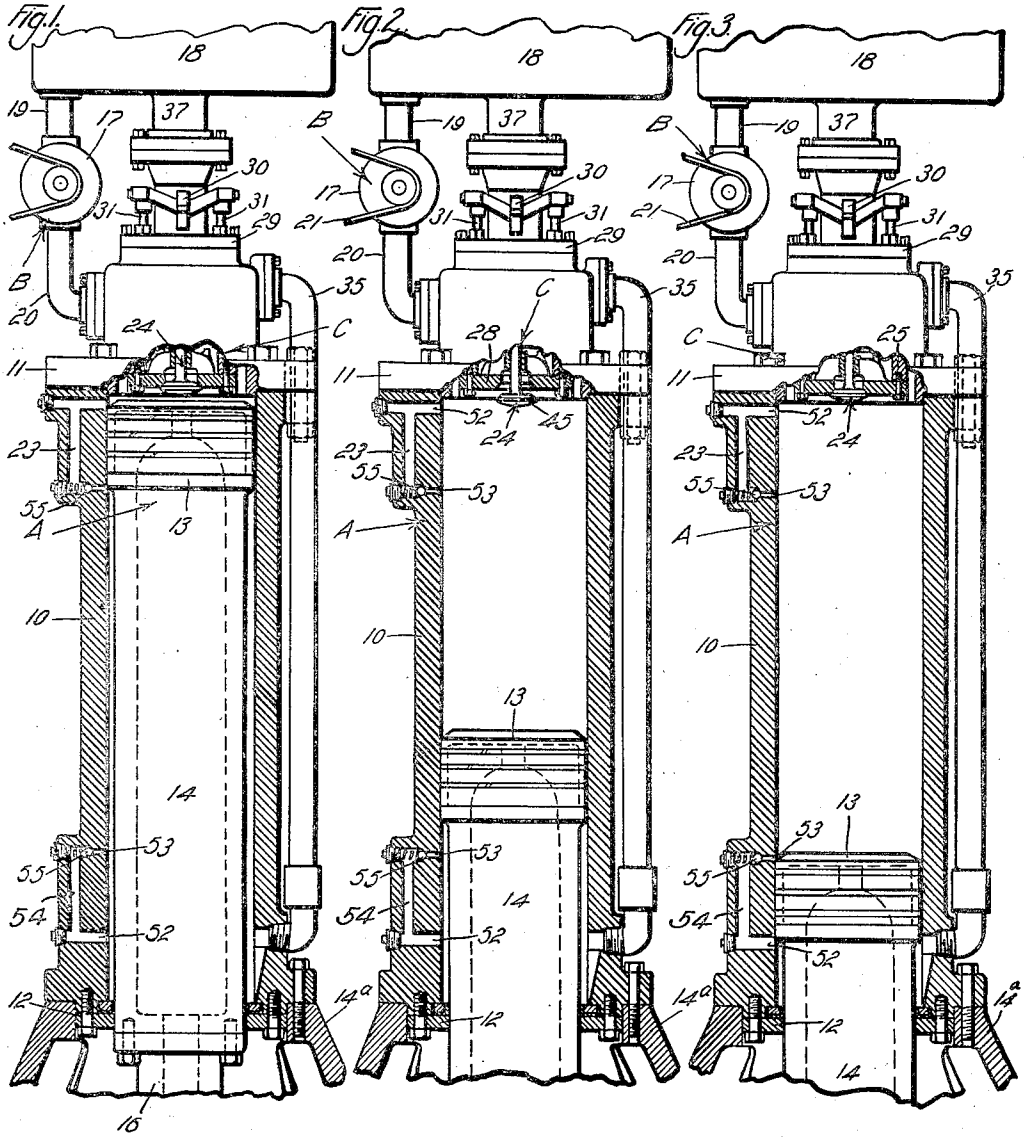
Aug. 8, 1933. H. F. VICKERS 1,921,955

HYDRAULIC MECHANISM

Filed June 8, 1929 2 Sheets-Sheet 1



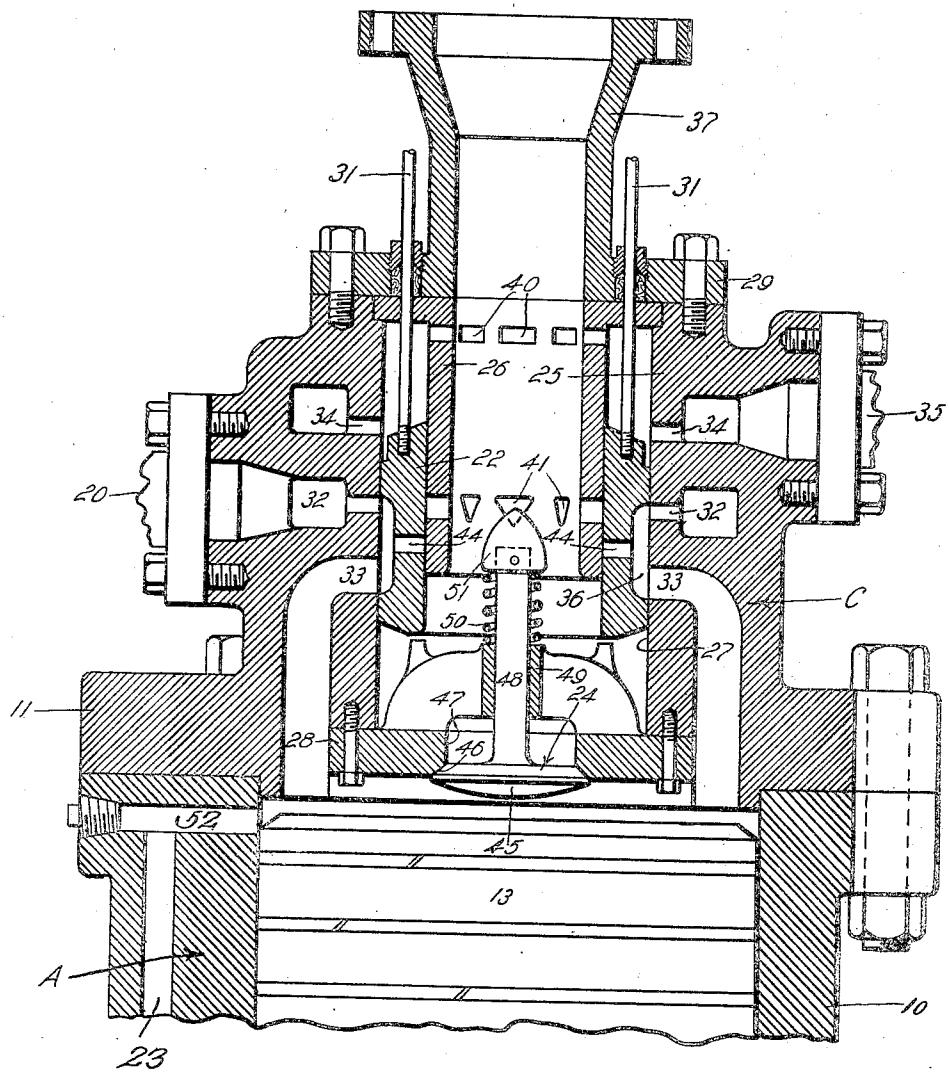
Inventor
Harry F. Vickers
by W. W. Caldwell
his Attorney

Aug. 8, 1933. H. F. VICKERS 1,921,955

HYDRAULIC MECHANISM

Filed June 8, 1929 2 Sheets-Sheet 2

Fig. 4.



Inventor
Harry F. Vickers
by W. H. Caldwell
his Attorney

Patented Aug. 8, 1933 1,921,955

UNITED STATES PATENT OFFICE

1,921,955

HYDRAULIC MECHANISM

Harry F. Vickers, Los Angeles, Calif.

Application June 8, 1929. Serial No. 369,454

6 Claims. (Cl. 60—52)

This invention has to do with a hydraulic mechanism and relates more particularly to a mechanism that can be used to advantage in a press or ram, it being a general object of the invention to provide a mechanism of this character which overcomes certain difficulties heretofore characteristic of mechanisms of this character and to provide a construction and arrangement which is commercially practical.

Hydraulically actuated mechanisms such as rams, presses, etc., have had various undesirable features that have materially interfered with their commercial development. For instance, water hammer or pressure surge, such as occurs in the ordinary hydraulic mechanism, makes it necessary to employ very heavy construction, and in some cases makes such mechanisms commercially impractical. Further, hydraulic mechanisms such as I have mentioned are usually employed where it is desired to exert heavy pressure. Hydraulically actuated cylinder and piston mechanisms are particularly adapted to this class of work; however, such mechanisms have heretofore been slow in operation or excessively complicated and expensive of construction. For instance, the ordinary hydraulic press of the cylinder and piston type is operated from a source of pressure which delivers liquid in small quantities and at high pressures, with the result that the action of the mechanism, whether engaged in active work or not, is slow. Complicated and more or less expensive constructions employing pressure accumulators have been tried with a view of overcoming the difficulty just mentioned; however, such mechanisms, in addition to being complicated and expensive, give trouble from water hammer or pressure surge.

It is a general object of the present invention to provide a hydraulic mechanism such as a press, or the like, including a pump, the flow of which is directed so that it performs useful work, or is by-passed, and is thus continuous at all times. By providing for the continuous operation of the actuating pump, a pressure accumulator is eliminated and various features which cause water hammer or pressure surge are avoided.

It is another object of the present invention to provide a hydraulic mechanism in which the moving element, say, for instance, a piston, can be operated under full control of the operator and without surging of pressures or actions such as usually attend the controlling of the movable element of a mechanism of this character.

A further object of the invention is to provide a hydraulic mechanism such as a press or ram operated by a constant fluid supply without the use of a pressure accumulator, or the like.

It is a further object of the present invention to provide a hydraulic mechanism operable to quickly feed or advance to working position and then operate under full pressure. The mechanism provided by the invention may be operated a substantial distance, in fact, any desired distance until resistance is encountered, before the slow heavy pressure characteristic of a hydraulic press, or the like, is exerted. This makes the mechanism practical for use in many situations where hydraulic presses of ordinary construction cannot be used as no appreciable delay is incurred in bringing the press into engagement with the work.

A further object of the invention is to provide a mechanism of the character mentioned operable by gravity in a position where it is necessary to operate under pressure.

It is another object of the present invention to provide a hydraulic mechanism in which a cylinder and piston mechanism, or the like, is directly connected with a constant delivery pump.

A further object of the invention is to provide a mechanism in which a piston is allowed to fall by gravity until resistance is encountered whereupon it automatically continues in operation by pressure.

The various objects and features of my invention will be best and more fully understood from the following detailed description of a typical form and application of the invention, throughout which description reference is had to the accompanying drawings, in which:

Fig. 1 is a side view of a typical mechanism embodying the invention showing the cylinder of the mechanism in section and the piston of the mechanism up, or unactuated. Fig. 2 is a view of the cylinder and piston portion of the mechanism showing the cylinder in section and the piston lowered or operated to a position such as it may operate to before resistance is encountered. Fig. 3 is a view similar to Fig. 2 showing the piston at the lower end of its stroke ready to be returned to the position shown in Fig. 1, and Fig. 4 is an enlarged detailed sectional view of the control, which is a feature of the invention, showing the parts positioned to correspond to that illustrated in Fig. 1.

The present invention may be employed in hydraulic mechanisms of various forms or types, however, it is particularly applicable to a hydraulic ram or press, and therefore I have chosen to

disclose it as applied to the cylinder and piston type of press, it being understood that the broader principles of the invention are not to be construed as limited to the particular details herein set forth.

The mechanism illustrated includes, generally, a cylinder and piston mechanism A, fluid pressure supply means B, and a control C relating the pressure supply means with the cylinder and piston mechanism A. The mechanism A includes, generally, a cylindrical body, or cylinder proper, 10, heads 11 and 12 closing the ends of the cylinder, and a piston 13 slidably carried in the cylinder 10 and attached to a rod 14 which projects from the cylinder 10 through one of the heads. In accordance with the preferred form of the invention, the piston is adapted to be actuated in one direction, at least through a portion of its stroke, by gravity, and preferably by gravity acting on the piston and its attached part or parts such as the rod 14. In the preferred arrangement the cylinder body 10 is vertically disposed, as illustrated in the drawings, so that the piston which slides in its will drop or move downwardly by gravity. In the drawings I have illustrated the cylinder body 10 supported by means of a suitable mounting or base 14a.

It is to be understood that the outer or projecting end of the rod 14 may be related to the work or object to be pressed, for instance, it may be attached to a push rod 16 which actively engages the work. In the preferred arrangement the piston rod 14 projects downwardly through the lower head 12 of the cylinder. The present invention is not specifically concerned with the manner in which the rod 14 is related to the work or object to be pressed, and therefore such detail has been omitted from the present disclosure. It will be obvious that various constructions used in presses, and the like, may be used with the present invention.

The fluid pressure supply means may be varied in different forms or applications of the invention. For purpose of example, I have disclosed this means as including a pump 17 receiving fluid, say, for instance, water or oil, from a reservoir 18 through a pipe 19 and delivering it under pressure to a pipe 20 which conducts it to the control C. The pump 17 illustrated is of the rotary type and is shown driven by a belt 21. In the preferred arrangement the reservoir 18 is located above the pump 17 so that the oil flows to the pump by gravity.

The control C, which handles the oil delivered by the pump 17 so that the piston 13 is operated in the desired manner in the cylinder 10, includes, generally, a valve 22 controlling the supply of oil from the pump to the cylinder and the exhaust of oil from the cylinder, by-passes 23 at the ends of the cylinder to conduct oil pased around the piston at the ends its stroke, and an auxiliary supply valve 24 for admitting or introducing fluid into the cylinder upon the piston moving faster than it is operated by normal action of the pump 17.

In the particular construction illustrated the by-passes 23 are embodied or incorporated directly in the cylinder body 10 while the valves 22 and 24 are embodied in an assembly carried by the upper cylinder head 11. The assembly carried in the cylinder head 11 includes a cylindrical valve cage 25 carrying the valve 22 which in this case is in the nature of a sleeve, and a core 26 fitting within the valve 22. The cylindrical cage 25 is formed integral with the head 11 and is arranged vertically as clearly shown in the drawings. The bore 27 of the cage 25 extends vertically through it. The lower end of the cage 25 is closed or separated from the interior of the cylinder body 10 by a closure plate 28 while the upper end is closed by a cover 29. The valve 22 is in the form of a sleeve slidably carried in the bore 27 of the cage 25 and is adapted to be operated from a lever 30 at the exterior of the construction through rods 31 extending through the cover 29, as clearly illustrated in Fig. 4. The core 26 is stationary in the cage 25 and fits the interior of the valve 22. In the construction shown the core 26 is tubular in form and is supported from its upper end to project downwardly into the valve 22.

Supply ports 32 are provided in the wall of the cage 25 communicating with the bore 27 and receiving fluid from the pump 17 through the connection 20. Cylinder ports 33 are provided in the cage 25 and communicate with the bore 27 at a point below the ports 32 and extend to the upper end of the cylinder 10. Cylinder ports 34 are formed in the cage 25 to communicate with the bore 27 at a point above the ports 32, the ports 34 being connected with the lower end of the cylinder 10 by a suitable manifold 35. An annular recess or port 36 is provided in the outer wall of the sleeve valve 22 to connect the ports 32 with the ports 33 when the valve 22 is down, as shown in Fig. 4 and to connect the ports 32 with the ports 34 when the valve is up. It will be obvious from inspection of Fig. 4 that communication between the ports 32 and 34 is cut off when the valve 22 is down and that communication between the ports 32 and the ports 33 is cut off when the valve 22 is up.

In the particular construction illustrated the core 26 is hollow or tubular and communicates with an exhaust manifold 37 which projects upwardly from the cover 29 and connects with the reservoir 18. The reservoir is located above the control C. A series of ports 40 is provided in the upper portion of the core 26 connecting the interior of the core with the space between the core and the bore 27, and a second series of ports 41 is formed through the wall of the core 26 at a point opposite the port 32. The valve 22 is related to the various ports above described so that the ports 34 are opened or uncovered by the valve 22 to communicate with the ports 40 when the valve is down, connecting the ports 33 with the ports 32, while the ports 33 are uncovered by the valve and opened to the interior of the core through the lower end of the core when the valve 22 is up connecting the ports 32 with the ports 34. With this relationing of parts, when fluid under pressure is being supplied to the upper end of the cylinder 10 through the ports 33, fluid below the piston is allowed to escape through the manifold 35, ports 34, ports 40, and manifold 37, and when fluid under pressure is supplied to the lower end of the cylinder through the ports 34 and manifold 35 fluid above the piston is allowed to escape through the ports 33 through the lower end of the core 26 and through the manifold 37. The ports 41 formed in the core 26 opposite the ports 32 are designed to cooperate with ports 44 formed through the wall of the valve 22 so that part of the oil delivered to the ports 32 by the pump can be by-passed to the interior of the core 26 and thus exhausted to the reservoir 18 while the rest is conducted by the ports 33 to the upper end of the cylinder. This construction provides for

regulating or controlling the speed with which the piston is forced downwardly in the cylinder.

The auxiliary valve 24 when open as illustrated in Fig. 2 operates to admit fluid into the cylinder above the piston when the piston drops by gravity at a rate faster than oil is supplied by the pump 17 to force the piston downwardly. Primarily the valve 24 controls communication between the reservoir 18, or other source of fluid, and operates to admit fluid freely, for instance, by gravity, into the cylinder above the piston. In the particular form of the invention illustrated the auxiliary valve 24 is arranged to admit fluid by gravity to the cylinder above the piston, and, as above stated, the valve 24 is arranged in the assembly carried by the head 11 so that fluid being exhausted from the lower end of the cylinder or fluid from the reservoir may flow downwardly through the core 26, through the lower portion of the valve cage 25, and into the upper end portion of the cylinder 10. In the case illustrated the valve 24 is in the nature of a puppet valve having a head 45 seating upwardly on a seat 46 surrounding an opening 47 formed through the plate 28 which closes the lower end of the cage 25. The head 45 is carried by a stem 48 operating in a guide 49. A spring 50 surrounds the stem 48 between the guide 49 and stop 51 on the upper end of the stem to normally yieldingly hold the valve up, or closed, as shown in Fig. 4. The valve spring is made so that the valve opens as soon as the piston 13 starts to fall or move downwardly in the cylinder faster than it is forced down by the fluid supplied by the pump 17. It will be obvious that the valve 24 continues to admit fluid from the exhaust side of the system, or from the reservoir, directly into the top of the cylinder, until the downward movement of the piston is checked or slowed down as by the resistance of the work acting through the push rod 16 and piston rod 14. As soon as the work or resistance stops or materially arrests the gravitational movement of the piston, the valve 24 closes and the fluid supplied under pressure by the pump 17 operates to move the piston downwardly under pressure, the pressure thus exerted operating to hold the valve 24 closed and thus prevent leakage.

The by-passes 23, arranged at the ends of the stroke of the piston 13 in the cylinder 10, operate to allow continued circulation of fluid under action of the pump 17 without operation of the valve means to reverse or alter the direction of flow of the fluid. Each by-pass includes an outer port 52 and an inner port 53 communicating with the interior of the cylinder 10, a connecting passage 54 between the ports, and a check valve 55 allowing the flow in only one direction through the passage 54. The ports 52 and 53 are spaced apart longitudinal of the cylinder 10 a distance exceeding the length of the piston, as will be apparent from Figs. 1, 2 and 3 of the drawings. The check valve 55 is arranged to allow flow from the inner port 53 to the outer port 52 and to check flow in the other direction.

When the parts are in the position shown in Fig. 1 and pressure is admitted above the piston 13, the check valve 55 in the by-pass at the upper end of the cylinder prevents the fluid from bypassing the piston and thus causes the oil to act on the piston to force it downwardly in the cylinder. When the piston reaches the down position, that is, the lower end of its stroke as shown in Fig. 3, the fluid opens the check valve 55 in the by-pass at the lower end of the cylinder, allowing flow around the piston so that the fluid circulated by the pump exhausts around the piston and out through the manifold 35. When the piston is at the lower end of its stroke and the valve 22 is operated to circulate fluid under pressure downwardly through the manifold 35 to the lower end of the cylinder, the check valve 55 in the by-pass at the lower end of the cylinder is closed so that the fluid introduced into the lower end of the cylinder forces the piston upwardly in the cylinder. It is to be noted that the piston rod 14 is very large in diameter and therefore occupies a substantial portion of the cylinder area below the piston. With this construction the fluid delivered by the pump returns the piston to the upper end of the cylinder quickly.

It is believed that the features and operation of the mechanism will be fully understood from the foregoing description. In general, however, it may be stated that the pump 17 operates continuously and when the piston 13 is at the upper end of the cylinder and the valve 22 positioned as shown in Fig. 4, the piston starts downward movement in the cylinder and will fall by gravity until the work or resistance is encountered. During the gravitational drop of the piston the auxiliary valve 24 opens as above described admitting fluid into the upper end of the cylinder above the piston at the same time that fluid is being pumped into the cylinder above the piston through the ports 33. When the resistance or work is encountered, the valve 24 closes and the fluid under pressure from the pump 17 exerts pressure on the piston, forcing it downwardly against the work. When the piston has been operated to the lower end of its stroke, for instance, to the position shown in Fig. 3, the by-pass at the lower end of the cylinder automatically opens allowing the fluid delivered by the pump 17 to by-pass around under the piston 13 and out through the manifold 35. When it is desired to raise the piston or to return it to the upper end of the cylinder, the valve 22 is shifted so that the fluid under pressure is introduced under the piston through the manifold 35, which reversal of direction of flow causes the check valve in the by-pass at the lower end of the cylinder to close and the piston to move upwardly, the fluid escaping from the upper end of the cylinder through the ports 33 and the core 26. When the piston reaches the upper end of its stroke, the check valve in the by-pass at the upper end of the cylinder automatically opens allowing the fluid circulated by the pump 17 to by-pass around the piston and discharge through the ports 33. It will be obvious that the pump 17 is thus allowed to operate continuously and that the fluid in the system is constantly flowing and never reverses flow in such volume or under such circumstances as to cause severe pressure surge or water hammer. It is also to be particularly noted that the construction eliminates entirely a pressure accumulator or other corresponding element and thus provides a simple, inexpensive construction that is commercially practical.

In the drawings and in the foregoing description I have disclosed inventions other than the one claimed in this particular application; for instance, the assembly including the valves 22 and 24 is the subject of my copending application entitled Valve, Serial No. 369,453, filed June 8, 1929 (now Patent Number 1,855,433) in which application this construction is set forth in detail and is specifically claimed.

Having described only a typical, preferred form of the invention, I do not wish to limit myself to

the specific details set forth, but wish to reserve to myself any changes or variations that may appear to those skilled in the art or fall within the scope of the following claims.

Having described my invention, I claim:

1. In combination, a vertical cylinder, a piston operable in the cylinder, a fluid reservoir, a continuously operating pump receiving fluid from the reservoir and delivering it under pressure, a fluid connection between the pump and the two ends of the cylinder and between the two ends of the cylinder and the reservoir, a reversible valve mechanism at the upper end of the cylinder and in said connection whereby the pumped fluid may be delivered to either end of the cylinder and allowed to escape from the other end of the cylinder to the reservoir so that the piston can be operated in either direction in the cylinder, and an auxiliary connection between the portion of said connection communicating with the reservoir and one end of the cylinder allowing fluid to enter said end of the cylinder at the same time that fluid is being delivered to said end of the cylinder by the pump.

2. In combination, a cylinder, a piston operable in the cylinder, a fluid reservoir, a continuously operating pump receiving fluid from the reservoir and delivering it under presseure, a fluid connection between the pump and the two ends of the cylinder and between the two ends of the cylinder and the reservoir, a reversible valve in said connection whereby the pumped fluid may be delivered to either end of the cylinder and allowed to escape from the other end of the cylinder to the reservoir, by-passes at the ends of the cylinder allowing fluid to pass the piston at the ends of its stroke, and an auxiliary connection between the portion of said connection communicating with the reservoir and one end of the cylinder allowing fluid to enter said end of the cylinder at the same time that fluid is being delivered to said end of the cylinder by the pump.

3. In combination, a vertical cylinder, a piston operable in the cylinder, a fluid supply, a continuously operating pump receiving fluid from the fluid supply, a valve supplied with fluid by the pump and connected between the ends of the cylinder and the fluid supply operable to control delivery of pumped fluid to either end of the cylinder or to the fluid supply, and an auxiliary fluid supply at the upper end of the cylinder delivering fluid to the cylinder upon the piston moving faster than it is operated by fluid from the pump.

4. In combination, a vertically disposed cylinder, a piston operable in the cylinder, a piston rod connected to the piston and projecting through the lower end of the cylinder, the rod being only slightly smaller than the cylinder, a fluid reservoir, a pump taking fluid from the reservoir, a valve at the upper end of the cylinder receiving fluid from the pump and directing it to the cylinder to reciprocate the piston therein, the valve controlling the exhaust of fluid from the ends of the cylinder to the reservoir and a fluid connection through the valve between the reservoir and the upper end of the cylinder allowing fluid to enter the upper end of the cylinder from the reservoir upon the piston moving downwardly faster than it is operated by fluid from the pump.

5. In combination, a vertically disposed cylinder, a piston operable in the cylinder, a piston rod connected to the piston and projecting through the lower end of the cylinder, the rod being only slightly smaller than the cylinder, a fluid reservoir immediately above the cylinder, a pump taking fluid from the reservoir and delivering it to the cylinder to reciprocate the piston therein, and a fluid connection between the reservoir and the upper end of the cylinder allowing fluid to flow directly down and enter the upper end of the cylinder from the reservoir upon the piston moving downwardly faster than it is operated by fluid from the pump.

6. In combination, a vertically disposed cylinder, a piston in the cylinder, a piston rod connected with the piston and projecting from the lower end of the cylinder, a fluid reservoir above the cylinder, a pump taking fluid from the reservoir, and a control including a body on the upper end of the cylinder, a valve operable in said body to control the passage of fluid under pressure from the pump to the ends of the cylinder and to control the discharge of fluid from the ends of the cylinder, there being a passage in said body to pass fluid from the reservoir into the upper end of the cylinder, and a normally closed valve in the said body controlling said passage adapted to open when the piston moves downwardly faster than it is operated by fluid under pressure supplied by the pump.

HARRY F. VICKERS.