

Aug. 15, 1967

E. T. WARD
HYDRAULICALLY-OPERATED SHORING APPARATUS
WITH PRESSURE SAFETY LOCK

3,335,573

Filed July 27, 1965

2 Sheets-Sheet 1

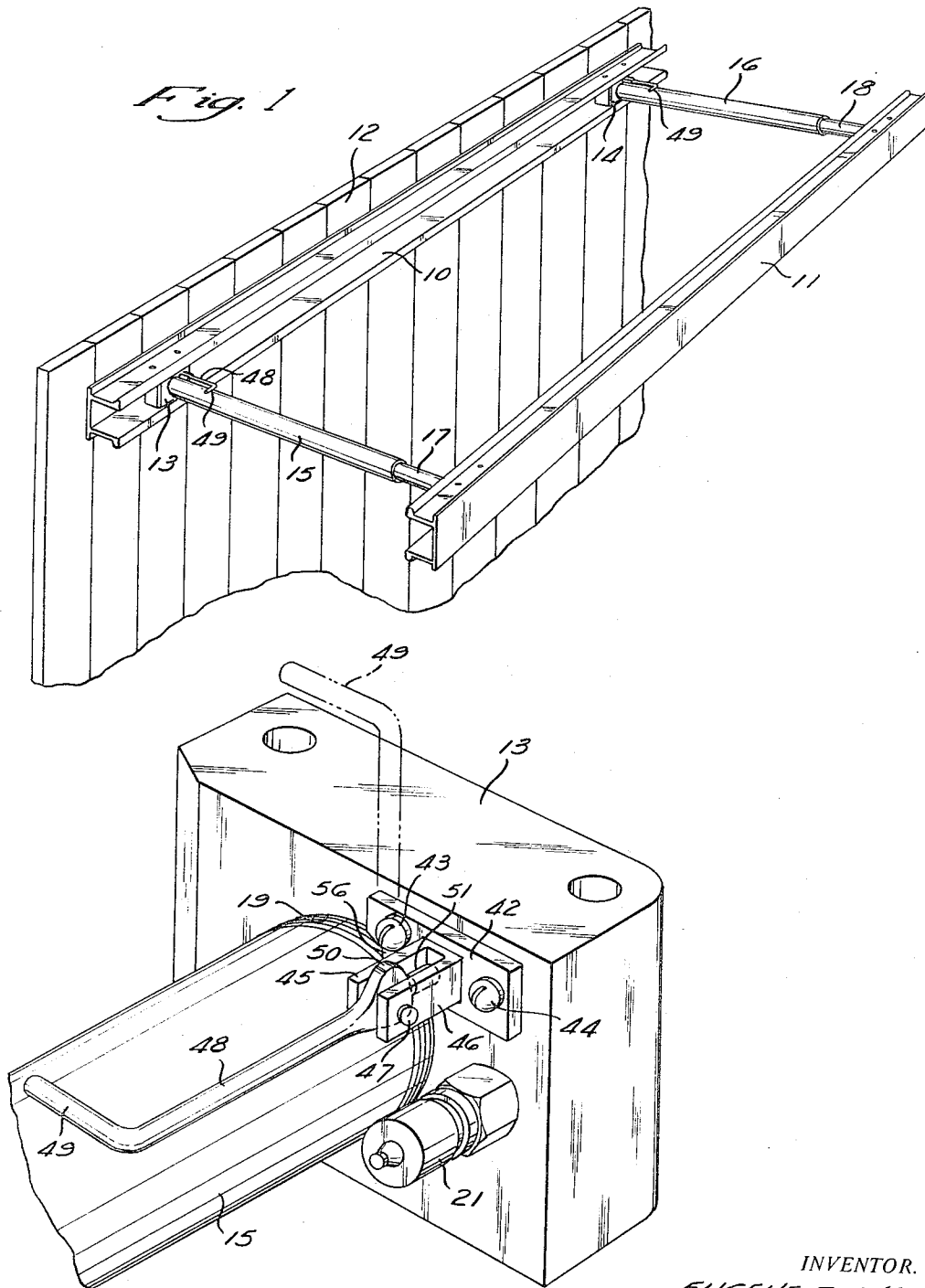


Fig. 2

INVENTOR.
EUGENE T. WARD
BY
Ely, Golnick & Flynn
ATTORNEYS

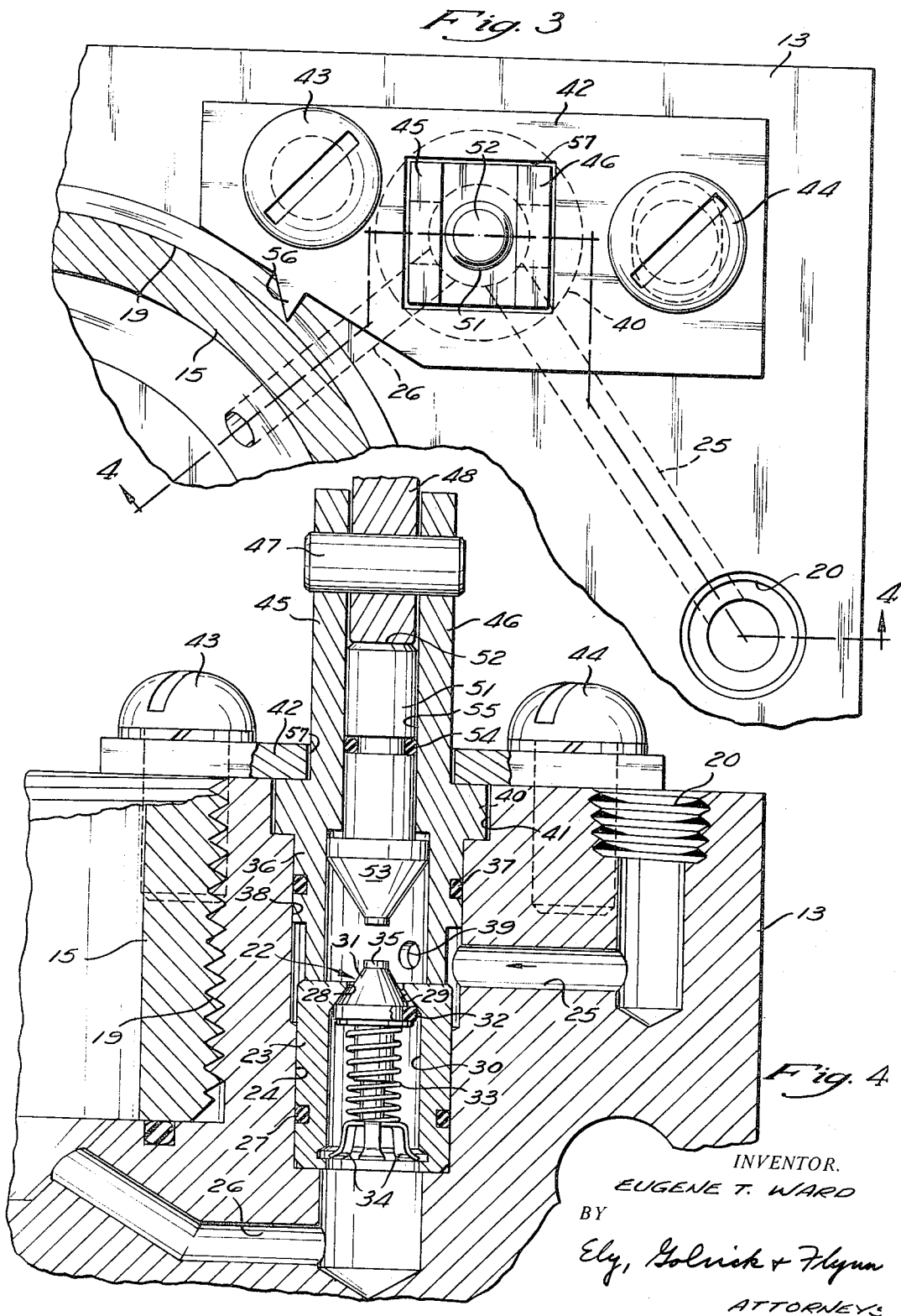
Aug. 15, 1967

Filed July 27, 1965

E. T. WARD
HYDRAULICALLY-OPERATED SHORING APPARATUS
WITH PRESSURE SAFETY LOCK

3,335,573

2 Sheets-Sheet 2



1

3,335,573

HYDRAULICALLY-OPERATED SHORING APPARATUS WITH PRESSURE SAFETY LOCK

Eugene T. Ward, Highland Heights, Ohio, assignor to Allied Steel & Tractor Products, Inc., a corporation of Ohio

Filed July 27, 1965, Ser. No. 475,143
4 Claims. (Cl. 61—41)

ABSTRACT OF THE DISCLOSURE

Collapsible shoring in which shoring rails are forced against opposite trench walls by a hydraulic jack cylinder expanded by a disconnectable pressure line to a cylinder base; an external fitting on the base maintains cylinder pressure when the line is disconnected. An internal fail-safe check valve in series with the fitting maintains cylinder pressure if the fitting is damaged during use but is operable by means (preferably a lever normally protected by a cylinder wall from accidental operation) to open the check valve when pressure relief is required to collapse the shoring.

This invention relates to hydraulically-operated apparatus for shoring the sides of trenches dug in unstable soils, such as sandy soils.

Heretofore, various hydraulic jack parallelogram arrangements have been used for shoring the sides of such trenches. In one such arrangement, a pair of horizontally disposed, vertically spaced, hydraulic cylinder-and-piston units are connected pivotally at their opposite ends to plate-like shoring rails which extend upright against the opposite sides of the trench. In another type, a pair of horizontally disposed, horizontally spaced, hydraulic cylinder-and-piston units are connected pivotally at their opposite ends to horizontal shoring rails which abut against conventional shoring timbers or planks at the opposite sides of the trench. In both types of such apparatus, the cylinder-and-piston units are cross braces extending across the trench. After the parallelogram is inserted in the trench, hydraulic liquid is pumped into the cylinders to force the respective pistons to extend positions until the shoring rails are jacked apart to the desired extent.

In certain types of such shoring apparatus the respective cylinder-and-piston cross braces are connected at their opposite ends to hinge blocks, which are pivotally connected to the respective shoring rails. One hinge block, at the cylinder end of a cross brace, has an inlet fitting for connection to an inlet hose which passes hydraulic liquid under pressure from the pump. This inlet fitting, of known design, includes a check valve which is held open while the inlet hose is connected, permitting hydraulic liquid to flow from the pump into that hinge block and from there to the cylinder. When the inlet hose is disconnected, this check valve in the inlet fitting closes to prevent hydraulic liquid from flowing out of the cylinder.

While the shoring apparatus is in shoring position in the trench, with its cylinders under hydraulic pressure, the inlet fitting may be broken off of the hinge block if it is struck by a digging tool or the like. In that event, there is nothing to prevent hydraulic liquid from spilling out of the cylinder, so that the shoring apparatus would no longer shore up the sides of the trench. The present invention is directed to a novel safety lock for preventing this.

Accordingly, it is a principal object of this invention to provide a novel safety lock for a hydraulically-operated

2

shoring apparatus to prevent the accidental loss of hydraulic pressure in the latter.

Further objects and advantages of this invention will be apparent from the following detailed description of a presently-preferred embodiment thereof, which is illustrated in the accompanying drawings.

In the drawings:

FIGURE 1 is a perspective view showing a hydraulic jack parallelogram shoring apparatus on which the present safety lock is provided;

FIGURE 2 is an enlarged fragmentary perspective view showing the present safety lock on the hinge block at the cylinder end of one of the cylinder-and-piston cross braces in the FIG. 1 apparatus;

FIGURE 3 is an enlarged view, partly in elevation and partly in section, showing part of this hinge block and the present safety lock thereon, with the operating lever removed; and

FIGURE 4 is a section taken along the line 4—4 in FIG. 3, with the operating lever added.

Referring to FIG. 1, the shoring apparatus shown therein comprises a pair of horizontal shoring rails 10 and 11 for engagement respectively with conventional shoring planks or timbers 12 at the opposite sides of the trench. Shoring rail 10 pivotally supports a pair of hinge blocks 13 and 14, as does the opposite shoring rail 11. The hinge blocks 13 and 14 on shoring rail 10 are rigidly connected threadedly to respective cylinders 15 and 16. These cylinders slidably receive respective pistons (not shown) carrying piston rods 17 and 18 for connection to the respective hinge blocks (not shown) pivoted on the opposite shoring rail 11. Each cylinder-and-piston unit is a hydraulic cross brace. These two hydraulic cross braces and the shoring rails 10, 11, to which they are pivotally connected by the hinge blocks, together make up a hydraulic jack parallelogram.

Referring to FIG. 4, the hinge block 13 has a screw-threaded opening 19, which threadedly receives one end of cylinder 15, and an internal passageway communicating with this opening for passing hydraulic liquid into and out of cylinder 15.

Hinge block 13 has a screw-threaded inlet opening 20. An inlet fitting 21 (FIG. 2) of known design is mounted in this opening. This inlet fitting has a check valve which is arranged to be held open as long as a hose (not shown) is attached to it, which takes place while the parallelogram is being jacked into place against the shoring planks. Afterwards, when the inlet hose is detached, this check valve stays closed so as to prevent the escape of hydraulic liquid from cylinder 15.

In accordance with the present invention, a second check valve 22 (FIG. 4) is provided between the cylinder 15 and the inlet fitting 21. This additional check valve 22 comprises a sleeve-like body 23 seated in a recess 24 in the hinge block 13 between a passage 25 connected to the inlet opening 20 and a passage 26 leading into the cylinder 15. An O-ring seal 27 is provided between the valve body 23 and the wall of this hinge block recess 24. This valve body has an opening 28 at its upper end in FIG. 4, a frusto-conical valve seat 29 just beyond this opening, and a longitudinal passage 30 between valve seat 29 and the hinge block passage 26 leading to cylinder 15.

Check valve 22 also includes reciprocable valve member 31 inside valve body 23 and carrying a rubber ring 32 for sealing engagement with valve seat 29. A coil spring 33 is engaged under compression between valve member 31 and a stamping 34 carried by the valve body 23. Normally, this spring biases valve member 31 to a closed position, in which the rubber ring 32 sealingly engages the valve seat 29 to prevent fluid flow between opening 28 and passage 30, as shown in FIG. 4. In this

position, the front end nose 35 of valve member 31 projects beyond the valve body 23.

An annular body 36 is seated in the hinge block 13 with its inner end abutting against the front end of valve body 23, surrounding the latter's opening 28. This body 36 carries an O-ring 37 which sealingly engages the wall of a bore 38 in the hinge block. The inlet passage 25 in the hinge block intersects this bore, and the inner end of body 36 has openings 39 for passing liquid between passage 25 and the opening 28 in valve body 23.

Body 36 has an annular flange 40 which is received in a counterbore 41 in the front of hinge block 13. A clamping plate 42, which is held against the front face of hinge block 13 by a pair of screws 43, 44, engages the outer end face of this body flange 40. Body 36 presents a pair of opposite ears 45, 46 (FIG. 2), which extend through a rectangular opening 57 in plate 42 to the front of hinge block 13. These ears support a pivot pin 47 for an operating lever 48. This lever is adapted to extend away from the front of hinge block 13, presenting a transverse handle 49 adapted to rest on top of cylinder 15, as shown in FIGS. 1 and 2. As shown in FIG. 2, the clearance between ears 45, 46 and the opening 57 in plate 42 is sufficiently close to prevent any substantial rotation of body 36 on its own longitudinal axis. This insures that the pivot pin 47 for lever 48 will be horizontal, as shown in FIG. 2.

At its opposite, pivoted end the lever 48 has a cam 50. This cam has a minimum radius along the longitudinal axis of lever 48 (i.e., directly toward the hinge block 13 in FIG. 2) and a progressively increasing radius in a counterclockwise direction in FIG. 2 upward from the longitudinal axis of lever 48.

A plunger 51 (FIG. 4) is slidable in the body 36. The outer end face 52 of this plunger engages the cam 50 on lever 48. At its inner end this plunger presents an enlarged head 53 for engagement with the front end nose 35 of valve member 31. Plunger 51 carries an O-ring 54 which sealingly engages the wall of the bore 55 in body 36.

Plate 42 has a projecting tooth 56 (FIG. 3) for engagement in a complementary recess in cylinder 15 to lock the latter in hinge block 13.

When the lever 48 extends substantially horizontal, with its handle 49 overlying the cylinder 15, as shown in FIGS. 1 and 2, the minimum radius part of the cam 50 is engaging the plunger 51. Under this condition, spring 33 will maintain check valve 22 closed, as shown in FIG. 4.

However, when the user pivots the lever 48 to a vertical upstanding position (indicated in phantom in FIG. 2), this will move the progressively larger radius surface of cam 50 over the plunger 51 to force the plunger inwardly so as to unseat valve member 31 in check valve 22.

While the cylinder 15 is being filled from the pump, the lever 48 may be in its horizontal position. The pressure of the hydraulic liquid delivered by the pump will open the check valve 22 and also will force the plunger 51 outward to the position shown in FIG. 4. When the pump is stopped, check valve 22 will close under the urging of its spring 33. It will remain closed to prevent backflow from the cylinder 15 even if the inlet fitting 21 is broken off, in which event the check valve in the inlet fitting would no longer be effective to prevent such backflow. Check valve 22 is completely disposed within the hinge block 13 so that any blow which might disable the check valve in the inlet fitting 21 normally will not also disable check valve 22.

When the user wishes to empty the cylinder, in addition to opening the check valve in fitting 21 by connecting a hose to it, he will turn the lever 48 to its upright position, causing cam 50 to force plunger 51 inwardly to unseat the valve member 31 in check valve 22.

In the particular shoring apparatus shown in FIG. 1, the hinge block 14 at the cylinder end of the other cross

brace is identical in all respects, including the safety control, to the arrangement just described. With such apparatus two separate hose connections are provided, one for each cross brace. However, it is to be understood that the present invention also may be embodied in shorting apparatus in which the two cylinder-end hinge blocks are interconnected by a hose and only one of them has an inlet fitting, so that the two cylinders may be pressurized or emptied simultaneously through a single hose connected to this inlet fitting.

Accordingly, it is to be understood that, while a presently-preferred embodiment of this invention has been described in detail herein with reference to the accompanying drawings, the invention is susceptible to other embodiments differing structurally from the particular embodiment shown.

I claim:

1. In a hydraulic jack parallelogram for shoring the opposite sides of a trench or the like and comprising a pair of opposite shoring rails; a pair of cylinder-and-piston cross braces, each including a cylinder and a piston slidable therein; means coupling each piston pivotally to one of said shoring rails; and a pair of hinge blocks pivotally connecting the respective cylinders to the opposite shoring rail, at least one of said hinge blocks having an inlet fitting for connection to a hose and a passageway between said inlet fitting and the respective cylinder, said inlet fitting having provision for preventing the escape of hydraulic liquid from said cylinder when the hose is detached; the improvement which comprises:

a normally-closed check valve in said passageway to prevent the escape of liquid from the respective cylinder if said inlet fitting is disabled, and means for selectively holding said check valve open to permit the withdrawal of hydraulic liquid from said cylinder.

2. In a hydraulic jack parallelogram for shoring the opposite sides of a trench or the like and comprising a pair of opposite shoring rails; a pair of cylinder-and-piston cross braces, each including a cylinder and a piston slidable therein; means coupling each piston pivotally to one of said shoring rails; and a pair of hinge blocks pivotally connecting the respective cylinders to the opposite shoring rail, at least one of said hinge blocks having an inlet fitting for connection to a hose and a passageway between said inlet fitting and the respective cylinder, said inlet fitting having normally-closed valve means for preventing the escape of hydraulic liquid from said cylinder when the hose is detached; the improvement which comprises:

a normally-closed check valve in said passageway to prevent the escape of liquid from the respective cylinder if said inlet fitting is disabled, an operating lever pivotally supported from said one hinge block, and means acting between said lever and said check valve for opening said check valve in response to a predetermined movement of said lever.

3. In a hydraulic jack parallelogram for shoring the opposite sides of a trench or the like and comprising a pair of opposite shoring rails; a pair of cylinder-and-piston cross braces, each including a cylinder and a piston slidable therein; means coupling each piston pivotally to one of said shoring rails; and a pair of hinge blocks pivotally connecting the respective cylinders to the opposite shoring rail, at least one of said hinge blocks having an inlet fitting for connection to a hose and a passageway between said inlet fitting and the respective cylinder, said inlet fitting having normally-closed valve means for preventing the escape of hydraulic liquid from said cylinder when the hose is detached; the improvement which comprises:

a normally-closed check valve in said passageway to prevent the escape of liquid from the respective cylinder if said inlet fitting is disabled, said check valve being completely disposed within said one

5

hinge block, an operating lever pivotally supported from said one hinge block and extending therefrom along the cylinder and having a handle resting on the cylinder, said lever having a cam at its pivoted end, and a plunger slidably disposed in the hinge block 5 between the cam on the lever and said check valve, said plunger being engageable by the cam to move inward to open said check valve in response to pivotal movement of the lever toward an upright position.

4. In a hydraulic jack parallelogram for shoring the opposite sides of a trench or the like and comprising a pair of opposite shoring rails; a pair of cylinder-and-piston cross braces, each including a cylinder and a piston 10 slidable therein; means connecting each piston pivotally to one of said shoring rails; and a pair of hinge blocks pivotally connecting the respective cylinders to the opposite shoring rail, at least one of said hinge blocks having an inlet fitting for connection to a hose and a passageway between said inlet fitting and the respective 15 cylinder, said inlet fitting having normally-closed valve means for preventing the escape of hydraulic liquid from said cylinder when the hose is detached; the improvement which comprises:

a normally-closed check valve in said passageway to 20

6

prevent the escape of liquid from the respective cylinder if said inlet fitting is disabled, said check valve being completely disposed within said one hinge block, a hollow body seated in said one hinge block in front of said check valve and presenting spaced ears at the front of said one hinge block, a pivot pin supported by said ears, an operating lever on said pin extending therefrom along the respective cylinder and having a handle resting on the cylinder, said lever having a cam at its pivoted end, and a plunger slidably disposed in said body between said cam on the lever and said check valve, said plunger being engageable by said cam to move inward along said body to open the check valve in response to pivotal movement of the lever toward an upright position.

References Cited

UNITED STATES PATENTS

3,295,330 1/1967 Meshorer ----- 61—41.1

DAVID J. WILLIAMOWSKY, *Primary Examiner*.

JACOB SHAPIRO, *Examiner*.