

June 27, 1944.

F. GASCHE

2,352,192

CLOSURE

Filed June 24, 1941

4 Sheets-Sheet 1

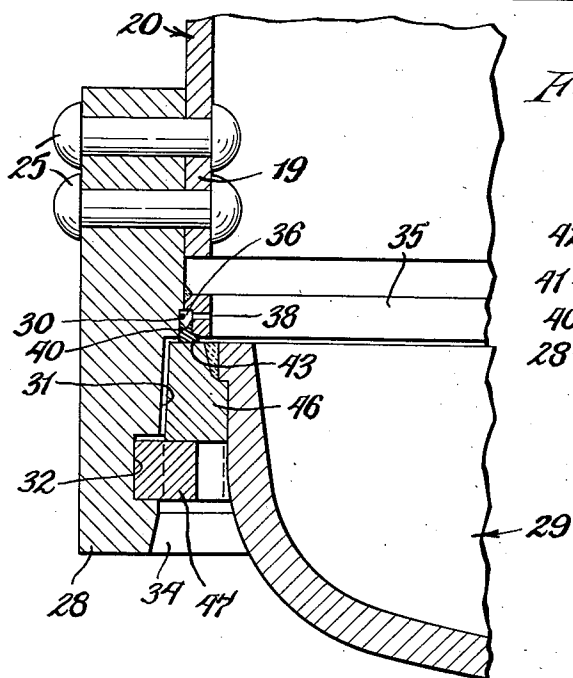
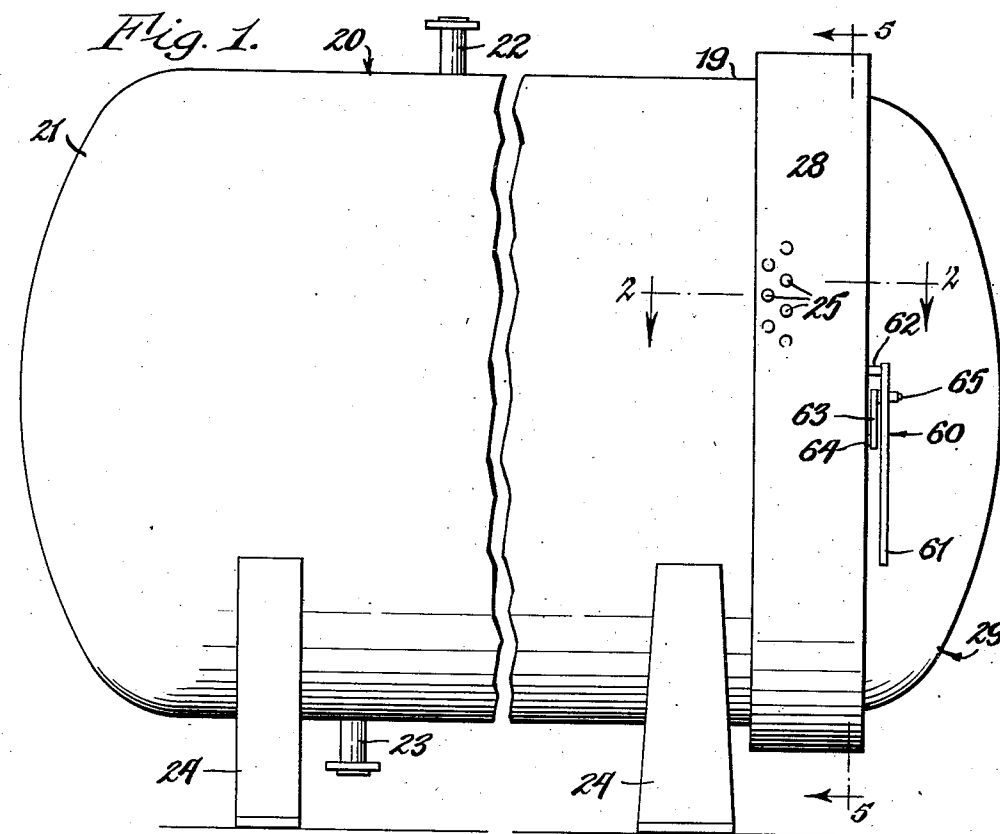
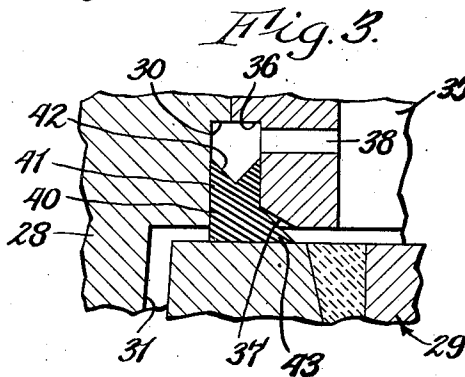


Fig. 2.



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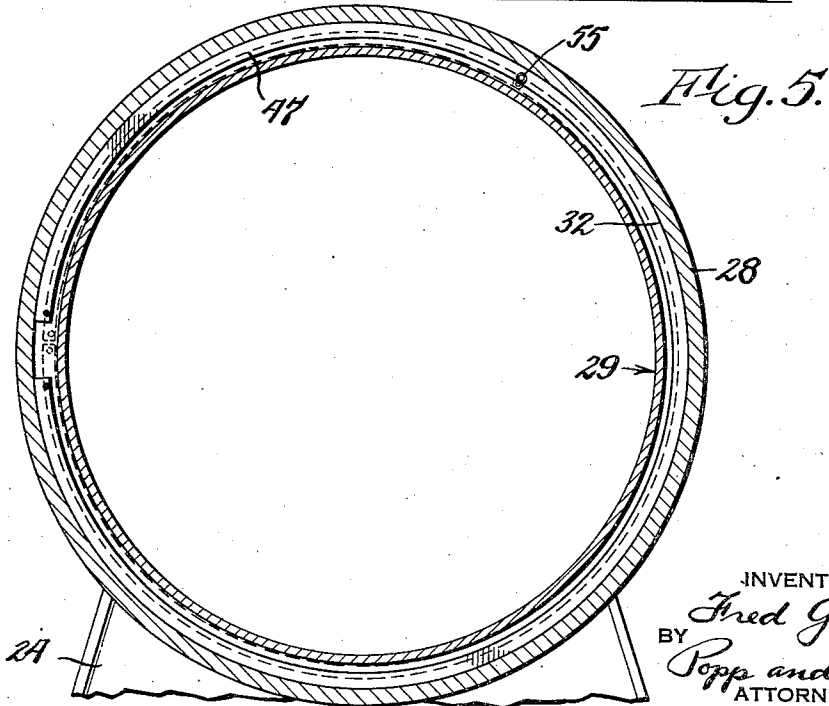
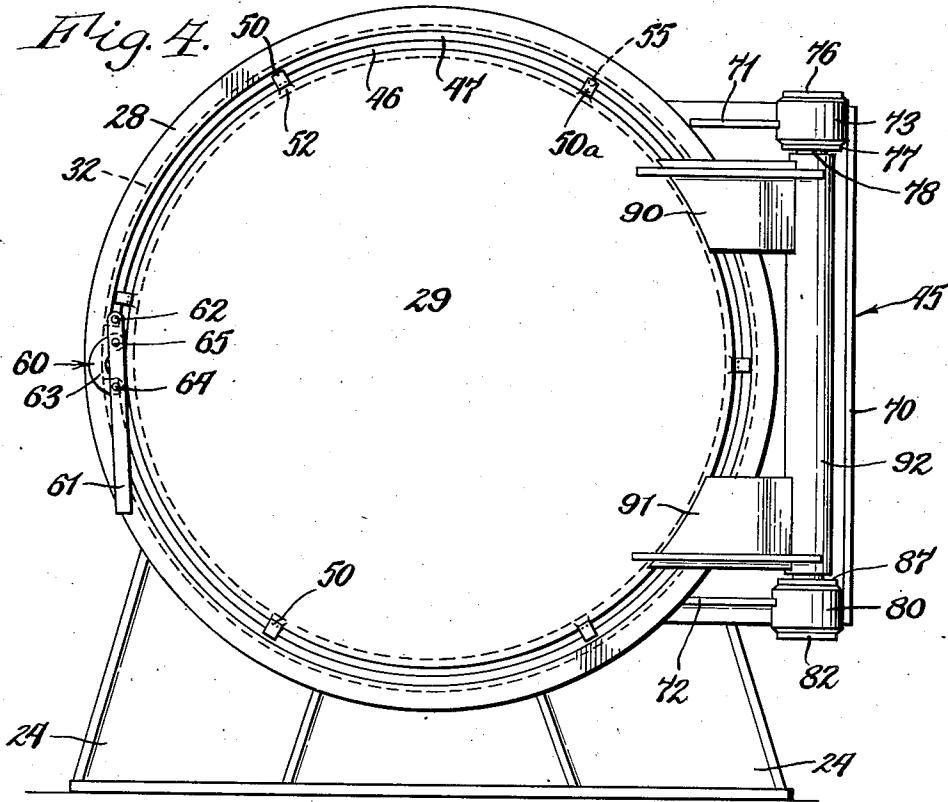
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4 Sheets-Sheet 3

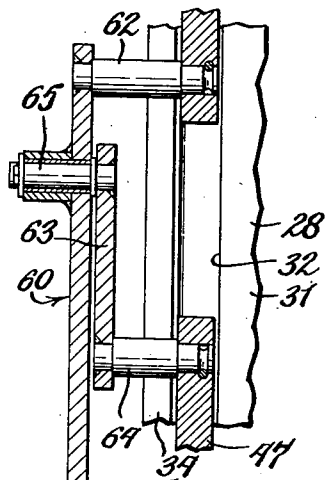


Fig. 6.

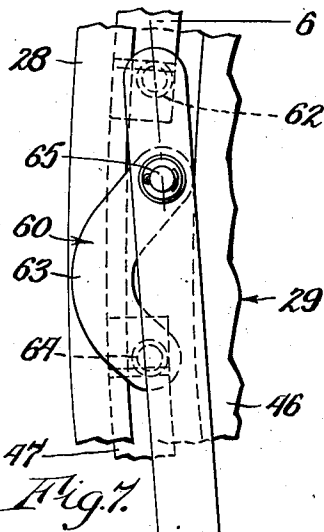


Fig. 7.

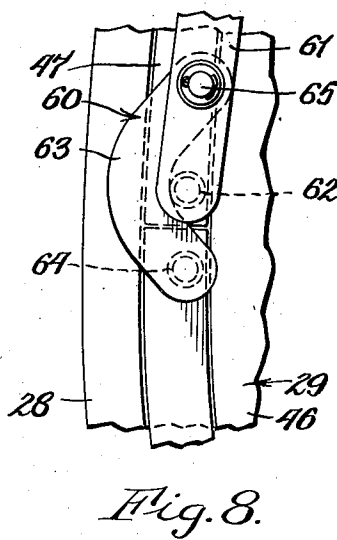


Fig. 8.

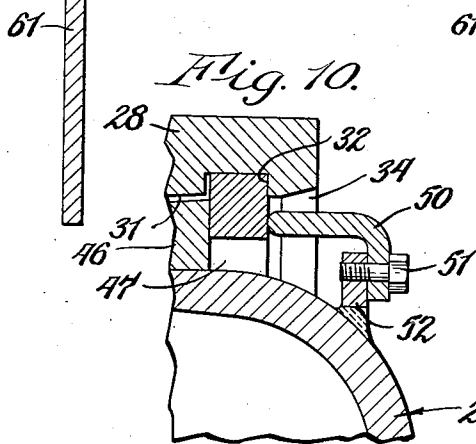


Fig. 9.

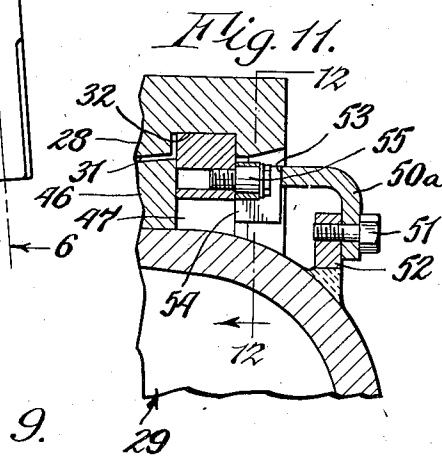
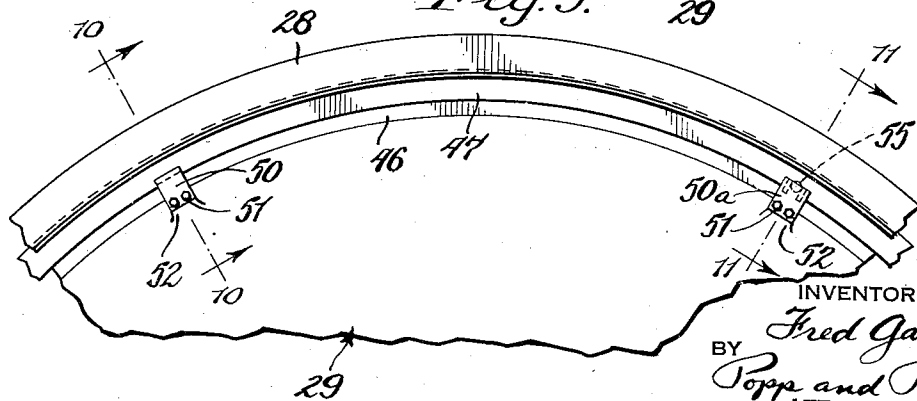


Fig. 10.



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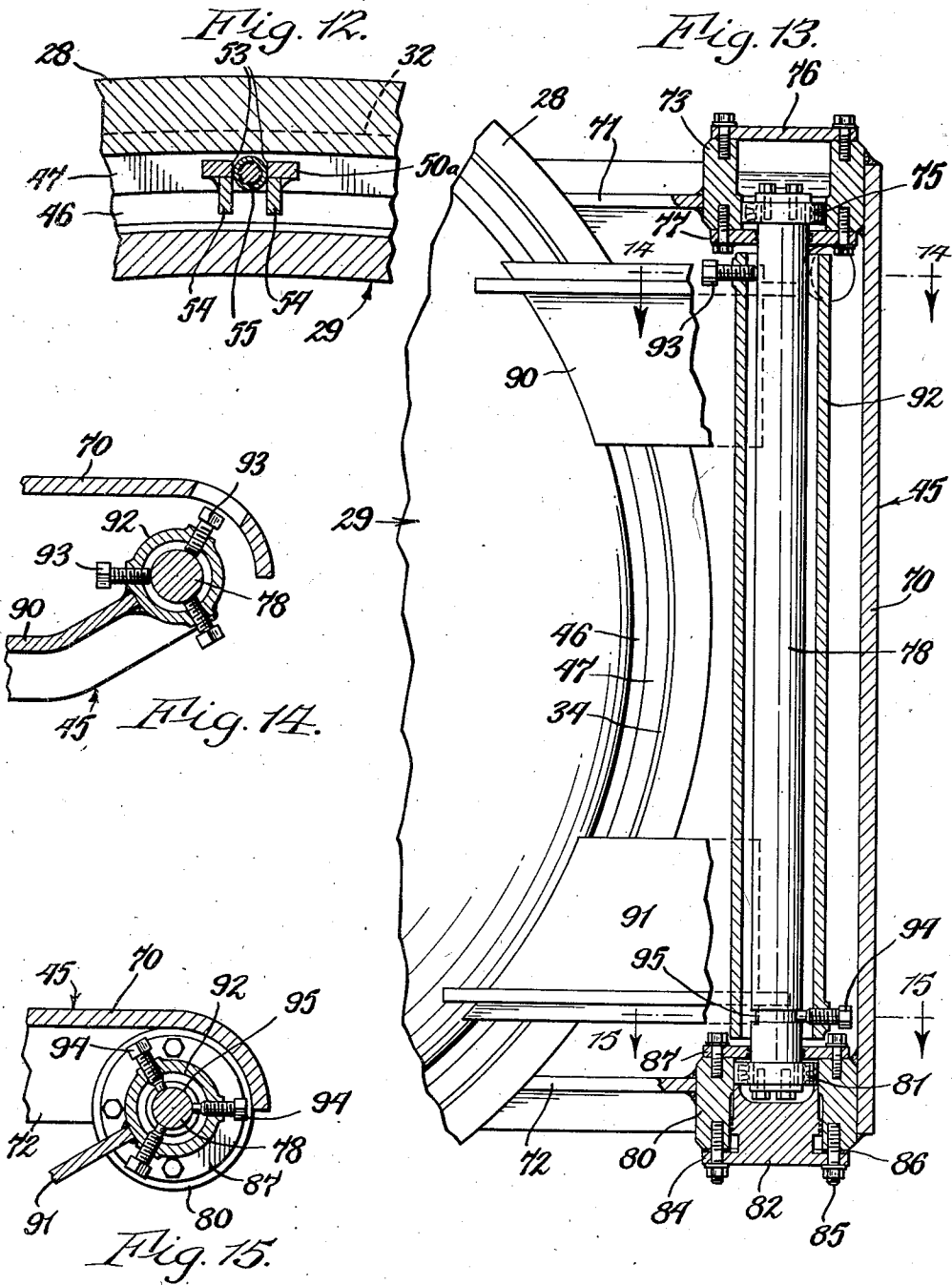
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CLOSURE

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Application June 24, 1941, Serial No. 399,559

1 Claim. (Cl. 220—61)

This invention relates to a closure and more particularly to a swift working door for closing large tanks which are placed under high pressure.

It is the principal object of the present invention to provide a swift working door of this character which can readily be opened and closed and which, when closed, provides an adequate seal to prevent the escape of the fluid or gases under high pressure or vacuum contained within the tank.

Another object of the invention is to provide such a swift working door in which an effective interlock and seal is provided between the cooperating margins of the door and the tank by the manipulation of a single latch handle.

Another object of the invention is to provide such a swift working door having an adjustable hinge which adjustment permits the door to swing accurately into cooperative engagement with the opening in the tank.

Another object is to provide, in such an adjustable hinge, anti-friction bearings which permit the door to be readily swung to its open and closed positions.

Another object is to provide such a swift working door in which all parts are readily accessible and can be readily replaced.

Another object of the invention is to provide such a swift working door in which the weight of the door is very materially reduced as compared with other swift working doors having like requirements.

Another object of the invention is to provide such a quick working door which can be readily produced in any desired size and without the necessity of a large number of complicated patterns.

Other objects of the invention are to provide such a swift working door which is of simple and inexpensive construction and which will stand up under conditions of severe and constant use without getting out of order or requiring replacements, adjustments or repairs.

In the accompanying drawings:

Fig. 1 is a fragmentary side elevation of a large pressure tank having at one end a circular swift working door embodying my invention.

Fig. 2 is an enlarged fragmentary horizontal section, taken on line 2—2, Fig. 1.

Fig. 3 is a further enlarged fragmentary section similar to Fig. 2 showing, in greater detail, the form of the sealing gasket or ring which is employed to insure a tight seal between the co-

operating margins of the door and the opening in the tank.

Fig. 4 is an end elevation of the tank shown in Fig. 1 and showing the swift working door embodying my invention.

Fig. 5 is a vertical transverse section, taken on line 5—5, Fig. 1.

Fig. 6 is a fragmentary vertical section, taken generally on line 6—6, Fig. 7 and showing the position of the parts when the door is latched.

Fig. 7 is an enlarged fragmentary elevation similar to Fig. 4 and showing, in greater detail, the latch handle by means of which the door is latched in its closed position and showing the position of the parts when the door is latched.

Fig. 8 is a fragmentary end elevation similar to Fig. 7 and showing the position of the parts when the door is unlatched.

Fig. 9 is an enlarged fragmentary view similar to Fig. 4 and showing, in greater detail, the upper part of the door and the adjacent part of the tank.

Figs. 10 and 11 are enlarged fragmentary radial sections, taken on the correspondingly numbered lines of Fig. 9.

Fig. 12 is a fragmentary vertical section, taken on line 12—12, Fig. 11.

Fig. 13 is an enlarged fragmentary view similar to Fig. 4 and showing parts of the hinge broken away to disclose the construction of the hinge.

Figs. 14 and 15 are fragmentary horizontal sections, taken on the correspondingly numbered lines of Fig. 13.

The swift working door forming the subject of the present invention is adapted to a wide range of uses but is shown as forming the end closure for the open end 19 of a generally cylindrical tank 20, the opposite end 21 of which can be closed in any suitable manner and the tank being shown as provided with pipe connections 22, 23 whereby any desired pressure can be built up within the tank and any desired materials introduced for the process to be carried out therein. The tank is shown as supported on legs 24.

Secured by rivets 25, or in any other suitable manner, to the exterior of the tank 20 at its open end 19, is a ring 26 which projects beyond the open end 19 of the tank 20 and forms a frame for the swift closing door which is indicated generally at 29. As best shown in Fig. 2, this ring is provided a short distance beyond the open end 19 of the tank 20 with an annular step 30 of slightly larger diameter than the in-

side diameter of the ring 28, this step leading to a deeper and broader annular step 31 of still larger diameter, which latter step 31 terminates in an annular locking groove 32. The outer extremity of the ring 28 beyond the locking groove 32 is preferably provided with an interior bevel 34 to facilitate the movement of the door 29 into the projecting end of the ring 28.

To the inside of the ring 28 is welded, or otherwise secured, an internal abutment ring 35, this abutment ring being externally recessed to provide, complementary with the step 30, an annular axially extending groove 36 which faces the door 29. This abutment ring 35 is preferably provided with an annular bevel 37 at its corner forming one side of the open end of the groove 36, as best shown in Fig. 3. The pressure within the tank 20 is also communicated to the base of the groove 36 in any suitable manner as by the provision of holes 38 extending radially through the abutment ring 35 and communicating with the groove 36.

In this annular groove 36 is arranged a gasket 40 of yielding rubber-like material, this gasket comprising an annular portion 41 housed within the groove 36 and provided at its inner end with a deep V-shaped groove 42 which is so designed that the pressure within the base of the groove 36 tends to force the sides of the gasket 40 against the side walls of the groove 36 and hence prevent the outward leakage of pressure through the groove 36. To similarly prevent leakage from the tank outwardly past the door 29, the projecting end of the gasket 40 is provided with an inward V-shaped extension 43 which bears at one side against the opposing face of the door 29 and is so designed that the pressure in the tank tends to force this V-shaped extension against the door and hence provide an annular seal between the door and the gasket. It will therefore be seen that the V-shaped groove 42 prevents leakage in a direction axially of the tank through the groove 36 and that the V-shaped extension 43 prevents radial leakage between the door 29 and the gasket. It will be appreciated, of course, that the pressure built up in the base of the groove 36 behind the gasket 40 forces this gasket into firm union with the opposing face of the door 29 and also into firm union with its own walls.

The door 29 is mounted at one side on a hinge indicated generally at 45 and is shown as being of steel and as having welded to its rim an outwardly extending abutment ring 46, this ring being adapted to fit into the step 31 of the ring 28 of the tank 20. The outer radial face of this ring 46 is arranged a short distance beyond the inner radial face of the groove 32 and forms a bearing face for a split locking ring 47 which is of rectangular form in cross section. This locking ring is adapted to be expanded into the locking groove 32 and engage its outer radial face, thereby to provide a latch between the door 29 and the ring 28, as shown in Fig. 4. The locking ring 47 is held in bearing engagement with the outer radial face of the ring 46 by a plurality of holders or retainers 50 which are arranged at spaced intervals around the door and are shown as being of L-shaped form in cross section, as best shown in Fig. 10, and as having one leg bearing against the outer radial face of the locking ring 47 and as having its other leg projecting inwardly and secured by a pair of screws 51 to a lug 52 welded or otherwise suitably secured to the adjacent part of the door 29.

In order to hold the locking ring 47 against rotation, one of these L-shaped holders or retainers, indicated at 50a, is bifurcated, as indicated at 53 in Figs. 11 and 12, and to the opposing faces of the bifurcations is secured a radially extending plate or guide piece 54. These plates or guide pieces 54 form the radial bearing surfaces for a roller 55 which can be secured to the locking ring 47 in any suitable manner. It will be seen that the roller 55 on the locking ring 47 is held against circumferential movement by the plates or guide pieces 54 and that hence the split locking ring 47 is held against circumferential movement. At the same time the portion of the split locking ring 47 adjacent the roller 55 is free to move radially into locking engagement with the groove 32.

The split locking ring 47 is expanded and contracted into and out of the locking groove 32 by a toggle linkage, indicated generally at 60, which connects the ends of the split locking ring 47, one of the links of this toggle linkage forming a handle for conveniently operating the toggle linkage. As best shown in Figs. 6-8, a hand lever 61 is pivotally secured by a pivot pin 62 with one end of the split locking ring 47. A curved toggle link 63 is pivotally secured by a pivot pin 64 to the opposite end of the split locking ring 47. The free end of the curved toggle link 63 is pivotally secured through a pivot pin 65 to an intermediate part of the hand lever 61 adjacent its pivot 62. With the arrangement as shown, swinging the hand lever in a clockwise direction, as viewed in Fig. 7, causes the pivots 62 and 64 to move toward each other and causes the pivot 65 to be carried to a position above the pivot 62, as best shown in Fig. 8. This, of course, radially contracts the split locking ring 47 so as to withdraw it from the locking groove 32 and hence permit the door 29 to be freely opened. In the fully contracted position of the locking ring 47, the pivot pin 65 of the toggle linkage passes beyond dead center, that is, passes to the right of the line intersecting the axes of the pivots 62 and 64. By this means it will be seen that the toggle linkage tends to hold itself in its contracted position when moved to this position by the clockwise manipulation of the hand lever 61 as just described.

When it is desired to latch the door 29 it is closed and the hand lever 61 is swung from the upright position shown in Fig. 8 in a counterclockwise direction to the pendant position shown in Fig. 7. This counterclockwise movement of the hand lever 61 effects a movement of the pivot 65 to a position below the pivot 62 and effects an expansion of the pivots 62 and 64 so as to effect a radial expansion of the locking ring 47 into the locking groove 32. In the full latching position of the toggle linkage, as shown in Fig. 7, the pivot 65 is again carried beyond dead center, that is, it is carried beyond the line intersecting the axes of the pivots 62 and 64. By this means the toggle linkage tends to hold itself in the position shown in Fig. 7 until the handle is intentionally swung in a clockwise direction to contract the split locking ring as previously described. In manipulating the toggle linkage through the hand lever 61 the split locking ring 47 is prevented from moving circumferentially by the roller 55, as previously described, thereby to prevent the toggle linkage and operating lever 61 from wandering around the margin of the door.

To insure the free entry of the ring 46 on the

door 29 into its step 31, the hinge 45 for the door is rendered adjustable so as to adjust the position of the door with reference to the axis of rotation of the hinge pin and this hinge pin is mounted in roller bearings and provided with means for insuring an adequate supply of oil to these bearings.

To this end a vertical hinge plate 70 is welded or otherwise suitably secured to the ring 28 which is riveted to the mouth of the tank 20, this hinge plate extending laterally outward from its supporting ring 28 and having its outer vertical extremity curving forwardly, as best shown in Figs. 14 and 15. This hinge plate 70 is also preferably reinforced with horizontal ribs 71 and 72 at its upper and lower ends. To the upper rib 71 and to the adjacent curved portion of the hinge plate 70 is welded a cylindrical bearing block 73, this bearing block being internally provided with a vertical bore, the lower part of which provides a seat for the outer race of a roller bearing, indicated generally at 75, and the upper part of which forms a well for retaining a quantity of oil to insure the proper operation of the roller bearing 75. The upper part of the bearing block 73 is capped by a removable plate 76 and the lower end of the bearing block is similarly capped by a removable plate 77, this lower plate 77 being provided with an opening for the hinge pin 78, the upper end of which is journaled in the roller bearing 75. This opening in the lower plate 77 is preferably provided with an oil seal to prevent the escape of the lubricant from the bearing block.

Similarly, a cylindrical bearing block 80 is welded to the lower rib 72 and the adjacent curved portion of the hinge plate 70. This lower bearing block 80 is provided with a vertical bore, the upper part of which forms a seat for the outer race of a roller bearing, indicated generally at 81. This roller bearing, as well as the roller bearing 75, are so designed as to act as thrust bearings in supporting the hinge pin 78 and the door 29. The outer race of the lower bearing 81 is supported on the rim of a cylindrical plug 82 which is fitted into the lower part of the bore of the bearing block 80 and is preferably formed to provide an oil seal to prevent the escape of oil from the bearing 81. This plug 82 is provided at its lower end with an outwardly projecting annular flange 84, this flange being secured to the underside of the bearing block 80 by stud bolts 85 or in any other suitable manner. In order to adjust the vertical position of the bearing 81 and hence the vertical position of the hinge pin 78, any number of shims 86 can be interposed between the flange 84 and the underside of the bearing block 80, the number of the shims, of course, determining the position of the supporting plug 82 with reference to the supporting bearing block 80.

The top of the bearing block 80 is preferably enclosed by a removable plate 87 having an opening through which the hinge pin 78 extends and this plate preferably being formed to provide an oil seal for this pin.

The door 29 is adjustably secured to the hinge pin 78 as follows:

To the door 29 is welded upper and lower horizontal outwardly extending arms 90 and 91, each of which is preferably reinforced by a rib and the extremities of which are welded to a vertical tube 92 which surrounds the hinge pin 78 and is interposed between the bearing blocks 73 and 80. A substantial clearance is provided between the hinge pin 78 and the tube 92 and at its upper end the tube 92 carries three set screws 93 which

are arranged radially and are adapted to be screwed into engagement with the hinge pin 78, as best shown in Figs. 13 and 14. Similar set screws 94 are provided at the lower end of the tube 92, the inner ends of the set screws 94 being, however, reduced to enter a groove 95 provided at the lower end of the hinge pin 78. The set screws 93 and 94 are preferably so arranged that one of the screws of each of the sets is in direct line with the maximum lateral load imposed upon the hinge pin 78 by the door. It will also be seen that the lower set screws 94 serve to support the door against downward movement along the hinge pin 78.

The set screws 93 and 94 permit of obtaining any desired relation between the axis of the hinge pin 78 and the axis of the tube 92 thereby to permit of a corresponding adjustment of the door. Thus, by the adjustment of the upper set screws 93 the tube 92 can be moved forwardly or rearwardly or can be moved to any lateral position with reference to the hinge pin 78 and a similar adjustment is provided by the lower set screws 94 for the lower end of the tube 92. Since the number of shims 86 between the plug 82 and the lower bearing block 80 determines the elevation of the hinge pin, it will be seen that a full adjustment is provided for the door which permits it to be adjusted so as to accurately enter the step 31 of the ring 28 which carries the door.

In operation, assuming the door to be open, and with the toggle linkage in the position shown in Fig. 8, the operator swings the door on its hinge 45 until its ring 46 enters the step 31 of the ring 28 on the tank and engages the opposing face of the gasket 40. The operator then swings the handle 61 of the toggle linkage in a counterclockwise direction to the position shown in Fig. 7, in which position the ends of the split locking ring 47 are spread and the axis of the pin 65 is brought to a position beyond a line intersecting the axes of the pins 62 and 64 whereby the pin 65 is carried beyond dead center to hold the parts in the position shown in Fig. 7. The expanding of the locking ring 47 forces this ring radially outward into the locking groove 32, the locking ring 47 being guided in this movement by the outer radial face of the ring 46 and by the legs of the holders or retainers 50 and 50a which are provided at spaced intervals around the door.

The tank is now in condition for operation. Upon introducing pressure into the tank this pressure is communicated through the holes 38 (Figs 2 and 3) into the base of the annular groove 36, this pressure forcing the gasket 40 axially outward into firm engagement with the opposing face of the ring 46 of the door and this pressure also spreading the sides forming the V-shaped groove 42 in this gasket so as to prevent leakage through the groove 36. At the same time the pressure within the tank acts against the V-shaped extension 43 of the gasket 40 so as to force this extension into firm sealing engagement with the opposing face of the ring 46 of the door, the pressure of the seal being in direct relation to the pressure carried within the tank 20. The door can readily be opened by first releasing the pressure within the tank 20 and swinging the handle 61 in a clockwise direction from the position shown in Fig. 7 to the position shown in Fig. 8. This collapses the toggle linkage and effects a contraction of the locking ring 47 from the locking groove 32 which permits the door to be readily swung open. In so collapsing the toggle linkage the axis of the pivot 65 is carried beyond

the line intersecting the axes of the pivots 62 and 64, thereby to again carry this pivot beyond dead center so that the linkage holds itself in the position shown in Fig. 8. In the manipulation of the handle 61, the split locking ring 47 is prevented from creeping circumferentially by its roller 55 which engages with the guide pieces 54 provided on the bifurcated holder 50a.

In setting up the door it is necessary to insure its proper entry into the step 31 of the ring 28 on the end of the tank. The vertical position of the door is readily adjusted by increasing or decreasing the number of shims 86 between the supporting plug 82 and the lower bearing block 80, the number of these shims determining the elevation of the hinge pin 78 and hence the door. The adjustment of the set screws 93 and 94 (Figs. 13-15) between the tube 92 and the hinge pin 97 also permits any desired axial relation to be obtained between this tube and the hinge pin and hence between the door and this hinge pin. It will therefore be seen that the hinge, in addition to providing ready movement by the provision of the roller bearings 75 and 81, also permits the easy adjustment of the hinge to insure the free closing of the door.

From the foregoing it will be seen that the present invention is particularly adapted to be incorporated in large heavy doors for large tanks

placed under great pressure and where it is desirable to provide a switch working door. It will also be seen that the door is easily manipulated by the operation of one latch handle and that its ready operation is insured by an anti-friction hinge which is readily adjustable to insure the proper fit of the door in its frame. It will also be seen that the door is comparatively simple and inexpensive in construction and will stand up under conditions of severe and constant use without getting out of order or requiring repairs.

I claim as my invention:

A swift working closure, comprising a frame having a door opening, a door mounted for movement into and out of said opening, a split locking ring mounted on said door and extending around the margin thereof, means connecting the ends of said split locking ring and adapted to expand said locking ring radially into engagement with a locking recess provided in said door frame, and means for restraining said split locking ring against circumferential movement comprising a roller carried by said split locking ring and projecting laterally therefrom in a direction generally parallel with its axis and means providing a radial guideway on said door in which said roller is arranged.

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