a tube and shell heat-exchanger, the combination of a shell, a heat-exchanger core unit comprising a bundle of parallel radially-spaced tubes spanning and bonded at their ends to header plates, a plurality of apertured truncated disks assembled on said tubes in axially-spaced relationship with the truncated portions of adjacent disks oppositely disposed to form baffles dividing said shell into communicating compartments and directing a fluid flow axially through said shell in constantly-reversing radial direction, and a truncated spring metal ring of channel-shaped cross-section embracing the peripheral portion of each of said disks and expansible and contractible in the plane of the respective disks to insure contacting of the periphery of each ring the interior of said shell to form a practically fluid-tight seal between said compartment around said shell and the peripheral portions of said disks.

5. A baffle for tube and shell heat-exchangers comprising, a truncated disk apertured for assembly on a bundle of parallel radially-spaced tubes bonded to supporting headers and thereafter insertable into a shell whereby said disk divides the interior of said shell around said tubes into separate compartments on opposite sides of said disk, an arcuate-shaped spring metal element of channel-shaped cross-section with an inside diameter of the channel normally slightly greater than the diameter of said disk to permit a yielding embracing of said element around the circumferential periphery of said disk and circumferentially contractible in the plane of said disk to permit the sliding insertion of said tube-supported disk into said shell and form a practically fluid-tight seal between said compartments around said disk, and shoulders formed at the ends of said arcuate-shaped element adapted to engage the edge of the subtended periphery of said truncated disk for removably holding said element in place on said disk.

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