Nov. 5, 1929. V. JAKOB 1,734,582

HYDRAULIC LIFTING JACK

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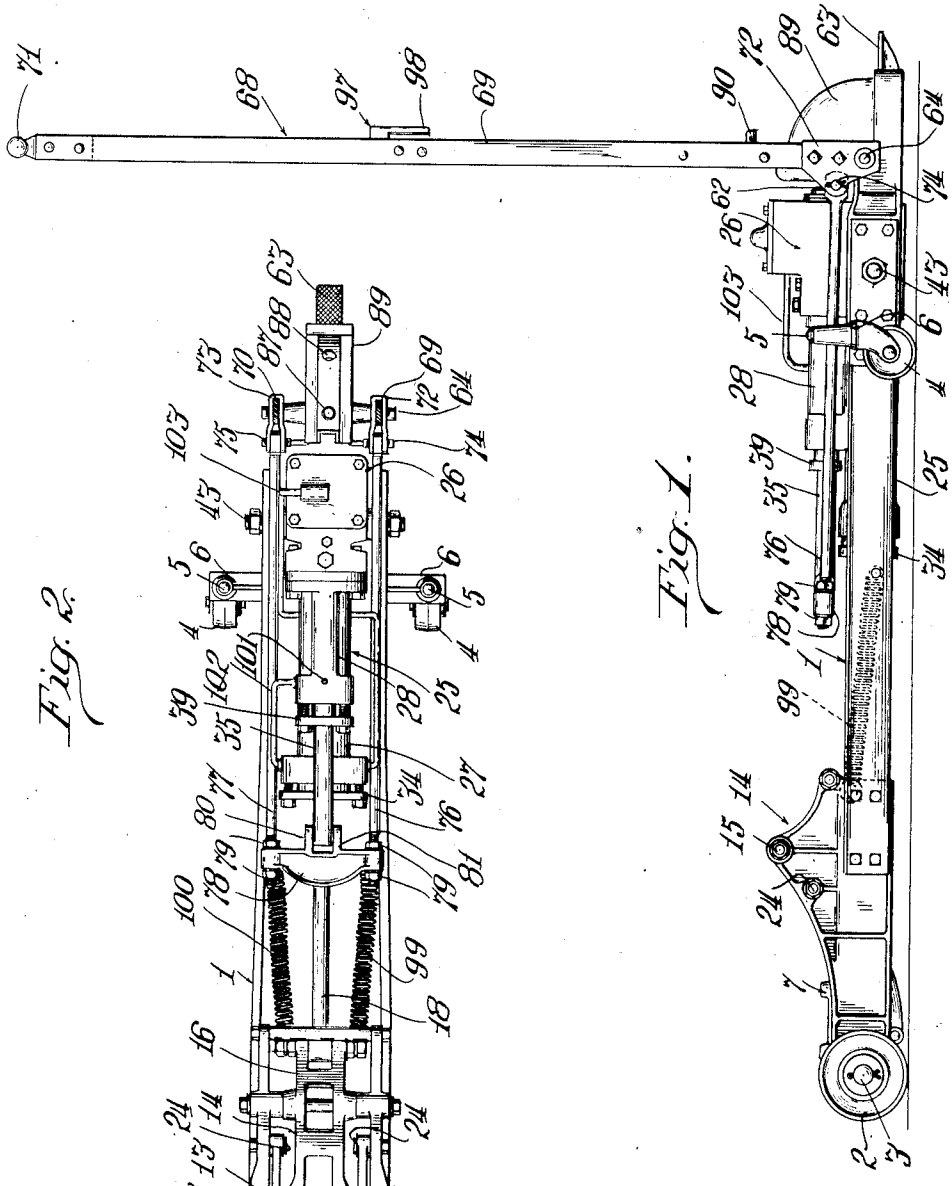


Fig. 1.

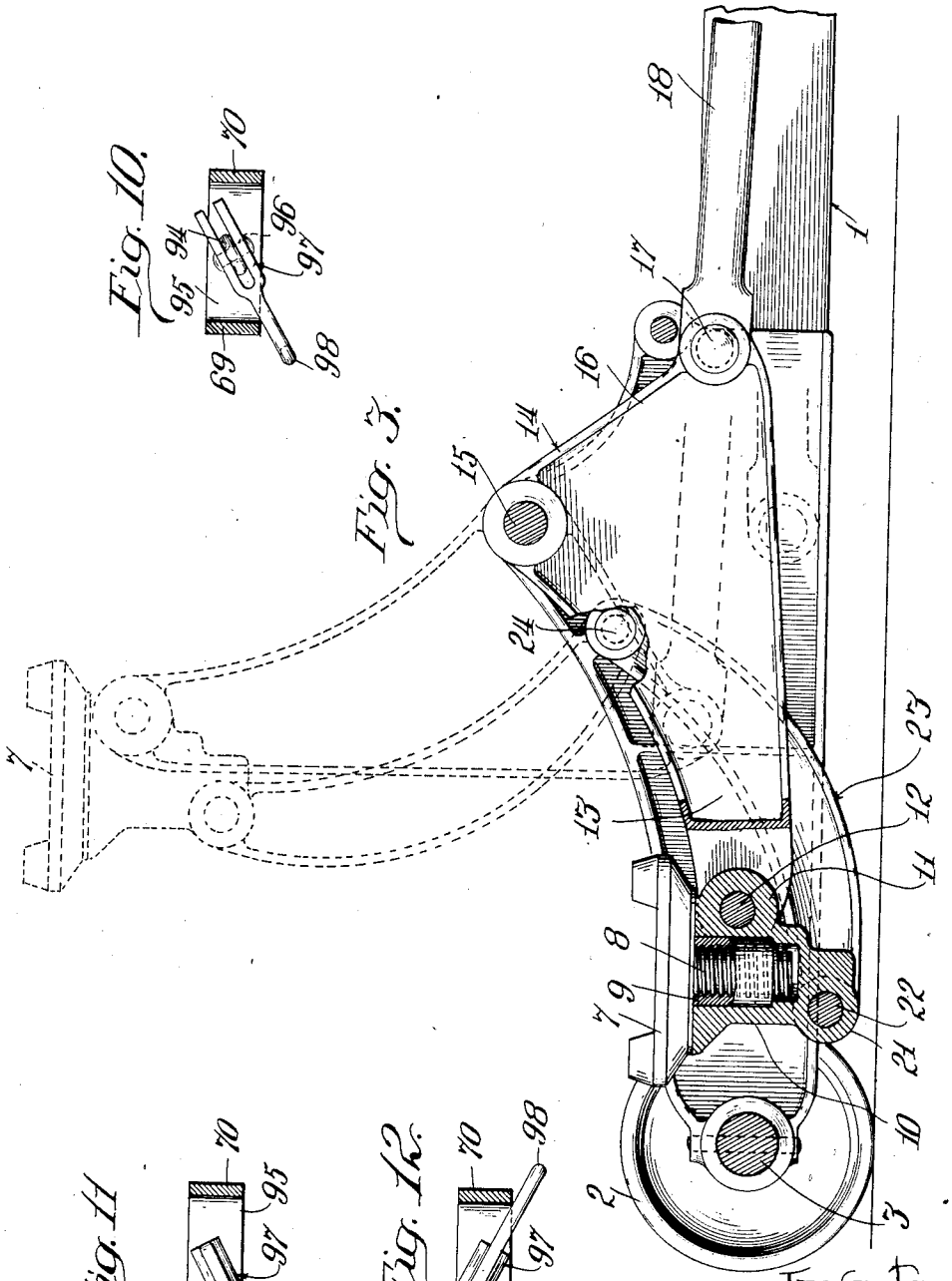
Fig. 2.

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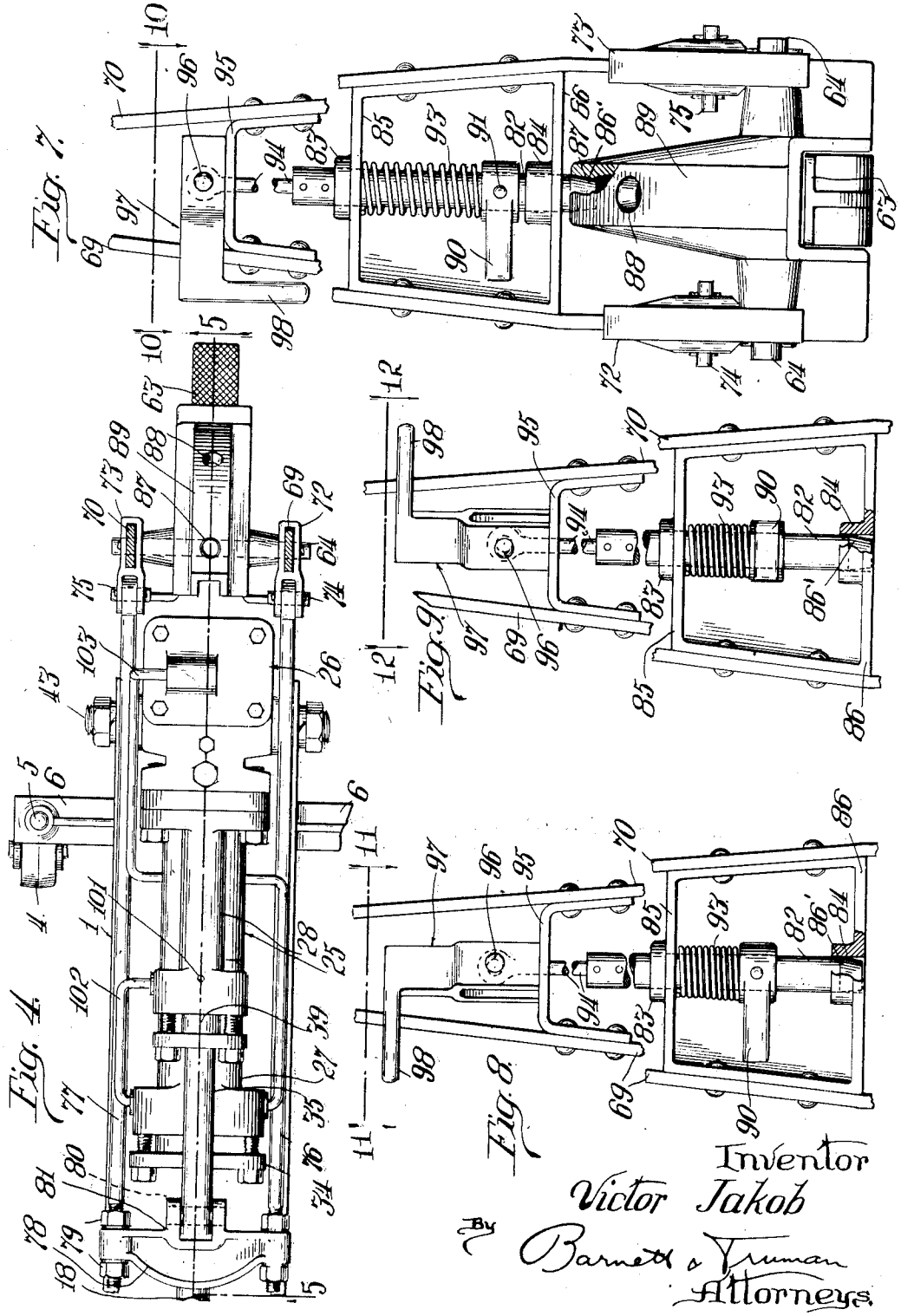


Fig. 7.

Fig. 9.

Fig. 4.

Fig. 8.

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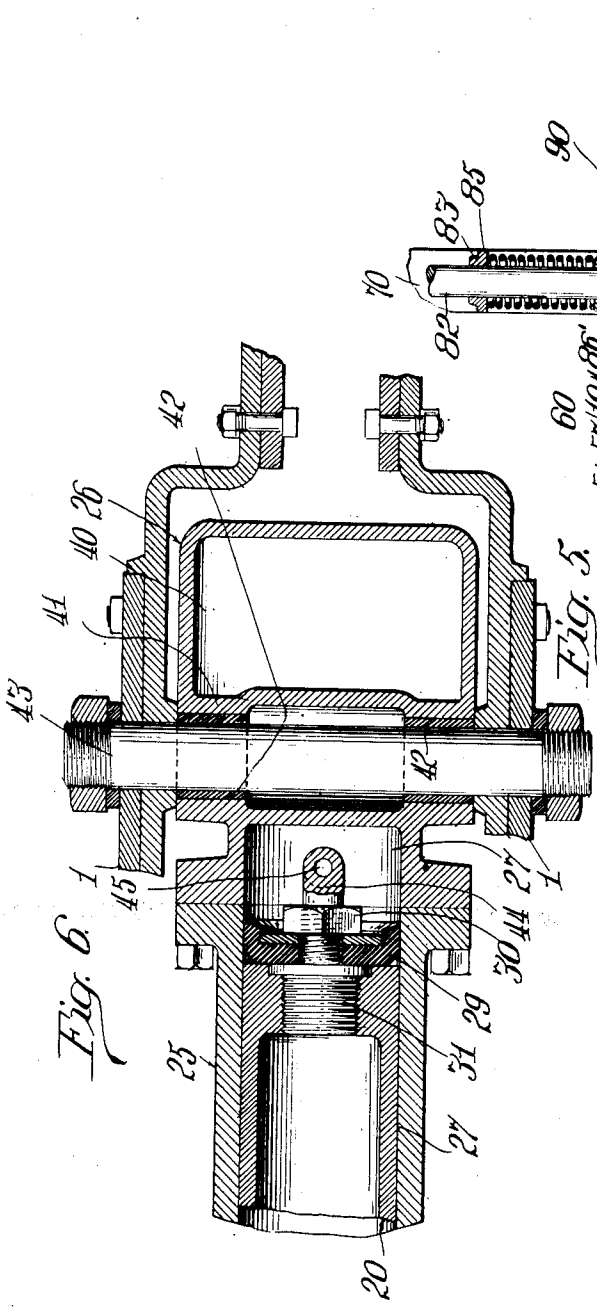


Fig. 6

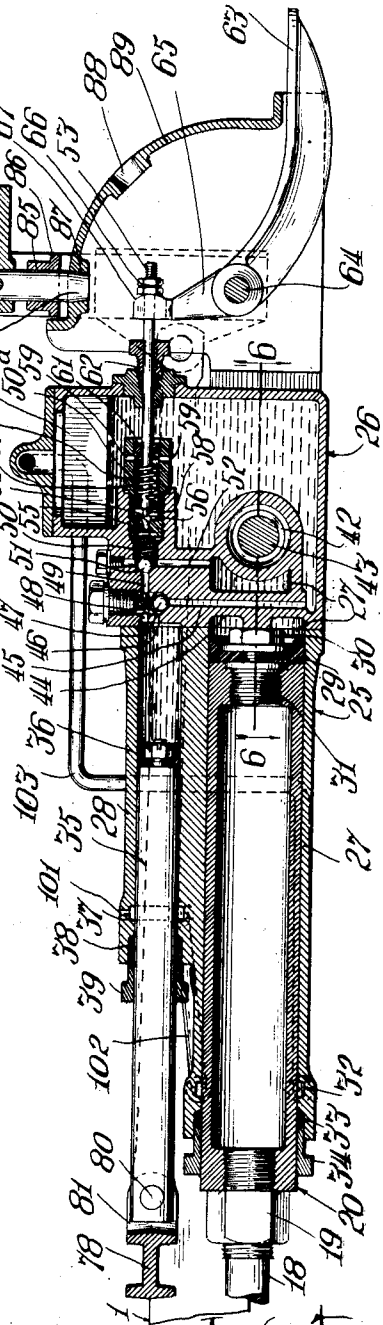


Fig. 5

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UNITED STATES PATENT OFFICE

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HYDRAULIC LIFTING JACK

Application filed November 17, 1927. Serial No. 233,817.

This invention relates to a new and improved hydraulic lifting jack, particularly designed for use about garages and repair shops, for quickly and easily lifting heavy loads, such as one end of an automobile, and for transporting the elevated load from place to place.

In general, the jack comprises a rather long low truck or carriage supported at its ends on small wheels or rollers, all of the mechanism carried by the carriage being of very small height, or capable of being depressed to an extremely low position, so that the assembly can be pushed under very low hanging loads. The actual load-lifting mechanism is mounted on the forward end of the carriage, while the hydraulic pump mechanism is mounted adjacent the other end of the carriage. A long operating handle pivoted at the latter (or rear) end of the jack is adapted to both operate the pump and to steer and propel the carriage from one position to another.

One object of the invention is to provide an improved hydraulic power mechanism for operating the jack.

Another object is to provide a hydraulic power unit which is pivotally mounted within the carriage so that it may share in certain swinging movements of the load-lifting mechanism with which it is connected.

Another object is to provide an improved safety mechanism for preventing overloading of the jack.

Another object is to provide improved means for lowering the jack, which is controlled either by a foot treadle or from the main operating handle.

Another object is to provide improved means for preventing leakage of the motor fluid from the hydraulic lifting mechanism.

Numerous other objects and advantages of this invention will be apparent from the following detailed description of one approved form of the apparatus.

In the accompanying drawings:

Fig. 1 is a side elevation of the complete jack.

Fig. 2 is a plan view of the same, the upper portion of the operating handle being broken away for the sake of clearness.

Fig. 3 is a side elevation of the front or lifting end of the jack, on a much larger scale.

Fig. 4 is a plan view of the rear, or motor end of the jack.

Fig. 5 is a longitudinal vertical section taken substantially on the line 5—5 of Fig. 4.

Fig. 6 is a partial horizontal section taken substantially on the line 6—6 of Fig. 5, and on a larger scale.

Fig. 7 is an elevation, partially broken away, showing portions of the main operating handle, and co-operating parts.

Figs. 8 and 9 are views similar to Fig. 7, but showing the plunger mechanism in different adjusted positions.

Fig. 10 is a horizontal section taken substantially on the line 10—10 of Fig. 7.

Fig. 11 is a horizontal section taken substantially on the line 11—11 of Fig. 8.

Fig. 12 is a horizontal section taken substantially on the line 12—12 of Fig. 9.

The frame 1 is built up of suitable castings and connecting members and is of such a length that when the lifting end is positioned beneath one of the axles of an automobile, the other end on which the operating mechanism is positioned will normally extend out to an accessible position beyond the body of the car, although the device is capable of being operated when the entire carriage is beneath the automobile body. The front or lifting end of the carriage 1 is supported upon a pair of rather small rollers or wheels 2, mounted on the ends of a transverse axle 3. The rear end of the carriage is supported by a pair of small rollers or casters 4, pivoted at the lower ends of vertical stub shafts 5, which are swiveled in brackets 6 extending from the respective sides of the carriage 1. These swiveled casters 4 permit steering of the carriage, which can be swung around abruptly into any desired position by manipulating the operating and steering handle, hereinafter described.

The lifting head 7 (see Fig. 3) has a screw threaded stem 8 mounted in a nut 9, which is seated in a recess in the lifting block 10. By manually rotating the load-carrying head 7, a certain amount of initial adjustment of the lifting head is permitted to adapt the device

for loads of different character. The nut 9 may pivot in the block 10 at all times, thus permitting turning movement of the carriage beneath the load, even when the screw 8 is completely raised or lowered. A lug 11 on block 10 is pivoted on journal 12, between the forked end portions of the longer arm 13 of the bell crank 14, which is suspended from and fulcrumed on the transverse shaft 15, which is mounted in the highest portions of the side members of frame or carriage 1. The shorter arm 16 of the bell crank 14 is hinged at 17 to the front end of the piston rod 18 which is rigidly connected at 19 to the front end of piston 20 (see Fig. 5). A lug 21 at the lower front side of lifting block or head 10 is pivoted at 22 between the forward ends of a pair of similar links 23, the rear ends of the links being pivoted at 24 to the side members of frame 1. The spacing of shafts 15 and 24 is the same as that of journals 12 and 22, and the links 23 are of the same length as the longer arm 13 of the bell crank so that when lifting bell crank 14 is swung about its pivot 15, the load supporting head 7 will be moved vertically, but will remain horizontal at all times, one elevated position of the load supporting head being indicated in dotted lines in Fig. 3. It will be noted that when the load supporting head is in its completely lowered position, as indicated in full lines in Fig. 3, its upper surface is no higher than the tops of the rollers 2 so that any load can be elevated, under which the supporting rollers 2 can be pushed.

The hydraulic motor mechanism comprises a pair of rigidly connected castings 25 and 26, (see Figs. 5 and 6). In the casting 25 are formed the main motor cylinder 27 and the pump cylinder 28. The piston 20 which is of considerable length and hollow to save weight, is fitted snugly within the cylinder 27 and rigidly connected with the rear end of connecting rod or piston rod 18, which is screwed into one end of the piston and provided with check nut 19. A leather packing cup 29 is secured at the other or inner end of piston 20 by means of nut 30 engaging the screw plug 31. The leather packing 29 tends to prevent the passage of liquid from cylinder 27 beyond the inner end of piston 20. An annular channel 32 is formed in the walls of cylinder 27 near its outer end for collecting such oil or other liquid as may leak past the packing 29, and means hereinafter described are provided for returning this oil to the oil-reservoir. As an additional sealing means, a stuffing box consisting of a packing or gasket 33 and a gland 34 is provided at the extreme outer end of the cylinder. In a quite similar manner, the pump piston 35, provided with the packing 36 at its inner end, is slidably housed within the pump cylinder 28. An annular leakage collecting channel 37, and a packing ring 38 and gland 39 are provided at the outer end of pump cylinder 28 in much the same manner as already described in connection with the main cylinder 27.

The other casting 26 is for the most part hollow, as indicated at 40, to serve as a reservoir for the supply of oil or other motor fluid, which is forced by the pump into the main operating cylinder 27, or permitted to return to the reservoir 40, all as hereinafter described. A substantially cylindrical cross-member 41 extending horizontally through reservoir 40 is bored out at 42 to receive the shaft 43 mounted at its ends in the side members of carriage 1. The entire hydraulic motor unit is thus pivotally supported in the carriage 1 by means of shaft 43. It will be apparent from Fig. 3 that as the bell-crank 14 is swung from its solid line to its dotted line position, the pivot pin 17 must swing downwardly and forwardly through an arc centered at the upper shaft 15. This will also necessitate a downward swinging movement of the piston rod 18 in substantially the same vertical plane, and this movement is permitted by a corresponding vertical oscillation of the entire hydraulic motor mechanism about the supporting shaft 43.

A web 44 extends upwardly through the inner end portion of cylinder 27 (see Fig. 6) and through this web is formed a fluid passage 45 leading from the reservoir 40 to the valve chamber 46. A suction valve comprising a ball 47 held down by a spring 48 normally closes the upper end of passage 45. A horizontal oil passage 49 leads from pump cylinder 28 to the valve chamber 46 and thence to a second valve chamber 50. The entrance of passage 49 to the chamber 50 is normally closed by a spring operated pressure valve 51 similar to the valve 47, already described. An oil passage 52 leads from valve chamber 50 to the inner end of main cylinder 27.

A screw plug 50[a] closes the rear end of valve chamber 50, and in this plug is housed the lowering and relief valve. This valve comprises a valve rod 53 formed at its inner end with a conical valve member 54 adapted to plug into the valve passage 55 leading from valve chamber 50. A cylindrical head 56 on valve stem 53 is slidable in the bore 57 of screw plug 52, there being grooves or passages 58 formed in the head 56 to permit oil to flow from one side of this head to the other. Passages 59 lead from bore 57 to the reservoir 40. A rather strong compression spring 60 surrounds the valve stem 53 and is confined between the head 56 and adjusting nut 61 screwed into the outer end of plug 52. This spring normally holds the relief valve 54 closed, but is so adjusted that its pressure will be overcome so as to permit the valve to open in case the fluid pressure in the operating cylinder 27 exceeds a predetermined maximum. The rear end of valve stem 53 extends out

through a stuffing box 62 in the rear wall of the reservoir 40. A treadle 63, intermediately pivoted at 64 at the rear end of the carriage 1, has an upwardly projecting arm 65 formed with a passage for receiving the outer end portion of valve stem 53. The adjusting nut and lock nut 66 threaded on the end portion of the valve stem engage the rounded surface 67 at the upper end of arm 65. It will be apparent that a downward pressure on the treadle 63 will pull valve stem 53 back against the pressure of expansion spring 60 and open the relief valve 54. When the treadle 63 is released, the spring 60 will again close the valve.

The main operating handle 68 is built up of a pair of side members 69 and 70, which converge upwardly to their connection with the cross-bar or handle grip 71. The lower end portions of the side bars 69 and 70 are pivotally mounted on the projecting ends of the shaft 64, already described. A pair of clevises or brackets 72 and 73 are respectively secured near the lower ends of the side bars 69 and 70, and are pivotally connected at 74 and 75 with the respective rear ends of the two similar pump connecting rods 76 and 77. The front ends of these connecting rods project through the side portions of a cross-head 78 and are secured thereto by nuts 79, as clearly shown in Fig. 4. The front end of the pump piston 35 is pivotally connected at 80 between the pair of ears 81 projecting rearwardly from cross head 78. It is apparent that by means of these connections the piston 35 will be propelled in and out of the cylinder 28 as the operating handle 68 is oscillated about its pivot 64.

A plunger 82 is mounted for rotation and reciprocation in guides 83 and 84 formed in the cross members 85 and 86 which are bolted between the side members 69 and 70 of the handle. The lower tapered end portion 86′ of plunger 82 is adapted to be engaged selectively in any one of a plurality of sockets 87 and 88 formed in the arcuate bracket 89 which is rigid with the carriage 1 and projects upwardly between the lower side portions of the operating handle. An outwardly projecting arm or finger 90 secured at 91 to the plunger 82 serves as an abutment for the lower end of a spring 93 which surrounds the plunger, the upper end of this spring bearing against the cross member 85. It will be apparent that the spring 93 normally tends to force the plunger down into engagement with one of the sockets 87 or 88. A connecting rod 94 extends from the upper end of plunger 82 upwardly through a third cross member 95 secured between the side members of the handle near their upper ends. The upper end of rod 94 is pivoted at 96 between the lower forked ends of an angular adjusting member 97, shown in Figs. 7 to 12 inclusive. Member 97 has a right angled extension 98 at its upper end for conveniently manipulating same. When this member 97 is in the position shown in Figs. 7 and 10, the spring 93 will be permitted to force the plunger 82 downwardly into engagement with one of the sockets in the arcuate bracket 89. When the member 97 is pulled up to the position shown in Figs. 8 and 11, the upper pivoted end 96 of connecting rod 94 will be pulled upwardly, thus lifting the plunger 82 against the spring 93 and holding the plunger out of engagement with bracket 89 so that the handle is free to be oscillated. When member 97 is in the raised position, shown in Fig. 8, it may be swung around, about the axis of rod 94 and plunger 82, to the position shown in Figs. 9 and 12. This will swing the plunger about its own axis so as to swing the projecting arm or finger 90 from its normal laterally projecting position, as shown in Figs. 7 and 8, to the rearwardly projecting position shown in Figs. 5 and 9. When in this position, by swinging the operating handle 68 downwardly, the finger 90 may be brought into engagement with the treadle 63, whereupon further downward movement of the handle 68 will result in opening the relief valve 54 in an obvious manner.

When the jack is not being used, the operating handle may be conveniently maintained in the vertical position shown in Fig. 1, by locking plunger 82 within the upper socket 87, as shown in Fig. 7. When the jack is to be manipulated into position beneath a load, the plunger may be engaged with a lower socket, such as 88, thus locking the operating handle to the carriage, so that the carriage may be tilted about the rear wheels to facilitate jockeying the jack into place within a limited space. When the pump is to be operated, the locking plunger is secured in withdrawn position, as shown in Fig. 8.

In the general operation of this device, the lifting head 7 will ordinarily be lowered to approximately the position shown in Figs. 1 and 3, so that the front end of the jack may be shoved into position beneath the load. If the load to be engaged is somewhat higher than usual, above the floor or other supporting surface, the supporting head 7 is first rotated within the nut 9 to elevate the head above the supporting block 10 before the jack is pushed into position beneath the load. When the supporting head 7 has been properly positioned beneath the load, the operating handle 68 is oscillated through as wide an arc as is convenient, and as is permitted by overhanging objects, thus reciprocating the piston 35 within pump cylinder 28, by means of the connections already described. During the outward stroke of piston 35, a suction will be created within cylinder 28 causing oil from reservoir 40 to pass up through passage 45 into valve chamber 46 (the suc-

tion valve 47 moving upwardly against the spring 48 to permit the oil to pass) and thence through passage 49 into the pump cylinder. During the return or inward movement of the piston 35, this oil will be expelled from the pump cylinder through the passage 49, the pressure thus created closing the valve 47, but opening the spring pressed valve 51 so that oil will flow into valve chamber 50 and thence through passage 52 into the main operating cylinder 27. As successive charges of oil are withdrawn from reservoir 40, and forced into the cylinder 27, as above described, the piston 20 will be forced outwardly, and through piston rod 18 will swing the bell-crank 14 about its pivot 15 and raise the load supporting head 7. This operation will be continued until the load has been lifted to the desired height. During this operation, the relief valve 54 will be held against its seat in outlet passage 55 by the rather powerful spring 60 so that no oil is permitted to escape from valve chamber 50 through this passage 55. However, should the pressure developed by the pump become excessive, or an excessive load be placed upon the supporting head 7, the pressure thus developed upon the oil is transmitted to the chamber 50, thus forcing open the relief valve 54 and permitting oil to escape through passage 55, grooves 58 in head 56, bore 57 and passages 59, back into the reservoir 40. When the jack is to be lowered, the operator simply presses down with his foot on treadle 63, thus opening the relief valve 54. The oil flows out slowly from main cylinder 27 through the restricted passages 52, 50 and 55 so that the main cylinder now acts as a dash-pot to lower the load gradually and smoothly. If it is desired to halt the lowering movement at any point, this may be accomplished by simply releasing the treadle 63, whereupon the relief valve 54 will automatically close. If the jack is in such a position that it is inconvenient to reach the treadle 63 with the foot, the finger 90 on the operating handle may be manipulated to the position shown in Figs. 5 and 9, whereupon, by swinging the operating handle down to approximately a horizontal position, the finger will engage the treadle 63 and serve to open the relief valve. In order to insure the lowering movement of the jack taking place in case there is no load on the supporting head 7, a pair of pull-back springs 99 and 100 are secured at their forward ends to the ends of the pivot pin 17, by means of which piston rod 18 is pivotally connected to the bell-crank 14, the rear ends of these springs being anchored to the side frame members of the carriage 1.

It will be noted that the hydraulic motor unit here utilized is a closed system employing a substantially constant body of oil or other motor fluid, which is forced to or from the main cylinder 27 and reservoir 40 to accomplish the movements, as hereinabove described. In case any oil leaks past the piston packings 29 and 36, it will serve to lubricate the sliding pistons, but before passing completely out of the cylinders will be caught in the leakage collecting channels 32 and 37. A small air inlet is provided at 101 leading to the channel 37. Channel 37 is connected by a pipe or conduit 102 with the channel 32. A pipe or conduit 103 leads from the lower portion of channel 32 back to the air space 104 above the oil in reservoir 40. It will be apparent that as the pump withdraws oil from the reservoir and forces same into the main cylinder 27, the air space 104 above the oil in the reservoir will be increased so as to create a suction through pipe 103 to draw in the oil which has collected in channel 32, as well as the oil that has drained thereinto from channel 37 through pipe 102.

This jack has an extremely low overall height, except for the handle 68, and may be operated under loads that are low and difficult to reach. The jack may be elevated smoothly and steadily in any position where any substantial arc of oscillation is permitted the handle 68. The jack is self-lowering, merely in response to a depression on the treadle 63, and this treadle may be operated from the far end of the operating handle 68, at such times as the treadle is relatively inaccessible.

I claim:

1. A lifting jack comprising a carriage, load-lifting means at the front end of the carriage comprising a swinging lever-arm, a hydraulic power unit pivotally mounted in the rear end of the carriage to permit a swinging movement in the same plane as the lever arm, the unit comprising a main cylinder, a reservoir, a pump, valved connections for controlling the flow of the motor fluid between the pump, cylinder and reservoir, a piston in the cylinder, a piston rod rigid with the piston and pivotally connected with the lever-arm, the pump comprising a piston having a forwardly projecting portion, a crosshead pivotally connected with the piston, a main operating lever pivoted at the rear end of the carriage, and links connecting the crosshead with the operating lever.

2. A lifting jack comprising a carriage, load-lifting means mounted on the carriage, a cylinder, a piston in the cylinder connected with the lifting means, a reservoir, a pump for forcing fluid from the reservoir into the cylinder to move the lifting means, a valve adapted to automatically open under excessive fluid-pressure to permit the return of fluid from the cylinder to the reservoir, and means for manually operating this valve to lower the jack.

3. In a lifting jack including a carriage and load-lifting means mounted thereon, a hydraulic-pump mechanism for operating the lifting means, a valve for permitting the lift-

ing means to lower, a treadle for operating the valve, a handle pivoted on the carriage for operating the pump, a plunger carried by the handle and adapted to engage the carriage to lock the handle in different selected positions, and means carried by the plunger for engaging and operating the treadle.

4. In a lifting jack including a carriage and load-lifting means mounted thereon, a hydraulic-pump mechanism for operating the lifting means, a valve for permitting the lifting means to lower, a treadle for operating the valve, a handle pivoted on the carriage for operating the pump, a plunger mechanism mounted for reciprocation and rotation in the handle, and means for reciprocating the plunger to lock the handle to the carriage in different selected positions, or for rotating the plunger to position it for engaging and operating the treadle.

5. In a lifting jack including a carriage and load-lifting means mounted thereon, a hydraulic pump mechanism for operating the lifting means, a handle pivoted on the carriage for operating the pump, and means movably carried by the handle and engageable with the carriage for selectively locking the handle to the carriage in a plurality of different positions.

6. A lifting jack comprising a carriage, load-lifting means mounted on the carriage, a cylinder, a piston in the cylinder connected with the lifting means, a reservoir, a pump for forcing fluid from the reservoir into the cylinder to elevate the lifting means, a passage for permitting the return of fluid from the cylinder to the reservoir, a spring-pressed valve normally closing said passage, said spring being adapted to automatically yield under excessive fluid-pressure in the cylinder and permit the valve to open, and means for manually opening the valve against the resistance of the spring to lower the jack.

7. A lifting jack comprising a carriage, load-lifting means mounted on the carriage, a hydraulic pump mechanism for operating the lifting means, a valve for permitting the lifting means to lower, a treadle for operating the valve, a handle pivoted on the carriage for operating the pump, a plunger mechanism mounted for either reciprocation of rotary movement in the handle, an arcuate member on the carriage provided with spaced openings, spring means for moving the plunger longitudinally into engagement with a selected opening to lock the handle to the carriage in a selected position, means for locking the plunger in withdrawn position so that the handle is free for swinging movement, and a member on the plunger rotatable therewith into position to engage and operate the treadle.

8. A lifting jack comprising a carriage, a load-lifting means mounted on the carriage, a handle pivoted on the carriage for operating the lifting means, a treadle for releasing the lifting means to permit the jack to lower, a plunger carried by the handle and adapted to engage the carriage to lock the handle to the carriage in different selected positions, and means carried by the plunger to engage and operate the treadle.

9. A lifting jack comprising a carriage, load-lifting means mounted on the carriage, a handle pivoted on the carriage for operating the lifting means, a treadle for releasing the lifting means to permit the jack to lower, a plunger mounted in the handle for both longitudinal and rotary movement, spring means for moving the plunger longitudinally into engagement with different selected portions of the carriage to lock the handle thereto in selected positions, means for locking the plunger in withdrawn position so that it is free for swinging movement, and a member on the plunger rotatable therewith into position to engage and operate the treadle.

10. A lifting jack comprising a carriage, load-lifting means mounted on the carriage, a handle pivoted on the carriage, connections between the handle and lifting means whereby swinging movement of the handle operates the lifting means, and means movably carried by the handle and engageable with fixed portions of the carriage for selectively locking the handle to the carriage in a plurality of different positions.

11. A lifting jack comprising a carriage, load-lifting means mounted on the carriage, a handle pivoted on the carriage, connections between the handle and lifting means whereby swinging movement of the handle operates the lifting means, the carriage comprising a fixed portion having a plurality of openings, and a plunger carried by the handle and adapted to selectively engage the openings to lock the handle to the carriage in different positions.

12. A lifting jack including a carriage and load-lifting means mounted thereon, a hydraulic-pump mechanism for operating the lifting means, a handle pivoted on the carriage, connections between the handle and pump for operating the pump by oscillatory movements of the handle, a carriage comprising a fixed portion having a plurality of openings, and a plunger carried by the handle and adapted to selectively engage the openings to lock the handle to the carriage in a plurality of different positions.

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