

Sept. 17, 1946.

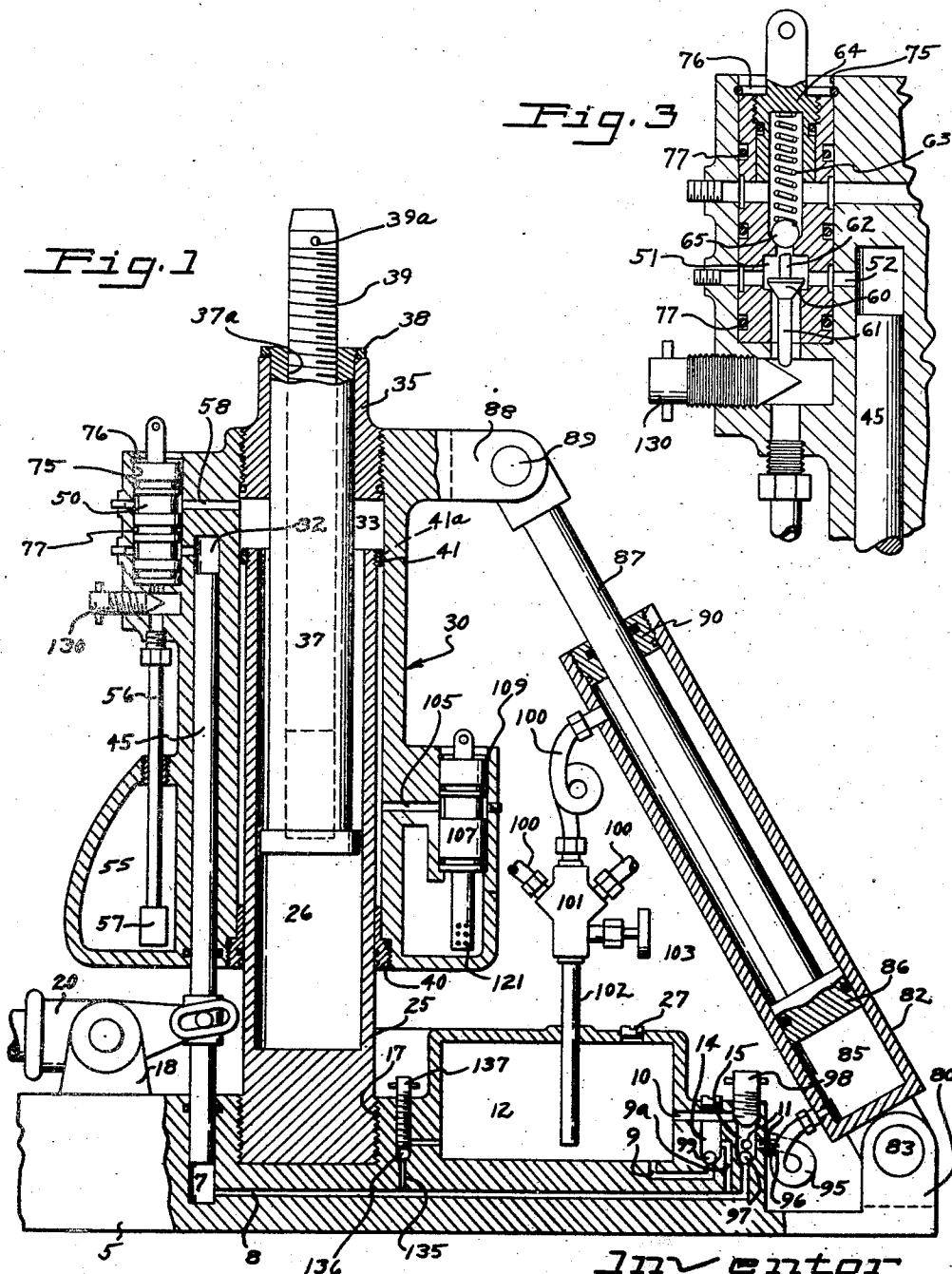
H. E. PAGE

2,407,796

TRIPOD JACK

Filed Aug. 17, 1943

2 Sheets-Sheet 1



Inventor
Herbert E. Page
By *W. H. Mott*
Atty.

Sept. 17, 1946.

H. E. PAGE

2,407,796

TRIPOD JACK

Filed Aug. 17, 1943

2 Sheets-Sheet 2

Fig. 4

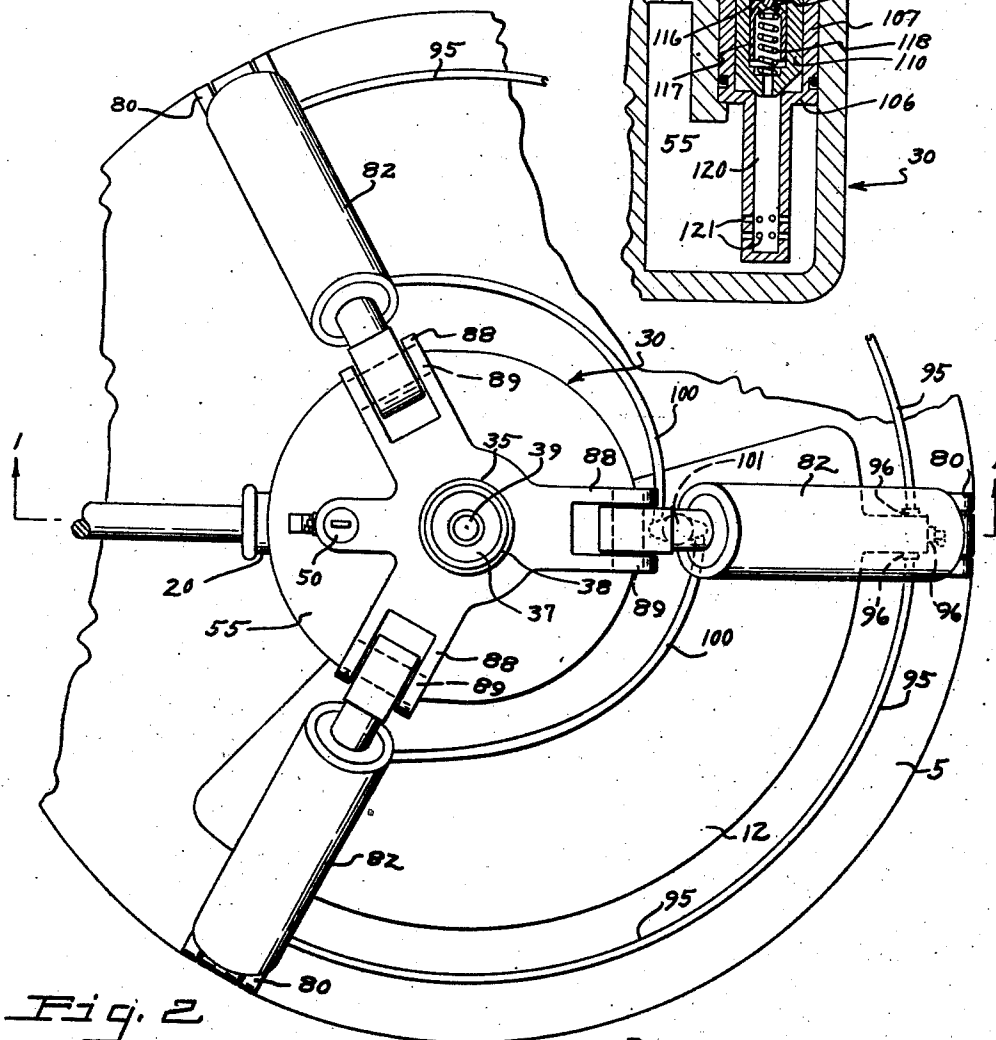
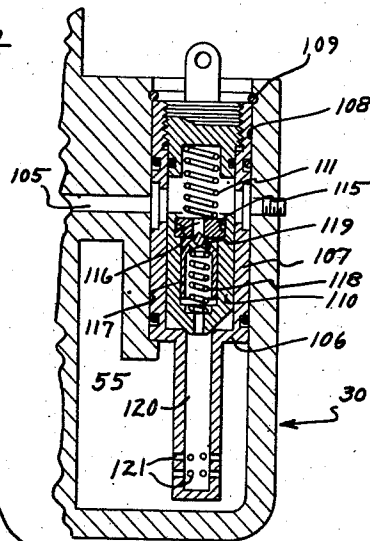


Fig. 2

Inventor
Herbert E. Page
By *Edmund*
Atty.

UNITED STATES PATENT OFFICE

2,407,796

TRIPOD JACK

Herbert E. Page, Pasadena, Calif.

Application August 17, 1943, Serial No. 498,930

13 Claims. (Cl. 60—52)

1

This invention has to do with jacks and, more particularly, it relates to hydraulically actuated tripod jacks such as are used for raising loads to substantial heights. Although such jacks have many uses, one of the chief uses is as an airplane jack.

While tripod jacks are known in the art, heretofore they have had certain inherent shortcomings such as lack of proper rigidity, limitations of height, dangerous side sway characteristics, slowness of operation, and lack of adequate safety features.

It is one of the objects of my invention to provide a hydraulically actuated tripod jack in which the tripods are telescopic and are automatically extended in consonance with elevation of the load, each of the tripods being comprised of a piston member and a cylinder member.

Another object is to provide a jack capable of effecting quick contact with the load to be lifted by a minimum of effort, this feature being by way of an improvement upon and a novel adaptation of the invention shown in my prior Patent No. 2,154,956.

Another object is to provide a jack utilizing a plurality of lifting pistons which function to decrease the pumping effort required to lift a given load and which provides desirable safety features against accidental lowering of the load.

Another object of my invention is to provide a hydraulic jack in which hydraulic locks are provided in the tripods to prevent side sway.

Another feature of my invention resides in its double acting pressure generating piston.

In the accompanying drawings I show and in the following description I describe a presently preferred adaptation of the invention from which it will be obvious to those skilled in the art that my invention possesses still further important advantages and may be carried out in other specific physical forms, all within the broader scope of the invention as defined by the appended claims.

In the drawings:

Fig. 1 is a vertical medial section taken on line 1—1 of Fig. 2;

Fig. 2 is a top plan view;

Fig. 3 is an enlarged fragmentary sectional view showing one of the valve elements; and

Fig. 4 is an enlarged fragmentary sectional view showing another of the valve elements.

The numeral 5 designates a base presenting a cylinder bore 7, fluid passageways 8, 9, 9a, 10 and 11, a fluid reservoir 12, fluid chambers 14 and 15, a threaded socket 17 and a bifurcated boss 18

2

which latter provides a fulcrum for the pumping lever 20. A tubular guide member 25 has its lower end threaded into the socket 17 and presents a cylinder 26. Threaded filling plug 27 is provided for reservoir 12.

A body 30 presents a cylinder bore 32 and a relatively larger cylinder bore 33. Within the top end of bore 33 there is a threaded sleeve 35 within which is slidably mounted a piston 37. A stop ring 38 is threaded onto the top end of piston 37 for engagement with the top end of sleeve 35 to prevent further inward movement of piston 37. The inner end of the piston 37 is reciprocally mounted in cylinder 26, which cylinder communicates with bore 33, an extension screw 39 being threaded into an internally threaded longitudinal bore 37a in piston 37. The tubular member 25 slidably fits in bore 33 of the body, a guide ring 40 being threadedly mounted in the bore. A stop ring 41 is threaded onto the top end of tube 25 and is adapted to be engaged by the top end of ring 40 when the body 30 reaches the upper limit of its movement relative to the tube, as will be hereinafter described. Ring 41 has a plurality of fluid-passing ports denoted by the dotted lines 41a in Fig. 1.

A piston 45 reciprocates at one end in cylinder 32 and at the other end in cylinder 7. The upper end of cylinder 32 communicates with the bore 51 of a valve housing 50 through port 52. The lower or inlet end of the bore 51 communicates with a fluid reservoir 55 in the body by means of tube 56 carrying a screen 57 at its lower end. Another port 58 in the body provides communication between valve housing bore 51 and cylinder 33.

A poppet 60, having oppositely disposed stems 61, 62, seats by gravity towards the reservoir in bore 51 and a ball valve 65 seats towards the reservoir in bore 51. A coil spring 63, seating against a plug 64 threadedly mounted in bore 51, bears against and normally retains ball 65 against its seat. This spring is of a strength to maintain ball 65 seated during initial upward movement of the body to establish contact with the load to be lifted, but is yieldable to pressure generated by the pressure stroke of piston 45 when further upward movement of the body is resisted by the load being lifted, thus permitting fluid to flow into cylinder 33 and provide lifting pressure therein.

The valve housing 50 is held in the body bore 75 by a snap ring 76 and packing rings 77 are interposed between the housing and the side wall of the bore.

Three bifurcated bosses 80 are provided on the base 5 and between the bifurcations of each of the bosses the lower end of a tube 82 is pivoted by means of pin 83. The interior of each tube 82 provides a piston chamber 85 within which a piston 86 reciprocates. A rod 87 connects each of the pistons 86 to an arm 88 formed integral with the upper end of the body, the upper end of the rod being pivotally connected to the arm by pin 89. Thus the tubes 82, pistons 86 and rods 87 provide tripods for the body. A plug 90 threaded into the top end of each tube 82 provides a bearing for reciprocation of the rod 87.

The lower end of each cylinder chamber 35 communicates with base chamber 15 through a flexible tube 95, the three tubes being connected into the port 11 by means of three connection members 96. Chamber 15 communicates with the cylinder bore 7 through passageway 8, the passage of fluid from chamber 15 to cylinder 7 being prevented by ball check valve 97 seating towards cylinder 7. Chamber 15 also communicates with reservoir 12 through port 10, the latter communication being controlled by valve member 98 threadedly mounted in the base. To enable fluid to be drawn from reservoir 12 into cylinder 7 upon the upstroke of piston 45, passageways 9, 9a are provided in the body in communication with chamber 14, the return movement of fluid to the reservoir being prevented by a ball valve 99 seating towards the reservoir.

The upper end 85a of the chamber 85 in each tube 82, above the piston 86 therein, communicates with the reservoir 12 through a flexible tube 100, a three-way valve 101 being interposed between the tubes 100 and 102. The valve 101 is of conventional construction and a hand wheel 103 is provided for manually opening and closing the valve so that it may be closed to trap hydraulic fluid in the chambers 85 above the pistons therein, for the purpose to be hereinafter set forth.

Cylinder 33 also communicates with reservoir 55 through a port 105 and valve member 106, which latter consists of a valve housing 107 held in a body bore 108 by a snap ring 109. A poppet 110 is slidably mounted in the bore of the housing 107, seating towards the reservoir and being urged against its seat by spring 111. A safety valve is incorporated in the poppet and consists of a plug 115 having a port 116 against whose periphery an auxiliary hollow poppet 117 is urged by a spring 118, fluid passing through ports 119 provided through poppet 117. Housing 107 has a tubular extension 120 disposed in the reservoir, the lower end of the tube 120 being closed and the side wall being perforated as shown at 121.

Operation of the device is as follows: To initially contact the top end of the screw extension 39 or sleeve 35 with the work to be lifted, lever 20 is operated to reciprocate piston 45 in cylinders 32 and 7, respectively, the upper end of the piston operating in cylinder 32 and the lower end operating in cylinder 7. Upon each downward stroke of piston 45 fluid is drawn from reservoir 55 past poppet 60 and through port 52 into the upper end of cylinder 32, and on each upward stroke of the piston in cylinder 32, prior to establishing contact with the work to be lifted, the spring-pressed valve 65 and poppet 60 trap the fluid in cylinder 32, causing the body to be lifted into contact with the work by virtue of the fluid pressure between the top end of piston 45 and the adjacent end of cylinder 32. Valve spring 63 is made strong enough to hold valve 65

seated until a substantial resistance, such as is offered by contact with the load to be lifted, is encountered. During this initial movement of the body, fluid is drawn from reservoir 55 past poppet 110 and through port 105 into cylinder 33, any unsafe back pressure on poppet 110 being relieved by the auxiliary, oppositely seating poppet 117. When the load is contacted, its resistance to further movement of the body 30 causes valve 65 to be unseated against its spring by the pressure generated on the upstroke of piston 45 and the fluid is therefore forced into cylinder 33 through port 58 to lift the body relative to the base. During this operation, each upward stroke of piston 45 in cylinder 7 draws fluid from reservoir 12 through ports 9, 9a, into cylinder 7, and on each downward stroke of piston 45 in said cylinder the fluid thus previously drawn from the reservoir is forced past valve 97 into the lower ends of the respective cylinder chambers 85 to exert lifting pressure against the respective pistons 86. The extension screw 39 may be manually rotated, as by inserting a rotating pin in hole 39a, to unscrew it from the threaded bore 37a. Inasmuch as upon each downward movement of pistons 86 in chambers 85 fluid is drawn from the reservoir 12 through tube 100, there is always some fluid in the upper ends of the chambers 85 and by closing valve 101 this fluid may be trapped in the chambers and, together with the fluid pressure against the bottom of pistons 86, side sway of the jack is prevented. The operation of piston 45 in the respective cylinders 32, 7 being alternate, when the body is being lifted by pressure in cylinders 32 or 33, fluid will be drawn into cylinder 7 from reservoir 12 and when the body is being lifted by operation of piston 45 in cylinder 7, fluid will be drawn into cylinders 32 and 33 from reservoir 55.

It is possible to provide a hydraulic lock in cylinder 35 even before the load is fully elevated, and to facilitate this I provide an auxiliary inlet passageway 135 from passage 8 to reservoir 12, passage of fluid from the reservoir to cylinder 7 through this passageway being prevented by check valve 136 seating towards cylinder 7. Thus if it be desired to lock pistons 86 against movement during the lifting operation—as may sometimes be necessary when a load exposed to heavy wind pressure is being lifted and such lock is necessary to prevent side sway—valves 101 and 98 are closed. Thereafter the pressure stroke of piston 45 in cylinder 32 will lift the load by projecting piston 37 from the body 30, as is the case when body 30 reaches the upper limit of its travel, and the pressure stroke of piston 45 in cylinder 7 merely returns fluid to reservoir 12 through passageway 135. When piston 45 is being operated in cylinder 7 to raise pistons 86, the check valve 136 is held closed by the screw plug 137. Also, if it be desired to raise the load by lifting body 30 or piston 37 alone and without providing a hydraulic lock in cylinders 85, this can be accomplished by unscrewing plug 137 to permit valve 136 to be raised.

In lifting extremely heavy loads it may sometimes require too much manual pumping pressure to lift body 30 or piston 37 by pressure generated in cylinder 32, and in such cases it is desirable to utilize only the pressure generated in cylinder 7 to raise the three pistons 86. To accomplish this it is only necessary to screw valve 130 inwardly to open valves 60, 65 which renders cylinder 33 ineffective.

To lower the load, valve 101 is opened and the

5

valve screw 98 is unscrewed to permit the fluid trapped below the pistons in the respective cylinders 85 to flow back into the reservoir 12 and thus relieve the pressure in those cylinders. Either simultaneously or subsequently, the valve-actuating screw 130 is screwed into the valve housing 50 until its tapered inner end contacts stem 61 and lifts poppet 60 off its seat, which force relieves the pressure in cylinder 32 and further operation of the screw 130 causes stem 62, which is normally spaced from ball 65, to contact and lift said ball off its seat to relieve the pressure in cylinder 33. Either one of the screws 98 or 130 may be employed to control the rate of descent by controlling the rate of return flow of the hydraulic fluid to the reservoir.

The advantages of my jack will be readily understood when it is realized that such devices are employed to lift loads to substantial heights, often of the order of eight feet or more, and when the load surface is exposed to the wind a considerable side sway would develop but for my novel construction wherein the tripod pistons 86 may be locked against reciprocation in the tubes 82. Moreover, the multiple cylinders in the pistons materially reduce the manual effort required to lift a given load and also distribute the stresses. The double acting piston 45 also saves considerable time. The automatic quick contact feature of my device is also a great advantage as a time and labor saver.

I claim:

1. In a jack, the combination of a base, a telescopic work-engaging member mounted for telescopic movement perpendicular to the base, pressure-actuating means for extending the work-engaging member, and means for laterally supporting the work-engaging member comprising a plurality of telescopic support members, each including a cylinder and a piston, disposed symmetrically around and inclining towards the work-engaging member, each of said telescopic support members being secured at its opposite ends to the base and work-engaging member, and hydraulic pressure-generating means communicating with the cylinders of the support members.

2. In a jack, the combination of a base, a body movable relative to the base, a telescopic tripod supporting the body from the base, each leg of the tripod comprising a tubular member providing a piston chamber therein and a piston member reciprocably mounted in the chamber, one of said members being secured to the base and the other member being secured to the body, hydraulic means cooperating with the chamber of each leg at opposite sides of the piston therein whereby to provide fluid pressure on opposite sides of the piston, and fluid pressure generating means independent of said hydraulic means cooperating with the body and base to raise the body relative to the base.

3. In a jack, the combination of a base, a body movable relative to the base, a telescopic tripod supporting the body from the base, each leg of the tripod comprising a tubular member providing a piston chamber therein and a piston member reciprocably mounted in the chamber, one of said members being secured to the base and the other member being secured to the body, a fluid reservoir, a fluid pump communicating with the reservoir and with each piston chamber below the piston therein whereby to generate fluid pressure acting against the piston, a line providing communication between the reservoir

6

and each piston chamber above the piston therein, valve means operable to open and close said line, and hydraulic means for moving the body relative to the base.

4. In a jack, the combination of a base, a body movable relative to the base, cooperating piston and piston chamber means provided in the base and body, a telescopic tripod supporting the body from the base, each leg of the tripod comprising a tubular member providing a cylinder and a piston member reciprocably mounted therein, one of said members being pivotally connected to the base and the other being pivotally connected to the body, said body and base presenting respectively oppositely opening concentric cylinder bores, a pumping piston reciprocably mounted at one end in one of the cylinder bores and at its other end in the other cylinder bore, means providing communication between one of said cylinder bores and said piston chamber and means providing communication between the other cylinder bore and the cylinder in each of the respective legs, whereby reciprocation of said pumping piston alternately generates pressure in the piston chamber and in the cylinders in the legs, respectively.

5. In a jack, the combination of a base, a body movable relative to the base, cooperating piston and piston chamber means provided by the base and body, a telescopic tripod supporting the body from the base, each leg of the tripod comprising a tubular member providing a cylinder and a piston member reciprocably mounted therein, one of said members being pivotally connected to the base and the other being pivotally connected to the body, said body and base presenting respectively oppositely opening concentric cylinder bores, a pumping piston reciprocably mounted at one end in one of the cylinder bores and at its other end in the other cylinder bore, means providing communication between one of said cylinder bores and said piston chamber and means providing communication between the other cylinder bore and the cylinder in each of the respective legs, whereby reciprocation of said pumping piston alternately generates pressure in the piston chamber and in the cylinders in the legs, respectively, and means for providing fluid pressure in the cylinders of the respective tubular members in a manner to oppose movement of the pistons therein by virtue of pressure generated by the pumping piston.

6. In a jack, the combination of a base presenting an upright tubular guide member, a body presenting a cylinder slidably receiving the guide member, a work-lifting piston slidably mounted in the body and reciprocably disposed in the tubular guide member, a cylinder bore in the body substantially parallel to the said cylinder, a fluid reservoir in the body, a fluid passageway in the body providing communication between the reservoir and cylinder bore, a check valve in the passageway seating towards the reservoir, a pumping piston reciprocably mounted in the cylinder bore, a second fluid passageway in the body providing communication between the cylinder bore and the first-mentioned cylinder, a check valve in the second fluid passageway seating towards the said cylinder bore, spring means normally maintaining the last-named check valve seated and being of a strength sufficient to oppose pressure generated by the pumping piston when the work-lifting piston is out of contact with the work to be lifted but yieldable to said pressure when the work-lifting piston is bur-

7

dened with the load to be lifted, and a telescopic tripod pivotally secured at one end to the body and pivotally secured at its other end to the base.

7. In a jack, the combination of a base presenting a fluid reservoir, a first cylinder bore and a second cylinder bore, a body movable relative to the base and presenting a chamber concentric with the first cylinder bore in the base and a fluid reservoir, a work-lifting piston slidably carried by the body and reciprocally disposed in the second cylinder bore in the base, a pumping piston reciprocally mounted at one end in said first cylinder bore in the base and at its other end in said chamber in the body, a tripod having legs each consisting of a tubular member providing a piston chamber and pivotally secured to the base and a piston reciprocally mounted therein and secured to the body, intercommunicating passageways in the base providing communication between the reservoir, the piston chambers in the tripod legs and the first cylinder bore, a check valve in one of said passageways preventing passage of fluid from the piston chambers in the tripod legs to the first cylinder bore but permitting passage of fluid from the first cylinder bore to the said piston chambers, a second check valve in one of the passageways permitting passage of fluid from the reservoir to the first cylinder bore but preventing passage of fluid from the first cylinder bore to the reservoir, a manually operable valve controlling passage of fluid from said piston chambers to the reservoir, a fluid passageway in the body providing communication between the body reservoir and the body chamber, a check valve in said last-named passageway seating towards the body reservoir, a second fluid passageway in the body providing communication between the body chamber and the second cylinder bore in the base, a check valve in the last-named passageway seating towards the body chamber, a spring urging the last-named check valve seated, said spring being yieldable to pressure generated by the pumping piston only when the work-lifting piston is burdened by a load being lifted, and manually actuated means for unseating the last-named two check valves.

8. In a jack, the combination of a base, a work-lifting element movable towards and away from the base, a longitudinally extensible tripod secured at one end to the base and at its other end to the work-lifting element, said work-lifting element presenting a pair of substantially parallel cylinders, a pumping piston reciprocally mounted in the first of the cylinders, a work-engaging piston protractable from and reciprocally mounted in the second cylinder, a fluid reservoir, fluid passageways establishing communication between the reservoir and the first cylinder and between the first and second cylinders, and valve means in the passageway between the first and second cylinders maintaining said passageway closed when movement of the work-lifting element is not opposed by work being lifted, said pumping piston being operable when moved in one direction, in conjunction with the last-named valve means and fluid from the reservoir, to extend the tripod and move the work-lifting element into engagement with the work independently of pressure in the second cylinder, and hydraulic means for locking the tripod in such extended position.

9. In a jack, the combination of a base, a work-lifting element movable towards and away from the base, a longitudinally extensible tripod

8

secured at one end to the base and at its other end to the work-lifting element, said work-lifting element presenting a pair of parallel cylinders, a pumping piston reciprocally mounted in the first of the cylinders, a work-engaging piston protractable from and reciprocally mounted in the second cylinder, a fluid reservoir, fluid passageways establishing communication between the reservoir and the first cylinder and between the first and second cylinders, and valve means in the passageway between the first and second cylinders maintaining said passageway closed when movement of the work-lifting element is not opposed by work being lifted, said pumping piston being operable when moved in one direction, in conjunction with the last-named valve means and fluid from the reservoir, to extend the tripod and move the work-lifting element into engagement with the work independently of pressure in the second cylinder, and hydraulic means operable to exert extending pressure on the tripod in response to movement of the pumping piston in the other direction.

10. In a jack, the combination of a base, a body, an extensible tripod supporting the body from the base, each leg of the tripod comprising a tubular member providing a piston chamber therein and a piston member reciprocally mounted in the chamber, one of said members being secured to the base and the other being secured to the body, a piston member carried by and projectible from the body, fluid pressure generating means for moving the piston members, and valve means for selectively communicating the fluid pressure to the said tripod piston members or to the said body piston member.

11. In a jack, the combination of a base, a body, an extensible tripod supporting the body from the base, each leg of the tripod comprising a tubular member providing a piston chamber therein and a piston member reciprocally mounted in the chamber, one of said members being secured to the base and the other being secured to the body, a piston member carried by and projectible from the body, hydraulic means so operatively associated with the body and the piston member carried thereby as initially to move the body relative to the base until the body contacts a load to be lifted and subsequently to move said piston member relative to the body to lift the load, and hydraulic means operable to extend the tripod.

12. In a jack, the combination of a base, a body, an extensible tripod supporting the body from the base, each leg of the tripod comprising a tubular member providing a piston chamber therein and a piston member reciprocally mounted in the chamber, one of said members being secured to the base and the other being secured to the body, a piston member carried by and projectible from the body, hydraulic means so operatively associated with the body and the piston member carried thereby as initially to move the body relative to the base until the body contacts a load to be lifted and subsequently to move said piston relative to the body to lift the load, and hydraulic means operatively associated with the tripod, said last-named means being operable to lock the tripod pistons against movement relative to the tripod piston chambers whereby to prevent side sway of the body.

13. In a jack, the combination of a base, a telescopic work-engaging member mounted for telescopic movement perpendicular to the base, pressure-actuating means for extending the

9

work-engaging member, and means for laterally supporting the work-engaging member comprising a plurality of telescopic support members, each including a cylinder and a piston, disposed symmetrically around and inclining towards the work-engaging member, each of said telescopic support members being secured at its opposite

10

ends to the base and work-engaging member, and hydraulic means cooperating with the respective cylinders of the support members to provide fluid pressure on opposite sides of the pistons therein.

HERBERT E. PAGE.