Sept. 27, 1960 J. H. KRAMER ET AL 2,954,141

CLOSURE FOR PRESSURE VESSELS

Filed Jan. 26, 1956 2 Sheets-Sheet 1

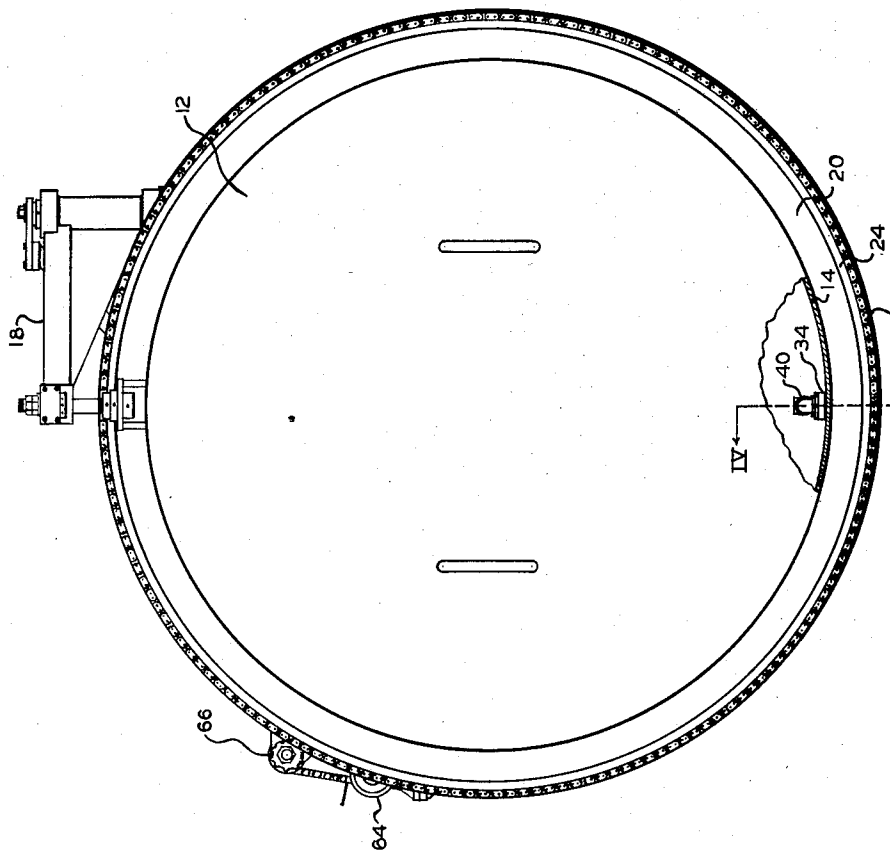


FIG. 2

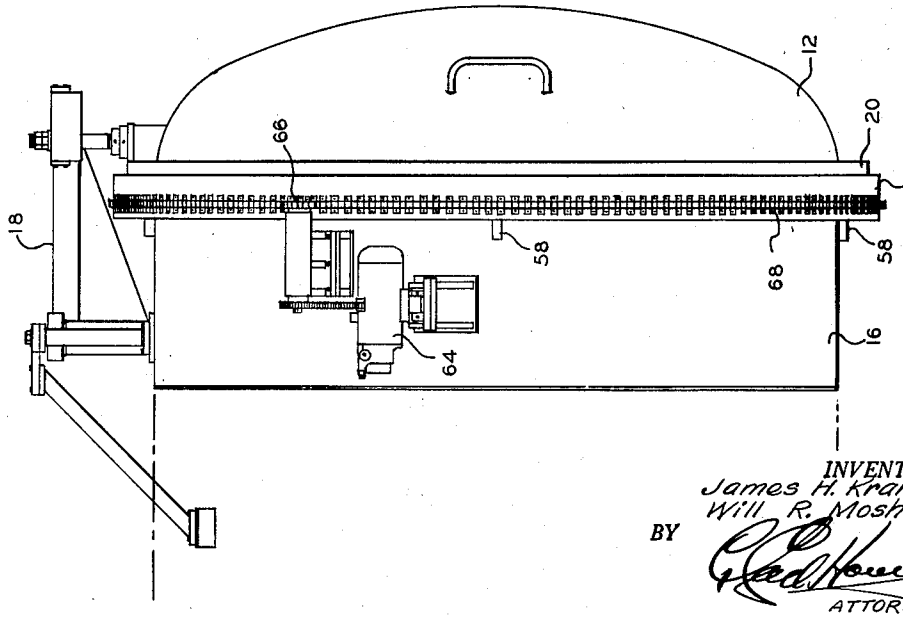


FIG. 1

INVENTORS.
James H. Kramer
Will R. Moshier
BY
ATTORNEY.

Sept. 27, 1960 J. H. KRAMER ET AL 2,954,141

CLOSURE FOR PRESSURE VESSELS

Filed Jan. 26, 1956 2 Sheets-Sheet 2

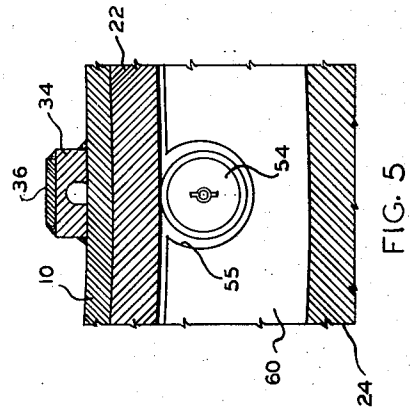


FIG. 5

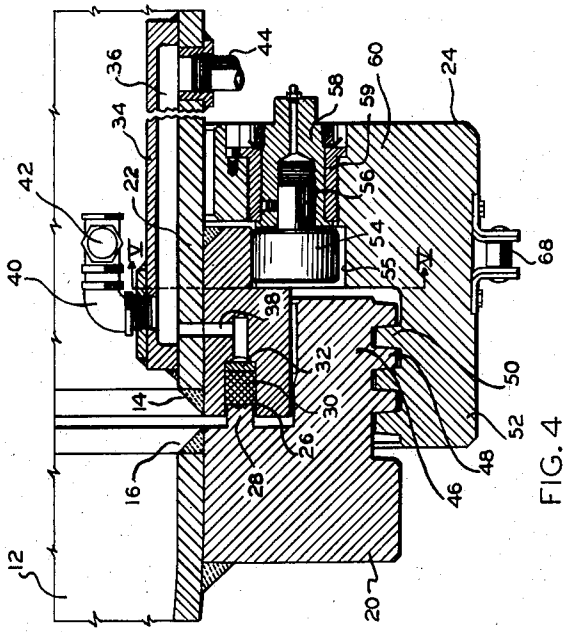


FIG. 4

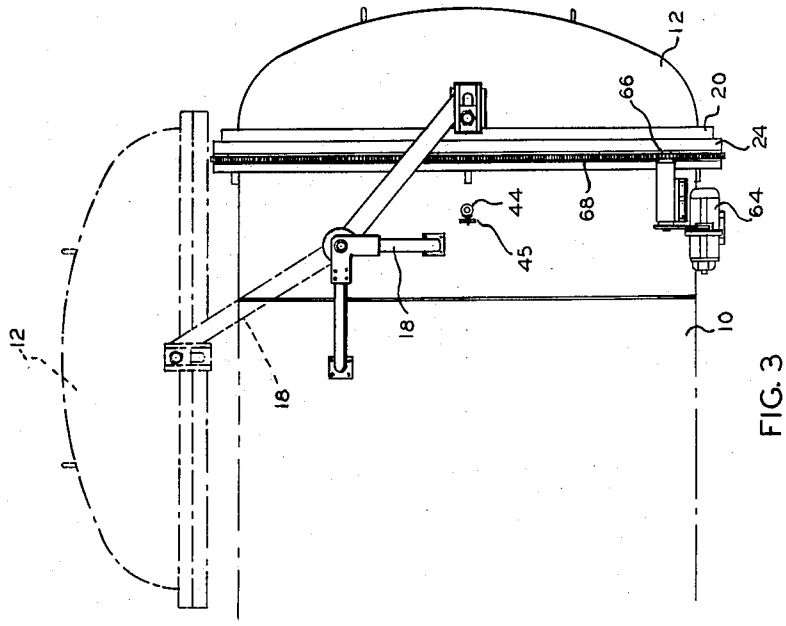


FIG. 3

INVENTORS.
James H. Kramer
Will R. Moshier

BY

ATTORNEY.

United States Patent Office 2,954,141 Patented Sept. 27, 1960

2,954,141

CLOSURE FOR PRESSURE VESSELS

James H. Kramer, Leavenworth, Kans., and Will R. Moshier, Independence, Mo., assignors to Kramer Machine and Engineering Products Co., Leavenworth, Kans., a corporation of Michigan

Filed Jan. 26, 1956, Ser. No. 561,557

9 Claims. (Cl. 220—39)

This invention relates to improvements in autoclaves and other pressure vessels, the primary object being to provide an improved door or closure unit adapted to be quickly, easily and safely shifted to and from a closed position and including parts for not only assuring a tight effective seal, but which eliminates virtually all hazards to the operators during handling of the door, as well as while the vessel is under high pressure.

Many types of closures have heretofore been provided for high pressure vessels and for the most part the various types of bolts, clamps and other fasteners for attaching the closure to the vessel have been effective so far as holding the door in place when the vessel is pressurized. However, such fasteners have been expensive, heavy and of such complicated nature as to require a considerable amount of time and energy for mounting and removing the door as required.

In addition to the aforementioned disadvantages of the assemblies of the prior art, it has been recognized in the field that the same have not been altogether satisfactory from the standpoint of effecting a tight, long-lasting seal. Wherever gaskets or the like are utilized in connection with the closure assemblies heretofore employed, it is to be expected that the same be replaced from time to time because of the damage thereto following but a short period of use.

It is the most important object of the present invention therefore, to provide closure structure for high pressure vessels that includes simple interlocking means between the door and the vessel for holding the door in place while a primary sealing arrangement is employed utilizing pressure for compressing a sealing element tightly in place between the door and the vessel.

Another important object of the instant invention is to provide closure means for vessels adapted to utilize the fluid pressure within the vessel itself as a power source for compressing the sealing member and thereby clamping the same into sealing relationship to the door and the vessel with which the same is used.

A still further object of this invention is the provision of a closure for pressure vessels adapted for use when the vessel is pressurized, or when the pressure therein is reduced, all without modification of any parts of the assembly.

Other objects include the way in which the novel structure aforementioned makes possible the use of a suitable davit for swingably suspending the door for easy movement toward and from a closed position; the manner in which interlocking holding means in the nature of cooperating rings having intermeshing screw threads are utilized to hold the door in the closed position while fluid pressure is applied to the sealing element; the way in which one of the screw-threaded rings is rotatably mounted on the vessel and driven by an operable connection with a suitable prime mover; the manner of adjustably mounting the rotatable ring on the pressure vessel through use of shiftable rollers attached thereto; and

many other objects including important details of construction to be made clear as the following specification progresses.

In the drawing:

Figure 1 is a side elevational view of a closure for pressure vessels made pursuant to the present invention.

Fig. 2 is an end elevational view thereof, parts being broken away for clearness.

Fig. 3 is a plan view on a reduced scale showing the closure open in dotted lines.

Fig. 4 is an enlarged, fragmentary, cross-sectional view taken on line IV—IV of Fig. 2; and

Fig. 5 is a fragmentary, cross-sectional view taken on line V—V of Fig. 4.

The pressure vessel chosen for illustration of the principles of the instant invention is designated by the numeral 10 in the drawing, and closure 12 is adapted to close one annular end 14 of the cylindrical vessel 10 which is normally disposed horizontally as shown, closure 12 likewise having an annular edge 16 in facing relationship to the edge 14 when the door 12 is closed.

Through use of a suitable davit or other suspension assembly 18, door 12 is mounted on the vessel 10 for swinging movement to and from the closed position.

In accordance with the present invention, a ring device 20 is secured rigidly to the door 12 in surrounding relationship thereto adjacent the edge 16 and a band 22, serving not only as a track for rotatable ring member 24 but cooperable with the device 20 in providing a seal, is secured rigidly to the vessel 10 in surrounding relationship thereto adjacent the edge 14.

The band 22 is provided with an annular groove 26 facing outwardly toward the device 20 when door 12 is closed and adapted to receive an annular tongue 28 on the device 20.

Groove 26 has a continuous compressible sealing element 30, as well as a pressure ring 32, floatingly mounted therein.

Through use of one or more shallow boxes 34 secured rigidly to the vessel 10 therewithin, there are presented chambers 36 which communicate with the cavity 26 through passages 38 formed in the band 22 and vessel 10. Each of the chambers 36 communicates with the vessel 10 through a conduit 40 provided with a one-way check valve 42 disposed to permit flow of fluid only from the vessel 10 to the chambers 36. Each chamber 36 is provided with a fluid pipe 44 having a control valve 45.

In this connection, it is to be preferred that vessel 10 be equipped with a pair of boxes 34 and corresponding chambers 36 to the end that one of the pipes 44 may be utilized as an inlet for fluid under pressure and the other pipe 44 used as an outlet therefor.

The ring device 20 on door 12 has an annular extension 46 provided with external screw threads 48 that mesh with internal screw threads 50 formed on an extension 52 of the ring member 24, it being noted that the extension 46 is fitted between the annular extension 52 and the band 22 when the door 12 is closed.

Ring member 24 is rotatably mounted on the band 22 through the medium of a plurality of rollers 54 disposed in cavities 55. Each of the rollers 54 is rotatably carried by a shaft 56 which is in turn mounted eccentrically within a member 58 carried by a sleeve 59. Sleeve 59 is threadably received by an annular extension 60 forming a part of the ring member 24.

It can be appreciated therefore, that, through use of a wrench applied to member 58, the latter may be rotated within the extension 60 to thereby shift the rollers 54 and move the ring member 24 radially with respect to the vessel 10. This adjustment assures proper meshing

of the screw threads 48 and 50 when the door 12 is moved to the closed position.

While the ring member 24 may be moved manually to rotate the same about the longitudinal axis of the vessel 10, it is to be preferred that such rotation be effected by energization of a reversible prime mover such as an air motor 64 attached to the vessel 10. The operable connection between the motor 64 and the ring member 24 as shown in the drawing, consists of a sprocket wheel 66 and a chain 68, the latter of which surrounds the ring member 24 and is attached directly thereto.

When the door 12 is swung on the suspension means 18 toward the closed position, bringing threads 48 into engagement with the threads 50, energization of the prime mover 64 in one direction, rotates the ring member 24 about the band or track 22 to draw the door 12 toward the vessel 10. This action moves the tongue 28 into the groove 26 against the sealing element 30, but it is unnecessary to clamp the element 30 tightly between the tongue 28 and the ring 32 during this stage of the operation. Thereupon, fluid pressure is admitted to the groove 26 in any suitable manner. The fluid pressure within the vessel 10 itself may be utilized for that purpose, it being seen that when the valves of both pipes 44 are closed, the check valve 42 will permit the passage of the fluid pressure to the chambers 36 and thence to the groove 26 by way of passages 38.

Consequently, whatever pressure is utilized in the vessel 10 itself is also employed for the purpose of compressing the sealing element 30 tightly against the tongue 28 through the freely floating pressure ring 32. As the sealing element 30 is thus clamped in place and compressed, its vertical dimensions increase and sealing element 30 is forced tightly against the side walls of the groove 26. The threads 48 and 50 of the male and female rings 20 and 24 respectively, are quite adequate to withstand the pressure and it is seen that extension 60 of ring member 24 is disposed behind the band 22 to eliminate pressure on the rollers 54 and their bearings 56.

It is to be preferred that the tongue 28 progressively decrease in width slightly as its outermost edge is approached so that the same will fit snugly within the groove 26 as the door 12 is swung to the closed position without binding and that such innermost edge of the tongue 28 be serrated, as shown, to effect a firm and proper contact with the sealing element 30.

Similarly, it is to be noted that the innermost annular edge of the extension 46 progressively increases in diameter as the outermost end thereof is approached for the purpose of permitting easy movement of the door 12 toward the closed position, yet with a firm contact between its extension 46 and the band 22 when the door 12 is fully closed. So far as the threads 48 and 50 are concerned, a rather loose and easy fit is preferred so that little energy is required in the prime mover 64 to manipulate the ring member 24; in fact, as aforementioned, the ring member 24 may be manipulated by hand if desired.

It is now also apparent that, whenever the vessel 10 is under pressure and the fluid therewithin is utilized for the purpose of effecting the seal between the door 12 and the vessel 10, it will become necessary to first evacuate the vessel 10 or reduce the pressure therein before the door 12 can be opened. When the pressure is thus removed, prime mover 64 may again be manipulated to release the rings 20 and 24. It is manifest that by such construction there is provided a safety factor eliminating the hazard of an explosive outward movement of the door 12 as the operator attempts to open the same.

If, when the vessel 10 is placed in use, the pressure is reduced therewithin, check valves 42 will prevent such reduced pressure from having any adverse effect upon the sealing of door 12. In that event, an outside pressure source may be employed through use of one of the pipes 44 and in that event, the check valves 42 also prevent such pressurized fluid from entering the vessel 10. When the door 12 is to be opened under such conditions, the valve of the opposite pipe 44 is then opened to release the pressure of the chambers 36, passages 38 and groove 26, whereupon the door 12 is released by operation of prime mover 64.

Having thus described the invention what is claimed as new and desired to be secured by Letters Patent is:

1. Structure of the kind described comprising a cylindrical pressure vessel having an open end; a door for closing said end; a ring device surrounding the door and affixed thereto; a rotatable ring member mounted on the vessel in circumscribing relationship thereto and of slightly greater diameter than the latter, said device and said member having intermeshing screw threads for drawing the door toward the vessel upon rotation of said member; and spaced, eccentric means between the vessel and the member for shifting the latter eccentrically of the axis of the vessel.

2. Structure of the kind described comprising a cylindrical pressure vessel having an open end; a band surrounding the vessel adjacent said end thereof and fixed to the vessel, said band being provided with an annular, outwardly-facing groove; a continuous, compressible sealing element in the groove; a door for the vessel; means mounting the door on the vessel for swinging movement to and from a position closing said end; a ring device surrounding the door and fixed thereto, said device being provided with external screw threads and a continuous tongue fitting in the groove when the door is closed; a ring member surrounding the band; rollers for rotatably mounting the member on the band, and means radially shiftably mounting the rollers on the member for moving the latter radially of the vessel, said member being provided with internal screw threads meshing with the threads of said device for drawing the door toward the vessel upon rotation of the member, said band having a passage communicating with said groove for receiving fluid under pressure whereby to compress the sealing element against the tongue and therefore, tightly within the groove.

3. A pressure vessel as set forth in claim 2, wherein is provided an element surrounding the ring member and secured thereto, and a prime mover carried by the vessel and operably engageable with the element for rotating the ring member.

4. A pressure vessel as set forth in claim 2, wherein is provided a toothed element surrounding the member and secured thereto, and a prime mover carried by the cylinder having structure operably meshed with the toothed element for rotating the ring member.

5. Structure of the kind described comprising a cylindrical pressure vessel having an open end; a door for closing said end; a ring device surrounding the door and affixed thereto; a rotatable ring member mounted on the vessel in circumscribing relationship thereto, said device and said member having intermeshing screw threads for drawing the door toward the vessel upon rotation of said member; a band surrounding the vessel and affixed thereto between the member and the device for holding the member against movement toward the device as the member is rotated; and a plurality of rollers between the band and the member rotatably supporting the latter, said rollers being eccentrically mounted on the member for rotation on axes parallel with the axis of the vessel to adjust the member eccentrically relative to said axis of the vessel for proper meshing of the threads of the member with the threads of the device.

6. In pressure vessel apparatus provided with a cylinder having an open end, a door for closing said end, a ring device surrounding the door, affixed thereto and having an annular tongue, and a rotatable ring member mounted on the cylinder in circumscribing relationship thereto, said device and the member having interengageable means thereon for drawing the door toward the cyl-

inder upon rotation of the member, the combination with said apparatus of an annular band surrounding the cylinder, affixed thereto and rotatably supporting said member, said band having an annular groove receiving said tongue; continuous sealing gasket means in said groove; means on said vessel defining a hollow chamber, said band having a fluid passage therein communicating said groove with the chamber; structure intercommunicating the interior of the cylinder and said chamber and provided with valve means permitting fluid to pass only from the cylinder into the chamber; and means connected with said chamber for permitting controlled communication of the same and thereby the cylinder and the groove with the atmosphere.

7. In pressure vessel apparatus provided with a cylinder having an open end, a door for closing said end, a ring device surrounding the door, affixed thereto and having an annular tongue, and a rotatable ring member mounted on the cylinder in circumscribing relationship thereto, said device and the member having interengageable means thereon for drawing the door toward the cylinder, the combination with said apparatus of an annular band surrounding the cylinder, affixed thereto and rotatably supporting said member, said band having an annular groove receiving said tongue; continuous sealing gasket means in said groove; at least one, relatively small box within the cylinder defining a hollow chamber, said band and the cylinder having aligned passages therein communicating the groove with said chamber in the box; a pipe connected to the box and intercommunicating the chamber with the interior of the cylinder; a one way check valve in said pipe permitting fluid to pass through the pipe only from the cylinder into the chamber; a fluid conduit coupled with the box extending outwardly through said cylinder and communicating the chamber with the atmosphere; and a manually controlled valve in said conduit disposed exteriorly of the cylinder for controlling flow of fluid through said conduit in either direction.

8. In pressure vessel apparatus provided with a cylinder having an open end, a door for closing said end, a ring device surrounding the door, affixed thereto and having an annular tongue, and a rotatable ring member mounted on the cylinder in circumscribing relationship thereto, said device and the member having interengageable means thereon for drawing the door toward the cylinder, the combination with said apparatus of an annular band surrounding the cylinder and affixed thereto between the latter and said member, said band having an annular groove receiving said tongue; continuous sealing gasket means in said groove; a plurality of rollers; a shaft rotatably carrying each of the rollers; and eccentric sleeve means mounting each of said shafts on the band with peripheral surfaces thereof rotatably supporting the member and the axes thereof parallel with the axis of said cylinder, said shafts and thereby the rollers being shiftable radially of the cylinder as said eccentric means are rotated about their respective shafts.

9. Apparatus as set forth in claim 8 wherein said eccentric sleeves may be rotated from points exteriorly of the band while the member is in interengagement with said ring device.

References Cited in the file of this patent

UNITED STATES PATENTS

1,663,755	Gammeter	Mar. 27, 1928
1,889,606	Lange	Nov. 29, 1932
2,016,223	Bowers	Oct. 1, 1935
2,435,913	Wall	Feb. 10, 1948
2,601,936	Harris	July 1, 1952
2,685,189	Watson	Aug. 3, 1954
2,770,260	Henderson	Nov. 13, 1956
2,841,308	Weicker	July 1, 1958