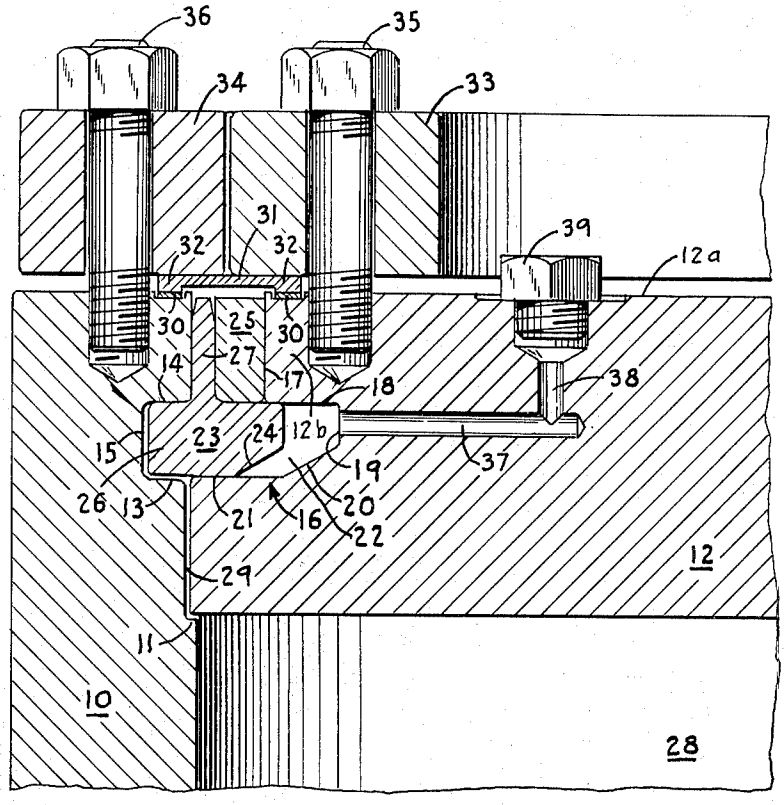
Jan. 3, 1956 E. N. SIEDER 2,729,491

HIGH PRESSURE CLOSURE FASTENER

Filed March 22, 1952



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United States Patent Office 2,729,491 Patented Jan. 3, 1956

2,729,491

HIGH PRESSURE CLOSURE FASTENER

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Application March 22, 1952, Serial No. 278,081

3 Claims. (Cl. 292—256.6)

This invention relates to closures for pressure vessels and more particularly to closures for high pressure heads of heat exchangers.

In high pressure closures of the class in which the cover is inserted within the head barrel and which employs shear pieces to transmit the hydrostatic pressure load from the cover to the barrel, one of the problems encountered is the cocking of the shear pieces due to the couple acting upon them. Such cocking permits looseness in the seating of the cover with consequent movement thereof and binding at the corners of the recess where the shear pieces fit into the channel barrel.

The principal object of the invention is the provision of a closure for the head of a high pressure vessel, such as a feed water heater, wherein the hydrostatic load of the shell fluid upon the cover is transmitted to the barrel by a novel shear ring structure.

Another object is the provision of a novel shear ring structure wherein cocking of the shear pieces is eliminated.

A further object is to provide a shear ring construction employing a minimum number of elements to provide a simple and economical closure.

Other and further objects of the invention will appear from the following description, the accompanying drawings and the appended claims.

In the drawing, there is shown a partial sectional view of a closure construction employing the present invention.

Referring now to the drawing, barrel **10** of the head of a heat exchanger of the shell and tube type is formed with a shoulder **11** against which cover **12** is located when the cover is originally assembled into the barrel. Barrel **10** is provided with at least one inwardly opening annular recess defined by radial walls **13** and **14** and end wall **15**. Cover **12** has an annular cut-out portion, generally indicated at **16**, defined by longitudinal wall **17**, radial wall **18**, longitudinal wall **19**, preferably a tapered wall **20**, and radial wall **21**. The chamber **22** forming part of said cut-out is provided to facilitate assembly of shear ring **23** which has a tapered wall **24** conforming to the tapered wall portion **20**. The tapered portion serves two purposes in the illustrative embodiment. On the cover, it permits a greater amount of material to be used than a square corner would permit. The cover, which is a disc supported at its edges, can thus better resist the bending moment created by the internal pressure. The tapered wall **24** or the shear ring, of course, conforms to the wall **20** and facilitates assembly. It has a more important function as a means of localizing the force on the shear ring as will later appear. The forward portion of the cover between the chamber **22** and the forward face **12***a* of the cover is shaped as an annular flange **12***b* whose peripheral wall **17** is spaced from the barrel thus forming an annular opening. The diameter of the flange is intermediate the diameters of the cover and of the cut-out portion. Forward or outer, as used herein, is the direction of the open end of the barrel, or upward as viewed in the drawing.

Shear ring **23**, conventionally segmented to permit its assembly into operative position between the barrel and cover, is retained in assembled position in the barrel by any suitable means such as the continuous backing ring **25**. In cross section, shear ring **23** comprises a main body having an annular radial flange **26** extending into the barrel recess and preferably although not necessarily an annular projection **27** extending forwardly between backing ring **25** and the barrel. The radial dimension of the forward wall of flange **26** is substantially equal to that of the forward radial wall **14** of the barrel recess so that there is full mating engagement between the adjacent surfaces. When hydrostatic pressure builds up in the chamber **28** of the heat exchanger head, cover **12** will be forced forwardly to the small extent permitted by the manufacturing clearances of the parts so that its wall **21** engages the shear ring. The latter is forced into tight sealing engagement with the shear bearing wall **14**.

It should be pointed out that the projection **27** on shear ring **23** used in conjunction with ring **25**, is illustrative only of one means to hold the shear ring in position during initial assembly. Other equally suitable means will readily suggest themselves for the same purpose.

It should be noted that the forward wall of shear ring **23** extends radially inward to overlap a portion of wall **18** and provide an outer contact area thereof. It is this novel overlap structure that comprises the essence of the present invention.

Without the overlapping contact area an unbalanced couple tends to rotate the shear ring counterclockwise as is customary in all the shear ring closures with which applicant is familiar. This couple is made up of the forward pressure force of the cover applied on radial wall **21** forming an inner contact area, times its lever arm, and the rearward reactive force in the shell applied on wall **14** times its lever arm. The lever arm extends from the point of application of the forces to a fulcrum that lies within the shear ring and on an extension of the joint line **29** for this example. This couple, which induces cocking, is resisted by a clockwise movement on the shear ring which consists of an inward reactive force exerted by wall **18** on the shear ring through the outer contact area as cover **12** moves outwardly under load, times its longer lever arm to the same fulcrum. So under load the shear ring, in effect, becomes an integral part of the cover.

It will be apparent that the balancing or reactive force can be changed. The point of application of the cover force to ring **23** can be localized on the ring by suitable means such as the hereinbefore mentioned tapered wall **24**. If the taper is changed or the ring's radial dimension or the diameter of flange **12***b* changed, the point of application of the force can be moved radially inwardly or outwardly. Thus any balancing force can be created by the ways mentioned above or by a combination of them. Suitable equivalents will readily suggest themselves, such as projections in the cover or ring to provide contact, all within the scope of the invention.

It is then apparent that a number of arrangements will produce the desirable and reactive force to prevent the cocking of shear ring **23**. The salient features of the invention require that the cover overlap the shear ring on the forward or outer edge to provide an outer contact area between the cover and ring. It is necessary that the elements be formed, as previously described in the illustrative embodiment, so that the reactive force is applied radially inwardly of the outward force applied by the cover to the shear ring. That is to say, there

are two annular contact areas between the cover and the ring, one on each side of the ring. These are an outer and an inner contact area at walls **18** and **21** respectively. If the uniformly distributed force or load applied at either contact area is treated as applied at a line, it will be applied on the median diameter of the contact areas. Then, according to the invention, the median diameter of the outer contact area must lie radially inwardly of the median diameter of the inner contact area. The median diameter is defined as that diameter which divides each annular contact area into two equal areas. If a non-circular member such as an elliptical barrel is used, the median line of each contact area corresponds to the median diameter as defined for circular members. Expressed in another manner, the total peripheral length of the inner contact area must exceed the total peripheral length of the outer contact area.

A construction, however made, must fall within these limitations. If it does, it will balance the twisting couple and prevent cocking of the shear ring.

To provide a seal for the joint **29** between the cover and the barrel, a conventional sealing structure is used which consists of two gaskets **30** secured in position by a gasket retaining ring **31**. The gaskets are received in slots or channels in the cover and barrel as clearly seen in the drawing. Gasket ring **31**, spanning the joints where leakage may occur, has gasket-compressing projections **32** joined by a relatively thin flexible central portion. Inner and outer compression rings **33** and **34** respectively are used to hold the gasket ring in position and are fastened to the cover and barrel by bolts **35** and **36** respectively. Such construction provides a fluid tight seal.

A plurality of radial holes **37** and axial holes **38** (only one of each being shown) are provided around the periphery of the cover for the purpose of blowing out the chamber **22** in the event it should become clogged with foreign matter. A plug **39** is provided to seal off hole **38**.

From the above description, it will be apparent that cocking of the shear ring is prevented by the novel overlapping arrangement described.

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 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 opening at one end and an inwardly facing continuous recess having a shear bearing wall adjacent the opening, a segmented shear member disposed in said recess and extending into the barrel, a cover in the opening radially overlapping the shear member on each side thereof to form an inner contact area and an outer contact area between the shear member and the cover, the median line of said outer contact area being radially inward of the median line of said inner contact area.

2. Apparatus of the character described comprising a hollow pressure-sustaining barrel having an opening at one end thereof and an inwardly facing annular recess having a shear bearing wall adjacent the opening, a cover disposed in the opening and having an annular cut-out portion radially opposite said recess, an annular flange on the cover between the cut out portion and the forward face of the cover, said flange having a lesser diameter than said cover diameter, a segmented shear ring having a radial flange extending into the barrel recess to engage the shear bearing wall of the recess and a forward wall extending radially inward into overlapping engagement with the flange of the cover, and means to hold said shear ring in place.

3. Apparatus of the character described comprising a hollow pressure-sustaining barrel having an opening at one end thereof and an inwardly facing annular recess having a shear bearing wall adjacent the opening, a cylindrical cover disposed in the opening, the diameter of the rear portion of the cover being substantially equal to the inner diameter of the barrel and the diameter of the forward portion of the cover being less than that of the barrel thus defining an annular opening between the barrel and cover, an annular cut out portion in the cover opposite the barrel recess, a segmented shear ring filling the barrel recess and extending into the cut out portion to form an overlapping engagement with the forward portion of the cover, and means to hold the shear ring in place.

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