June 14, 1966 A. G. LONDON 3,255,587

HYDRAULIC JACK WITH BACK PRESSURE SAFETY CHECK

Filed June 27, 1962

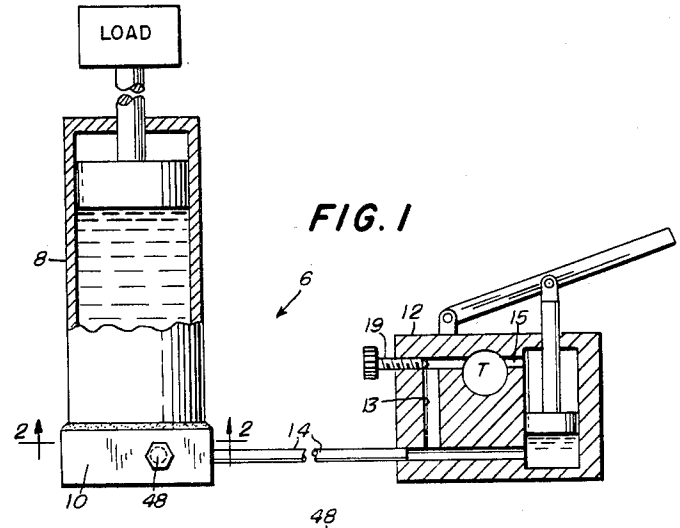


FIG. 1

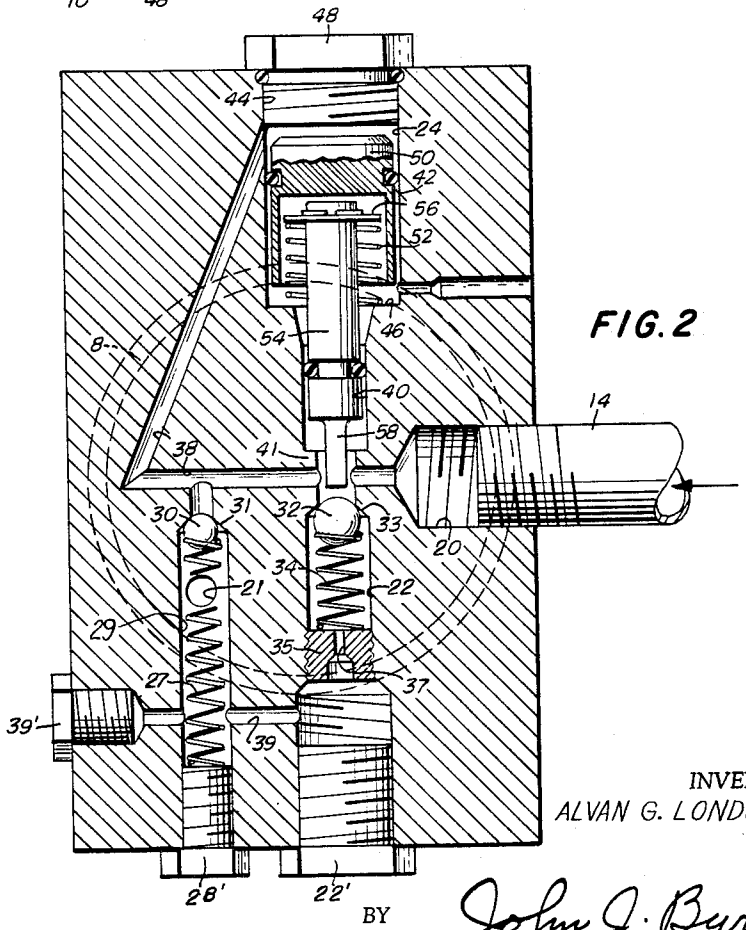


FIG. 2

INVENTOR
ALVAN G. LONDON

BY John J. Byrne
ATTORNEY

United States Patent Office 3,255,587 Patented June 14, 1966

3,255,587

HYDRAULIC JACK WITH BACK PRESSURE SAFETY CHECK

Alvan G. London, Wauwatosa, Wis., assignor to Applied Power Industries, Inc., Milwaukee, Wis., a corporation of Wisconsin

Filed June 27, 1962, Ser. No. 205,575
3 Claims. (Cl. 60—52)

This invention relates to a safety improvement in hydraulic systems for moving a reactive or live load, and relates specifically to an improvement for preventing the fall of a raised load in the event there is a pressure loss in the fluid transmission system. The prior art has taught safety mechanisms which include pilot lines for the sensing and sending of pressure loss intelligence to a safety mechanism. However, due to their costly nature, and due to the fact that, if the pilot lines were plugged or restricted along their lengths, performance became erratic or inoperative, and such safety devices did not fill the requirement of the art. Therefore, a principal objective of the present invention is to provide an inexpensive, reliable safety device to prevent personal injury and property damage from such mechanisms.

More particularly, the invention provides safety checks built into the pressure cylinder itself, which eliminate pilot lines and provides apparatus for using a back pressure princple for activating the safety mechanism.

A further objective of the invention is to provide a system which relies on only one conduit between the pumping station and the load lifting jack, and further provides a relatively free flow of fluid from the station to the jack, but includes a controlled, restricted flow from the jack to the pumping station.

A further objective of the invention is to provide a reliable safety device having steps of operation which are easily understood by users having very little skill or training in the operation of such apparatus.

Another important objective of this invention is to provide a safety check device which positively locks a load into position under pressure loss conditions.

Another objective of the invention is to provide a safety lock assembly which readily adapts itself to accept replacement members which can limit the speed of retraction of the operating cylinder.

A still further objective of the invention is to provide an assembly which relies on pressure sensing intelligence rather than fluid flow.

These and other objectives and advantages of the invention will be more fully understood upon a reading of the following specifications taken in view of the attached drawings wherein:

FIGURE 1 is a schematic-diagrammatic view of a cylinder-safety check-hand pump combination; and

FIGURE 2 is a sectional view of the back pressure safety assembly.

Referring now to the drawings more in detail, wherein like numerals indicate like elements, a load lifting hydraulic system is indicated by the numeral **6**. The system is basically comprised of a load lifting cylinder or jack **8**, a back pressure operated safety check housing **10**, and a hand pump or the like **12**. In the embodiment described, the housing **10** forms the bottom of jack **8**.

In the present invention, a single fluid conduit **14** of a selected length communicates the pump assembly **12** to the interior of the housing. Within the interior of the pumping station, a first branch line or passageway **13** connects conduit **14** to tank. Along the length of branch line **13**, there is a pressure release valve (diagrammatically shown) **19** which may be of a standard needle type construction. A second branch or passageway **15** connects

the fluid reservoir or tank (as indicated by the letter T) to the intake of the pumping cylinder **18**.

The interior of the safety housing **10** is disclosed in FIGURE 2. The housing is formed with a plurality of access channels including an inlet bore **20** which receives the conduit **14**, and an outlet bore **21** leading directly to the pressure end of the lifting jack. The housing is also formed with two check ball receiving bores **22** and **29**, and a piston bore **24**.

Within bore **22** there is a check ball **32** biased toward its seat **33** by a compression spring **34**. The spring is positioned by a threaded plug **35** having an orifice **37** therethrough. Within bore **29** there is a check ball **30** biased toward its seat **31** via a compression spring **27**. A suitable plug member **28'** is threadably received within the outer end of bore **29** and provides a base upon which the spring may rest. A cross bore **39** communicates the lower ends of bores **22** and **29**. A threaded plug member **22'** is provided to seal bore **22** and a threaded plug **39'** is provided to seal bore **39**.

Passageway **20** is placed in communication with the upper end of bore **24** and the inlet sides of bores **29** and **22** by a pressure sensing passageway **38**.

The bore **24** is comprised of a stem receiving section **40**, a counter bore **42**, and an outer threaded section **44**. A shoulder **46** is formed between section **40** and counter bore **42**, and section **40** is terminated about its lower end by an annular flange **41**. The upper end of bore **24** is sealed by a conventional cap screw and seal assembly **48**. A floating inverted U-shaped piston **50** is slidably received in counter bore **42**. Its upper limit of movement is terminated by cap **48** and its lower limit is terminated by shoulder **46**. Receivable within the inverted, piston is a valve stem **54** having an annular, outwardly, extending flange **56** about its upper surface and an extension **58** of reduced cross-section at its lower end. It will be noted that compression spring **52** is secured between the lower surface of flange **56** and shoulder **46**. Springs **52** and **34**, therefore, are effective in biasing the stem **58** and piston **50** normally upwardly. Flange **56** is not essential and it should be understood that spring **52** would perform the same function of biasing piston **50** upwardly if it were received between shoulder **46** and the bottom of the counterbore.

The bore **24** is coaxial with bore **22** which permits the extension **58** to remove ball **32** from its seat when in its lower position (as seen in FIG. 2). It will be noted that extension **58** penetrates passageway **38** but is so dimensioned that it does not seriously interfere with fluid flow therethrough.

In operation, pump **12** develops a pressure in fluid line **14** which transmits a pressure into the interior of the housing **10** via aperture **20**. As pressure increases, check balls **30** and **32** are forced from their respective seats permitting relatively free fluid flow through passageway **21** into the pressure side of lift cylinder **8**. Concurrent with the increasing pressure, passageway **38** permits pressure to reflect itself on the upper surface of the floating piston, causing the stem **54** and stem extension **58** to engage ball **32** and positively hold it from its seat **33**.

When the load is lifted to a desired level, an operator completely opens valve **19** such that line **14** is dumped to tank. As pressure in line **14** falls, the floating stem is biased upwardly by springs **34** and **52** as their strength overcomes the fluid pressure on the upper surface of piston **50**. The check balls **30** and **32** are then seated and any displacement of fluid from the lift cylinder is prevented. At this point the lift cylinder is positively locked at its selected level. When it is desired to lower the load, the valve **19** is closed to interrupt the communication between line **14** and tank, and the operator gives one or

two strokes to his pump to develop a pressure in passageway **38** sufficient to overcome the bias of the compression spring **52**. Such a pressure causes the stem extension **58** to remove ball **32** from its seat. The valve **19** is then partially opened thus permitting fluid to drain from the lift cylinder via the passageway **21**, orifice **37**, through inlet **20**, line **14**, and thence to tank. When valve **19** is only partially opened, the pressure within the system remains sufficiently high to maintain the stem extension **58** in position for unseating ball **32**. In other words the pressure in lines **20** and **38** is maintained sufficiently high due to the restricted flow caused by valve **19** to maintain ball **32** away from its seat **33**.

It can be seen that any loss of pressure remote from housing **10** will be reflected in passageway **38**, causing the load to be positively locked at its existing height. Only through the application of additional pressure in passageway **38** can fluid be drained from cylinder **8**. It should be noted that the fluid leaving the rod end of the cylinder must all pass through the orifice **37**. In the event it is desired to drain the cylinder at different rates, it is an easy matter to substitute a plug having either a greater or lesser orifice diameter. Due to the fact that bore **21** is immediately adjacent the cylinder, it is extremely unlikely that a faulty condition would develop therein. This is true even though some environments may call for the housing to be displaced slightly from the cylinder and the connection accomplished by a short steel conduit or a suitable fitting.

In a general manner, while there has been disclosed an effective and efficient embodiment of the invention, it should be well understood that the invention is not limited to such an embodiment, as there might be changes made in the arrangement, disposition, and form of the parts without departing from the principle of the present invention as comprehended within the scope of the accompanying claims.

I claim:

1. A safety circuit for a hydraulic system comprising in combination, a hydraulic pump having an inlet in fluid communication with a reservoir and an outlet, a first fluid connection between said outlet and said reservoir, and a second fluid connection between said reservoir and the intake of said pump, a release valve for opening, partially opening or closing said first fluid connection, a lift jack operable by said pump, a hydraulic back pressure safety housing forming an end wall of said jack, a conduit in fluid communication with said first fluid connection, said housing having a first bore receiving said conduit and a second bore in communication with said jack, first and second passageways between said bores, a check ball in said first passageway normally blocking fluid flow therethrough from said second bore to said first bore and permitting relatively free flow from said first bore to said second bore, a one way check valve and a restriction orifice in said second passageway, and a plunger to open said check valve when fluid is to be drained from said jack through said release valve causing all of said fluid to exhaust through said orifice.

2. A safety circuit for a hydraulic system comprising in combination, a hydraulic pump having an inlet in fluid communication with a reservoir and an outlet, a first fluid connection between said outlet and said reservoir, a release valve having a first position for opening, a second position for partially opening and a third position for closing said first fluid connection, an expansion cylinder operable by said pump, a bottom housing enclosing said cylinder, a conduit in fluid communication with said outlet, said housing having a first bore receiving said conduit and a second bore in communication with said cylinder, passageway means between said bores, first and second one-way check valves in parallel arrangement in said passageway means normally blocking flow from said second bore to said first bore and normally permitting fluid flow from said first bore to said second bore, a piston reciprocal in said housing having a first position which opens said first check valve, and a second retracted position, and means causing said piston to move to said first position when said release valve is in said second position.

3. A safety circuit for a hydraulic system comprising in combination, a hydraulic pump having an inlet in fluid communication with a reservoir and an outlet, a first fluid connection between said outlet and said reservoir, and a second fluid connection between said reservoir and said pump, a release valve for opening, partially opening or closing said first fluid connection, an expansion cylinder operable by said pump, a hydraulic back pressure safety housing enclosing one end of said cylinder, a conduit in fluid communication with said first fluid connection, said housing having a first bore receiving said conduit and a second bore in direct communication with the interior of said cylinder, passageway means communicating said bores, valve means in said passageway means having a first position normally blocking fluid flow from said second bore to said first bore and permitting relatively free fluid flow in said passageway means from said first bore to said second bore, a third bore in said housing communicating with said passageway means, a stem member slidably received in said third bore having one end movable to a retracted position and to an extended position when in said extended position said stem causing said valve means to move from said first position to a second position permitting fluid flow between said second bore and said first bore, and fourth bore means communicating the pressure in said first bore to the other end of said stem.

References Cited by the Examiner

UNITED STATES PATENTS

974,988	11/1910	Northam	60—52
2,286,880	6/1942	Traut	91—446 X
2,603,235	7/1952	Kirkham	91—443 X
2,618,929	11/1952	Bidin	60—52
2,868,174	1/1959	Shutt	91—443
2,954,800	10/1960	Searles et al.	91—446 X

JULIUS E. WEST, *Primary Examiner.*