United States Patent

Bregantini

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[54] SAFETY MECHANISM FOR A HYDRAULICALLY OPERATED DOCKBOARD

[72] Inventor: **Robert R. Bregantini,** Menomonee Falls, Wis.

[73] Assignee: **Kelley Company, Inc.,** Milwaukee, Wis.

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[52] **U.S. Cl.** **14/71**
[51] **Int. Cl.** **B65g 11/00**
[58] **Field of Search** 14/71

[56] **References Cited**

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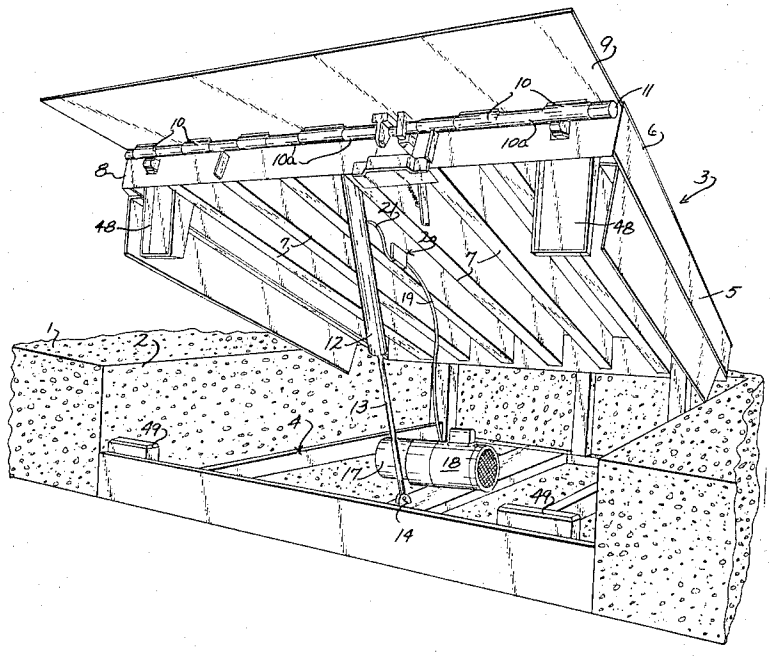
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Primary Examiner—Jacob L. Nackenoff
Attorney—Andrus, Sceales, Starke & Sawall

[57] **ABSTRACT**

A safety mechanism to be incorporated with a hydraulically operated dockboard for preventing free descent of the ramp if a carrier pulls away from the dock when a load is on the ramp. The dockboard includes a ramp having its rear edge hinged to the dock and adapted to be raised upwardly to an inclined position by a hydraulic cylinder unit. The safety mechanism is located in the hydraulic supply line that supplies hydraulic fluid to the cylinder unit from a pump and the mechanism includes a pair of valves, one of which is biased to a normally closed position and the second valve is biased to a partially open position. To raise the ramp, the pump is operated and the pressurized fluid acts to move both valves to the fully open position. When the ramp is lowered in normal operation, the hydraulic fluid being displaced from the cylinder unit passes through the partially open second valve to provide a slow rate of descent from the ramp. If a truck or carrier pulls away from the dock when a load is on the ramp, the combined weight of the ramp and the load will increase the force of the hydraulic fluid flowing from the cylinder to the pump, thereby overcoming the spring force on the second valve and moving the second valve to a fully closed position. The closing of the second valve will prevent descent of the ramp and will retain the ramp in that position until the load is removed from the ramp.

9 Claims, 6 Drawing Figures



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SHEET 1 OF 2

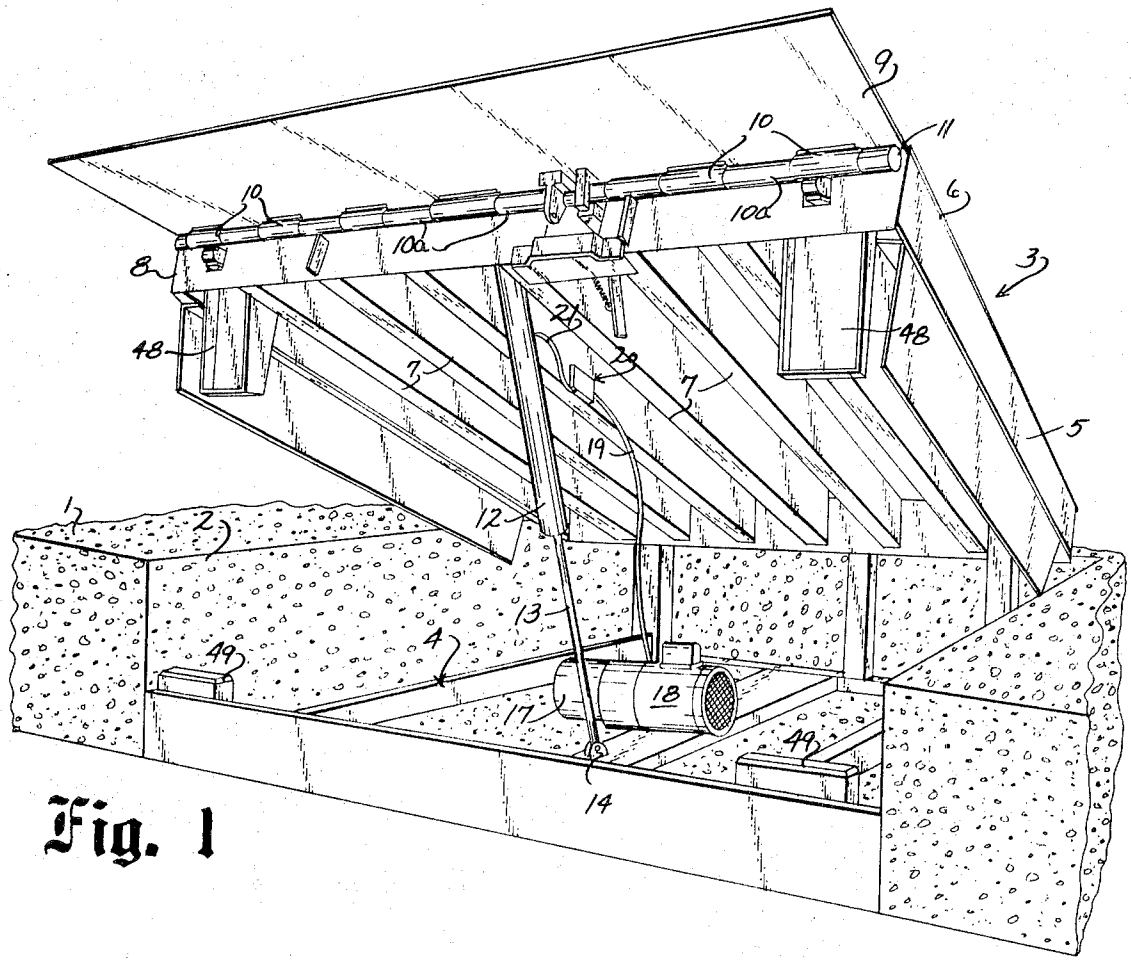


Fig. 1

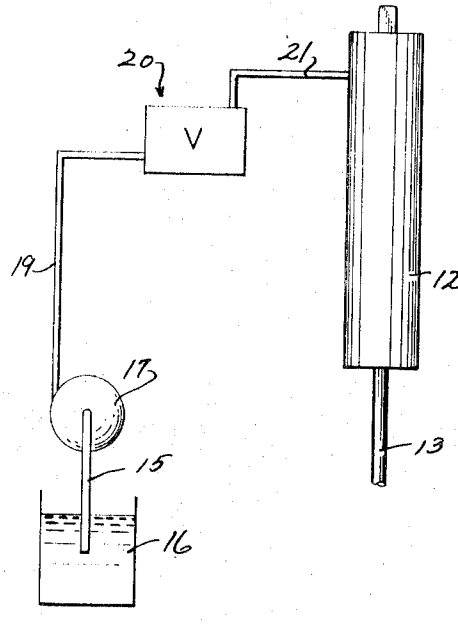


Fig. 2

INVENTOR.
Robert R. Bregantini

BY
Andrus Scales Starke & Sawall

Attorneys

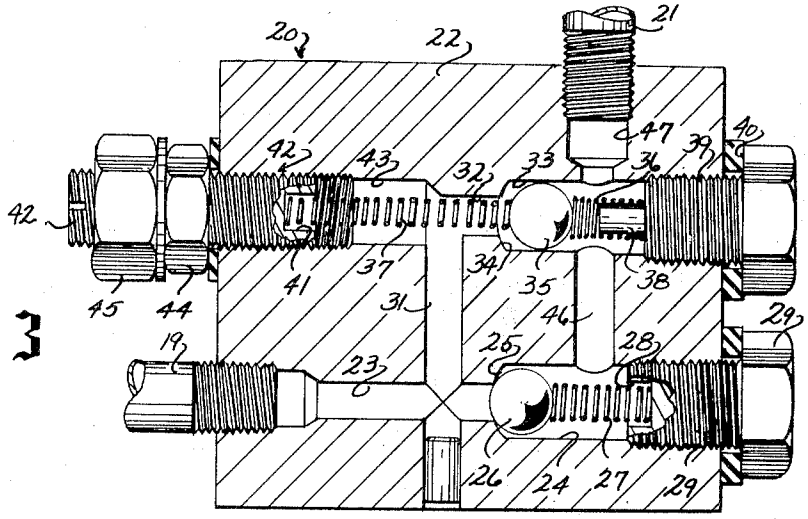


Fig. 3

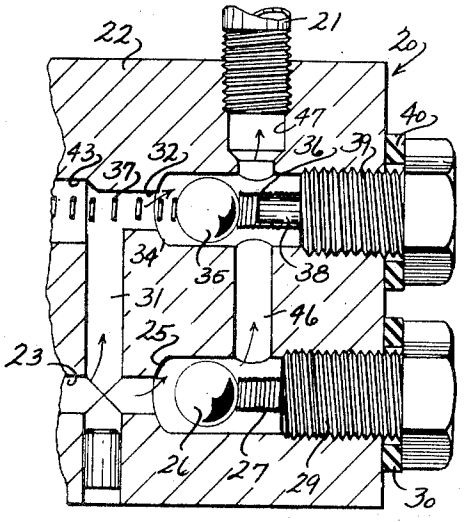


Fig. 4

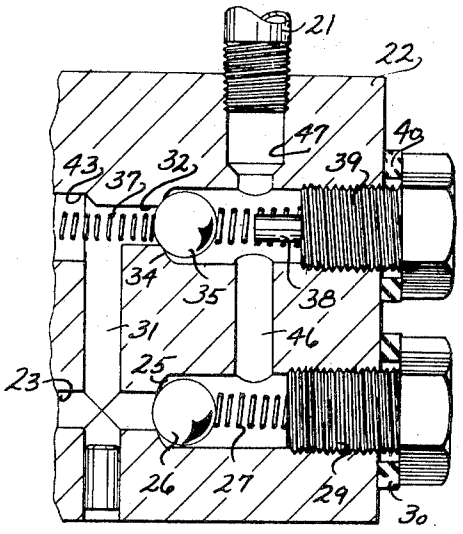


Fig. 5

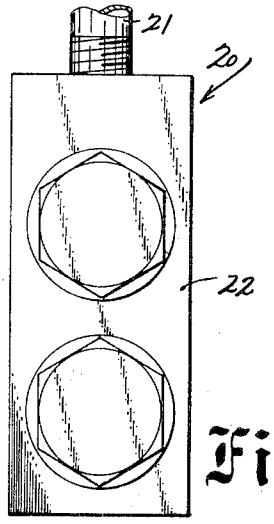


Fig. 6

INVENTOR.
Robert R. Bregantini

BY
Andrus, Sceales, Starke & Sawall

Attorneys

SAFETY MECHANISM FOR A HYDRAULICALLY OPERATED DOCKBOARD

This invention relates to a dockboard and more particularly to a safety device for a hydraulically operated dockboard which prevents free descent of the ramp in the event a carrier pulls away from the dock when a load is on the ramp.

The conventional hydraulically operated dockboard is installed in a shallow depression or pit formed in the upper surface of the dock. The dockboard includes a ramp which is hinged at its rear edge to the back of the dock pit and when not in use the ramp is in a cross-traffic position, generally flush with the upper surface of the dock. With this type of dockboard, the ramp is adapted to be pivoted upwardly to an inclined position by a hydraulic cylinder unit which is connected between the ramp and the supporting structure. When a truck or other carrier backs toward the dock, the cylinder unit is extended to move the ramp upwardly to the inclined position, and simultaneously, an extension lip which is hinged to the front edge of the ramp and is moved by second hydraulic cylinder unit from a pendant position to a partially extended position. Upward movement of the ramp also actuates a lip latching mechanism which engages the lip and holds it in the partially extended position. With the ramp in the upwardly inclined position and the lip extended, the operator then shuts off the pump motor and the ramp will slowly lower by gravity, displacing the hydraulic fluid from the cylinder, until the lip moves into engagement with the bed of the carrier. As the lip engages the carrier, it is moved to its fully extended position thereby releasing the lip latching mechanism.

When the loading is completed and the truck pulls away from the dock, the ramp will continue to lower, if above dock level, until projections or legs at the front of the ramp engage stops on the frame or supporting structure. If the ramp is at a below dock level position during the loading operation, the ramp will continue to move downwardly by gravity, when the truck pulls away from the dock, to its lowermost below dock level position, until the ramp hits stops on the dock and this will actuate a switch to start the pump and automatically raise the ramp to the cross traffic position.

In the past, problems have arisen when the carrier would pull away from the dock, when a lift truck or other heavy load was on the ramp. This additional load on the ramp, which may be thousands of pounds, would cause the ramp to move downwardly at a substantially increased rate of speed with the result that personnel or equipment on the ramp, or portions of the hydraulic system were apt to be injured or damaged when the ramp descent was stopped.

The present invention is directed to a safety device for a hydraulically actuated dockboard which will prevent the descent of the ramp in situations where a carrier pulls away from the dock when a load is on the ramp. The safety mechanism includes a valve assembly which is connected to the conduit leading from the discharge side of the pump to the hydraulic cylinder which operates the ramp. The valve assembly includes a pair of valves one of which is spring biased to a normally closed position, and the second of the valves is biased to an open position. To raise the ramp to the inclined position the pump is operated and the pressurized fluid acts to move both of the valves to a fully open position to thereby supply fluid from the pump to the hydraulic cylinder.

When it is desired to lower the ramp under normal operating conditions, the pump is stopped and the ramp will descend by gravity, forcing the fluid from the cylinder back to the pump. As the first valve is biased to a closed position, the fluid returning to the pump will pass through the partially open second valve to provide a slow rate of descent for the ramp. The biasing force on the second valve is greater than the force exerted by the fluid being displaced from the cylinder so that the second valve will remain partially open as the ramp descends.

In the event that a carrier pulls away from the loading dock when a leavy load, such as a fork lift truck, is on the ramp, the combined weight of the ramp and the load will increase the pressure of the hydraulic fluid and this increased force of the fluid will overcome the spring bias on the second valve to move the second valve to the fully closed position. With both valves in the fully closed position, the descent of the ramp will be stopped and the ramp will be retained in that position until the added load is removed from the ramp. Thus, the present invention provides a safety mechanism which will prevent free descent of the ramp in situations where a predetermined added load is on the ramp, but will permit free controlled descent of the ramp where there is no added load on the ramp.

Other objects and advantages will appear in the course of the following descriptions.

The drawings illustrate the best mode presently contemplated of carrying out the invention.

In the drawings:

FIG. 1 is a perspective view of a hydraulically operated dockboard incorporating the safety mechanism of the invention, with the ramp shown in the upwardly inclined position;

FIG. 2 is a schematic view of the hydraulic system for operating the ramp;

FIG. 3 is a section of the valve assembly showing one valve in the closed position and the second valve in the partially open position;

FIG. 4 is a view similar to FIG. 3, showing both valves in the fully opened position;

FIG. 5 is a view similar to FIG. 3, showing both valves in the closed position; and

FIG. 6 is an end view of the valve assembly.

The drawings illustrate a loading dock 1 formed with a shallow pit or depression 2 and a dockboard 3 is installed in the pit. The dockboard 3 is provided with a structural mounting frame 4, which is mounted in the pit and the rear edge of a ramp 5 is hinged to the frame 4 at the rear of the pit. Ramp 4 includes a generally flat tread plate 6, which is supported by a series of channel-shaped parallel beams 7, and the forward edges of the beam 7 are welded together by a front plate 8.

An extension lip 9 is pivotally connected or hinged to the forward edge of the ramp 5. To provide the hinged connection, a series of hinged sockets 10 are welded to the under surface of the lip and a second series of hinge sockets 10*a* are welded to the front plate of the ramp. Hinge pins 11 extend through the aligned sockets to provide the hinge connection between the lip 9 and the ramp 5.

In the cross-traffic position the ramp 5 will be substantially flush with the upper surface of the dock and the lip 9 will assume a pendant position in which it hangs downwardly in front of the ramp. As the ramp is pivoted upwardly to an inclined position, as illustrated in FIG. 1, the lip 9 will also be pivoted outwardly to a partially extended position by a hydraulic cylinder unit, not shown.

The ramp is moved to the upwardly inclined position by a hydraulic unit which includes a cylinder 12 and a ram or piston rod 13. As shown in FIG. 1, the upper end of the cylinder 12 is pivotally connected to the undersurface of the ramp and the outer end of the ram 13 is pivotally connected to lugs 14, secured to the frame 4 of the dockboard. By supplying hydraulic fluid to the cylinder 12, the ram 13 will move to the extended position, to thereby pivot the ramp 5 fo the inclined position as illustrated in FIG. 1.

The hydraulic system for supplying hydraulic fluid to the cylinder is illustrated schematically in FIG. 2.. As shown in FIG. 2, a line 15 connects a fluid reservoir 16 with the inlet side of a pump 17 driven by motor 18, and a line 19 connects the discharge side of the pump to the inlet of a valve assembly 20. Line 21 connects the outlet of the valve assembly to the cylinder 12.

The safety device of the invention is incorporated in the valve assembly 20, which is best illustrated in FIGS. 3–6. The valve assembly 20 includes a casing or valve block 22 having a passage 23, and the line 19, which is connected to the discharge side of the pump, is threaded into the passage 23, so that hydraulic fluid will be supplied from the pump to the passage 23. The inner end of passage 23 communicates with

an enlarged passage 24 that defines a valve seat 25. A ball valve 26 is adapted to engage the valve seat 25, and valve 26 is biased to the normally closed position by a coil spring 27. One end of the spring 27 bears against the valve 26, while the opposite end of the spring is retained within a recess 28 formed in the inner end of the stud 29 is threaded within the outer end of the passage 24. A sealing gasket 30 is located between the head of the stud 29 and the outer wall of the valve block 22.

As shown in FIGS. 3–5, a cross passage 31 is connected between the central portion of passage 23 and a passage 32 which is substantially parallel to the passage 23. The end of passage 32 communicates with an enlarged passage 33 which defines a valve seat 34. A ball valve 35 is adapted to seat on the valve seat 34.

The ball valve 35 is biased to a partially open position by a pair of coil springs 36 and 37 which act against opposite portions of the ball valve. One end of the spring 36 bears against the ball valve 35, while the opposite end of the spring is retained around a projection 38 formed on the inner end of stud 39, which is threaded within the outer end of the passage 33. A sealing gasket 40 is located between the head of the stud and the wall of the valve block 22.

Spring 37 acts on the opposite side of the ball valve 35, and the outer end of the spring 37 is retained within a recess 41 formed in the inner end of a stud 42 that is threaded within the enlarged passage 43 that communicates with passage 32.

A sealing gasket is located between the outer wall of the valve block 22 and a jam nut 44 threaded on the stud 42. A lock nut 45 is threaded on the outer end of stud 42 and the projecting end of stud 42 is provided with a slot to receive a screw driver, or other tool to provide an adjustment of the spring force on the valve 35. By loosening the nuts 44 and 45 and adjusting the position of the stud 42, the force of the spring 37 can be varied to thereby adjust the relative location of the ball valve 35 with relation to the valve seat 34. Valve 35 is acted on by both springs 36 and 37 and due to the fact that the force of spring 37 is greater than the force of the spring 36 the valve will be normally biased to the partially open position. By adjustment of the stud 42, the force of the spring 37 can be varied to thereby regulate the force necessary to move the valve 35 to the fully closed position.

A cross passage 46 connects the passages 33 and 24, and an outlet passage 47 is connected to the passage 33 and extends to the exterior of the valve block. The fluid line 21, which extends to the cylinder 12, is threaded into the outlet passage 47.

Under normal no-load conditions, the valves 26 and 35 will be in the position shown in FIG. 3, in which the valve 26 is closed and the valve 35 is biased by springs 36 and 37 to a partially open position. When it is desired to elevate the ramp, the pump is operated and the pressurized fluid acting within the passage 23 will move the valve 26 to the fully opened position, as shown in FIG. 4. The pressurized fluid will also act through the passages 31 and 32 to move the valve 35 to the fully open position so that the fluid will pass through both open valves through the outlet passage 47 to the cylinder. When the ramp 5 has been elevated to the inclined position and the lip 9 has been moved outwardly to the partially extended position, the operation of the pump is terminated and the ramp will then descend by gravity until the lip 9 engages the bed of the truck or other carrier. As the ramp descends the weight of the ramp will act to move the cylinder and piston to a retracted position causing the hydraulic fluid to be displaced from the cylinder and pass into the valve block 22 through the passage 47. In this situation, the force of the hydraulic fluid in the passage 47, plus the force of the spring 36 is slightly less than the force of the spring 37 so that the valve 35 will be in a partially open position to provide a restricted flow of the hydraulic fluid through the passages 32, 31 and 23 to the pump. The pump is designed so that the fluid will flow through the pump to the reservoir during non-operating conditions. Thus, the fluid will flow in a restricted manner through the partially open valve 35 to the pump, to provide a slow rate of descent for the ramp from its upwardly inclined position until the lip engages the bed of the carrier.

After the loading operation has been completed and the carrier pulls away from the dock, the ramp, if it is above dock level, will lower by gravity to the cross-traffic position, at which position the cross traffic legs 48 on the ramp engage the stops 49, and during the lowering the hydraulic fluid being displaced from the cylinder will flow through the partially open valve 35 to the pump and reservoir. The legs 48 can be of a construction similar to that shown in U.S. Pat. No. 3,137,017.

If the ramp, when the carrier pulls away, is in a below dock level position, in which case the legs 48 are retracted, the ramp will similarly descend slowly as the fluid flows through the partially opened valve 35 until the ramp frame engages the stops 49 and this will actuate a switch to start the pump and return the ramp to the cross traffic position. Thus, when the ramp descends by gravity with no added weight thereon, the hydraulic fluid will flow at a restricted rate through the partially open valve 35 to provide a slow rate of descent for the ramp. In this situation, the valves are in the position of FIG. 3.

In the event that the truck or other carrier pulls away from the dock when there is an additional load on the ramp, as for example, a lift truck or other cargo which may weigh several thousand pounds, the additional weight on the ramp will increase the pressure of the hydraulic fluid being displaced from the cylinder so that the force exerted by the fluid in combination with the force of spring 36 will overcome the force of spring 37, thereby moving the valve 35 to the fully closed position. As the valve 26 is also in the fully closed position, there will be no flow of fluid through the valve assembly with the result that the ramp bearing the additional load will be locked against downward movement and will be retained in this locked position until the added load is removed from the ramp. With the load removed from the ramp, the force of the spring 37 will again overcome the combined force exerted by spring 36 and the hydraulic fluid so that the valve 35 will be returned to the partially open position to permit free descent of the ramp.

The valve 26 is not essential to the operation of the mechanism, but is desirable in that it provides an increased rate of flow to the cylinder for elevation of the ramp. As the passage 32 is partially restricted by the spring 37, the valve 26 provides a secondary route for fluid flow to the cylinder to thereby provide a more rapid rate of ramp elevation.

The valve mechanism of the invention provides a full flow of hydraulic fluid from the pump to the cylinder in order to raise the ramp. Under normal conditions, the valve mechanism provides a restricted return of fluid from the cylinder to provide a slow and controlled rate of descent for the ramp. Under conditions where an added predetermined load is on the ramp when the carrier pulls away from the dock, the mechanism will prevent descent of the ramp until the load is removed. This latter feature will prevent rapid downward movement of the ramp due to the additional weight of the load and thus serves to protect personnel, loading equipment and material being handled, as well as protecting the dockboard against structural or other damage.

By the simple adjustment of stud 42, the biasing force on valve 35 can be changed to thereby vary the amount of additional load on the ramp which is necessary to move the valve 35 to the fully closed position and lock the ramp against descent.

While the above invention has illustrated the safety mechanism in conjunction with a pit mounted dockboard, it is contemplated that the safety mechanism can be incorporated with any hydraulically operated dockboard.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

1. In a dockboard, a supporting structure, a ramp mounted for movement on the supporting structure between a storage position and an upper position, hydraulic means for moving the ramp between the storage position and the upper position, said hydraulic means including a hydraulic power unit inter-

connecting the ramp and the supporting structure and said hydraulic means including a pump and conduit means connecting the discharge side of the pump and said power unit, valve means located in said conduit means, and biasing means for biasing said valve means toward an open position, said biasing means being arranged so that fluid being discharged from the pump to the power unit to raise the ramp will act in conjunction with said biasing means to move the valve means to a fully open position, said biasing means being arranged so that the force of the fluid being displaced from the power unit as the ramp is lowered under normal conditions will not overcome the force of said biasing means so that said valve means will be in a partially open position, and said biasing means being arranged so that the force of the fluid being displaced from the power unit when the ramp descends with an additional predetermined load applied thereto will overcome the force of said biasing means so that the valve means will be moved to a closed position and prevent further descent of the ramp.

2. The dockboard of claim 1, wherein said biasing means comprises a pair of resilient members with a first of said resilient members urging said valve means toward an open position and a second of said resilient members urging said valve means toward a closed position, the force of said first resilient member being greater than the force of said second resilient member whereby said valve means is biased to a partially open position under no-load fluid pressure conditions.

3. The dockboard of claim 2, wherein said valve means comprises a valve seat and a generally spherical ball valve, said resilient members being coil springs disposed in engagement with opposite portions of said ball valve.

4. The dockboard of claim 1, and including means for adjusting the force of said biasing means to thereby regulate the amount of said additional load necessary to move said valve means to the closed position.

5. The dockboard of claim 1, wherein said valve means comprises a casing having a passage comprising a part of said conduit means and defining a valve seat, said valve means also including a valve member adapted to engage the valve seat, said biasing means comprises a pair of resilient members with a first of said resilient members urging said valve member toward an open position and a second of said resilient members urging said valve member toward a closed position, the force of said first resilient member being greater than the force of said second resilient member whereby said valve member is biased to a partially open position under no-load fluid pressure conditions, and adjusting means for adjusting the force of at least one of said resilient members to thereby regulate the amount of said additional load necessary to move said valve member to the closed position.

6. The dockboard of claim 5, wherein said adjusting means is located on the exterior of said casing.

7. The dockboard of claim 1, and including check valve means disposed in said conduit means in parallel arrangement with said first valve means for permitting flow of fluid in a direction from the pump to the power unit and for preventing flow in the opposite direction.

8. The dockboard of claim 5, wherein said casing defines a second passage disposed in parallel arrangement with said first passage and constituting a part of said conduit means, said second passage defining a second valve seat, said dockboard also including a second valve adapted to engage said second valve seat, and second biasing means for urging said second valve member to the closed position.

9. The dockboard of claim 1, wherein said power unit is a hydraulic cylinder.

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