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STRONGBACK FOR PRESSURE VESSEL

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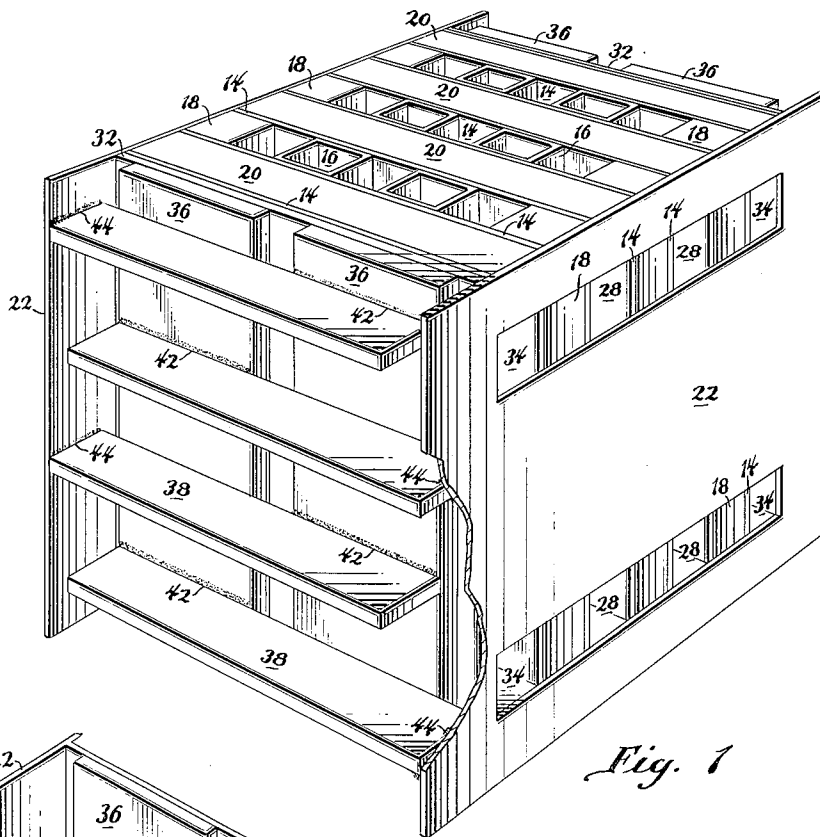


Fig. 1

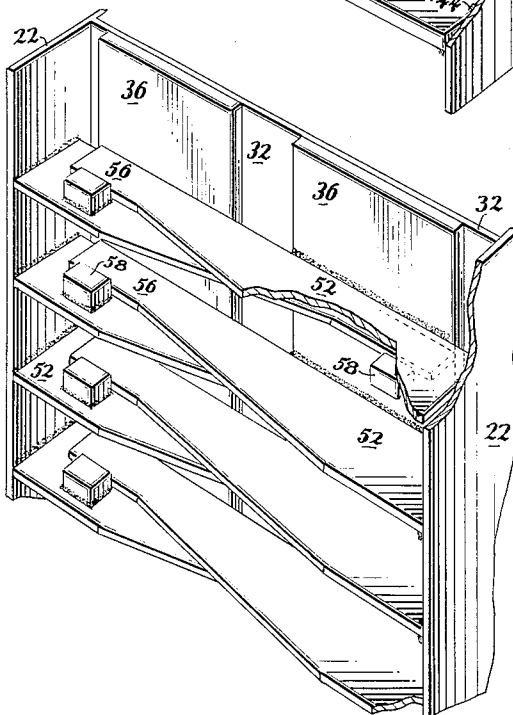


Fig. 2

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STRONGBACK FOR PRESSURE VESSEL

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The present invention relates generally to the construction of vessels that are to be subjected to high internal pressures, and more specifically it refers to the construction of plate type heat exchange apparatus adapted for use with high pressure fluids.

In a rectangular pressure vessel the walls thereof are usually of the ribbed plate strongback variety in which a housing having plate walls is merely reinforced at selected intervals by stiffening ribs to impart the necessary strength thereto. Such a strongback can readily be designed to withstand any predetermined pressure, however when the temperature of the pressurized fluid is other than ambient there will exist a temperature gradient through the strongback with its attendant thermal distortion. In such pressure vessels operated at high temperatures, internal ligaments or plates may be connected to opposing walls to provide rigidity, however the temperature difference between these internal ligaments and the extremities of the strongback effects high stresses within the core of the heat exchanger, the strongback, and its related connections.

The proposed strongback eliminates this basic problem since it is free to move as the core expands and contracts. As a result of this inherent flexibility, no great stresses are created in the structure and the strongback effectively carries out its primary function of safely containing the internal pressure forces.

The invention will be better understood upon reference to the accompanying drawing in which:

FIGURE 1 represents a perspective view of a plate type heat exchanger having a strongback constructed according to this invention.

FIGURE 2 illustrates a modified form of strongback arrangement.

In FIGURE 1 is shown a plate type heat exchanger for the transfer of heat between hot gas at low pressure and cooler air that exists at relatively high pressure. The heat exchanger includes essentially a series of envelopes comprising a pair of plates 14 spaced apart by a series of parallel tubes 16 to provide a fluid passageway therebetween with the sides of the tubes providing a series of transverse fins extending across the passageway between plates 14. The envelopes thus formed are closed at their lateral edges by closure bars 18 that are usually welded between the plates to provide an integral assembly during construction. A plurality of such envelope components are assembled in alignment with closure bars 20 at opposite ends thereof adapted to space the envelope units apart to provide passageways for the flow of a second fluid therebetween.

A series of such envelope units thus provide a core through which fluids may flow with the express object of transferring heat from one fluid to another. To further contain the different fluids in the passageways between the walls of such a heat exchange apparatus a housing is constructed around the assembly. Such a housing normally includes a pair of side plates 22 having an inlet aperture 24 and an outlet aperture 26 at opposite ends thereof adapted to direct the flow of air to and from the passageways 28 formed between envelopes. At opposite ends of the assembly end plates 32 are welded between the side plates 22 to complete the housing structure encircling the assembled envelopes and providing outer walls for air passageways 34 at opposite ends of the structure.

The fluid pressure in interior passageways 28 is completely neutralized in such a structure by equal pressures in similar passageways on opposite sides of the envelopes, however the high fluid pressure in passageways 34 acts upon the entire area of plates 32 with no neutralizing pressure on the opposite side thereof so as to require that plate 32 itself be given sufficient strength to withstand the fluid pressures in the passageway enclosed.

In accordance with this invention a strongback assembly is provided at opposite ends of the assembled apparatus to insure adequate structural rigidity for the outer walls 32 of passageways 34. The strongback assembly comprises a pair of heavy plate members 36 held in place by a plurality of transverse beams 38 that are secured to the plate members 36 and side plates 22 to permit relative movement thereof.

Each transverse beam 38 is somewhat shorter than the normal width of plates 32 and is secured to only one of plate members 36 as by welding at 42, alternate beams being connected to adjacent plates 36 in the manner illustrated in FIGURE 1. Furthermore, one end of each beam 38 is connected as at 44 to the inner face of one wall 22, the end of the beam connected being that end which is remote from connection 42 that bonds beam 38 to plate 36. A clearance space is provided between the adjacent edges of plates 36 and between the outer edges of plates 36 and the adjacent wall 22 to permit substantial relative movement of the plates 36 in accordance with contraction and expansion of the envelope core within the housing.

The ultimate strength of the strongback assembly is dependent upon the nature of the reinforcing plate members 36 and the characteristics and frequency with which the transverse beams are disposed across plates 36.

A modified form of strongback arrangement is illustrated in FIGURE 2 where a series of transverse beams 52 are arranged in substantially abutting relationship to provide a composite beam extending completely across the space between side walls 22 for the support of end plate 32. Each beam 52 is substantially shorter than the normal width of plate 32 and is bonded at one end to plate 22 while the opposite end thereof is spaced from its adjacent plate 22, however adjacent beams 52 are bonded to the opposite side plates to provide a continuous backing support across plate 32. Furthermore, each plate 36 lying adjacent the fixed end of beam 52 is also bonded to said beam to provide a projecting portion or cantilever 56 that extends over the adjacent relatively movable plate 36. To provide additional support for the projecting portion 56 of each beam 52, blocks 58 are abutted lightly against the upper edge thereof and connected to the fixed end of adjacent transverse beam 52.

What we claim is:

1. In a plate type heat exchange apparatus adapted for high internal pressure and wide temperature variation a housing, said housing enclosing said apparatus and comprising a pair of side walls including extensions protruding beyond ends of the enclosed heat exchange apparatus, end walls adjacent the ends of said heat exchange apparatus extending perpendicularly between the side walls, a pair of spaced reinforcing plates abutting each end wall; and a plurality of transverse beams supporting the reinforcing plates, each beam being connected to one of said side wall extensions and one of said reinforcing plates to permit relative movement of the other reinforcing plate with respect thereto.

2. In a plate type heat exchange apparatus adapted for high internal pressure and wide temperature variation a housing, said housing enclosing said apparatus and comprising a pair of side walls including side wall extensions protruding beyond ends of the enclosed heat exchange apparatus; end walls adjacent the ends of said heat ex-

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change apparatus extending between the side walls; a pair of spaced reinforcing plates abutting each end wall maintained in position by a plurality of transverse beams, said transverse beams fixed at one end to a side wall extension and spaced at the distal end from the opposite side wall extension to permit relative movement therebetween.

3. In a plate type heat exchange apparatus adapted for high internal pressure and wide temperature variation a housing, said housing enclosing said apparatus and comprising a pair of side walls including extensions therefor that protrude beyond the ends of the enclosed heat exchange apparatus; end walls adjacent the ends of the heat exchange apparatus extending between the side walls; reinforcing plates abutting each end wall to restrain fluid pressures within said housing; and transverse beams extending across the reinforcing plates from an abutting side wall extension into spaced relation with the oppositely disposed side wall extension, said transverse beams being connected to the abutting side wall extension and the reinforcing plate remote therefrom.

4. In a plate type heat exchange apparatus adapted for high internal pressure and wide temperature variation a housing, said housing enclosing said apparatus and comprising a pair of side walls including extensions therefor that protrude beyond the ends of the heat exchange apparatus therebetween; end walls adjacent the ends of the heat exchange apparatus extending between the side walls; a pair of spaced reinforcing plates abutting each end wall to impart an increased resistance to bending thereto; and transverse beams crossing adjacent reinforcing plates, said transverse beams being fixed at one end to a side wall extension and the adjacent reinforcing plate to provide a cantilever portion at the opposite end thereof overriding the spaced reinforcing plate.

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5. In a plate type heat exchange apparatus adapted for high internal pressure and wide temperature variation a housing, said housing enclosing said apparatus and comprising a pair of side walls for said apparatus including extensions therefor that protrude beyond the ends of the heat exchange apparatus; end walls at the ends of said heat exchange apparatus providing walls for fluid passageways therein; spaced reinforcing plates extending longitudinally of said end walls; and transverse beams extending across said reinforcing plates to simultaneously hold them in position and provide stiffening means therefor, alternate transverse beams projecting from opposite side wall extensions.

6. A housing enclosing a heat exchange apparatus as defined in claim 5 wherein the transverse beams are arranged in abutting pairs.

7. A housing enclosing a heat exchange apparatus as defined in claim 6 wherein the beams extend transversely a distance substantially less than the width of adjacent end walls supported thereby.

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