United States Patent [19]

Shulz

[11] **3,765,562**

[45] **Oct. 16, 1973**

[54] **CLOSURE FOR PRESSURE VESSEL**

[75] Inventor: **Robert J. Shulz,** Brookfield, Ill.

[73] Assignee: **Innovative Process Equipment, Inc.,** Palatine, Ill.

[22] Filed: **Mar. 2, 1972**

[21] Appl. No.: **231,250**

[52] **U.S. Cl.** **220/55.1,** 220/57, 220/32

[51] **Int. Cl.** **B65d 45/00,** A47j 27/08

[58] **Field of Search** 220/55.7, 3, 57, 220/32

[56] **References Cited**

UNITED STATES PATENTS

3,386,612	6/1968	Kirkwood et al.	220/57 X
3,045,861	7/1962	Dieter et al.	220/57

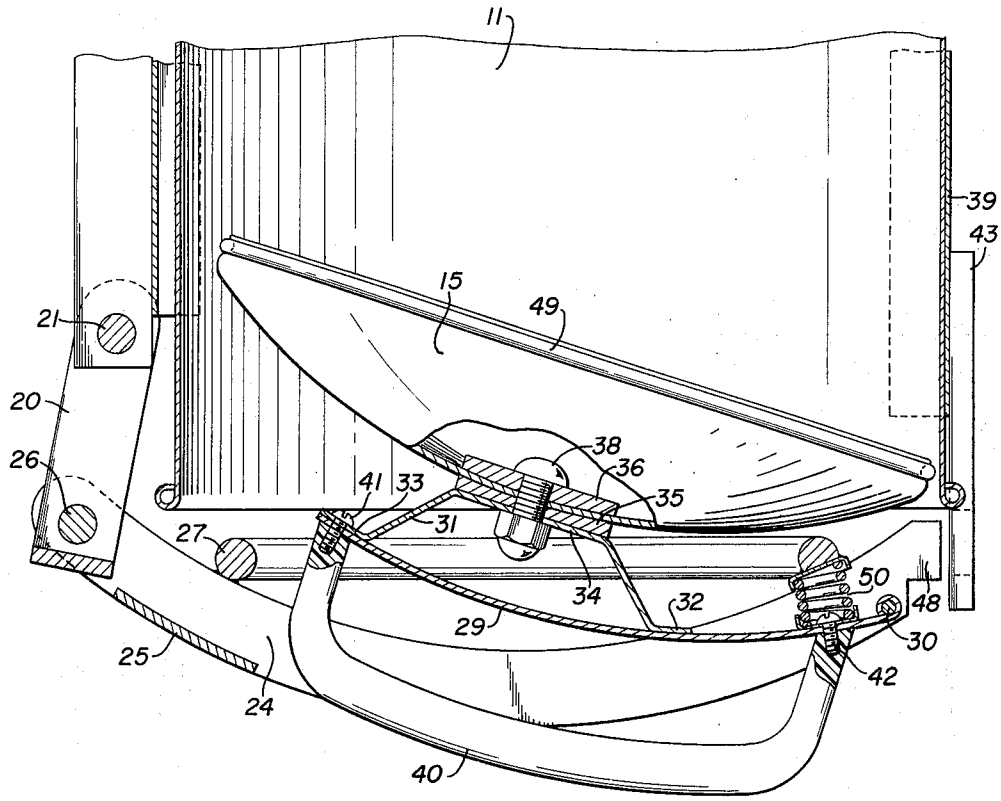
Primary Examiner—George T. Hall

Attorney—Raymond E. Fidler et al.

[57] **ABSTRACT**

A closure member having a peripheral resilient gasket is pivotally supported on a cross brace hingedly attached to the vessel for movement of the closure between an open position and a closed position wherein the closure is positioned within a cylindrical access opening in the vessel with the gasket compressed against the cylindrical wall of the vessel. With the closure in the sealed position the cross brace is locked to the vessel across the outer face of the closure to prevent outward movement thereof when the vessel is pressurized.

10 Claims, 9 Drawing Figures



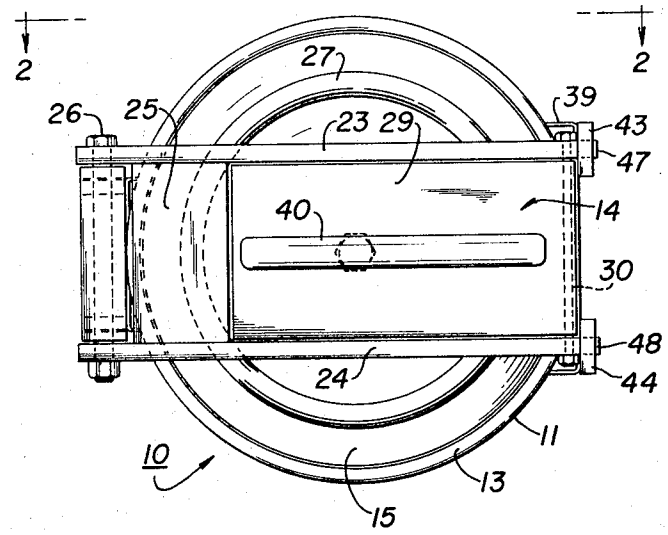

2
2
27
26
25
23 29
39
43
47
40
14
30
48
24
44
11
10
13
15

FIG. 1

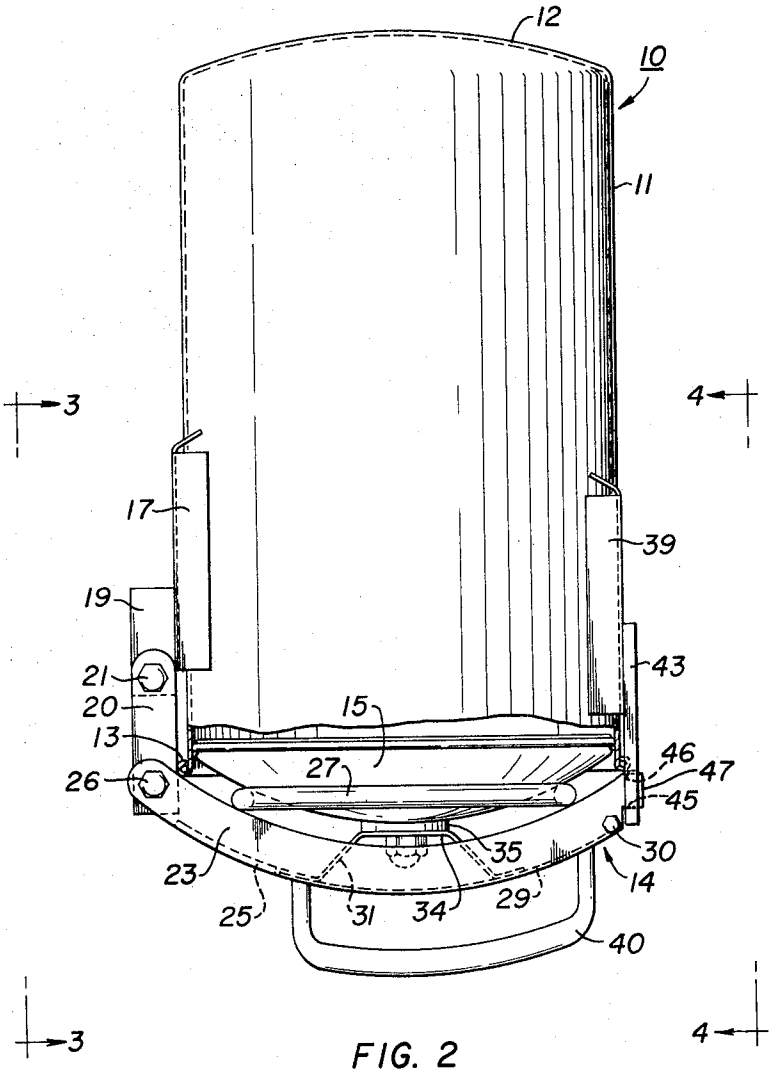

12
10
11
3
4
17
39
19
43
21
20
15
13
46
47
26
27
45
35
30
23
14
25
31
34
29
40
3
4

FIG. 2

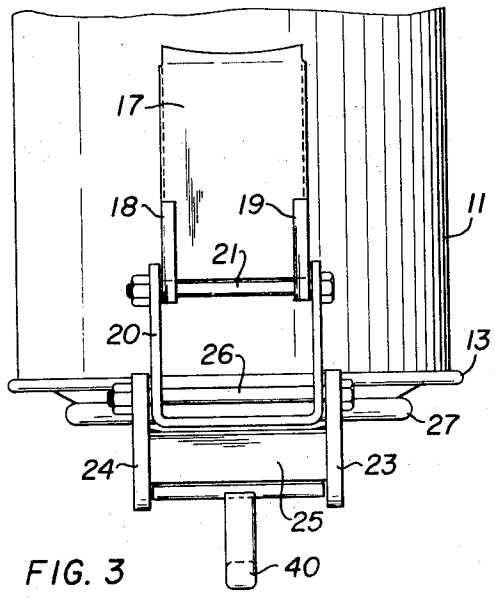


FIG. 3

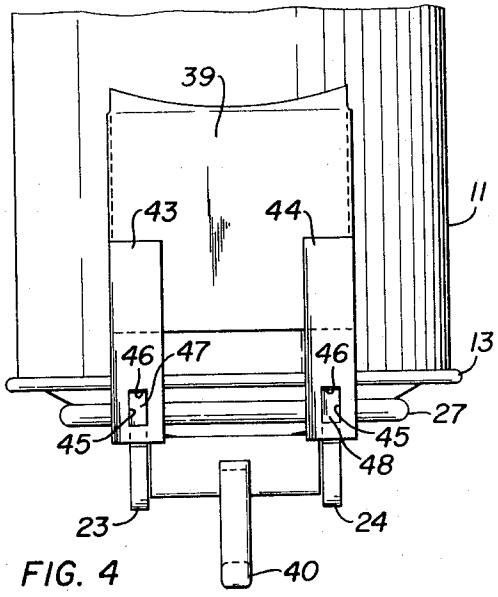


FIG. 4

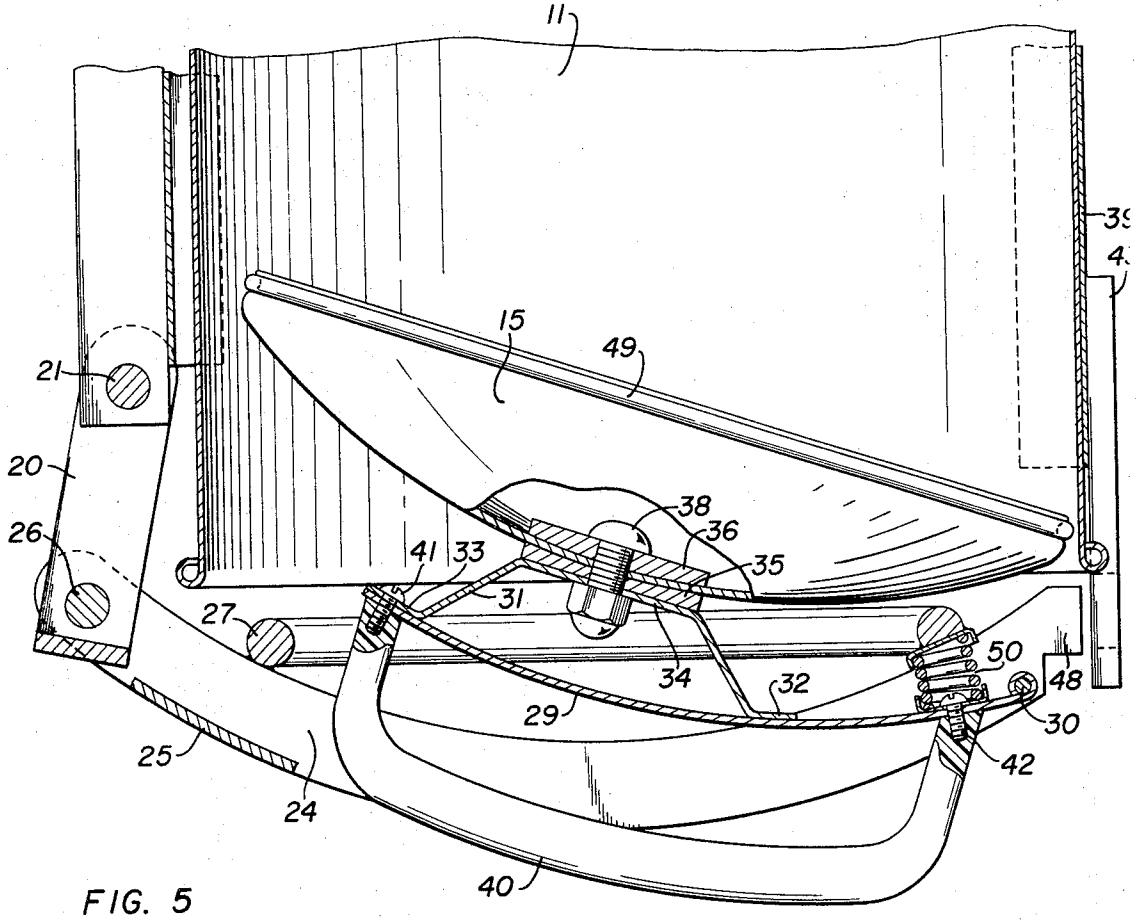
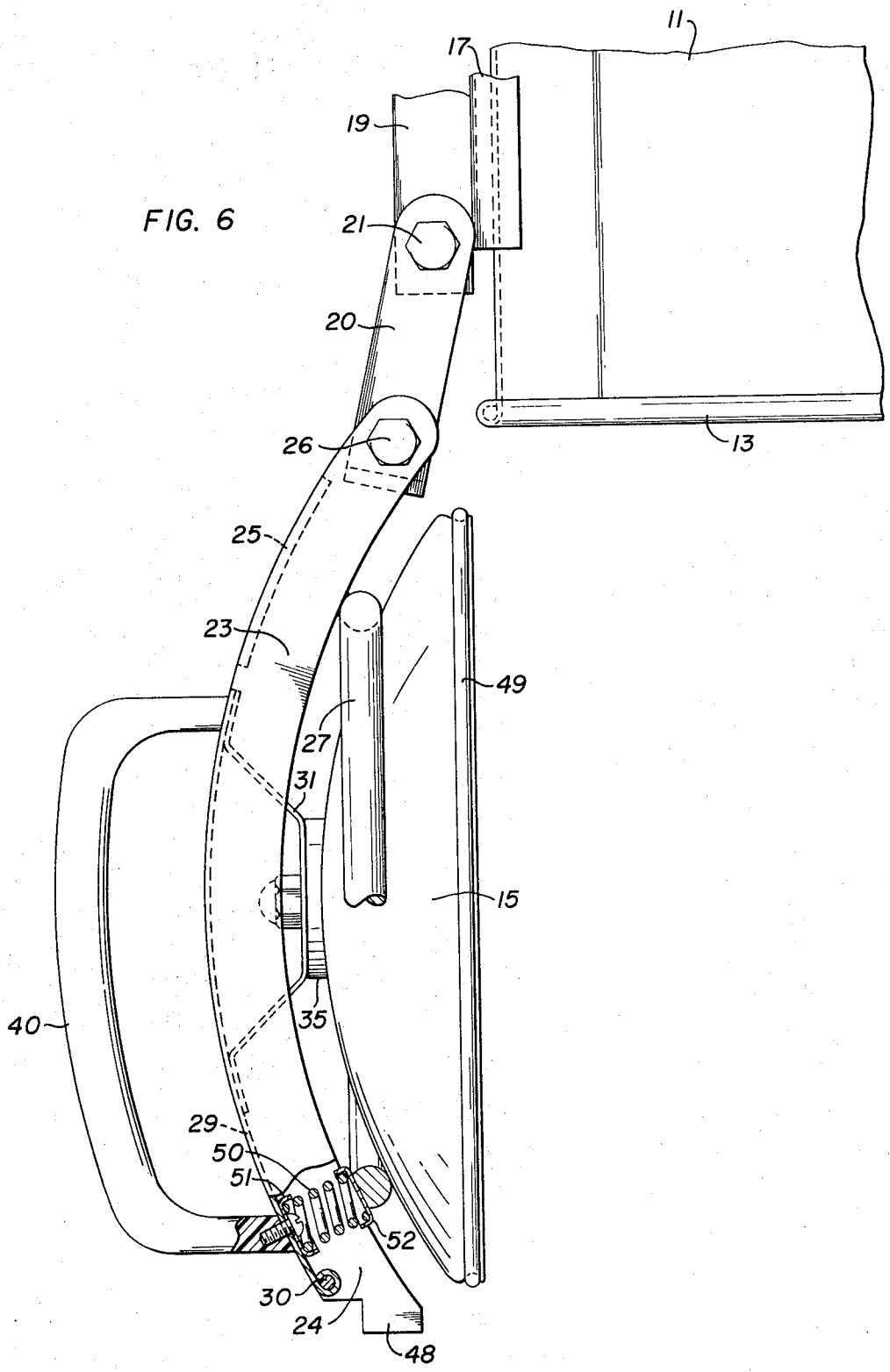


FIG. 5

FIG. 6



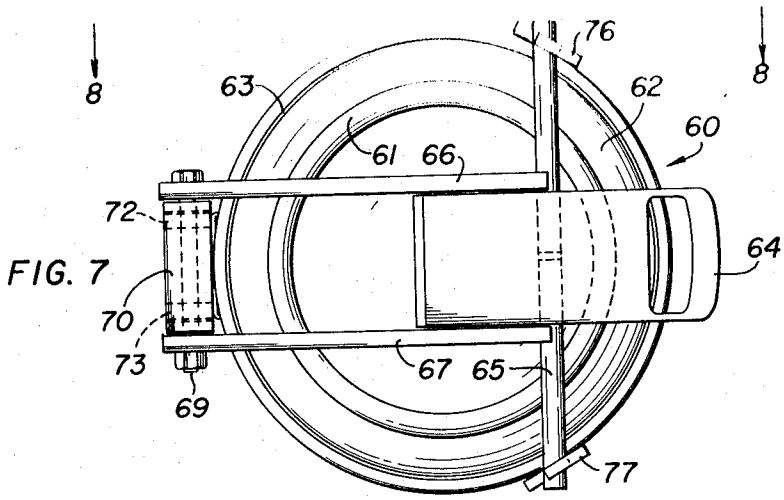


FIG. 7

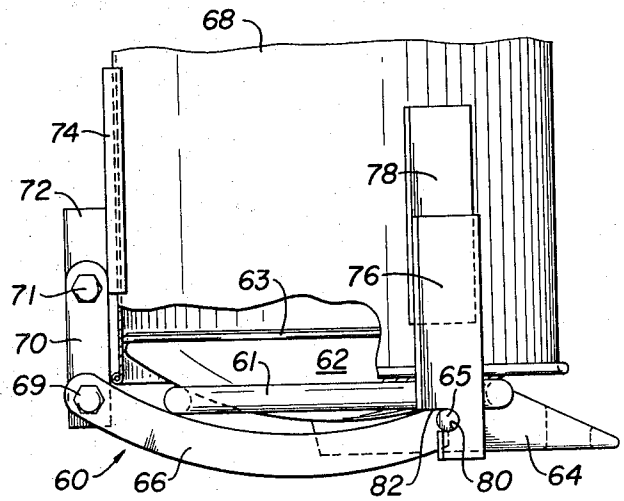


FIG. 8

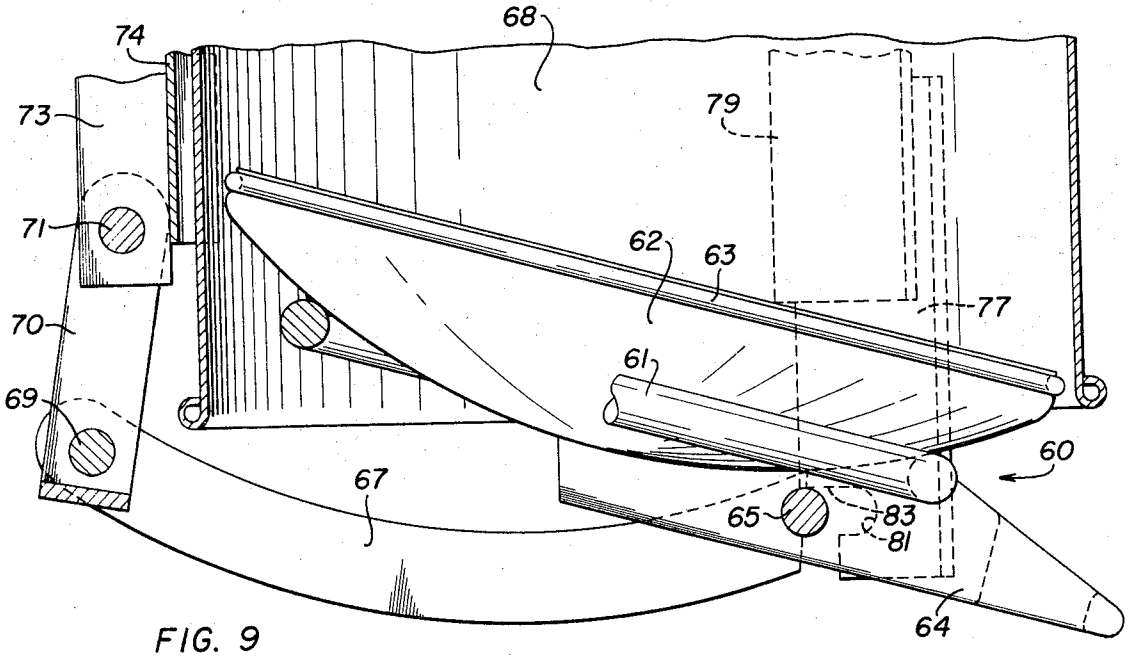


FIG. 9

CLOSURE FOR PRESSURE VESSEL

The present invention generally relates to pressure vessels and more particularly to closures of the type which are hingedly mounted to such vessels.

BACKGROUND OF THE INVENTION

Pressure vessels are widely used for many different purposes, the most common being for cooking foods under pressure and for sterilizing medical instruments and the like. Such vessels are usually cylindrical in shape having a circular opening at the front and an integral dished wall at the rear. Various types of closures have been hingedly connected to such vessels for movement between open and closed positions. Some of these prior art closure designs employ closures which are forced against the outer edge of the vessel surrounding the access opening thereto. Other prior art mechanisms position the closure within the vessel and an internal flange on the vessel engages the periphery of the closure to hold it in place while the vessel is under pressure.

A disadvantage of the first type of closure is that the closure can be opened while the vessel is pressurized. Pressure operated auxiliary latching mechanisms have been used to prevent complete opening of the closure unless the pressure in the vessel is below a predetermined value, but such mechanisms add to the cost of the system and provide one more potential source of danger. A disadvantage of the second type of closure is that the internal flange at the mouth of the vessels makes cleaning more difficult. Moreover, some of these closures are necessarily flexible in order to permit insertion and removal thereof from the vessel to open and close it whereby the thickness and thus strength of the closure is limited. In other designs of the second type the closure remains within the vessel at all times. This construction thus reduces the usable space in the vessel and makes cleaning extremely difficult. In both cases, however, the closure is held in the vessel solely by the internal head on the vessel which must, therefore, be of substantial strength to withstand the forces exerted thereon. Hence, the wall thickness of the vessel has been much greater than is required in all other areas thereof, substantially increasing the cost of the vessel.

OBJECTS OF THE INVENTION

An object of the present invention, therefore, is to provide a new and improved closure mechanism for use with a pressure vessel.

Another object of this invention is to provide a closure construction usable with pressurized vessels functioning as steam boilers.

A further object of the present invention is to provide a closure mechanism which is easy to operate, inexpensive to manufacture and safe to use.

A still further object of the present invention is to provide a pressure vessel and closure combination wherein the closure cannot be accidentally opened while the vessel is under pressure.

SUMMARY OF THE INVENTION

Briefly, the above and further objects may be realized in accordance with the present invention by pivotally mounting a circular closure member on a cross-brace member hingedly connected to a cylindrical pressure vessel adjacent a circular access opening at the end thereof. A locking member is mounted to the vessel diametrically opposite to the hinged connection for coaction with the brace to maintain it in a sealing position across the face of the closure member while such closure is in sealing engagement with the vessel. The closure is so connected to the brace and positioned in the vessel that it cannot be moved from the closed, sealing position while the vessel is pressurized wherefore the closure mechanism is maintained in a locked condition to prevent inadvertent opening thereof while the vessel is under pressure.

BRIEF DESCRIPTION OF THE DRAWINGS

Two embodiments of the present invention are illustrated in the accompanying drawings wherein:

FIG. 1 is a front view of a pressure vessel and closure mechanism embodying the present invention, the closure mechanism being shown in a closed, sealing condition;

FIG. 2 is a top view of the device as shown in FIG. 1;

FIG. 3 is a side elevational view taken from the left-hand side as shown in FIG. 2;

FIG. 4 is a side elevational view taken from the right-hand side as shown in FIG. 2;

FIG. 5 is an enlarged, top view similar to FIG. 2 but showing the closure mechanism in a partially open condition;

FIG. 6 is a fragmentary top view similar to FIG. 5 but showing the closure mechanism in a fully open condition;

FIG. 7 is a front view of a pressure vessel and closure mechanism embodying other features of the present invention and showing the closure mechanism in a closed, sealing condition;

FIG. 8 is a top view of the device of FIG. 7; and

FIG. 9 is an enlarged top view of the device of FIG. 7 with the closure in a partly open condition.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring now to the drawings and more particularly to FIGS. 1–4, a pressurizable vessel **10** includes as its principal elements a hollow, generally cylindrical vessel **11** having an integral rear wall **12** and an external annular flange **13** at the front surrounding the access opening to the vessel. The flange **13** is formed by outwardly rolling the distal end of the vessel **11** and its purpose is to strengthen the vessel in the area of the access opening to maintain it in a circular shape. A closure mechanism **14** includes a closure member **15** which sealably fits into the front end of the vessel **11** to sealably close the chamber within the vessel whereby such chamber may be pressurized.

Considered in greater detail, a mounting bracket **17** is fixedly secured to the outside surface of the vessel **11** by suitable means such as brazing or welding and a pair of blocks **18** and **19** are fixedly connected as by welding to the bracket **17** as best shown in FIGS. **2** and **3**. A generally U-shaped yoke member **20** is hingedly connected to the blocks **18** and **19** by an elongated bolt **21** which extends through aligned openings in the depending arms of the yoke **20** and in the blocks **18** and **19**. A cross brace assembly includes a pair of cross brace members **23** and **24**. A plate **25** is interconnected between the brace members **23** and **24** a short distance from the left-hand end of these brace members as shown in FIGS. **1** and **2**. Near the left-hand ends of the

brace members 23 and 24 are provided aligned openings for receiving a bolt 26 which extends through these openings and through aligned holes in the arms of the yoke 20 thereby to pivotally connect the cross brace assembly to the yoke 20 which is in turn hingedly connected to the fixed blocks 18 and 19. A ring 27 which is circular in cross section is welded to the bottom of the cross brace members 23 and 24 for engaging an annular external area on the cover 15 when the cover is in sealing engagement within the vessel as shown in FIG. 2.

In order to pivotally connect the cover 15 to the closure mechanism 14 and more particularly to the cross brace assembly, there is provided a plate 29 which is curled around a bolt 30 which extends between the cross brace members 23 and 24 near the right-hand end as shown in FIG. 1. A bracket 31 is connected to the bottom side of the plate 29 as by spot-welding and, with the cover located in a closed position as shown in FIGS. 1 and 2, is centrally located relative to the longitudinal axis of the vessel 11. The bracket 31 has a pair of mounting flanges 32 and 33 provided at the end thereof and a central web portion 34. The web 34 is centrally apertured and a block 35 (best shown in FIG. 5) having a concaved inner surface matching the convexity of the central area of the cover 15 is interposed between the cover 15 and the bracket 31. Similarly, a block 36 having a convex outer surface matching the concavity of the inner surface of the cover 15 is mounted inside the cover and is provided with a central opening aligned with the opening in the block 35 and the bracket 31. A carriage bolt 38 is used to sealably secure the assembly of the blocks 35 and 36 and the cover 15 to the bracket 31.

In order to facilitate operation of the closure mechanism, a handle 40 of generally U-shaped construction is connected as by means of a pair of screws 41 and 42 to the plate 29.

Diametrically opposite the hinge mechanism for the closure there is mounted to the vessel 11 a mounting bracket 39 to which a pair of upstanding latch bars 43 and 44 are fixedly connected as by means of welding. Rectangular openings 45 are provided in the latch bars 43 and 44 with the bottom edges 46 of these openings being aligned with the forward end surface of the vessel 11. The cross brace members 23 and 24 are provided with bolt extensions 47 and 48 which fit into the openings 45 for locking the closure mechanism in a closed condition.

The cover 15 has an external diameter which is slightly less than the internal diameter of the vessel 11 and is provided with an annular peripheral groove in which an annular resilient gasket 49 is mounted. The gasket may be formed of any high temperature elastomer and is preferably tubular in cross section to facilitate movement of the cover 15 into the fully closed position wherein the gasket 49 is compressed throughout its entire length between the cover and the interior wall of the vessel. It is important that the cover 15 is not sealed to the vessel until the ends 47 and 48 of the braces are within the slots in the latch bars 43 and 44. With a vessel having an internal diameter of 12 inches, a gasket 49 having an unstressed external diameter of 12 1/16th inches performs satisfactorily. The cover 15 may have an external diameter of 11 15/16th inches.

With the closure mechanism in a closed position as shown in FIGS. 1 and 2. a uniform outward force is exerted on the cover 15 by the pressure within the vessel which is restrained by the ring 27 and the remainder of the closure mechanism with the cross brace assembly being held in place at one end by the locking bars 43 and 44 and by the hinge assembly at the other end. The closure mechanism cannot be opened while the vessel 11 is pressurized inasmuch as the cross brace assembly 23 cannot be slidably moved toward the left as viewed in FIG. 2, while the cover 15 is in the sealing position within the vessel 11 parallel to the access opening thereof. Hence, the closure mechanism is self-locking to assure a pressure tight system which cannot be accidentally opened to any extent whatever while the vessel is pressurized. When, however, the pressure in the vessel is the same as ambient pressure so that there is no differential pressure across the door, the handle 40 may be moved inwardly to pivot the plate 29 about the hinge pin 30 thereby tilting the cover 15 out of the closed position into a tilted position as illustrated in FIG. 5. As the cover is thus tilted the cross brace assembly 22 slides toward the hinge end thereof with the yoke 20 pivoting about the hinge pin 21 to slide the locking bolt ends 47 and 48 of the cross brace assembly out of the locking apertures 45, thereby to clear the cross brace members 23 and 24 from the locked bars 43 and 44 whereby the closure assembly can then be swung open about the hinge bolt 26 to the fully open position shown in FIG. 6.

In order to bias the cover 15 into a fixed position against the ring 27 of the cross brace assembly, a coil spring 50 is compressed between the ring 27 and the plate 29 to bias the handle assembly into the position shown in FIG. 6. A pair of end caps 51 and 52 are respectively connected to the plate 29 and the ring 27 to hold the coil spring 50 in place.

Referring now to FIGS. 7–9 wherein is shown a closure mechanism 60 embodying additional features of the present invention. Unlike the embodiment of FIGS. 1–6, the closure mechanism 60 employs a ring 61 mounted directly on a circular cover 62 having a resilient sealing gasket 63 mounted in an annular peripheral groove therein. The ring 61 is welded to the cover 62 and a handle member 64 is also welded to the cover 62. The handle member 64 is rotatably mounted on a locking rod 65 forming part of a cross brace assembly including a pair of cross brace members 66 and 67. The members 66 and 67 are connected to the side of a cylindrical vessel 68 by a double hinge assembly including a hinge bolt 69, a yoke 70, a hinge bolt 71 and a pair of blocks 72 and 73 mounted to the vessel by a bracket 74. It may be seen that the double hinge assembly is identical to the double hinge assembly used in the the closure mechanism 14.

In order to lock the cover 62 in a closed sealing position paralleling the plane of the circular access opening to the vessel, a pair of latch plates 76 and 77 are mounted to the vessel by suitable mounting plate 78 and 79 welded to the vessel and to the respective plates 76 and 77. The plates 76 and 77 are respectively provided with locking slots 80 and 81 for receiving the end portions of the bar 65 to prevent outward swing movement of the cross brace assembly when the vessel is pressurized. The slots 80 and 81 extend parallel to the plane of the access opening and the inner sides of the slots are flush with shoulder portions 82 and 83 which provide a stop against which the bar 65 abuts when the closure assembly is initially swung into a closed posi-

tion as shown in FIG. 9. When in this position the operator merely pushes in the handle to pivot the cover 62 about the rod 65 into the completely closed sealing position as shown in FIG. 8 wherein the ring 61 abuts the cross brace members 66 and 67 and the bar 65. It will be apparent that as the handle 64 is pushed in toward the vessel the yoke 70 pivots about the hinge bolt 71 and the rod 65 slides along the shoulders 82 and 83 into the latching notches 80 and 81. Since the rod 65 can be moved out of the notches 80 and 81 only by tilting the cover 62 in the vessel, and since such tilting is prevented when the vessel is pressurized, the closure mechanism is securely locked in place and cannot be accidentally opened while the vessel is under pressure.

While the present invention has been described in connection with particular embodiments thereof, it will be understood that those skilled in the art may make many changes and modifications without departing from the true spirit and scope thereof. Accordingly, the appended claims are intended to cover all such changes and modifications as fall within the true spirit and scope of the present invention.

What is claimed is:

1. A closure mechanism for use with a pressure vessel having an annular area defining a circular access opening therein, comprising

a circular cover having an external diameter less than the internal diameter of said access opening,

an annular gasket supported about the periphery of said cover and having an external diameter slightly larger than the internal diameter of said access opening to seal said cover to said vessel when said cover is positioned in said annular area with the plane of said gasket parallel to said opening,

cross brace means positionable across said opening in engagement with said cover for holding said cover in a closed position against the pressure exerted thereon when said vessel is pressurized,

double hinge means connecting said cross brace means to said vessel adjacent said access opening to permit said cross brace to be moved parallel to said opening and to be swung outwardly away from said opening,

latch means carried by said vessel at a location for locking engagement with said cross brace means when it is moved in a direction parallel to said opening toward said latch means, and for preventing outward swinging of said cross brace means when it is positioned across said opening in locking engagement with said latch means, and

means pivotally connecting said cover to the said cross brace means about an axis parallel to the pivotal axes of said hinge means to permit tilting of said cover into said vessel out of sealing engagement with said annular area while said cross brace means is in a locked position across said access opening and thereby permit movement of said cross brace in a direction parallel to said access opening out of latching engagement with said latch means, said tilting of said cover into said vessel being opposed by the pressure in said vessel,

whereby said closure mechanism prevents accidental opening of said cover while said vessel is pressurized.

2. A closure mechanism according to claim 1 wherein

said vessel has a generally cylindrical inner wall surface extending to said access opening and having an outwardly rolled end portion surrounding said opening,

whereby said end portion strengthens said vessel but does not inhibit cleaning of the internal surfaces thereof.

3. A closure mechanism according to claim 1 wherein

said cross brace means includes a rigid ring engaging said cover throughout an annular area concentric with the principal axis of said cover when said closure mechanism is in a sealing position.

4. A closure mechanism according to claim 1 wherein

said cover includes a rigid ring secured to and engaging said cover throughout an annular area concentric with the principal axis of said cover and engaging said cross brace means when said closure mechanism is in a sealing position.

5. A closure mechanism according to claim 1 wherein said means pivotally connecting said cover to said cross brace means comprises

a handle connected thereto for manipulating said cover and said cross brace means between open and closed positions.

6. A closure mechanism according to claim 5 wherein said cross brace means comprises

a pair of spaced apart cross brace members having locking portions slidably receivable in openings in said latch means.

7. A closure mechanism according to claim 6 wherein

said locking portions are provided on a rod extending parallel to the pivot axes of said hinge means.

8. A closure mechanism according to claim 7 wherein

said means pivotally connecting said cover to said cross brace means includes said rod.

9. A closure mechanism according to claim 6 wherein said handle is interposed between said cross brace members.

10. A closure mechanism according to claim 9 wherein said double hinge means comprises

a yoke pivotally connected to said vessel and

means pivotally connecting said cross brace assembly to said yoke.

* * * * *