

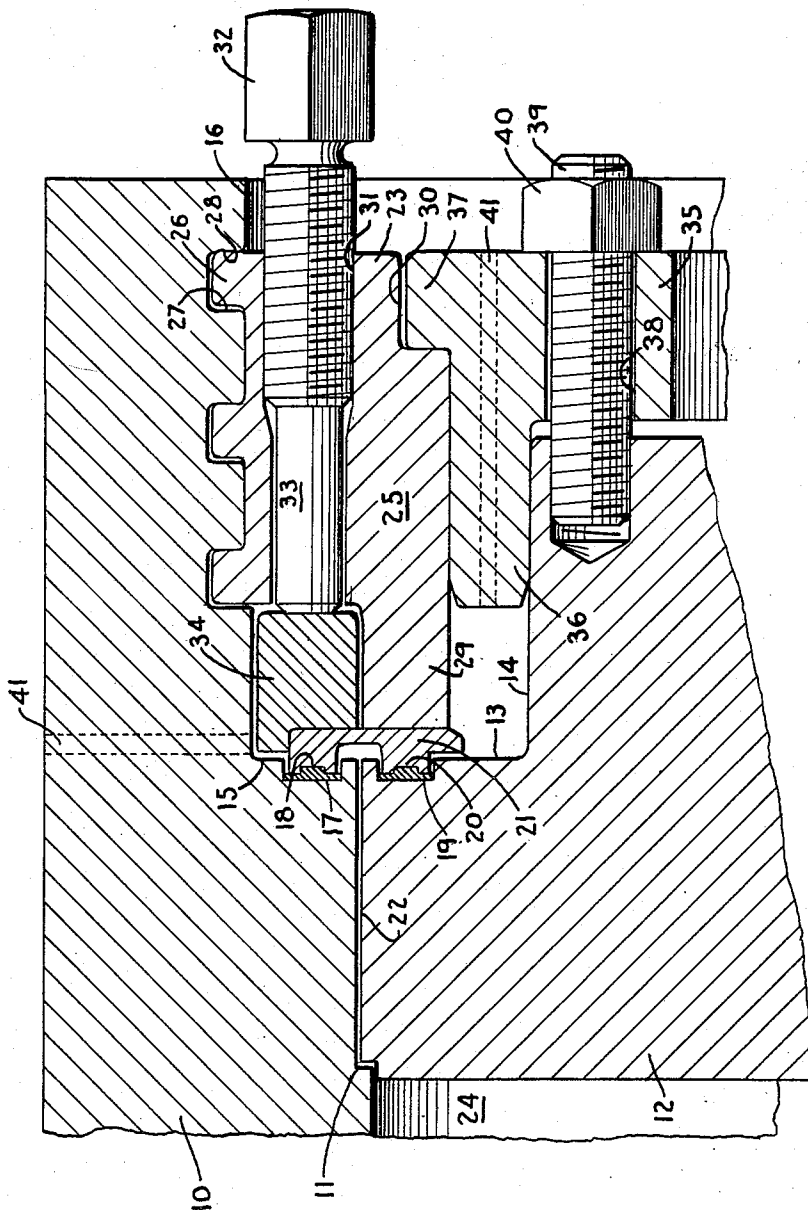
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HIGH-PRESSURE CLOSURE

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HIGH-PRESSURE CLOSURE

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This invention relates to closures for high pressure vessels and particularly for massive heat exchangers of the shell and tube type in which the hydrostatic pressure of the shell fluid is of the magnitude of several thousand pounds per square inch.

The principal object of this invention is to provide a sealed closure for a high pressure vessel, such as a heat exchanger of the class which functions as a feed water heater. A further object is to provide such a sealed closure which may be easily removed from its vessel to permit ready servicing of the interior of the assembly. Another object is to provide such a closure having sealing means which may be tightened, repaired, or replaced without the necessity of removing the cover from the vessel. Another object is to provide such a closure having a seal so disposed that the elements comprising the means for holding the cover in operative position in the barrel will be kept dry and clear of internal fluids which may cause corrosion or seizing. Still another object is to provide in a heat exchanger of the shell and tube type a closure construction in which the cover is disposed internally of the shell and is so designed that the joint between the cover and the shell may be effectively sealed by gaskets which are tightly seated in a novel and ingenious manner. Another object is to provide in such a closure construction gasketed sealing means which may be deflected without the loss of sealing effectiveness and which accommodates itself to relative movement between the sealed parts resulting from temperature differentials and expansion. Another object is to provide such a closure in which the cover need have only such thickness as is necessary for pressure requirements and which does not have to extend forwardly to the end of the shell to provide outer sealing means. An additional object is to provide such a sealing arrangement wherein any outward deflection of the cover caused by hydrostatic pressure which creates a moment at the sealing means is effectively absorbed by a plurality of axial surfaces and thereby resisted by the barrel. Another object is to provide sealing means for the joint of such a closure construction which is effectively seated by set screws and tap bolts arranged so that their threads are isolated from the force lines of hydrostatic compression stresses. Another object is to provide sealing means for the joint between the barrel and cover of a closure of the type described in which gaskets are disposed on radially opposite sides of the joint and are maintained in sealing position by a novel

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construction in which a sealing member bridges the joint and is clamped against one of the gaskets by the outward force of the cover against the shear ring resulting from hydrostatic pressure and against the other gasket by a series of bolts threaded in the shear ring. Other and further objects of the present invention will be apparent from the following description, the accompanying drawings, and the appended claims.

In the drawing:

The figure shows a fragmentary section of the barrel and the head of a heat exchanger vessel of the shell and tube type and of the vessel cover arranged in operative position within the barrel, the joint between the barrel and cover being sealed by gaskets clamped into position by the novel arrangement of the invention.

Referring now to the drawing, there is shown a fragmentary sectional view of a head for a high pressure heat exchanger of the shell and tube type in which the barrel 10 is formed with a counterbored shoulder 11 to provide a temporary support for cover 12 during the assembly of the closure with the shell. Cover 12 is formed with a peripheral forwardly facing cut-out portion defined by a radial wall 13 and the axially extending peripheral surface 14. In this specification, "forward" denotes the outer end of the construction shown at the right as viewed in the drawing whereas "outer" refers to the radially outer portion.

Barrel 10 has an annular cut-out portion extending completely around its mouth and defined by radial wall 15 and axial wall 16. Radial wall 15 of the barrel is preferably although not necessarily in substantial alignment with radial wall 13 of the cover and is provided with an annular slot 17 in which is disposed a gasket 18. An annular slot 19 is likewise formed in the cover radial wall 13 in which is disposed another gasket 20. A sealing retainer ring 21 having gasket engaging projections bridges the joint 22 between the barrel and cover and is independently clamped against the gaskets in the manner later to be described.

Shear ring 23, which is conventionally segmented, serves the usual purpose of holding cover 12 in position within the barrel when the cover is subjected to the fluid pressure of the chamber 24. It has a main body 25 formed with a plurality of parallel annular rectangular flanges 26 (three in the embodiment shown) fitting into corresponding annular recesses 27 milled into the barrel. The engagement of the flanges with the forward radial walls 28 of the recesses takes up

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the shear force of the cover against the barrel as the pressure of the chamber fluid builds up. An axial projection 29 extends rearwardly from the main body and a cut-out annular portion 30 is milled out of its forward and radially inward corner for the purposes later to be described. Obviously projection 29 could be a separate ring if desired similar to the back up ring later described.

A series of circumferentially arranged holes 31 are drilled through the main body of the shear ring and are threaded in their forward portions for the reception of a series of set screws 32. These set screws have smooth end portions 33 extending through the untapped part of the holes 31 to abut a back up ring 34. When tightened, screws 32 clamp the back up ring against the sealing ring so that the latter will hold gasket 18 in sealing position. It should be here noted that the tightening of screws 32 forces the back up ring 34 and shear ring 23 apart so that the reaction to the clamping force against the gasket is taken up in the barrel through flanges 26 and walls 28.

Support ring 35 is an integral member formed with a rearwardly extending annular flange 36 which serves to retain the component parts of the segmented shear ring in radial position against the barrel. Ring 35 has an annular shoulder 37 to fit into cut-out portion 30 of the shear ring and is formed with a series of circumferentially arranged smooth axial holes 38 through which a series of stud bolts 39 extend. Bolts 39 are threaded into the cover as shown. Obviously the bolts could extend through flange 36 and into the cover. When nuts 40 are tightened onto the bolts 39 during the original assembly of the unit, cover 12 is drawn forwardly to clamp gasket 20 against retainer ring 21. Of course, when fluid pressure in chamber 24 builds up, cover 12 is forced still more tightly against gasket 19 to improve the sealing effect.

It is to be observed that the construction of retainer ring 21 permits alignment of the ring with the gaskets so that a perfect seal is effected. The web or bridging portion of the ring between the gasket-engaging projections is flexible enough to permit the alignment and it may be flat as shown or formed so that ring 34 and projection 29 contact the back of ring 21 in different planes. The particular sealing arrangement keeps the locking members dry and free of any corrosive action. In other words, the seal is what is known as a dry seal.

Any outward bending moment of the cover due to fluid pressure after the seal has been made tight will be effectively resisted by the flat surface contacts between the cover 12 and flange 36 so that the moment passes through the shear ring and is absorbed by the barrel. Cocking of the shear ring is also prevented by this construction.

Inspection holes 41 are provided at several locations so that leaking due to a defective gasket may be detected. If leaking is observed, then the bolts or set screws may be tightened to eliminate the leak.

While there has been hereinbefore described an approved embodiment of this invention, it will be understood that many and various changes and modifications in form, arrangement of parts and details of construction thereof may be made without departing from the spirit of the invention, and that all such changes and modifications

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as fall within the scope of the appended claims are contemplated as a part of this invention.

What I claim is:

1. Apparatus of the character described comprising a pressure sustaining barrel having an open end, a cut-out portion in the barrel adjacent its open end, a plurality of annular spaced recesses in the barrel opening into the cut-out portion, a cover disposed within the barrel and having a peripheral cut-out portion opposite the barrel cut-out portion, a segmented shear ring disposed in said cut-out portions and having a plurality of spaced flanges extending into the barrel recesses, a fluid tight retainer ring rearwardly of the shear ring and spanning the joint between the cover and barrel, a back-up ring between the shear ring and retainer ring, a support ring to clamp and hold the shear ring in place, a plurality of set screws threaded through the shear ring into abutment with the back-up ring, and bolt means threaded into the cover and retaining the support ring against the shear ring, the set screws and bolt means independently clamping the retainer ring into seated position to seal the joint between the cover and barrel.

2. Apparatus of the character described comprising a pressure sustaining barrel having an open end, a plurality of spaced shear bearing walls adjacent the open end, a forwardly facing radial wall on the barrel rearwardly of said shear bearing walls, a cover disposed in the barrel, a forwardly facing radial wall on the cover in radial alignment with the barrel radial wall, gaskets disposed against said radial walls, a retainer ring spanning the joint between the barrel and cover and disposed in contact with the gaskets, a segmented shear ring having a plurality of spaced flanges abutting the shear bearing walls and contacting the retainer ring forwardly of the cover radial wall, a back-up ring between the shear ring and the retainer ring disposed forwardly of the barrel radial wall, a support ring to radially position the shear ring, a plurality of bolts threaded into the cover to retain the support ring against the shear ring, and a plurality of set screws threaded into the shear ring and extending therethrough into abutment with the back-up ring to clamp the latter against the gasket retainer ring thus to clamp the barrel gasket into position.

3. Apparatus of the character described comprising a pressure sustaining barrel having an open end, a forwardly facing radial wall, and a cut-out portion extending forwardly from said wall to the open end of the barrel; a plurality of spaced annular recesses in the barrel wall opening into the cut-out portion of the barrel to provide a plurality of rearwardly facing shear bearing walls; a cover in the barrel having a forwardly facing radial wall in radial alignment with the barrel radial wall and a cut-out portion extending from the cover radial wall to the forward face of the cover; gaskets upon the radial walls; a retainer ring spanning the joint between the cover and barrel and having projections positioned against the gaskets; a segmented shear ring having a plurality of spaced flanges extending into the barrel recesses; a projection extending rearwardly from the shear ring to contact the retainer ring opposite the cover radial wall; a back-up ring between the shear ring and retainer ring opposite the barrel radial wall; a support ring extending into the cover cut-out portion to hold the shear ring in radial

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position; a plurality of bolts extending through the support ring and threaded into the cover to hold the support ring in position; and a plurality of set screws threaded into the shear ring and extending therethrough into abutment with the back-up ring to clamp the latter against the gasket retainer ring thus to clamp the barrel gasket into position.

4. Apparatus of the character described comprising a pressure sustaining barrel having an open end, an interior outwardly facing radial wall on the barrel, a cut-out portion extending from said wall to the end of the barrel, a plurality of spaced annular recesses opening into the cut-out portion thus providing inwardly facing shear bearing walls, a cover in the barrel having a forwardly facing radial wall in radial alignment with the barrel radial wall and a cut-out portion extending from said cover radial wall to the outer face of the cover, gaskets disposed against the radial walls, a retainer ring spanning the joint between the cover and barrel and engaging the gaskets, a segmented shear ring having a plurality of spaced flanges extending into the recesses to engage the shear bearing walls, a rearwardly extending projection on the shear ring engaging the retainer ring opposite the cover radial wall, a back-up ring between the shear ring and retainer ring opposite said barrel radial wall, a support ring partially overlapping the shear ring, a plurality of bolts threadably anchored in the cover to hold the support ring in supporting position against the shear ring, a plurality of set screws threadably

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mounted in the shear ring and extending through the latter into abutment with the back-up ring, said bolts and set screws being adapted to exert independent pressure on the retainer ring opposite the gaskets.

5. Apparatus of the character described comprising a pressure sustaining barrel having an open end, a plurality of spaced shear bearing walls adjacent the open end, a sealing surface on the barrel rearwardly of said bearing walls, a cover within the barrel having a sealing surface thereon, a retainer ring spanning the joint between the cover and the barrel and seated upon said cover and barrel sealing surfaces, a segmented shear ring having a plurality of spaced flanges abutting said shear bearing walls, a back up ring disposed between the barrel sealing surface and the shear ring, screw means threaded through the shear ring into abutment with the back up ring to apply force to said back-up ring, annular means on the radially inner side of the shear ring and means threaded in the cover to independently apply force to said annular means and draw said cover toward said retainer ring.

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