July 1, 1958 F. C. WEICKER 2,841,308

PRESSURE VESSEL CLOSURE

Filed Dec. 23, 1954 3 Sheets-Sheet 1

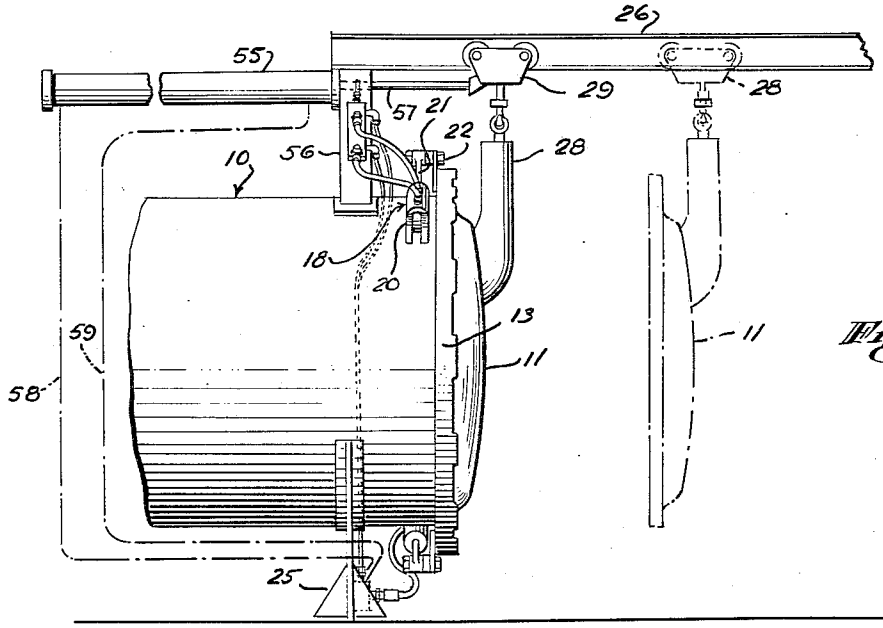


Fig. 1.

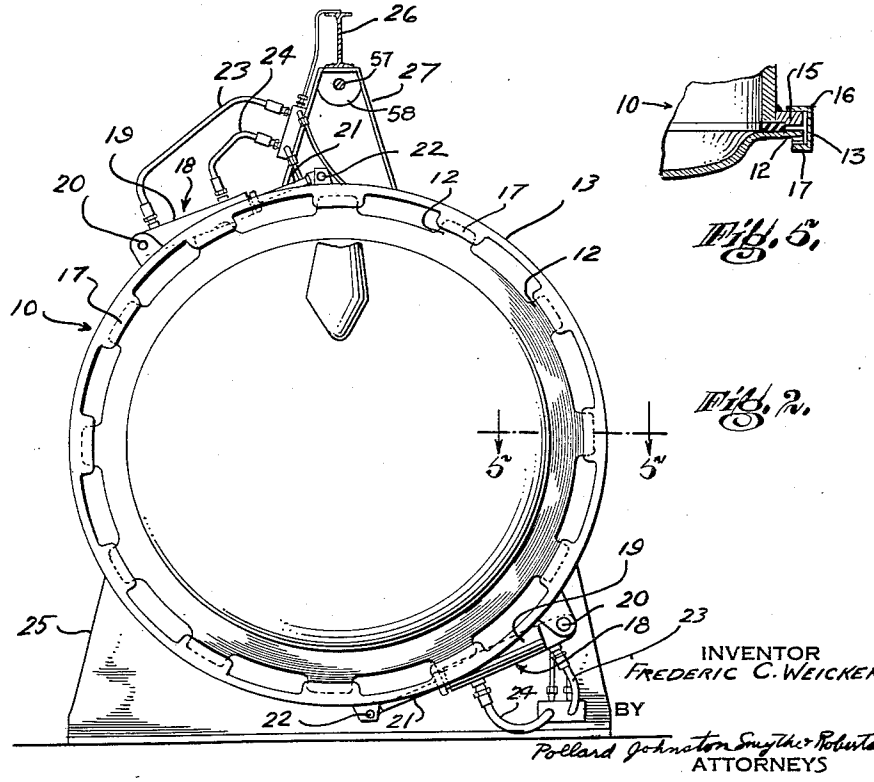


Fig. 5.

Fig. 2.

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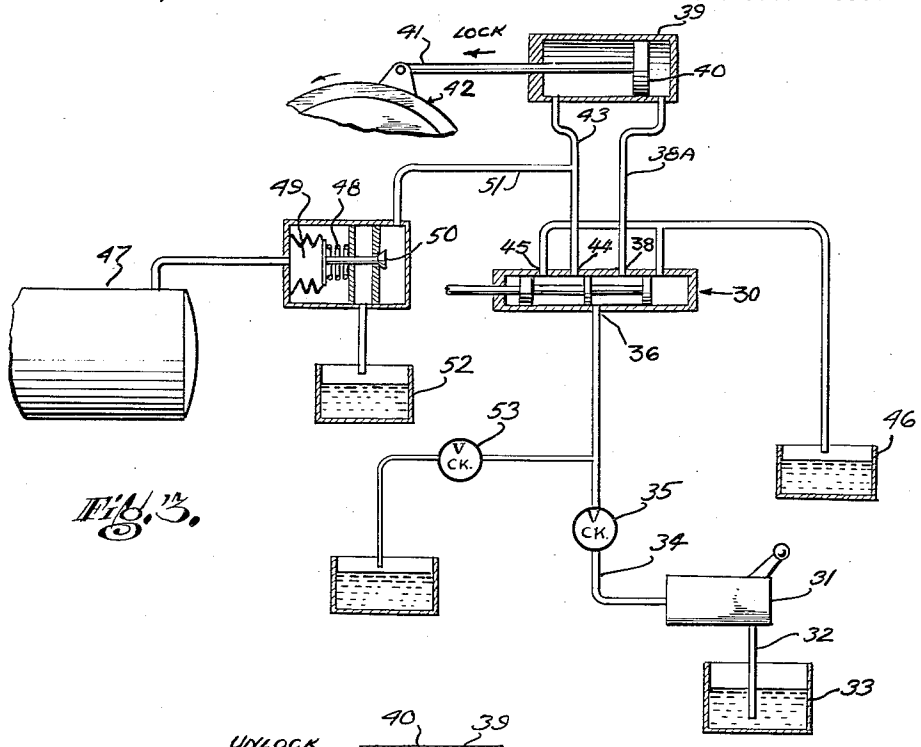


Fig. 1a.

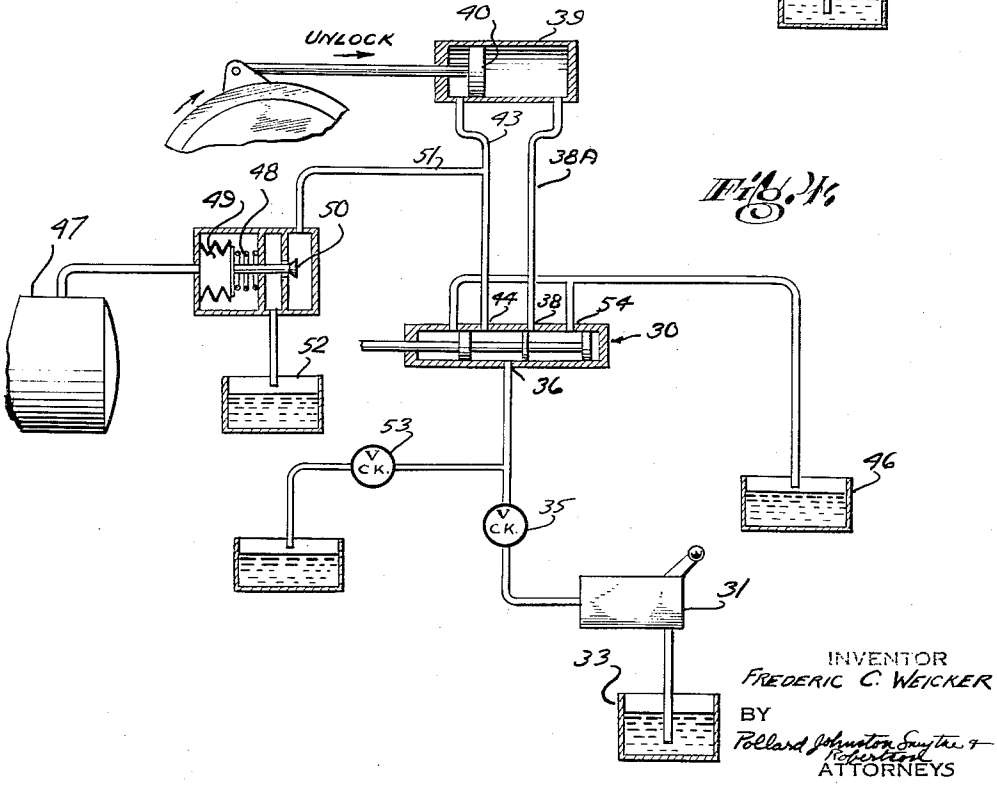


Fig. 1b.

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PRESSURE VESSEL CLOSURE

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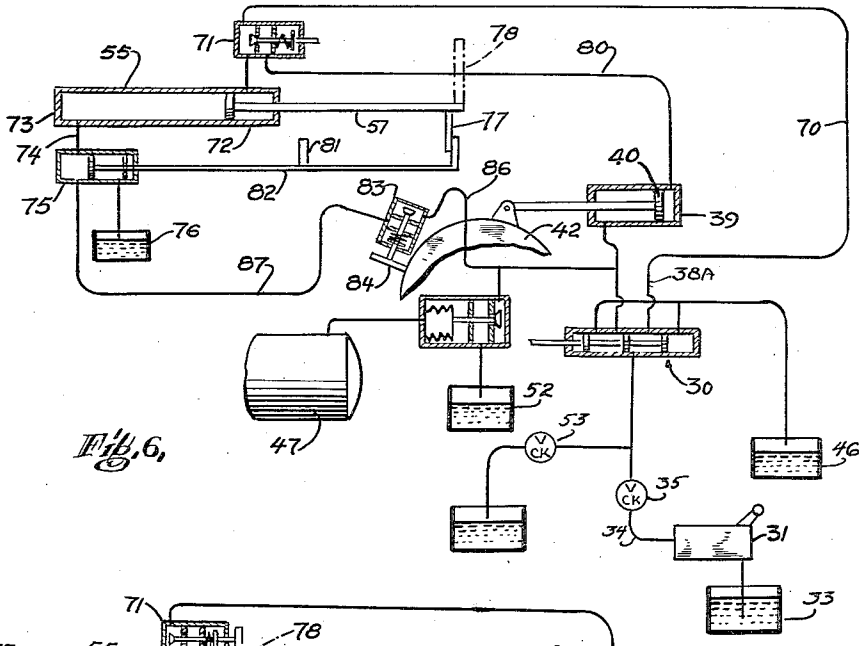


Fig. 6.

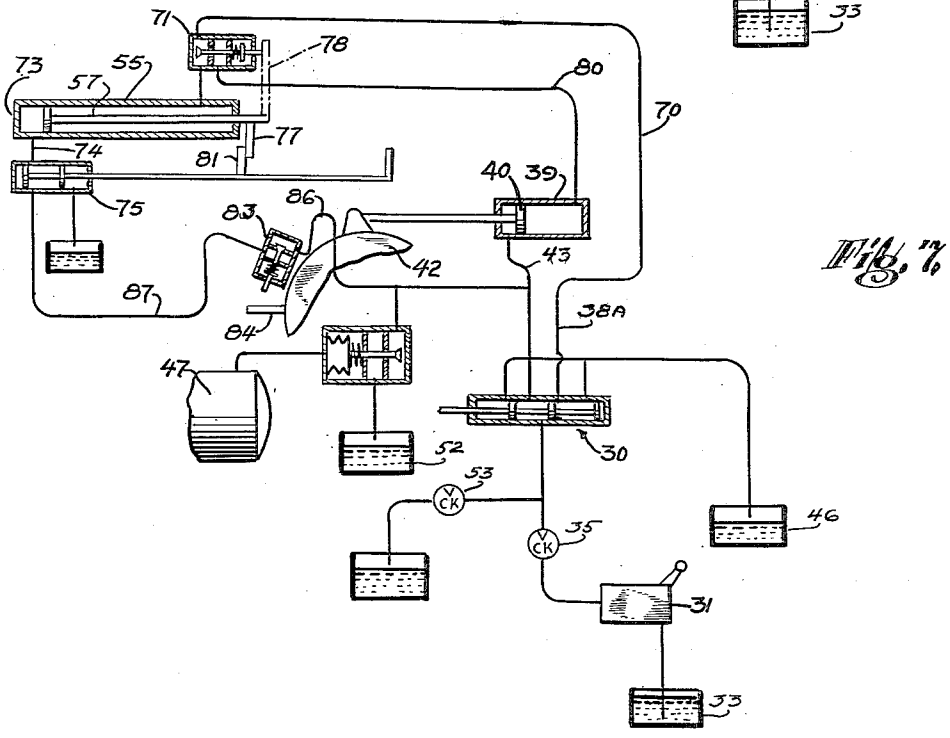


Fig. 7.

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PRESSURE VESSEL CLOSURE

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Application December 23, 1954, Serial No. 477,322

7 Claims. (Cl. 220—40)

This invention relates to closures for pressure vessels and particularly to an arrangement for locking and unlocking said closures.

In pressure vessels having an access opening, such as filters, cookers, and the like, it is necessary to have a removable closure member to provide ready access to the interior of said vessel, said closure member being lockable in sealing relation with said opening. For safety reasons, it is desirable that the closure member be arranged so that it cannot be unlocked or opened while substantial pressure exists within the vessel.

One of the objects of the present invention is to provide an improved arrangement for locking and unlocking the closure member of a pressure vessel.

A still further object is to provide an arrangement wherein the closure can be unlocked only when the pressure condition in the vessel is such that it is safe to unlock the same.

In one aspect of the invention, the pressure vessel may have a circular opening with a circular closure member adapted to be placed in sealing relationship therewith. A rotatable locking ring may be mounted on the vessel adjacent the aperture, said ring having lugs thereon. The ring lugs are arranged to cooperate with lugs on the closure member upon turning of the locking ring relative to the closure member so that when the ring is rotated relative to the closure member, the closure member will be locked in sealed relationship by cam surfaces on the lugs. The lugs on the closure are dimensioned relative to the lugs on the ring so that when the ring and closure are in unlocked angular relationship, the closure can be moved axially relative to the ring and vessel. The relative rotation of the locking ring to the closure member is accomplished by motor means, preferably fluid operated. In a preferred form, a hand, or otherwise operated, hydraulic pump can be connected to said fluid operated motor means through a master control valve movable to permit fluid pressure of the pump to operate said motor means in a closure locking or closure unlocking direction. When the pump is connected to the motor means by said control valve for unlocking the closure means, a motor means disabling or sequence valve is provided to prevent operation of the motor means in an unlocking direction except when the pressure within the vessel has been reduced to a predetermined safe level. In a preferred form, said disabling valve is connected to the pressure connection from said pump to the fluid motor means in such a manner as to relieve operating pressure in said connection when pressure exists in said vessel.

In a further aspect, a fluid motor can be attached to the cover for moving the cover away from and toward the vessel, suitable valves and connections being provided so that the cover closing and locking arrangement can be sequentially operated by the source of fluid.

These and other objects, advantages and features of the invention will become apparent from the following description and drawings, which are merely exemplary.

In the drawings:

Fig. 1 is a fragmentary elevation view showing a closure member in place on a pressure vessel, the dot-dash lines showing the position of the closure member when removed therefrom.

Fig. 2 is a view looking from the right of Fig. 1.

Fig. 3 is a schematic circuit showing one arrangement for operating the closure member locking and unlocking means, the motor control valve being in closure locking position.

Fig. 4 is a view similar to Fig. 1 with the motor control valve in a position for unlocking operation of the motor means, the disabling valve being open due to pressure within the pressure vessel.

Fig. 5 is an enlarged fragmentary view taken along the line 5—5 of Fig. 2.

Figs. 6 and 7 are similar to Figs. 3 and 4 except that means for sequentially actuating the door have been added.

The invention will be described in conjunction with a cylindrical pressure vessel having an open end with a cooperating closure member. Cylindrical shell **10** (Figs. 1, 2) has an open end surrounded by an annular lip **15**, the open end being closeable by closure or cover member **11**. The lip may be separately formed and welded to the shell or otherwise attached. A suitable gasket can be inserted between the closure member or cover **11** and the lip **15** or end of the vessel. Closure member **11** has a plurality of radially extending lugs **12** located around its periphery, the distance between adjacent lugs being greater than the arcuate length of a lug. Rotatable locking ring **13** cooperates with said lip **15**, said locking ring **13** having a flange **16** engageable with the rear side of lip **15**. Lugs **17** of said ring are arranged to engage operatively lugs **12** of the closure member when the ring is rotated relative to the cover after the cover has been moved axially relative to the pressure vessel and against said lip. Either or both sets of lugs **12** or **17** may have cam surfaces so that as the ring **13** is rotated, closure member **11** will be firmly locked in sealing relation to the vessel. Preferably, the cam surfaces extend continuously the length of the lugs.

One manner of rotating locking ring **13** is by employment of hydraulic or fluid motors **18**, said fluid motors having cylinders **19** pivotally mounted at **20** to an exterior portion of the shell of pressure vessel **10**, piston or ram arrangement **21** being pivotally connected at **22** with locking ring **13**. As will be described hereafter, suitable connecting pipes **23**, **24** can be employed to supply fluid from the hydraulic operating means. The stroke of the piston in its cylinder can serve to limit rotation of the ring.

The invention is illustrated in conjunction with a filter enclosed in pressure vessel **10**, said pressure vessel being supported on saddles or supports **25**. An overhead monorail can be supported at one end on the pressure vessel by bracket **27** and at the other end in any suitable manner. The closure member **11** can be connected through projection **28** to carriage **29** moveably mounted on monorail **26**. In this form, closure **11** is moveable axially relative to vessel **10** to and from open and closed position.

In a preferred arrangement for rotating locking ring **13**, reference may be made to Fig. 3, wherein main control valve **30** has been moved to the left to connect the fluid pump with the ring moving fluid motor to move the locking ring in a locking direction. First the operation of the ring locking and unlocking arrangement will be described.

Hand pump **31** may be of any suitable type having an inlet **32** connected to a reservoir or fluid supply tank **33**. pump output line **34** feeds through check valve **35** to central port **36** of body **37** of main control valve **30**,

With main valve 30 positioned as illustrated, when pump 31 is actuated, fluid will flow or pressure will be transmitted through line 34, check valve 35, central port 36, port 38 and line 38A to the right hand end of fluid motor 39. This will cause piston 40 to move connecting rod 41 and locking ring 42 into locking relationship relative to the cover. As viewed in Fig. 3, locking ring 42, corresponding to ring 13, can be considered to be moved into locking relationship when it is moved in a counter clockwise direction. Line 43 is connected through port 44 with port 45, which permits liquid from the left hand end of the cylinder to flow freely to reservoir 46, said reservoir, if desired, being suitably connected (not shown) to reservoir 33.

Inasmuch as there is no pressure in vessel 47, spring 48 will act on bellows 49 to keep the pressure relief valve 50 on its seat and thus close the relief passage 51 to relief reservoir or line 52. Relief reservoir 52 also may be connected to the main reservoir 33 through a suitable line (not shown).

Assuming that pressure vessel 47, corresponding to vessel 10, is under pressure and control valve 30 has been moved to the right (Fig. 4) for unlocking of the closure member, actuation of hand pump 31 will cause fluid to flow through port 36, port 44, line 43 to the left hand end of fluid motor 39. The right hand end of cylinder 39 is connected through line 38A, port 38, port 54, with reservoir 46. If sufficient pressure exists in 47 to cause expansion of bellows 49, valve 50 will be opened so that upon actuation of pump 31, fluid will pass through relief line 51 and valve 50 to the relief connection or reservoir 52, so that motor 39 will not move ring 42. After pressure in vessel 47 has been reduced sufficiently so that it is safe to unlock the vessel, valve 50 will close and thereafter actuation of pump 31 will result in movement of piston 40 to turn ring 42 in a clockwise or unlocking direction.

In a further aspect, power cylinder 55 may be mounted on bracket 56, said cylinder having a piston therein connected by rod 57 with carriage 29. Fluid connections can be provided for subjecting the appropriate end of the cylinder to move the door toward and away from the vessel.

If desired, the controls can be connected to the main fluid operating system for the ring in such a manner as to move sequentially the closure and ring so that, for example, the cover will be moved from an open position to one against its seat and the locking ring turned and vice versa.

One manner in which this can be carried out is illustrated in Figs. 6 and 7, similar parts to Figs. 3 and 4 being given identical numbers.

Line 38A is connected through line 70 to valve 71, valve 71 in Fig. 6 being open to end 72 of cylinder 55. The left hand end 73 is connected through line 74 and valve 75 to reservoir 76. Projection 77 on piston rod 57 is arranged to move valve 75 to that shown in Fig. 6 when the door is in its fully opened position. As fluid pressure is applied by pump 31, it will move piston rod 57 to the left until the door is in position against the vessel. Projection 78 then will open valve 71 so that further operation of pump 31 will exert pressure on the right hand end of piston 40 through line 80. Projection 77 also will contact projection 81 on valve operator 82 to move the valve to the position illustrated in Fig. 7.

As the locking ring is rotated to the locked position, valve 83 will be closed because projection 84 on the ring will move away from said valve 83.

When it is desired to open the vessel from the locked position of Fig. 7, assuming there is no pressure within the vessel, operation of pump 31 will exert pressure first on cylinder 39 in an unlocking direction through line 43, valve 83 being closed. Fluid flows from the right hand end of 39 through line 80, open valve 71, line 70, line 38A to reservoir 46. When the ring is fully opened,

valve 83 will be opened by projection 84 so that further operation of pump 31 will exert pressure on the left hand end of cylinder 55 through line 86, valve 83, line 87, valve 75, line 74. Fluid from the right hand end of cylinder 55 will flow through closed valve 71, line 70, line 38A to reservoir 46.

Thus, it can be seen that the door and locking ring can be sequentially operated.

Various types of pressure sensitive relief valve or sequence means can be used as well as any suitable main control valve. Also, various types of motor means for turning the ring can be employed, pressure in the vessel above a safe unlocking level disabling said motor means. It is to be further understood that other details of construction can be varied without departing from the spirit of the invention except as defined in the appended claims.

I claim:

1. In a pressure vessel having closure means for closing an opening in said vessel, said means including a locking ring and cover, one of these elements being rotatable relative to the other for locking said cover when rotated in one direction and unlocking said cover when rotated in the opposite direction, the combination including motor means connected to said ring for rotating said rotatable element relative to the other element, motor actuating means connected to said motor means for actuating said motor means in locking and unlocking direction, and fluid pressure responsive means communicating with the interior of said vessel and connected to said motor actuating means for preventing the actuation of said motor means by said actuating means to thereby prevent turning said rotatable element from a locked to an unlocked position relative to said other element when the pressure in the interior of said vessel is more than a predetermined value.

2. In a pressure vessel having closure means for closing an opening in said vessel, said means having a pair of elements, one of which is rotatable relative to the other for locking said closing means when rotated in one direction and unlocking said closure means when rotated in the opposite direction, the combination including fluid operated motor means for rotating said rotatable element relative to the other element, fluid pressure source means connected to said fluid operated motor means for actuating said motor means in locking and unlocking direction, and fluid pressure responsive means communicating with the interior of said vessel and connected to said fluid pressure source means for preventing the actuation of said fluid operated motor means by said source means when more than a predetermined pressure exists in said vessel, so as to prevent opening said closure except when the pressure within said vessel is below said predetermined value.

3. In a pressure vessel having closure means for closing an opening in said vessel, said means including a ring and cover, one of these elements being rotatable relative to the other for locking said cover on said vessel when rotated in one direction and unlocking said cover when rotated in the opposite direction, said ring and cover having cooperating cam means therebetween, the combination including pressure motor means for rotating said rotatable element relative to the other element, pressure supply means connected to said motor means for actuating said motor means in locking and unlocking direction, and safety interlock fluid pressure responsive means communicating with the interior of said vessel and connected to said pressure supply means to prevent actuation of said motor means by said supply means, thereby preventing opening of said cover when the pressure in said vessel is above a predetermined value.

4. In a pressure vessel having closure means for closing an opening in said vessel, said means including a ring and cover, one of these elements being rotatable relative to the other for locking said cover on said vessel when rotated in one direction and unlocking said cover when

rotated in the opposite direction, said ring and cover having cooperating cam means therebetween, the combination including a pair of pressure motor means connected to said ring for rotating said rotatable element relative to the other element, pressure supply means connected to said motor means for actuating said motor means in locking and unlocking direction, and safety interlock fluid pressure responsive means communicating with the interior of said vessel and connected to said pressure supply means to prevent actuation of said motor means by said supply means when the pressure in said vessel is above a predetermined value.

5. In a pressure vessel having closure means for closing an opening in said vessel, said means including a ring and cover, one of these elements being rotatable relative to the other for locking said cover on said vessel when rotated in one direction and unlocking said cover when rotated in the opposite direction, said ring and cover having cooperating cam means therebetween, the combination including a pair of pressure motor means connected to said ring for rotatiing said rotatable element relative to the other element, pressure supply means connected to said motor means for actuating said motor means in locking and unlocking direction, main control valve means connected to said motor means and said pressure supply means, so that said motor means can be operated selectively in locking and unlocking direction, and safety interlock fluid pressure responsive means communicating with the interior of said vessel and connected to said pressure supply means to prevent actuation of said motor means in unlocking direction when the pressure in said vessel is above a predetermined value.

6. In a cylindrical pressure vessel having a door for closing an open end thereof, and a locking ring mounted on said vessel, said door and ring having interengageable lugs with cooperating cam means, said ring being rotatable relative to said door for locking said door on said vessel when rotated in one direction and unlocking said door when rotated in the opposite direction, the combination including fluid operated motor means connected to said ring for rotating the ring relative to said door, fluid pressure supply means, a main control valve connected

to said motor means and said fluid pressure supply so that said motor means can be operated selectively in locking and unlocking direction, and safety interlock fluid pressure responsive means communicating with the interior of said vessel and connected to said fluid pressure supply means, said fluid responsive means relieving operating pressure to said fluid operated motor means when actuated in an unlocking direction when the pressure in said vessel is above a predetermined value.

7. In a pressure vessel having closure means for closing an opening in said vessel, said means including a locking ring and cover, one of these elements being rotatable relative to the other for locking said cover when rotated in one direction and unlocking said cover when rotated in the opposite direction, the combination including motor means connected to said ring for rotating said rotatable element relative to the other element, motor actuating means connected to said motor means for actuating said motor means in locking and unlocking direction, a main control means connecting said motor actuating means and motor means, so that said motor means can be selectively operated in locking and unlocking direction, fluid pressure responsive means communicating with the interior of said vessel and connected to said motor actuating means to prevent actuation of said motor means in unlocking direction when pressure in said vessel is more than a predetermined value, and fluid pressure motor means connected to said cover for moving the same toward and away from said vessel.

References Cited in the file of this patent

UNITED STATES PATENTS

1,002,029	Brown	Aug. 29, 1911
1,858,013	Heins	May 10, 1932
2,160,062	Drake et al.	May 30, 1939
2,583,073	Ahlborn	Jan. 22, 1952
2,670,099	Dunton	Feb. 23, 1954
2,718,239	Erbguth	Sept. 20, 1955

FOREIGN PATENTS

327,893	France	Sept. 11, 1903

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,841,308

July 1, 195

Frederic C. Weicker

It is hereby certified that error appears in the printed specificati of the above numbered patent requiring correction and that the said Lette Patent should read as corrected below.

Column 2, line 71, for "pump output" read -- Pump outlet --; column 4, line 39, for "closing" read -- closure --; column 5, line 21, for "rotatiing" read -- rotating --.

Signed and sealed this 25th day of November 1958.

(SEAL)
Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patent