Dec. 29, 1959 J. F. HARVEY 2,919,048

PRESSURE VESSEL FLANGE WITH ANTI-ROTATION RINGS

Filed Jan. 7, 1957

FIG. 1

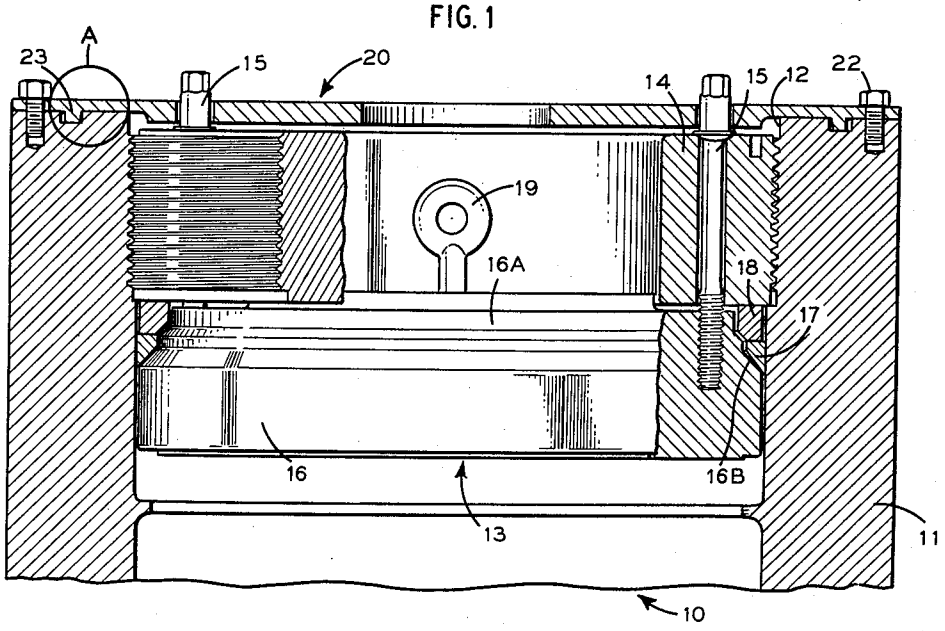


FIG. 2

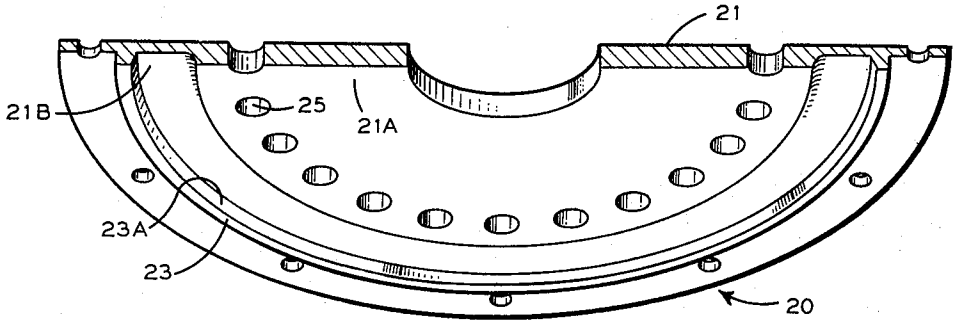
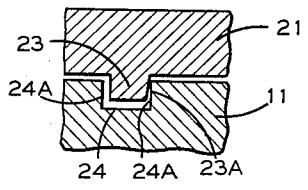


FIG. 3



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PRESSURE VESSEL FLANGE WITH ANTI-ROTATION RINGS

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2 Claims. (Cl. 220—39)

This invention relates to a pressure vessel and more particularly to a full open end vessel having a removable closure therefor and means for resisting rotational moment of distortion of the end wall portion of the vessel in the vicinity of the upper closure zone thereof when an internal pressure is applied thereto.

Heretofore, the full open end type of pressure vessel having either an interiorly or exteriorly seated removable closure therefor to seal the same was normally provided with a flange or thickened wall portion around the upper closure end thereof to resist any tendency of the wall portion in the closure end zone from rotating or distorting when an internal pressure was applied thereto, such resistance to rotation or distortion being necessary to prevent loosening of the cover or closure and resulting leakage to occur thereat. While the flanged or thickened wall portion heretofore used for resisting such rotational moment of the vessel walls adjacent the opening thereof is satisfactorily and economically feasible on relatively small vessels, or for medium vessels subjected to relatively low pressures, the flanged or thickened wall construction is not satisfactory, practical or economical for pressure vessels having relatively large diameter closure openings and/or which are subjected to relatively high internal pressures. The disadvantage of incorporating the flange or thickened wall structure to large diameter and/or high pressure vessel is that the amount of material or flange required to resist the turning moment in a large vessel was exceedingly large and resulted in a relatively heavy, bulky and expensive construction.

An object of this invention is to provide an economic and efficient means for resisting the tendency of the upper closure wall portions or a relatively large pressure vessel against a moment of rotation when an internal pressure is applied thereto.

Another object of this invention is to provide a relatively inexpensive anti-rotation means which is relatively simple, inexpensive to manufacture and positive in operation.

The above objects and advantages of this invention are accomplished by a pressure vessel having a substantially uniform wall thickness adjacent the upper closure zone, i.e., a wall having substantially the same internal and external diameter as down in the body of the vessel in which resistance to the moment of rotation or distortion of the upper end portion of the vessel is accomplished by a novel anti-moment rotating means connected to and extending across the top of the vessel. According to this invention, the anti-moment rotating means includes a plate member provided with depending shear lug positioned inwardly of the marginal edge position thereof, the shear lug being adapted to seat in a cooperating recess formed in the upper end of the substantially uniform vessel wall. According to this invention, the shear lug and recess are provided with co-operating surfaces to insure positive contact therebetween. Consequently, as the internal pressure is applied to the vessel, the tendency of the wall adjacent the upper closure end of the vessel from distorting

outwardly is successfully and economically resisted by the anti-moment rotating means of the instant invention.

A feature of this invention resides in the provision whereby the vessel wall adjacent the upper closure end requires no flange or thickened portion, the wall portion in the end closure zone having substantially the same internal and external diameter as down in the body of the vessel.

Another feature of this invention resides in the provision of an anti-moment rotating plate in the form of an annular member or ring provided with a depending shear lug adapted to be received in a recess formed in the upper end of the vessel to resist rotation of the end portion of the vessel.

Other features and advantages of the invention will be readily apparent when considered in view of the drawings and description in which:

Fig. 1 is a fragmentary, sectional view taken through the upper end of a pressure vessel in accordance with the instant invention.

Fig. 2 is a sectional, detail, perspective, bottom view of the improved anti-rotation ring in accordance with the instant invention, and

Fig. 3 is an enlarged view of detail A of Fig. 1.

In accordance with this invention, there is shown in Fig. 1 of the drawings, a pressure vessel **10** comprising a body portion **11** which is closed at the bottom end (not shown) and provided with a full open end **12** in the upper portion thereof, the open end being adapted to receive a suitable removable pressure seal closure **13**. While the size and shape of the vessel according to this invention may assume any desired proportions and is adapted for any purpose to which a pressure vessel may be used, the instant invention has particular utility for relatively large pressure vessels and/or vessels adapted to be subjected to relatively high internal pressures.

It is a fact that in pressure vessels which are closed by a readily removable pressure seal closure and subjected to an internal pressure, there is a tendency on the part of the vessel wall portion adjacent the closure end zone thereof to be subjected to a moment of rotation and to distort causing the closure to become loosened and for resulting leakage to occur thereat. In the past, this difficulty has been avoided by utilizing relatively small size pressure vessels, that is, vessels having a diameter of less than 36" and by providing such vessels with a flange or thickened wall portion adjacent the closure end zone thereof for effectively resisting the turning moment of the wall portions thereat.

However, with the tendency toward the utilization of pressure vessels having a diameter greater than 36" and/or vessels adapted to be subjected to relatively high pressures, for example pressures of 4,000 lbs. per square inch, the practice of utilizing a flange or thickening of the wall adjacent the closure end zone of such contemplated pressure vessels has proven to be impractical and costly to manufacture.

In accordance with this invention, as shown in Fig. 1, the improved pressure vessel of the instant invention is provided with a body portion **11** having a wall thickness adjacent the closure end zone thereof which is substantially equal in thickness to the wall portion making up the main body portion of the vessel. While the pressure vessel may be closed at its open end by either an externally or internally type of bolted cover or closure, in the illustrated form of the invention, a pressure seal closure **13** of the Bridgman type is illustrated. As shown, the upper wall portion of the vessel adjacent the closure end zone is provided with an internal portion suitably threaded for receiving an externally threaded securing ring **14**. Extending from ring **14** by a plurality of circumferentially spaced bolts **15** extending therefrom is a floating plug or

cover plate **16** which is adapted to form the closure for the vessel. As shown, the cover **16** is provided with a reduced portion **16***a* terminating in an inclined shoulder **16***b* which forms a conical seat for receiving a sealing gasket **17**. If desired, a pressure ring **18** is disposed between the cover **16** and the gasket **17**. As the cover **16** of such vessel is quite heavy, a lifting lug **19** may be provided to facilitate lifting of the cover.

In order to resist a tendency of the wall portion of the vessel adjacent the closure end thereof from being subjected to a rotating moment when an internal pressure is applied thereto, a novel anti-moment rotating means **20** is utilized. According to this invention, the anti-moment rotating means comprises an annular plate member illustrated as a ring **21** which is adapted to be removably fastened to the top of the vessel by means having a plurality of spaced bolts **22** adjacent the outer periphery thereof. As shown in Figs. 2 and 3, the anti-moment rotating ring comprises a central portion **21***a* and an outer marginal edge portion **21***b*, the former being provided with a relatively thicker cross sectional area than that of the latter. Spaced inwardly of the outer periphery of the marginal portion **21***b* of the ring, the latter is provided with a depending shear lug **23** which in the illustrated form of the invention comprises a continuous, annular, depending lug which is adapted to seat in a recess **24** formed in the upper end of the vessel, the recess being provided with vertical walls **24***a*. As shown in Figs. 1 to 3, the inner surfaces **23***a* of the depending lug is inclined. Thus, it will be noted that when the anti-rotation ring is positioned on the top of the vessel, the tapered surface **23***a* of the shear lug assures positive contact between the vessel body and the anti-rotation ring, Figs. 1 and 3. It will be further noted that the inclined surface of the shear lug further permits more liberal machining tolerances and increases the probability of maintaining positive contact between the surfaces of the lug and the recess. With the ring **21** in place on the end of the pressure vessel in the manner illustrated, when an internal pressure is applied to the vessel, the ring tends to resist the outward rotational movement of the end wall of the vessel. Thus, it will be noted that a desirable feature of the anti-rotation ring according to this invention is that it enables a more uniform loading to be exerted on the closure threads throughout their entire height. Furthermore, it will be noted that the vessel may be more readily fabricated in that the body of the vessel is provided with substantially a uniform wall thickness throughout its entire length and requires no build-up of additional material or flange portion adjacent the closure end zone thereof as heretofore required. Furthermore, the anti-rotation ring is of relatively simple construction, easily manufactured and rendered positive in operation. To accommodate bolts **15**, the ring **21** is provided with aperture **25**.

While the instant invention has been disclosed with reference to a particular embodiment thereof, it is to be appreciated that the invention is not to be taken as limited to all of the details thereof, as modifications and variations thereof may be made without departing from the spirit or scope of this invention.

What is claimed is:

1. A pressure vessel for withstanding relatively very high internal pressures comprising a body having enclosing wall portions of uniform thickness, said body having an opening in one end having a diameter substantially equal to the internal diameter of said body, the

enclosing wall portions defining said opening being provided with internal threads, said wall portions having in the upper edge thereof a continuous recess extending around said opening, a removable pressure closure for sealing said opening, a securing ring threaded in said opening for retaining said closure, means forming a fluid tight seal disposed between said closure and securing ring, said securing ring being adapted to accommodate the longitudinal thrust exerted on said closure when an internal pressure is applied to the vessel, a readily removable plate ring disposed across the top of said body, said plate ring being independently connected to said body for resisting only the outwardly rotational tendency of said wall portions so that uniform loading of said threads in the open end is assured as internal pressure is applied, said plate ring having a co-extensive annular depending, integrally connected, shear lug adaptable to seat in said recess, said lug resisting in shear the force tending to outwardly rotate the wall portions defining said open end and fastening means for readily connecting and disconnecting said ring to and from said body independently of said closure, said fastening means including a plurality of bolts having a relatively small bolting area in proportion to the forces resisted for securing said ring to the upper edge of the wall portion, said shear lug having an inclined surface to insure positive contact between said body and ring.

2. A pressure vessel adapted to be subjected to a relatively high internal pressure comprising a body having a closure zone adjacent one end thereof, said body having an enclosing wall portion of substantially uniform thickness in the closure zone to define therein an opening having a diameter substantially equal to the internal diameter of said body, said wall having in the upper edge thereof a continuous recess extending around said opening, a removable closure means sealing said opening, said closure means resisting the longitudinal thrust of the forces acting within the vessel, a readily removable ring disposed across the top of said body and independently connected thereto to resist only the outwardly rotational movement due to the lateral thrust of the forces acting on said wall portion adjacent the closure end when an internal pressure is applied to the vessel, said ring having a substantially co-extensive, integrally connected, depending annular shear lug on the bottom side thereof adapted to seat in said recess, and fastening means for readily connecting and disconnecting said ring to and from said body independently of said closure means, said fastening means including a plurality of bolts having a relatively small bolting area in proportion to the forces resisted for securing said ring to the upper end of the wall portion.

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