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3,406,997

PRESSURE DOOR LOCKING MECHANISM

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2 Sheets-Sheet 1

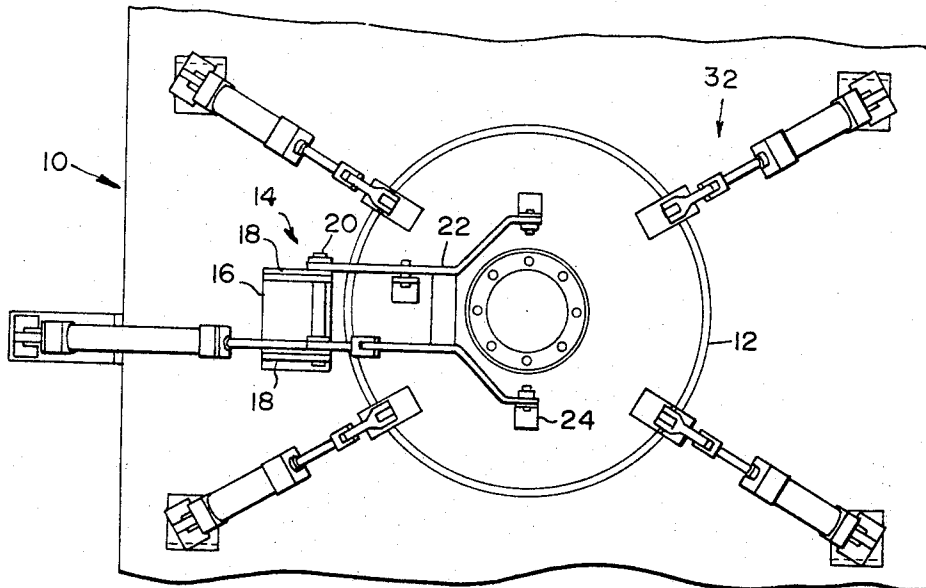


FIG. 1

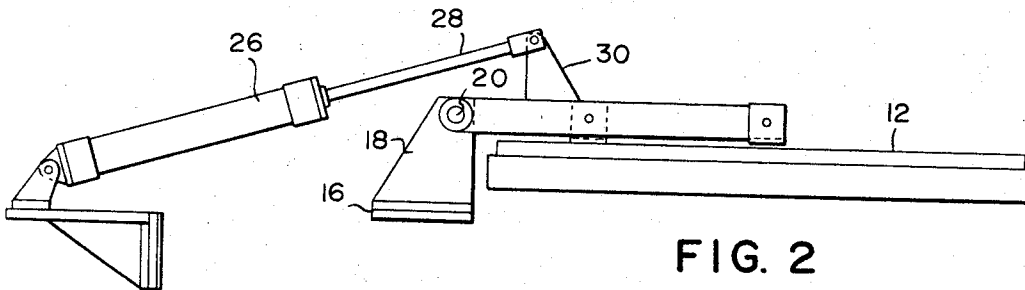


FIG. 2

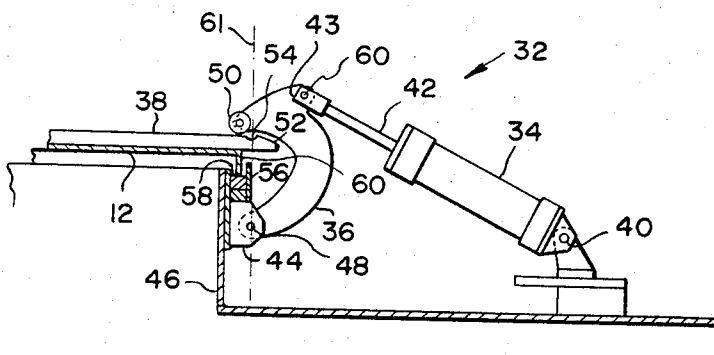


FIG. 3

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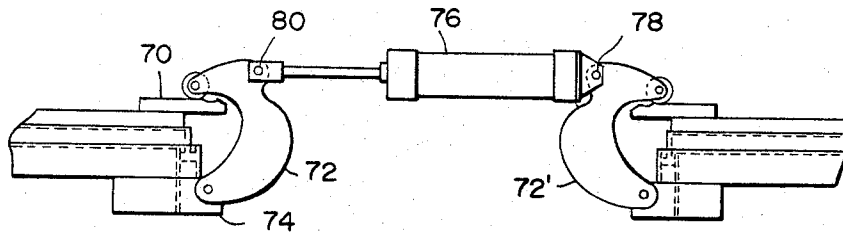


FIG. 4

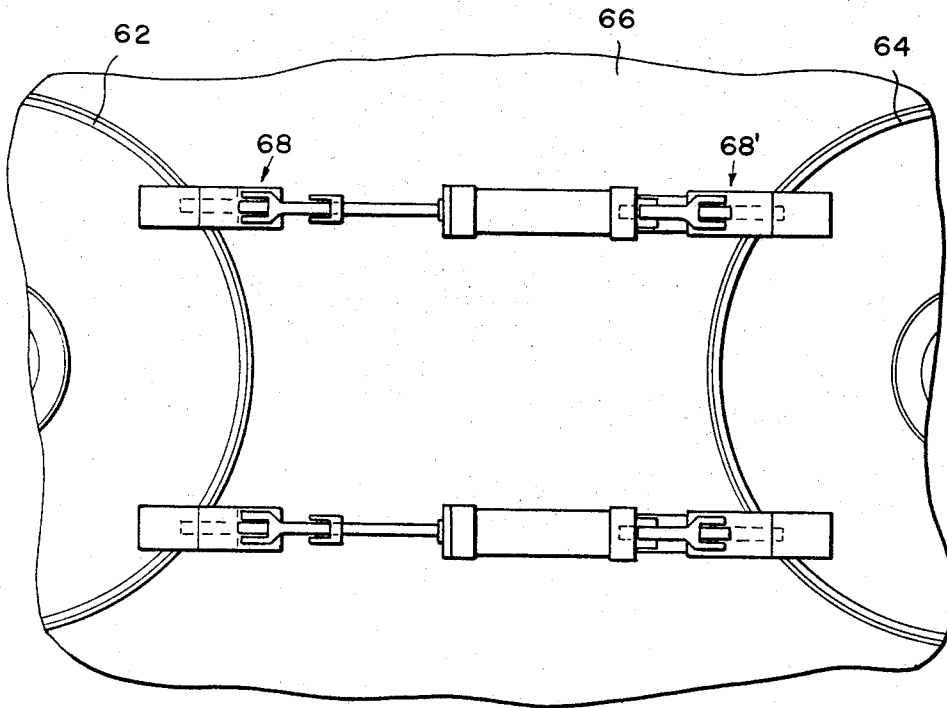


FIG. 5

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ABSTRACT OF THE DISCLOSURE

A locking mechanism is provided for securing a pressurized door such as the hatch for a pressurized tank. The locking mechanism includes a C-shaped clamp pivoted at one end to the tank wall and the other end is provided with a roller adapted to engage the margin of the door. A power cylinder is fixed to the tank wall and drivingly engages the clamp to move it into and out of locking engagement.

This invention relates generally to locking mechanisms for pressure-tight doors and more particularly is directed towards a new and improved fail-safe mechanism for securing pressure-tight doors in place over access openings in pressurized tanks and the like.

Most pressure vessels, particularly larger sized tanks of the sort used for dyeing textile goods, for example, have openings through the tank wall for access to the interior of the vessel. Such openings may be used frequently for feeding in materials, for example, and withdrawing the same when processed. The openings are usually closed by doors or hatches during operation in order to pressurize the tank.

Since the doors are used rather frequently, they should be able to be opened quickly and easily and yet should be able to lock tightly and positively insofar as the tanks are operated under internal pressures which may be on the order of 5 or 10 p.s.i., for example.

Conventional locking mechanisms for this type of door have not been entirely satisfactory for the reason that they do not provide a positive locking connection, are mechanically complicated, do not provide even sealing pressure throughout the door and/or lack fail-safe features in the event of a malfunction.

Accordingly, it is an object of the present invention to provide improvements in locking mechanisms for pressure-tight doors.

Another object of this invention is to provide a pressure-tight door-locking mechanism adapted to fail-safe in the event of a malfunction.

A further object of this invention is to provide a door-locking mechanism adapted to apply uniform locking pressure to the door.

Yet another object of this invention is to provide a door-locking mechanism with a mechanical advantage whereby a relatively small amount of pressure on the actuating mechanism will produce relatively large pressure on the door.

More particularly, this invention features a locking mechanism for pressurized doors and the like, comprising a C clamp one end of which is hinged to a fixed wall at a point adjacent the tank opening and behind the marginal overhand of the door when the door is in a closed position. The outer position of the clamp is drivingly connected to a power cylinder adapted to bias the clamp about its hinge into and out of locking engagement with the marginal edge of the door. The free leg of the clamp is provided with a roller which rides over a beveled and grooved plate mounted on the door, the clamp normally being biased past dead center by the power cylinder. The groove in the plate is positioned at dead center opposite the hinge axis whereby, in the event of a failure in the

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power supply to the cylinder, the C clamp will seat itself in the groove rather than to release the door thus providing a fail-safe locking feature. The invention also features a novel arrangement for applying pressure through the C clamp to the door whereby the pressure furnished by the cylinder is multiplied in its affect against the door.

However, these and other features of the invention, along with further objects and advantages thereof, will become more readily apparent from the following detailed description of preferred embodiments of the invention, with reference being made to the accompanying drawings, in which:

FIG. 1 is a view in front elevation of a pressure door with locking mechanisms made according to the invention,

FIG. 2 is a somewhat enlarged top plan view showing the door hinge and door actuating mechanism,

FIG. 3 is a somewhat enlarged top plan view showing details of a single door locking mechanism,

FIG. 4 is a view similar to FIG. 3 but showing a modification of the invention.

FIG. 5 is a view similar to FIG. 1 showing the multiplied locking mechanism of FIG. 4.

Referring now to the drawings and to FIGS. 1 through 3 in particular, the reference character 10 generally indicates a wall for a pressure tank such as a dye kettle or the like having a circular access opening normally closed by a door 12. The door itself typically is mounted to the tank wall by means of a hinge 14 comprising a hinge plate 16 welded or otherwise secured to the wall 10 and having a pair of ears 18 carrying a hinge pin 20. The hinge pin supports the two arms of a bracket 22 the outer ends of which engage the door 12 along its vertical center line by a pair of hinges 24. The door is power-operated by means of a pneumatic or hydraulic cylinder 26 having a rod 28 which drivingly engages an extension 30 rigidly fixed to the bracket 22. The opposite end of the cylinder 26 is hinged to the frame of the tank. It will be understood that the door 12 is opened and closed by actuation of the cylinder 26 typically through a remote control station.

Arrayed around the door 12 are spaced locking units 32 each comprising a power cylinder 34, a locking C clamp 36 and a cooperating plate 38 forming part of the door 12. The power cylinder 34 has one end hinged at 40 to the wall of the tank and is provided with a piston rod 42 the outer end of which drivingly engages a nose portion 43 formed on the outer portion of the clamp 36. The clamp 36 is in the form of a C, one leg of which is pivoted to the tank by means of hinge 44 welded or otherwise secured to a hatch coaming 46 extending about the hatch opening. The hinge 44 carries a pin 48 about which the clamp 36 is biased. The opposing free leg of the C clamp 36 carries a roller 50 which bears against the outer surface of the plate 38 when the door 12 is in the closed position shown in FIG. 3. The plate 38 will be seen in FIG. 3 to extend out over the side of the door edge to overhang the coaming 46 and to extend between the legs of the C clamp 36. The outer end of the plate 38 is formed with a bevel at 52 over which the roller 50 rides when the locking mechanism is actuated. It will be understood that the inclined bevel edge 52 facilitates engagement of the roller with the plate and also provides a gradually increasing closing pressure on the door as the clamp 36 is biased about the pivot pin 48 and the roller 50 rides up the bevel 52. At the top of the bevel a groove 54 is formed across the plate at a point that is along the dead-center line of the clamp pivot point 48. The coaming 46 is formed with a channel member 56 in which is mounted an annular resilient gasket 58. The door 12 is formed with an inwardly turned flange 60 the edge of which seats against the gasket 58 when the door is in the closed position.

In practice, the C-shaped clamp 36 is operated by the

power cylinder 34 and when locking the door the roller end of the clamp first rides over the bevel edge 52 and into and out of the groove 54, past dead-center, indicated by the line 61, so that the roller 50 rests upon the flat surface of the plate 38 when the door is fully secured. In the event of a failure in the air or hydraulic supply actuating the cylinder 34 the clamp will not release the door but rather the roller 50 will ride back and seat itself in the groove 54 which is at dead-center opposite the pivot point 48. This provides a fail-safe feature preventing sudden loss of pressure in the tank in the event of the failure of the cylinders or cylinder power system.

In practice, a door may be secured by perhaps four spaced locking units 32 each having its own power cylinder 34 and locking mechanism. According to the present invention, all cylinders for one door are pressurized on the same line and this arrangement allows for self-adjustment at the points of contact on the door without requiring other types of manually corrected adjustments. This also insures that uniform pressure will be applied to the door throughout.

It will be noted in FIG. 3 that the radial distance between the pivot pin 48 for the clamp and hinged connection 60 in the nose 43, where the piston rod 52 connects with the clamp, exceeds the radial distance between the pivot pin 48 and the axis of the roller 50. With this arrangement the pivot point 48 has a definite moment relative to the point of pressure application 60 by the air cylinder the corresponding moment for pressure application on the cover is the same. Due to the fact that the radius for the point of application of pressure on the cylinder is relatively short there results a multiplication of the pressure on the cover. In other words, if the ratio of the radii between points 48 and 60 and between points 48 and 50 were 4 to 1 it would be necessary to only apply 1/4 of the pressure on the air cylinders to furnish sufficient pressure against the cover to act against the internal pressure within the tank. The clamp 36 thus serves as a levering device in applying pressure to the door.

Referring now more particularly to FIGS. 4 and 5, there is illustrated a modification of the invention and in this embodiment a pair of doors 62 and 64 is provided for a pressure vessel such as a dye kettle or the like with a section of the tank wall being indicated by reference character 66. The two doors 62 are mounted side by side and hinged in the same fashion as the door of the principal embodiment. Each door is provided with a locking mechanism 68 including a door plate 70 and a C-shaped clamp 72 hinged to the tank by means of a hinge 74 in the same fashion as the clamp 36 of the principal embodiment. However, in this instance the locking unit 68 for one door 62 is mounted directly opposite another locking unit 68' for the other door 64 and in alignment therewith. The two clamps 72 and 72' are actuated by a common power cylinder 76 one end of which is connected by a pin 78 to the clamp 72' while the piston rod end is connected by a hinge 80 to the clamp 72. It will be understood that in multiple door tanks the number of power cylinders is halved thus reducing the cost of the assembly without in any way impairing the operation of the unit. Both doors are opened and closed in unison with the locking mechanism locking two doors at once. The features of the original embodiment are included in each unit, namely,

the fail-safe groove provided in the door plate and the lever arm advantage incorporated into each clamp for applying maximum closing pressure to the doors.

While the invention has been described with particular reference to the illustrated embodiments, it will be understood that numerous modifications thereto will appear to those skilled in the art. Accordingly, the above description and accompanying drawings should be taken as illustrative of the invention and not in a limiting sense.

Having thus described the invention, what I claim and desire to obtain by Letters Patent of the United States is:

1. Mechanism for locking a pair of doors in place over a pair of wall openings, comprising:

- (a) a clamp for each door with one end of each clamp hinged to said wall adjacent each opening,
- (b) each door being formed with a planar portion at the margin thereof parallel to said clamp axis and extending between the hinged end and free end of the clamp when in a closed position,
- (c) each door being further formed with a groove adjacent said planar portion,
- (d) said groove located along a dead center line of said clamp axis, and,
- (e) power means drivingly connected to both of said clamps and adapted to bias said clamps into and out of locking engagement with the planar portions of said doors when said doors are in closed positions.

2. Mechanism for locking a door in place over a wall opening, comprising:

- (a) a clamp one end of which is hinged to said wall adjacent said opening,
- (b) a roller mounted on the opposite end of said clamp for rotation about an axis parallel to the clamp axis,
- (c) said door being formed with a planar portion at the margin thereof parallel to said clamp and roller axes and extending therebetween when in a closed position,
- (d) said door being further formed with an inclined surface outwardly of said planar portion and a groove between said inclined surface and said planar portion,
- (e) said groove extending parallel to said roller axis and located along a dead center line of said clamp axis,
- (f) power means drivingly connected to said clamp at a point on said clamp spaced from the clamp axis by a distance exceeding that between the roller axis and the clamp axis,
- (g) said power means adapted to bias said clamp into and out of locking engagement with the planar portion of said door when said door is in a closed position.

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