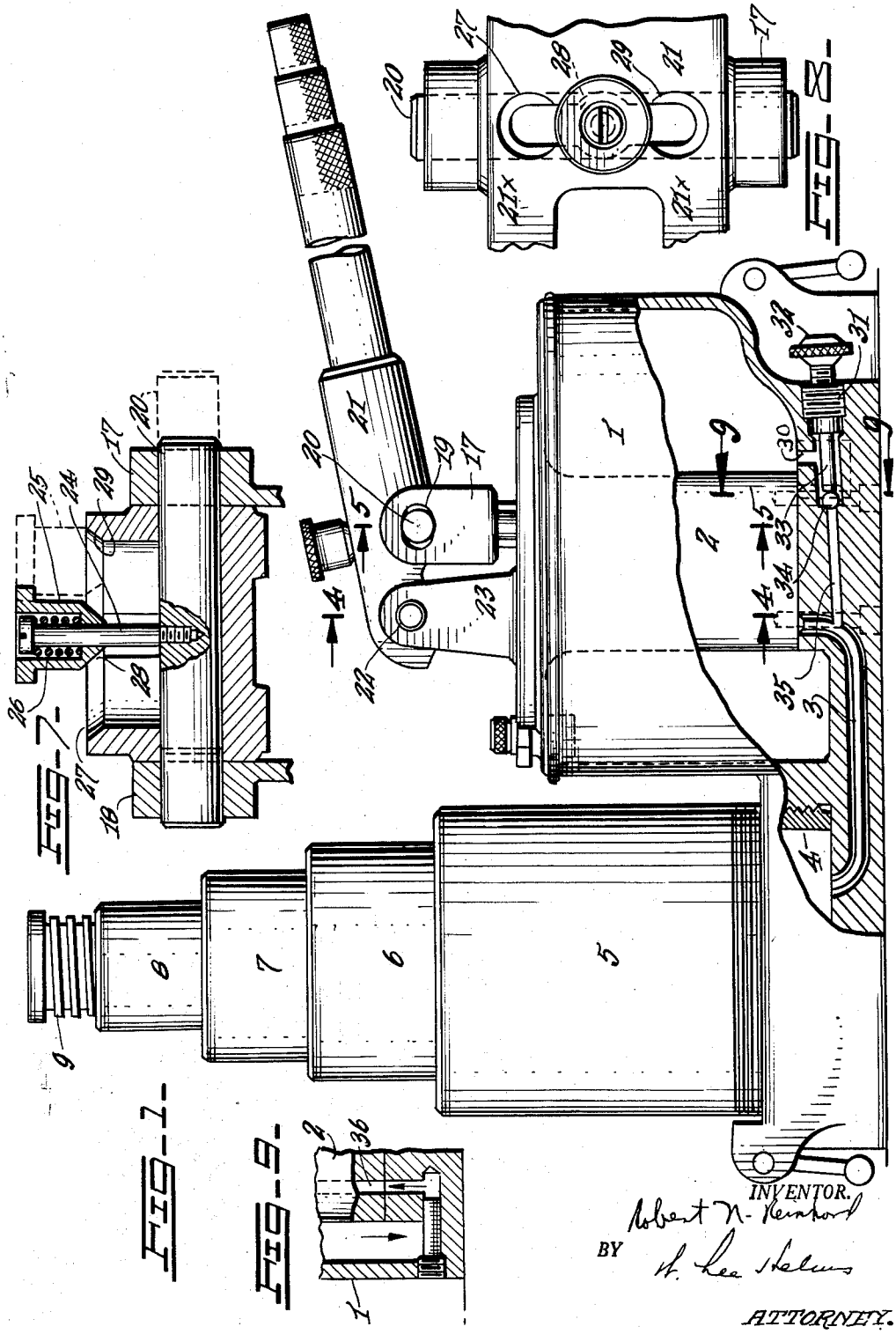
Jan. 8, 1957 R. N. REINHARD 2,776,624

MULTIPLE PISTON HYDRAULIC PUMP UNIT AND OPERATING MEANS TO SELECTIVELY OPERATE THE PISTONS THEREOF

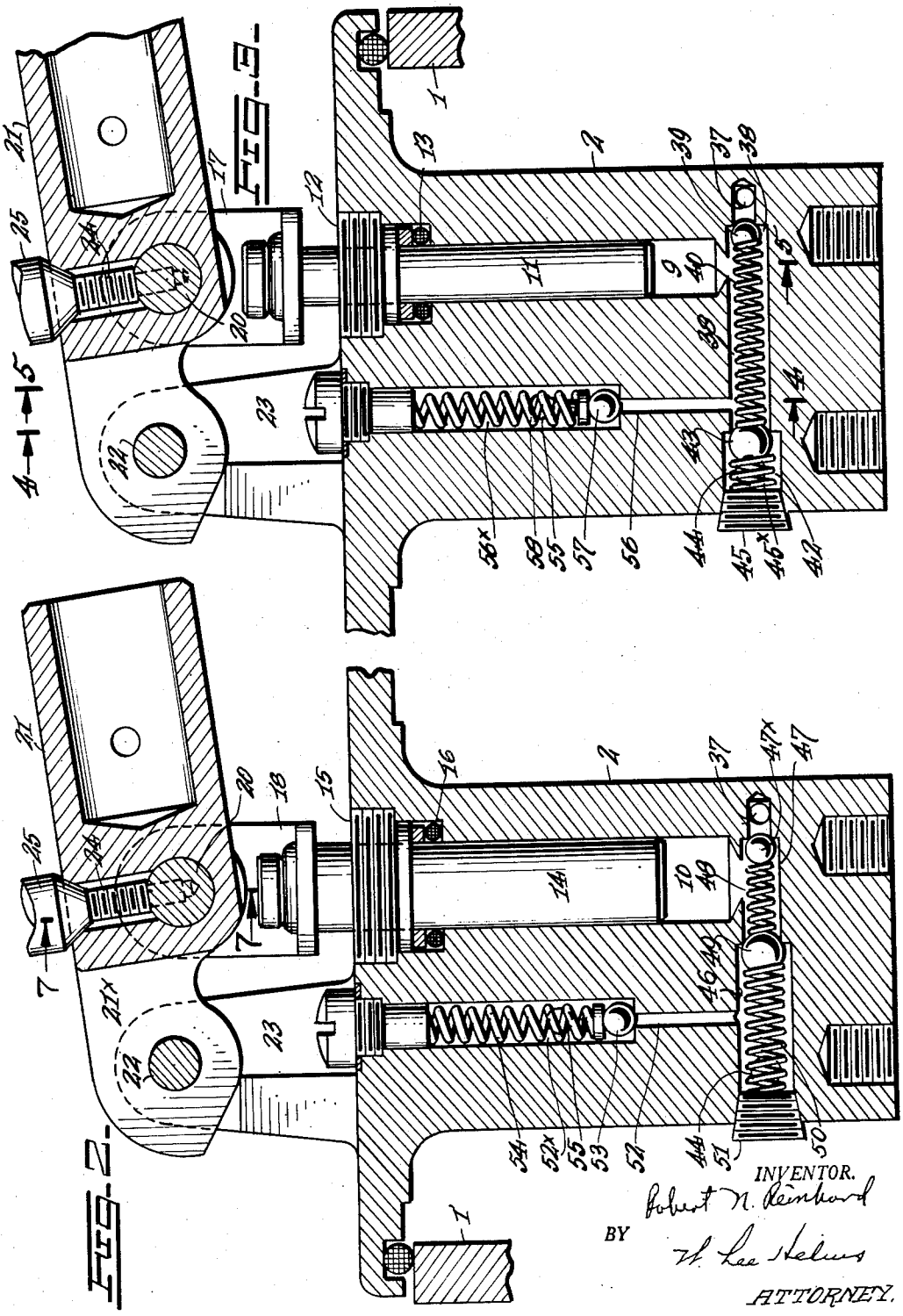
Filed June 2, 1953 3 Sheets-Sheet 1



Jan. 8, 1957 R. N. REINHARD 2,776,624

MULTIPLE PISTON HYDRAULIC PUMP UNIT AND OPERATING MEANS TO SELECTIVELY OPERATE THE PISTONS THEREOF

Filed June 2, 1953 3 Sheets-Sheet 2



INVENTOR.
Robert N. Reinhard
BY
H. Lee Helms
ATTORNEY.

Jan. 8, 1957 R. N. REINHARD 2,776,624

MULTIPLE PISTON HYDRAULIC PUMP UNIT AND OPERATING MEANS TO SELECTIVELY OPERATE THE PISTONS THEREOF

Filed June 2, 1953 3 Sheets-Sheet 3

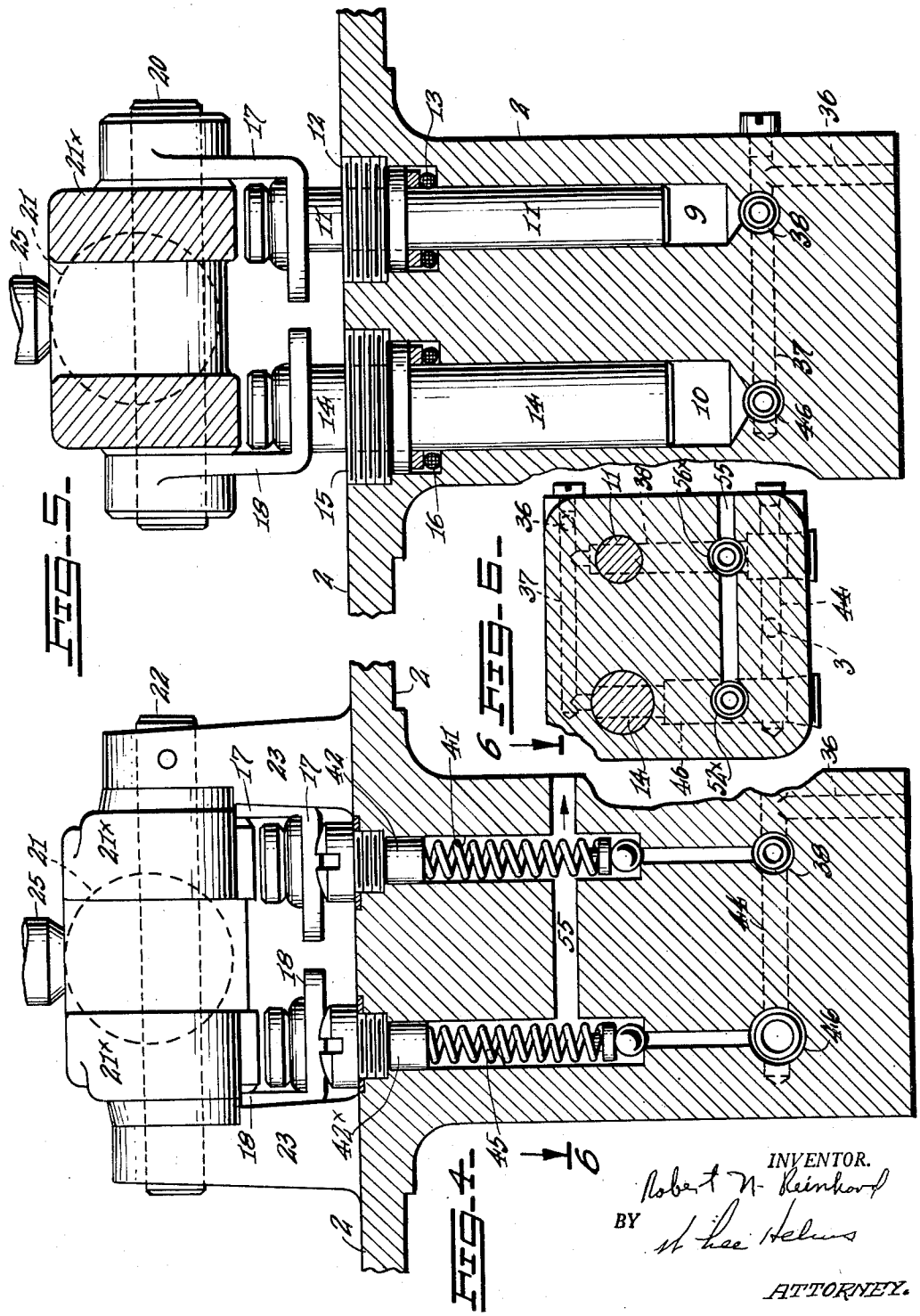


FIG-5-

FIG-6-

FIG-4-

INVENTOR.
Robert N. Reinhard
BY
W. Lee Helms
ATTORNEY.

United States Patent Office 2,776,624 Patented Jan. 8, 1957

2,776,624

MULTIPLE PISTON HYDRAULIC PUMP UNIT AND OPERATING MEANS TO SELECTIVELY OPERATE THE PISTONS THEREOF

Robert N. Reinhard, Glendale, Calif., assignor to Foremost Dairies, Inc., New York, N. Y., a corporation of New York

Application June 2, 1953, Serial No. 359,119

1 Claim. (Cl. 103—37)

The object of the present invention is to provide a compact, relatively light weight jack of very high capacity and safety and which will enable by manual operation of one man a lifting force of 16 tons, through progressive adjustments of the jack wherein the jack may be initially operated at high speed with a minimum required lever reaction force and as the load is raised the jack may be adjusted to impose a greater lifting force relative to the volume of fluid flow without any substantial increase in the lever reaction force.

A further object of the invention is to enable the aforesaid adjustments of the jack to be performed very quickly and by simple and inexpensive means.

A further object of the invention is to provide safety controls coming into action when, for example, a sudden load is applied to the jack in excess of its safety capacity. In such cases the jack slowly retracts and fluid is returned to the jack reservoir until the load is reduced to a predetermined safe degree.

The invention will be described with reference to the accompanying drawings in which

Fig. 1 is a view in elevation, partly broken away, showing an embodiment of the invention,

Fig. 2 is a vertical section taken through that portion of the jack in which the larger diameter cylinder and piston are disposed,

Fig. 3 is a view similar to Fig. 2, the vertical section being through that area of the jack in which the cylinder and piston of lesser diameter are disposed.

Fig. 4 is a vertical section on line 4—4, Figs. 1 and 3,

Fig. 5 is a vertical section on line 5—5, Figs. 1 and 3,

Fig. 6 is a horizontal section on line 6—6, Fig. 4,

Fig. 7 is a vertical section on line 7—7, Fig. 2,

Fig. 8 is a fragmentary plan view of the lever, its bracket mounting, its shaft, and its shaft adjusting means, and

Fig. 9 is a fragmentary vertical section (in part) taken on line 9—9, Fig. 1.

The jack now to be described is particularly adapted for raising aircraft in the changing of wheels and tires thereof, and for other purposes.

In Fig. 1 is shown the general jack assembly, the housing for the oil reservoir surrounding the piston and cylinder blocks being broken away, that housing being shown at 1 and the cylinder block being shown at 2. From the cylinder block leads a duct 3 communicating with the base 4 of the cylindrical jack head 5 into which a plurality of telescopic jack heads 6, 7, and 8 are adapted to telescope. Into jack head 8 is threaded the uppermost jack head 9 which may be raised and lowered, the entire jack head assembly being standard and not forming a part of this invention.

In the cylinder block 2, and as shown in Fig. 5, there are formed two cylinders, cylinder 9 being of minor diameter and cylinder 10 being of greater diameter. In cylinder 9 is disposed a piston 11 which passes through a threaded bearing 12 below which is a sealing ring 13.

In cylinder 10 is disposed a piston 14 which passes through a bearing head 15, below which is a sealing ring 16. To piston 11 is applied, for reverse action, a link 17 and to piston 14 is applied a like link 18. Each link, as is shown in Fig. 1, is formed with an elongated aperture 19 to receive an endwise movable shaft 20 which is slidably mounted in a handle lever 21, the latter being forked at one end, the forks being indicated at 21x, and apertured to receive a pivot shaft 22 mounted in brackets 23 rising from the top of the cylinder block 2. As shown more particularly in Figs. 7 and 8, shaft 20 has a centrally threaded area, a headed pin 24, and surrounding the upper portion of the pin is a latch head 25 which is chambered to receive a spring 26 surrounding the pin and having an abutment against the lower face of the pin head. This latch head is tapered at its base to fit selectively into each of three beveled seats, indicated in Figs. 7 and 8 at 27, 28 and 29.

In Fig. 7 the latch head holds shaft 20 into engagement with each of the piston links 17 and 18. When the latch head is raised out of its seat and moved to the left, it carries with it shaft 20 and the latter may be moved until it passes beyond link 17 at the point where the latch head may descend into beveled seat 27 to hold the shaft in such position. A reverse action takes place when the latch head is moved to the dotted line position, Fig. 7, whereupon shaft 20 will be moved out of its engagement with link 18.

When the latch head is in the position of Fig. 7 and the handle lever 21 is moved up and down by an operator, both pistons, 11 and 14, will be actuated for a rapid rise of the jack heads and until the resistance is too great for a single operator. Thereupon the latch head will be raised and shaft 20 moved out of engagement with link 17 for the smaller piston, and piston 14 actuated by the lever handle to give a slower but still rapid upward movement of the jack head until the resistance becomes such that the operator may raise the latch head and move shaft 20 to the right from its position in Figs. 5 and 7, disengaging piston link 18 and maintaining engagement with piston link 17, for continued operation of piston 11 and until the piston heads are moved to the position required. Thus when the jack is proportioned for a lift of 34,000 lbs. by a single operator, by the action which is described, the diameter of cylinder 9 may be 0.500" and the cylinder of greater diameter may be 0.750", both pistons having a stroke of between 1 and 2". Practice has shown that in the operation of both pistons an operator may easily and quickly raise 6,000 lbs. Then, upon shift to cylinder 14, the larger cylinder, the raising of the jack may continue by said single operator until the resistance is 10,000 lbs. Finally by shift to the single piston 11, the operator may raise the jack heads to a resistance of 34,000 lbs.

As stated in the forepart of this specification, safety factors are provided and this part of the invention, together with the flow ducts and their controls, will now be described.

The reservoir within the casing 1 and surrounding piston block 2 will receive the hydraulic fluid. This fluid passes through an aperture 30 in the base of casing 1. Below aperture 30 is a chamber and within the chamber is a release valve assembly consisting of an internally threaded plug and bearing member 31 into which is threaded a release valve member 32 which has a stem 33 adapted to act upon a ball valve member 34 to open duct 35 leading to duct 3 which communicates with the base of the jack heads. Thus when member 32 is moved outwardly, fluid can pass from the jack heads back into the reservoir if the jack heads are raised, and the heads will descend by their weight or pressure thereon.

The hydraulic fluid rises upwardly through a duct 36, Fig. 5, in the piston block 2 (as the pistons are raised) and passes into a manifold duct 37. Duct 37 communicates with two passageways. Passageway 38, Fig. 3, has therein a valve chamber normally closed by a ball 39 and communicating with cylinder 9. Ball 39 is seated by spring 40. Thus ball 39 is suction released as piston 11 is moved upwardly and moves back on its seat on a pressure stroke of the said piston.

Likewise duct 37 communicates, Fig. 2, with a valve chamber 47 leading to cylinder 10. Said valve chamber is normally closed by a ball 47*x* normally held down on its seat by spring 48. When piston 14 is raised the suction within cylinder 10 will raise ball 47*x* against the tension of spring 48 and fluid will be drawn into the cylinder.

On the pressure stroke of piston 11 the fluid under pressure dislodges a ball 43 from its seat and the fluid moves through a duct shown in dotted lines, Fig. 3, at 44, the ball moving against the tension of a spring 45*x* held in place in a chamber 42 by a plug 45. Duct 44 communicates, as shown in Fig. 6, with passageway 3 leading to the jack heads.

On the pressure stroke of piston 14 a second ball 49 is moved from its seat, this ball being normally seated by a spring 50 held in position in a chamber 46 by a plug 51. When moved from its seat by said pressure stroke, the fluid is forced into passage 44 and thence through duct 3 to the jack head.

Should the load being moved upwardly by the jack head be heavier than the maximum capacity of the jack, as, for example, impose a stress greater than 34,000 lbs., the pressure of the fluid through ducts 3 and 44 will cause the fluid to move upwardly through a passageway 52, Fig. 2, and ball valve 53 will be raised against the counter-pressure of its spring 54, permitting release of the fluid from chamber 52*x* into a relief passage 55, Fig. 6, leading to the oil reservoir.

In Fig. 3 is shown a similar and coacting lighter relief assembly for cylinder 9 and its piston 11. If the pump pressure imposed by piston 11 is greater than a normal predetermined pressure, this excess pressure will be relieved by the fluid passing upward through passageway 56, raising ball valve 57 against the tension of its spring 58, said spring being disposed in chamber 56*x*, and fluid will, as indicated in Figs. 4 and 6, be released through relief passage 55, flowing into the reservoir.

Summarizing the invention, very simple and effective means are provided for starting the jack head raising operation under a maximum volume of hydraulic pressure and thence successively reducing the volume of fluid

flow while maintaining the power-lift without undue strain upon the operator. Two safety provisions are embodied, one wherein above normal pressure induced by piston 11 is automatically released to the moment when the pressure resumes normalcy, and the second coming into effect when the back pressure upon the hydraulic fluid by the load is beyond the capacity of the jack, whereupon a release of the pressure will be effected, but only to the point where the back pressure is reduced to the predetermined degree of maximum lift.

The embodiment illustrated in the drawings is particularly adapted for use in raising wheels, or a wheel of an aircraft where the load is upwards of 34,000 lbs., for the changing of wheels or tires in a quick and effective manner, and, in the case of emergencies, by a single pilot-operator.

It will be understood that various changes may be made in the form and arrangement of the elements illustrated in the embodiment without departing from the original spirit of the invention.

Having described my invention, what I claim and desire to secure by Letters Patent is as follows:

Pump means for a hydraulic jack consisting of a fluid reservoir casing, a piston block within the casing, a plurality of cylinders within the piston block, pistons in the cylinders, check valve means between the cylinders and reservoir and adapted to shut off the reservoir from the cylinders upon pressure stroke of the pistons, an operating lever, a link carried by each piston, a shaft slidably mounted in said lever near the end thereof and adapted to selectively engage said links, and a headed pin engaging said shaft and having slidably mounted about its outer end a chambered latch member, said chamber holding a spring bearing against the under surface of the pin head, the inner end of said lever being provided with a seat for said latch member corresponding to each position of selective engagement of said links, said pin and latch member being adapted for movement between said seats, and to thereby slide said shaft into positions of selective engagement with said links.

References Cited in the file of this patent

UNITED STATES PATENTS

535,293	Leitch	Mar. 5, 1895
1,951,398	Dearsley	Mar. 20, 1934
2,091,876	Oldham	Aug. 31, 1937
2,420,910	Richards	May 20, 1947
2,605,999	Schultz	Aug. 5, 1952

FOREIGN PATENTS

401,386	Great Britain	Nov. 16, 1933