Feb. 3, 1948. F. H. SCHWERIN 2,435,326

FLUID PUMP

Filed March 2, 1945 3 Sheets-Sheet 1

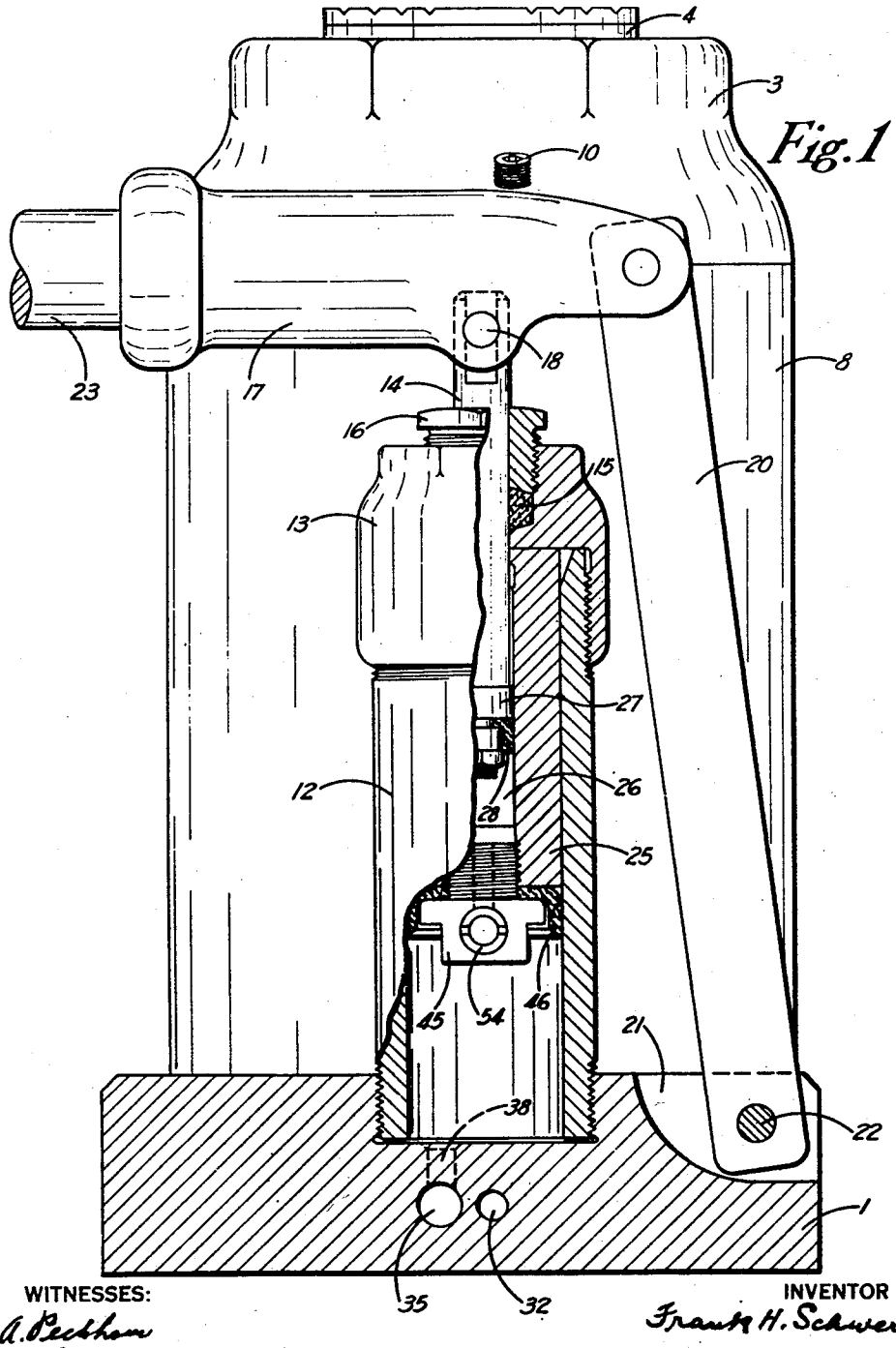


Fig. 1

WITNESSES:
V. A. Peckham
E. O. Johns

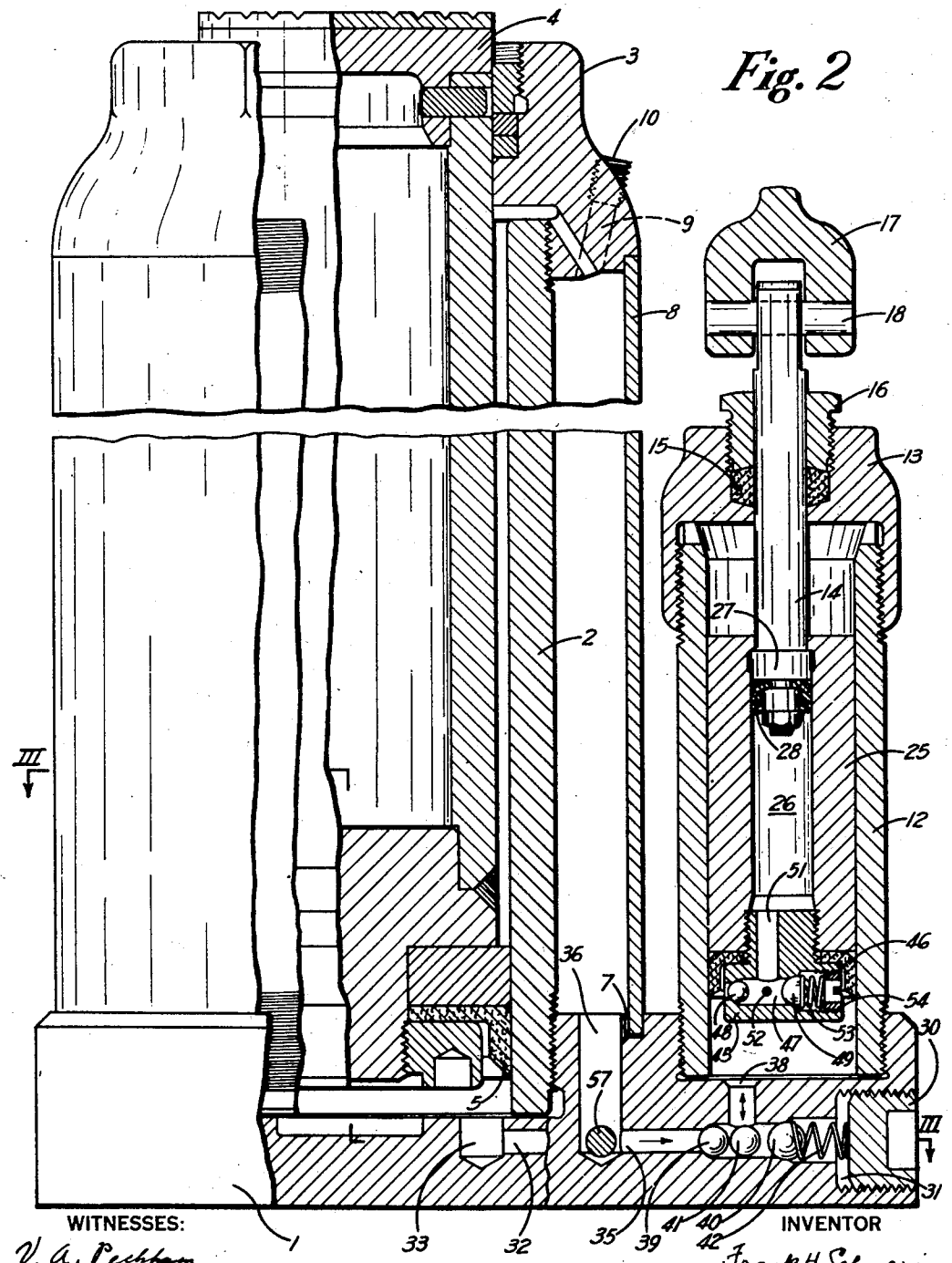
INVENTOR
Frank H. Schwerin
BY
Brown, Critchlow & Flick
his ATTORNEYS

Feb. 3, 1948. F. H. SCHWERIN 2,435,326

FLUID PUMP

Filed March 2, 1945 3 Sheets-Sheet 2

Fig. 2



WITNESSES:

V. A. Peckham

E. O. Johns

INVENTOR

Frank H. Schwerin

BY

Brown, Critchlow & Flick

his ATTORNEYS

Feb. 3, 1948. F. H. SCHWERIN 2,435,326

FLUID PUMP

Filed March 2, 1945 3 Sheets-Sheet 3

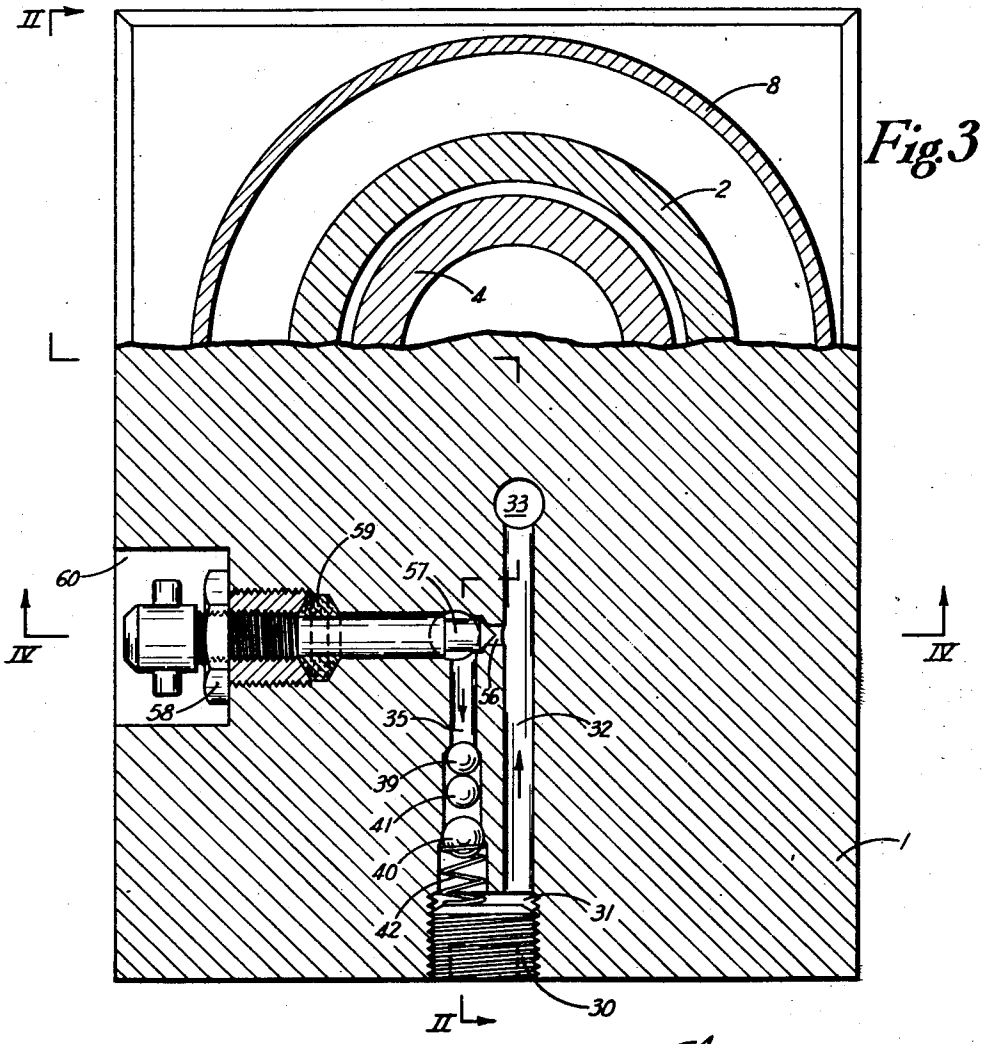


Fig. 3

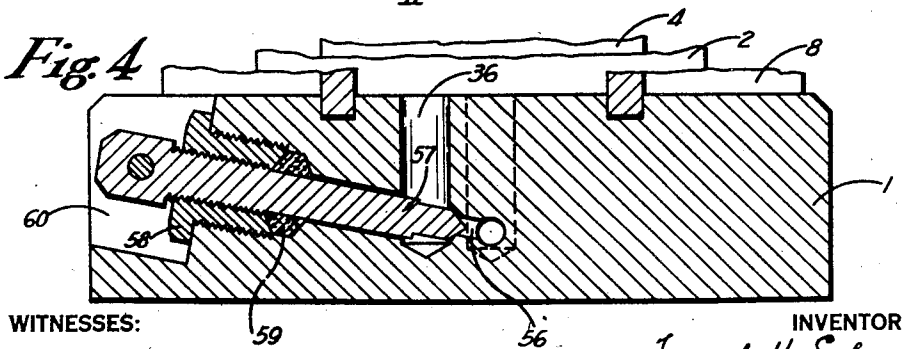


Fig. 4

WITNESSES:

V. A. Peckham

E. O. Johns

INVENTOR

Frank H. Schwerin

BY

Brown, Critchlow & Flick

his ATTORNEYS.

Patented Feb. 3, 1948 2,435,326

UNITED STATES PATENT OFFICE

2,435,326

FLUID PUMP

Frank H. Schwerin, Ben Avon, Pa., assignor to The Duff-Norton Manufacturing Company, Pittsburgh, Pa., a corporation of Pennsylvania

Application March 2, 1945, Serial No. 580,667

6 Claims. (Cl. 103—37)

1

This invention relates to fluid pressure actuated apparatus for exerting pushing or pulling forces, and more particularly to hydraulic jacks.

In the use of hydraulic jacks, for example, it saves time to raise the lifting member as fast as possible up to the load that it is to lift. However, if, for this purpose, the pump that creates the fluid pressure to raise the lifting member has a large displacement, it will be difficult to operate it after the lifting member engages the load. Attempts have been made to combine fast elevation of the lifting member up to the load with slower elevation at no material increase in effort of the operator after the load is engaged. For example, two pumps have been used for rapid elevation and then one pump for lifting the load. Also, jacks have been made in which the operator must change the stroke of the pump-actuating lever or shift its fulcrum when the load is engaged in order to elevate the load. The difficulty with such jacks is that they are unduly complicated, or require the operator to make some adjustment in the jack or a change in his method of operating it as soon as the lifting member engages the load.

It is among the objects of this invention to provide a hydraulic jack which is strong and durable, relatively simple in construction and operation, easy to service, and compact. Other objects are to provide such a jack in which the lifting member can be raised rapidly until it engages the load and then raised more slowly without undue increase of exertion by the operator, and in which this change in speed is accomplished automatically without the operator having to make any change or adjustment in the jack or in his operation of it.

The preferred embodiment of the invention is illustrated in the accompanying drawings in which Fig. 1 is an end view of my jack with the lifting member raised slightly and with the pump and base broken away to show them in section; Fig. 2 is a side view mostly in section taken on the line II—II of Fig. 3; Fig. 3 is a horizontal section taken on the line III—III of Fig. 2; and Fig. 4 is a vertical section of the base taken on the line IV—IV of Fig. 3.

Referring to Fig. 2 of the drawings, a rectangular block of metal that serves as the base 1 of the jack is provided with a pair of laterally spaced threaded recesses that open upwardly. Screwed into the larger of these recesses is the lower end of a jack cylinder 2 on the upper end of which a large capping nut 3 is screwed. Slidable vertically in this nut is a hollow plunger-

2

like lifting member 4 on the lower end of which a packing cup 5 is mounted so that fluid pressure below the lifting member can raise it in the cylinder.

Encircling the jack cylinder, but spaced from it, is a circular groove 7 in base 1 in which the lower end of a cylindrical shell 8 is mounted. The upper end of this shell is retained in position by the notched outer lower corner of capping nut 3 which presses the shell tightly against the base. The annular space between the shell and cylinder forms a reservoir for a suitable fluid, such as oil, which may be introduced through a port 9 in the capping nut. This port normally is closed by a screw plug 10.

Screwed into the other recess in the base is the lower end of a pump cylinder 12 (Figs. 1 and 2) on the upper end of which there is a screw cap 13 provided with a central opening and packing recess. Vertically reciprocable in this cap opening is a plunger 14 that is encircled in the packing recess by packing material 15 held in place by a gland nut 16. The upper end of the plunger projects into a slot in the lower part of a socket member 17 where it is pivotally retained by a pin 18. One end of this member is pivotally connected to the upper end of a link 20 (Fig. 1) the lower end of which extends into a recess 21 in the base where it is mounted on a pivot pin 22. The opposite end of the socket member is provided with a socket for receiving a hand lever 23 by which the socket may be swung up and down in order to reciprocate plunger 14 in the pump cylinder.

Inside the pump cylinder there is a floating piston 25 provided with an axial bore 26 through it. The lower end of plunger 14 extends into this bore, in which it can move up and down, and is provided with an integral collar 27 over which the upper end of the piston projects so that the plunger can lift the piston. The lower end of the plunger also carries a packing cup 28, whereby the plunger may act as a piston inside the floating piston if the latter is held stationary, which it sometimes is as presently will be described.

As shown in Figs. 2 and 3, the end of the base adjacent the pump is provided with a threaded socket into which a sealing plug 30 is screwed. The plug is spaced from the inner wall of the socket to form a chamber 31. Drilled inwardly through the base from the inner wall of the socket to a point beneath the jack cylinder is a passage 32 the inner end of which opens into a hole 33 drilled in the base below lifting member 4.

Also drilled inwardly through the base from the inner wall of the socket is a passage 35 parallel to passage 32. The inner end of passage 35 opens into the bottom of a hole 36 drilled down into the base from the bottom of the fluid reservoir. The reservoir thus is connected by hole 36, passage 35, socket chamber 31, passage 32, and hole 33 with the bottom of the jack cylinder.

The bottom of the pump cylinder is connected by a vertical passage 38 in the base with an enlarged portion of passage 35. This enlarged portion is provided on opposite sides of the vertical passage with check valve seats against which an inlet ball 39 and an outlet ball 40 normally rest. The inlet ball is prevented from closing vertical passage 38 by any suitable means, such as by a loose ball 41 that occupies most of the space between the valve balls. The outlet ball is urged toward its seat by means of a light coil spring 42 compressed between it and plug 30. With this arrangement, when the pump is operated, fluid from the reservoir is drawn past inlet ball 39 and up through passage 38 into the pump cylinder, and then is forced out through passage 38, past ball 40, and through chamber 31 to passage 32 by which it is conducted to the jack cylinder to elevate the lifting member therein. Reverse flow of fluid in passage 35 is prevented by check valve balls 39 and 40. The conduit from the reservoir to inlet ball 39 is a low pressure passage, while the conduit from the pump cylinder to the jack cylinder is a high pressure passage.

An important feature of this invention is that the lifting member 4 rises rapidly in the jack cylinder until it contacts the load it is to lift, and then, without any adjustment of the jack or any change in the stroke of the hand lever that operates the pump, the lifting member automatically slows down and slowly raises the load without requiring a material increase in manual effort to operate the pump. To accomplish this a valve is screwed into the lower end of the floating piston bore. This valve has a body 45 the upper part of which is screwed into the bore and the lower part of which is circular and projects laterally far enough to form a shoulder that clamps a packing cup 46 against the bottom of the piston. This lower part of the valve body is provided with a transverse passage 47 therethrough provided near its opposite ends with inlet and outlet check valve seats against which inlet and outlet balls 48 and 49, respectively, rest. Between these balls a passage 51 extends up through the valve body and into the piston bore. The inlet ball may be prevented from closing this last passage by a cross pin 52 in the transverse passage. The outlet ball 49 normally is maintained against its seat with considerable pressure. Preferably, this is done by a stiff coil spring 53 compressed between it and a retaining ring 54 screwed into the outlet end of passage 47. By turning this ring farther into or out of the passage, the spring pressure on the adjoining ball can be adjusted.

In operation, when an operator starts to move pump lever 23 up and down, fluid is drawn from the reservoir up into the pump cylinder and through the valve carried by the floating piston therein until the piston bore 26 is filled. Thereafter, until lifting member 4 is raised high enough to engage the load, the pressure of valve spring 53 against ball 49 is sufficient to keep the outlet of passage 47 closed against the fluid pressure created in the piston bore when plunger 14 is moved downwardly in the cylinder 12. Consequently, the

plunger can not move downwardly in the floating piston so it moves the piston down with it, as shown in Fig. 2, with the plunger serving only as a piston rod for piston 25. The relatively large area of the lower end of the hollow piston therefore is used to pump the fluid into the jack cylinder, with the result that lifting member 4 rises rapidly until it engages the load. As soon as the load is engaged, the increased fluid pressure required to lift it tends to hold the floating piston at the top of the pump cylinder while the plunger is reciprocated inside the piston which then serves as a cylinder for the plunger, as shown in Fig. 1. Downward movement of the plunger in bore 26 is permitted at this time because the force required to unseat outlet ball 49 is less than the force required to overcome the fluid pressure below the floating piston, due to the difference in areas of the lower ends of the piston and plunger. This difference is so great that the operator can continue to reciprocate the plunger without any undue increase in exertion on his part. Of course, the small effective area of the plunger will result in a much smaller volume of fluid than before being expelled from the pump cylinder for each stroke of the pump lever, and the rate of rise of lifting member 4 will be diminished accordingly. Nevertheless, the operator can operate the pump as before without having to make any adjustments or changes when the load is picked up. The change-over from piston to plunger operation is entirely automatic.

If desired, valve spring 53 can be set to prevent opening of the outlet from piston bore 26 even after the lifting member engages the load, in case the load is light.

In order to release the fluid pressure from the jack cylinder when the jack is to be lowered, a by-pass opening 56 is drilled in the base connecting the lower end of hole 36 with passage 32. This by-pass normally is maintained closed by a manually operable valve 57 having its inner end seated in the by-pass. This valve is threaded in a nut 58 that is screwed into an opening in the base. The nut also serves to compress packing material 59 around the valve. The outer end of the valve is disposed entirely within a recess 60 in one side of the base.

The pump is outside of the rest of the jack so that it can be serviced readily by merely unscrewing the cap 13 from the top of the pump cylinder. The other parts of the jack are just as accessible. The entire jack is compact and relatively simple and inexpensive in construction with little to get out of order.

According to the provisions of the patent statutes, I have explained the principle and construction of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. In fluid pressure actuated apparatus, a pump comprising a cylinder provided at one end with a fluid passage adapted to connect the cylinder with a fluid reservoir and with a load, check valve means associated with said passage to keep fluid from flowing from the load and cylinder to the reservoir, an axially reciprocable plunger extending into the outer end of the cylinder, means connected to the outer end of the plunger for reciprocating it to pump fluid through said

passage from the reservoir to the load, a floating piston in said cylinder provided with an axial bore therethrough receiving the inner end of the plunger for reciprocation therein, means carried by said piston for limiting retraction of the plunger from said bore, a valve body connected to the end of said bore opposite said plunger and provided with inlet and outlet passages connecting said cylinder with said bore, a check valve in each of said valve passages, and an adjustable spring maintaining said outlet check valve closed against fluid pressure in said bore until the piston builds up the fluid pressure between it and the load to a predetermined value that restrains inward movement of the piston.

2. In fluid pressure actuated apparatus, a pump comprising a cylinder provided at one end with a fluid passage adapted to connect the cylinder with a fluid reservoir and with a load, check valve means associated with said passage to keep fluid from flowing from the load and cylinder to the reservoir, an axially reciprocable plunger extending into the outer end of the cylinder, means connected to the outer end of the plunger for reciprocating it to pump fluid through said passage from the reservoir to the load, a floating piston in said cylinder provided with an axial bore therethrough receiving the inner end of the plunger for reciprocation therein, means carried by said piston for limiting retraction of the plunger from said bore, a valve body mounted in the inner end of said bore and projecting therefrom, the projecting portion of the valve body being provided with a transverse passage therethrough, said valve body also being provided with a vertical passage connecting said passage with said bore, a ball check valve in the inlet end of said transverse passage, another ball check valve in the outlet end of the transverse passage, an adjustable member mounted in the outlet of the transverse passage and spaced from the outlet ball, and a coil spring compressed between said member and outlet ball to maintain the ball seated against fluid pressure in said bore until the piston builds up the fluid pressure between it and the load to a predetermined value that restrains inward movement of said piston.

3. In fluid pressure actuated apparatus, a pump comprising a cylinder provided at one end with a fluid passage adapted to connect the cylinder with a fluid reservoir and with a load, check valve means associated with said passage to keep fluid from flowing from the load and cylinder to the reservoir, an axially reciprocable plunger extending into the outer end of the cylinder, a lever pivoted between its ends to the outer end of the plunger for reciprocating it to pump fluid through said passage from the reservoir to the load, a link pivotally connected at its ends to said base and to one end of said lever, a floating piston in said cylinder provided with an axial bore therethrough receiving the inner end of the plunger for reciprocation therein, means carried by said piston for limiting retraction of the plunger from said bore, a valve body connected to the end of said bore opposite said plunger and provided with inlet and outlet passages connecting said cylinder with said bore, a check valve in each of said valve passages, and means maintaining said outlet check valve closed against fluid pressure in said bore until the piston builds up the fluid pressure between it and the load to a predetermined value that restrains inward movement of the piston.

4. In fluid pressure actuated apparatus, a pump

comprising a cylinder provided at one end with a fluid passage, an axially reciprocable plunger extending into the opposite end of the cylinder, means connected to the outer end of the plunger for reciprocating it, a floating piston in said cylinder provided with an axial bore therethrough receiving the inner end of the plunger for reciprocation therein, means carried by the piston for limiting retraction of the plunger from said bore, a valve body connected to the end of said bore opposite said plunger and provided with inlet and outlet passages connecting soid cylinder with said bore, a check valve in each of said valve passages, and means maintaining said outlet check valve closed against fluid pressure in said bore until the piston builds up the fluid pressure to a predetermined value that restrains movement of the piston toward said first-mentioned passage.

5. In fluid pressure actuated apparatus, a pump comprising a cylinder provided at one end with a fluid passage adapted to connect the cylinder with a fluid reservoir and with a load, an axially reciprocable plunger extending into the opposite end of the cylinder, means connected to the outer end of the plunger for reciprocating it to pump fluid through said passage from the reservoir to the load, a floating member in said cylinder provided with an axial bore therethrough receiving the inner end of the plunger for reciprocation therein, means carried by said member for limiting retraction of the plunger from said bore, a valve body mounted in the inner end of said bore and projecting therefrom, the projecting portion of the valve body being provided with a transverse passage therethrough, said valve body also being provided with a vertical passage connecting said passage with said bore, a check valve in the inlet end of said transverse passage, another check valve in the outlet end of the transverse passage, and resilient means maintaining said outlet check valve closed against fluid pressure in said bore until the piston builds up the fluid pressure between it and the load to a predetermined value that restrains inward movement of said floating member.

6. In fluid pressure actuated apparatus, a liquid pump comprising a cylinder provided at one end with a liquid passage adapted to connect the cylinder with a liquid reservoir and with a load, a free floating low pressure piston in said cylinder provided with an axial bore therethrough, a high pressure piston in said bore, means extending from the high pressure piston out through the rear end of the low pressure piston and the cylinder for reciprocating the high pressure piston, means carried by said end of the low pressure piston for limiting retraction of the high pressure piston from the rear end of said bore whereby the high pressure piston will draw the low pressure piston backwardly with it, inlet and outlet valves connected to the opposite end of said bore to lock liquid in the bore in front of the high pressure piston so that the latter will move the low pressure piston forward with it, and check valve means associated with said cylinder passage to allow liquid to be pumped by said pistons from the reservoir to the load, said outlet valve being adapted to open to permit the high pressure piston to move forward in said bore when the low pressure piston builds up the liquid pressure in the cylinder to a predetermined value that restrains forward movement of the low pressure piston in the cylinder.

FRANK H. SCHWERIN.

(References on following page)

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,046,073	Joyce	Dec. 3, 1912
1,047,007	Drugan	Dec. 10, 1912
1,656,430	Dybens	Jan. 17, 1928
1,680,536	Gensmer	Aug. 14, 1928
1,781,404	McNab	Nov. 11, 1930
1,829,451	McNab	Oct. 27, 1931
1,904,115	Bacon	Apr. 18, 1933
1,940,823	Shinn	Dec. 26, 1933
1,969,920	Andrews	Aug. 14, 1934
2,091,876	Oldham	Aug. 31, 1937
2,250,551	Pfauser	July 29, 1941