Aug. 5, 1958 D. F. SAURENMAN 2,846,190

HYDRAULIC DEVICES

Filed Feb. 29, 1952 3 Sheets-Sheet 1

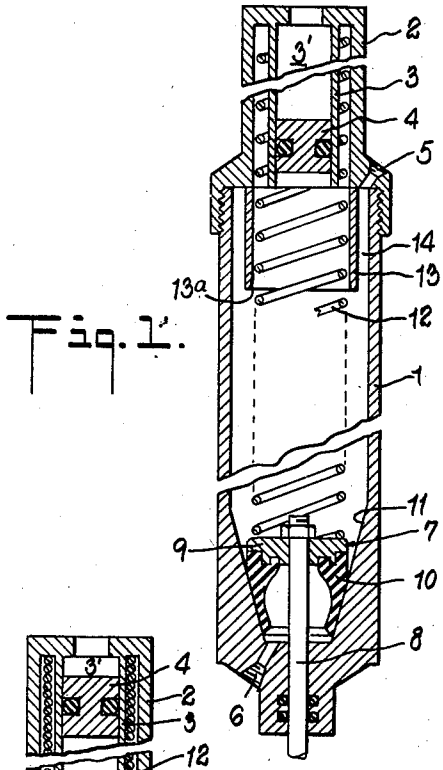

Fig. 1.

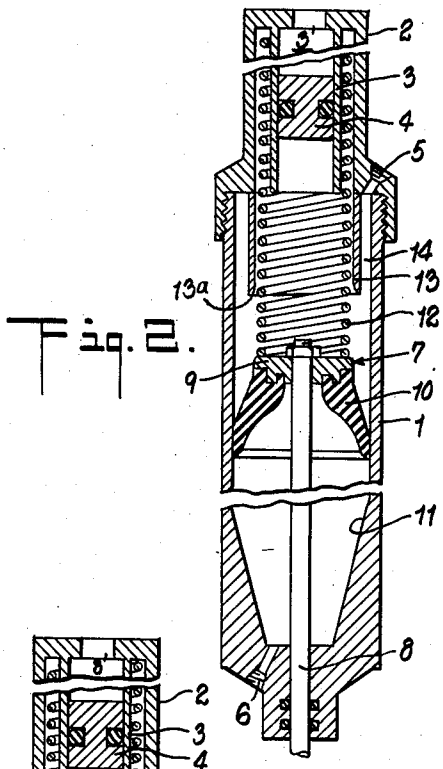

Fig. 2.

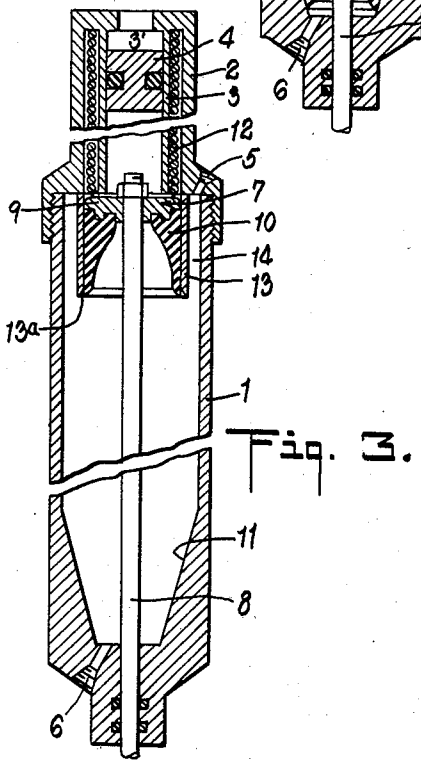

Fig. 3.

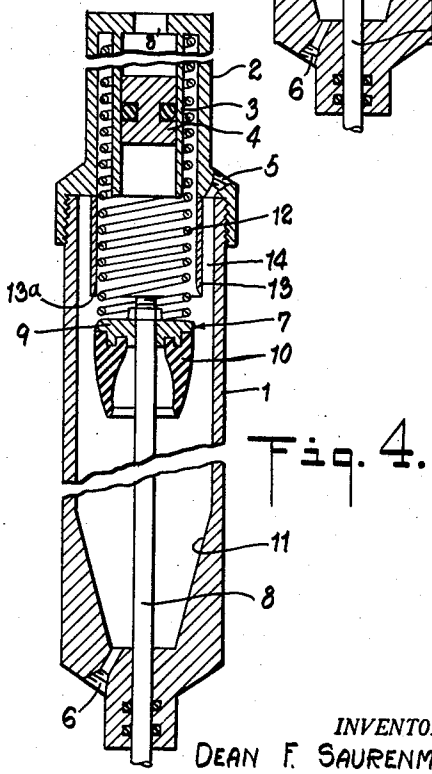

Fig. 4.

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Fig. 5.

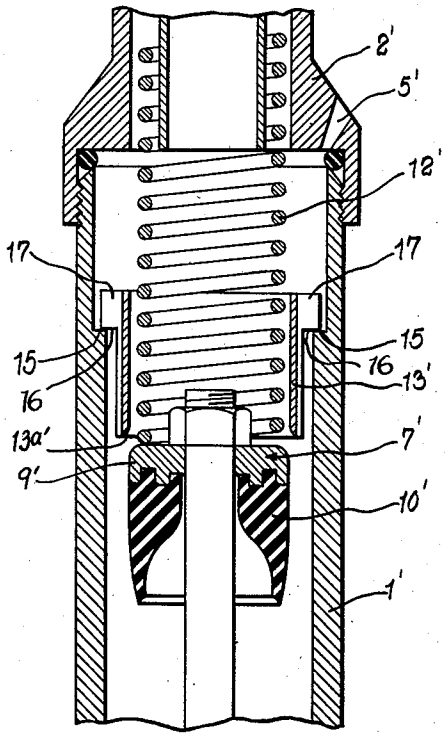


Fig. 7.

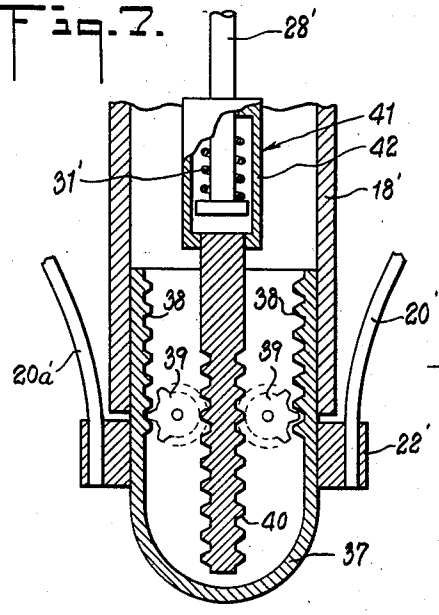
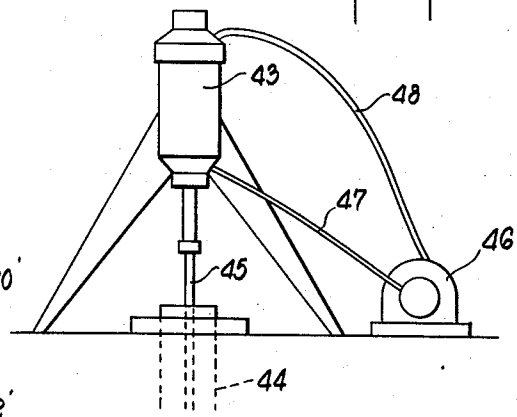


Fig. 8.



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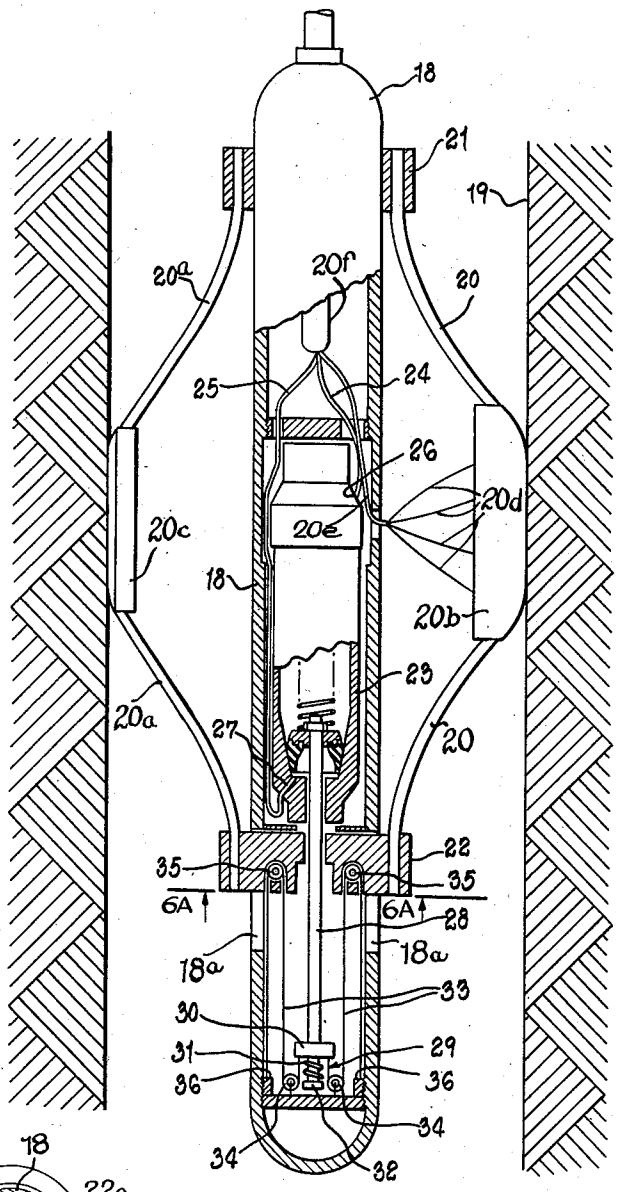

Fig. 6.

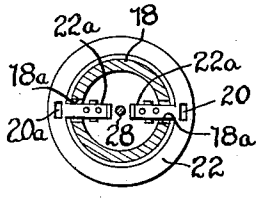

Fig. 6A.

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HYDRAULIC DEVICES

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Application February 29, 1952, Serial No. 274,103

13 Claims. (Cl. 255—1)

This invention relates to hydraulic devices and more particularly to new and simplified hydraulically actuated devices for effecting stroking motions.

Hydraulic jacks and related devices for utilizing differential pressures of fluid to provide continuous reciprocatory or random single stroke movements often require complicated valve means or auxiliary apparatus to control their actions. In some hydraulic jacks, for example, fluid is introduced into one end of a cylinder to force a piston through one stroke. To return the piston for another stroke it is necessary, as by the use of valves or other auxiliary controls, to discontinue the flow of fluid into that end of the cylinder. In other hydraulic jacks fluid under pressure is directed by a system of cooperatively acting valves alternately to the two sides of the piston in conjunction with a similar system of valves for relieving fluid pressure in reverse alternation on the two sides of the piston. Such devices may be complex and bulky as well as costly to build and maintain.

It is, therefore, an object of this invention to provide new and improved hydraulically actuated devices for providing stroking motions.

It is another object of the invention to provide hydraulically actuated devices which will provide reciprocatory output actions when supplied with a continuous unidirectional flow of hydraulic fluid.

It is another object of this invention to provide a simplified hydraulically actuated device which can be made to reciprocate without the use of cooperatively acting valves and the like.

It is a further object of the invention to provide a hydraulic cylinder and piston arrangement which may be operated to provide either continuous reciprocatory motions or single stroke motions.

According to the invention there is provided a cylinder into one end of which fluid may be continuously injected under pressure and from the opposite end of which fluid may be discharged. A piston, which is movable axially within the cylinder, is provided with an expandable portion having a normal configuration which permits the fluid to flow around the piston and an expanded configuration which establishes a fluid-tight seal with the cylinder so that the piston may be driven by the pressure of the fluid.

The cylinder is provided at its opposite ends with means for actuating the expandable portion of the piston. The end of the cylinder into which fluid is introduced is provided with piston-engaging means for effecting the fluid-tight seal between the piston and the cylinder. The end of the cylinder from which fluid is discharged is provided with piston-engaging means for breaking the seal to permit a return stroke of the piston counter to the direction of flow of fluid through the cylinder.

As one means of returning the piston to its initial driving position, resilient means may be connected to the piston which is activated during the pressure stroke of the piston and which is subsequently permitted to bring about the return stroke.

For a better understanding of the present invention

and certain applications thereof, reference may be had to the following specification taken in conjunction with the accompanying drawings, in which:

Figs. 1 to 4, inclusive, comprise a series of corresponding views taken in longitudinal section and showing the internal mechanism of a hydraulic device in four different stages of operation;

Fig. 5 is an enlarged fragmentary view in longitudinal section of the upper end of the device shown in Figs. 1 through 4 and showing a preferred form of structure for controlling the action of the piston;

Fig. 6 is a side view partly in longitudinal section showing a hydraulic device embodied in apparatus which may be used in an oil well bore hole, for example;

Fig. 6A is a transverse section of an instrument shown in Fig. 6 taken along the view line 6A—6A looking in the direction of the arrows;

Fig. 7 is an enlarged fragmentary view in longitudinal section showing a modification of the lower end portion of the hydraulically controlled apparatus of Fig. 6; and

Fig. 8 illustrates the present invention as incorporated in a pumping unit for pumping completed oil wells, for example.

Referring to the drawings, the invention is illustrated in Figs. 1 to 4 as embodied in a hydraulic device including a cylinder 1 having secured to its upper end as by screw threads, for example, a cylinder head 2. The cylinder head is provided with an inner sleeve 3 defining a hollowed out portion 3', which is vented to the atmosphere or other reference pressure at its end and which receives a small, floating piston 4. Formed in the walls of the cylinder head 2 and communicating with the cylinder 1 is a small outlet port 5 and at the lower portion of the cylinder 1 there is provided an inlet port 6. Slidably received in the cylinder 1 is a piston 7 to which a piston rod 8 is attached. The piston 7 includes an end portion 9 to which is attached an expandable portion 10 which may be in the form of a flexible sealing sleeve made of plastic or rubber, for example. The expandable portion has two operating configurations, one being a diametrically reduced configuration as shown in Figs. 1, 3 and 4 and the other a diametrically expanded configuration as shown in Fig. 2.

At one of its ends, the cylinder 1 converges in a frustoconically shaped portion 11 which is dimensioned to be engaged by the outer surface of the expandable portion 10 when the latter is in its reduced configuration.

At the upper portion of cylinder 1 there is provided an actuating or abutment member 13 which may be in the form of a sleeve of smaller diameter than the cylinder 1 and arranged coaxially therewith to receive the piston 7 at the upper end of its stroke. The abutment member 13 is so arranged that the expandable portion 10 of the piston will be urged by it into its diametrically reduced configuration as the piston approaches and to prevent damage to the piston during this motion the lower edge 13*a* of the abutment member 13 may be rounded. The outer surface of the member 13 and the walls of the cylinder 1 define an annular space 14 connecting the outlet port 5 and the cylinder 1 so that fluid may leave the cylinder. Resilient means in the form of a coiled compression spring 12 reacts between piston 7 and the cylinder head 2 to urge the piston downwardly, the spring passing through the member 13 and around the sleeve 3.

In operation, assuming for purposes of illustration that the piston is at the lower end of its stroke as shown in Fig. 1, hydraulic fluid, such as oil for example, may be supplied to the inlet port 6 by a small gear pump (not shown). Pressure will build up under piston 7, urging the portion 10 outwardly against the wall of the frustoconical portion 11 and driving the piston upwardly. As

the piston rises the portion 10 will be expanded outwardly by the fluid pressure so that it bears against the cylinder wall even after the piston has been raised past the frustoconical portion 11. Fig. 2 illustrates the position of the piston 7 at the midpoint of its power stroke. Any fluid which might be above the piston will be driven out the open outlet port 5 and back to the pump.

The piston 7 continues to rise until the expanded portion 10 engages the rounded edge 13*a* of the abutment member 13. This rounded edge urges the then expanded portion 10 inwardly to break the seal between it and the wall of cylinder 1 thereby permitting the fluid beneath the piston to flow into the annular space 14 and out of the port 5 as shown in Fig. 3. With the expandable portion 10 out of engagement with the walls of the cylinder 1, the compression spring 12 is able to return piston 7 to its lowermost position.

As shown in Fig. 4 the expandable portion 10 remains in its reduced configuration, the fluid flowing around the piston as the spring 12 returns the piston to the bottom of the cylinder. The portion 10 will not be expanded to engage the walls of cylinder 1 on its down stroke as there will be an insufficient pressure differential built up across the piston to effect this action. In other words, the portion 10 has sufficient stiffness to enable it to withstand the dynamic pressure exerted by the fluid against the inside walls of the portion 10 as the piston 7 is moved downwardly under the influence of the spring 12.

However, when the piston enters the frustoconical portion 11 at the lower portion of cylinder 1, the portion 10 engages the walls and re-sealing is effected to condition the device for another cycle.

The small, floating piston 4 in the cylinder head 2 is provided to accommodate variations in the fluid capacity of the system caused by the piston rod 8 entering and leaving the cylinder, to compensate for sudden pressure changes in the system and to accommodate the displacement of the piston within the sleeve 13. Further, the floating piston 4 will act to equalize pressures inside and outside the hydraulic system so that the hydraulic system will not be influenced by high fluid pressures such as encountered in bore holes, for example.

Fig. 5 discloses a preferred type of mechanism for actuating the expandable portion of the piston. In Fig. 5 certain components are similar to those shown in Figs. 1 to 4 and these components are identified by like, primed reference characters. In Fig. 5, the sleeve member 13′ is arranged to slide axially within the cylinder within the limits defined by the cylinder head 2′ and an annular shoulder 15 formed on the inside wall of the cylinder 1′. An annular flange 16 is formed at the upper end of the member 13′ to engage the shoulder 15. The flange 16 is provided with recesses or channels 17 to allow the hydraulic fluid to flow past the flange to the outlet port 5′. The member 13′ is shown with the channels 17 extending along its entire length to provide for an increased flow of fluid. However, it is apparent that the recesses or channels 17 may be formed only in the flange 16 if sufficient clearance between the walls of the cylinder 1′ and the member 13′ is provided for the flow of fluid.

In operation, the piston 7′, when rising, will engage the slidable sleeve member 13′ while the latter is disposed in its lower position, that is, when the flange 16 is in contact with the shoulder 15. The member 13′ will then be pushed upwardly by the rising piston until it is stopped by the cylinder head 2′. At this time the piston 7′ will be pushed into the member 13′, causing the movable portion 10′ to be disengaged from the cylinder wall, as described in connection with Figs. 1 to 4. Because the member 13′ is slidable, the compression spring 12′ will move both the member 13′ and the piston 7′ in a downward direction until the flange 16 on member 13′ is stopped by the shoulder 15, at which time piston 7′ will be pushed out of the member 13′ to its lowermost position. Fig. 5 illustrates the relation of the piston 7′ on its downward stroke immediately after it has been pushed out of the member 13′.

An advantage in having member 13′ slidable resides in the fact that during the initial downward movement of both the member 13′ and the piston 7′ by the spring 12′, fluid pressures above and below the piston 7′ will positively equalize, that is, since the member 13′ is moving with the piston 7′, fluid flow, which may be set-up by pressure differentials above and below the piston 7′, will not be blocked from entering the area above the top surface of the piston 7′ by the member 13′. Thus, an equalization of pressure above and below the piston 7′ on its initial downward stroke is assured, and there is no chance that the member 10′ may become resealed against the cylinder wall 1′ until the piston has reached its lowermost position.

It will be noted that by means of the disclosed arrangements of Figs. 1 to 5, continuous reciprocation of the piston is effected by merely supplying the cylinder with a constant flow of fluid in one direction.

Moreover, it will be clear that the piston 7 may be stopped at any point along its power stroke merely by stopping the pump which supplies the fluid.

The instant invention has been found to be quite useful, for example, in combination with certain electrical logging instruments used in oil well bore holes. In Figs. 6 and 6A there is shown an electrical logging instrument carrier 18 disposed in a bore hole 19. Movable members in the form of bowed spring arms 20 and 20*a* respectively urge logging and backup pads 20*b* and 20*c* against the bore hole walls. Instruments of this type are sometimes used, for example, to measure as a continuous operation, successive diameters of the bore hole or to measure the resistivity of surrounding formations by means of electrodes in the pad 20*b* urged against the wall of the bore hole. The electrodes are joined by conductors 20*d* to a cable 20*e* in the instrument 18, the cable 20*e* being connected by a lowering cable 20*f* to conventional recording devices at the surface of the earth. In any case, it is desirable to include means for retracting the pads 20*b* and 20*c* characteristic of such instruments. For example, if the instrument became stuck in the bore hole, retraction of the pads might facilitate its removal.

As shown in Fig. 6, the pads 20*b* and 20*c* are biased to press against the wall 19 of the bore hole, the upper ends of the arms 20 and 20*a* being anchored in a fixed collar 21 and the lower ends in an axially displaceable member or collar 22. Radially oriented flanges 22*a* on the collar 22 extend into the instrument 18 through longitudinal slots 18*a* permitting axial movement of the collar. The arms 20 and 20*a* are preferably so arranged that their natural resilience causes them to bow outwardly, raising the member 22. Within the instrument carrier 18 is disposed a hydraulic cylinder and piston apparatus 23 of the type described above. Hydraulic lines 24 and 25 connect outlet and inlet ports 26 and 27 respectively to a hydraulic pump (not shown), which may be located at the surface of the earth or within the instrument 18. The piston rod 28 of the hydraulic apparatus 23 comprises a driving member and is operatively connected through a lost motion coupling arrangement 29 to the arms 20 and 20*a*. The coupling arrangement 29 may comprise, for example, an annular member 30 slidably mounted on the piston rod 28 and from which depends a small helical compression spring 31, the lower end of which is attached to the lower end 32 of the piston rod 28. A pair of cables 33 are fixed to the member 30 and pass over a pair of fixed pulleys 34 anchored to the bottom of the instrument 18 and over a pair of pulleys 35 journalled in the flanges 22*a* and movable therewith to which the lower ends of the arms 20 and 20*a* are attached through the collar 22. From the pulleys 35, the cables 33 are brought down and anchored to the lower portion of the instrument 18 at anchoring points 36.

This system of pulleys affords a mechanical advantage of two and comprises a motion modifying connection between the arms 20 and 20*a* and the driving member or piston rod 28.

It will be appreciated from the above description that upon applying hydraulic fluid to the inlet port 27 of the apparatus 23, the piston rod 28 will rise and through the cable-pulley system will draw the member 22 downwardly with a force equal to twice that exerted by the piston. Movement of the collar 22 downwardly will retract the pads 20*b* and 20*c* to a position closer to the sides of the instrument 18. By providing a mechanical advantage as shown, the hydraulic apparatus 23 may be made of smaller diameter, as only half of the normal force to retract the arms is necessary. Accordingly, the system would be particularly advantageous in small diameter bore holes where a small diameter instrument is of paramount consideration.

When retracting the pads 20*b* and 20*c*, the piston rod 28 is raised to a position just below that at which the expandable portion of the piston is activated to terminate the power stroke and held in that position by stopping the pump which supplies the fluid. When the pads 20*b* and 20*c* are to be released, the pump may be started causing the piston rod 28 to move up a small amount sufficient to cause the piston to be disengaged from the cylindrical wall, all as described with reference to Figs. 1 to 5. This small additional movement may be taken up by the lost motion coupling arrangement 29. The piston will then be returned to the lower position shown in Fig. 6, the natural bias in the arms 20 and 20*a* keeping the cables 33 taut and assisting in causing the return stroke of the piston. The pump supplying hydraulic fluid should not, of course, be operating when the piston is at its lowermost position. The coupling arrangement 29 also absorbs small variations in movement of the pads 20*b* and 20*c* and the cables 33 which would result from variations in the bore hole diameter, for example, thus preventing wear of the hydraulic apparatus 23.

Another form of mechanism for actuating the spring arms is illustrated in Fig. 7, wherein primed reference numerals are used to designate parts which are similar to those of Fig. 6. In this embodiment the lower portion of the instrument 18′ is fitted with a cylindrical end member 37 to which the collar member 22′ is secured and which is arranged to slide telescopically within the body of the instrument. On opposite inside walls of the member 37 are cut an array of gear teeth 38 which mesh with a pair of gears 39 carried by the instrument 18′ and in turn meshing with a straight gear rack 40. The rack 40 is resiliently coupled to the piston rod 28′ by a lost motion coupling arrangement 41 including a sleeve part 42 affixed to the rack 40 and reacting with the piston rod 28′ through a compression spring 31′ such that small variations in the bore hole diameter will not be felt by the hydraulic apparatus. When it is desired to retract the arms 20′ and 20*a*′, the piston rod 28′ is hydraulically raised taking up first any play due to the resilient coupling to the rack 40 and then retracting the arms 20′ and 20*a*′ through the gear mechanism as shown.

In Fig. 8 a further useful application for the hydraulic cylinder of the present invention is illustrated schematically. In this case, the hydraulic apparatus, identified generally by the numeral 43, is used to operate an oil pump within a well 44 by actuating a series of sucker rods 45. A pump unit 46 supplies hydraulic fluid through a line 47 to the cylinder inlet port and a further hydraulic line 48 provides a return path to the pump. In this instance the hydraulic cylinder is continuously reciprocated, as explained in connection with Figs. 1 to 4, by merely supplying fluid at a constant rate in one direction. The absence of complicated valve systems and reversing mechanism constitutes one of the principal advantages of this system. The rate of reciprocation can

be changed by merely changing the speed of the pump unit 46.

Other useful combinations utilizing the principles of the present invention may be effected. For example, instead of the bowed spring arms of Fig. 6, the hydraulic apparatus of the present system could be used to retract arms of the hinged caliper type, or to actuate mechanism for taking side wall core samples. Various combinations of the hydraulic cylinder and oil well tools used in a bore hole will readily occur to those skilled in the art. Moreover, the hydraulic apparatus may take various forms within the scope of the invention, which should not, therefore, be thought of as limited to the particular embodiments disclosed.

I claim:

1. In hydraulic apparatus, wall means defining a cylinder, inlet port means for introducing a flow of fluid into one end of the cylinder and outlet port means for discharging fluid from the other end of the cylinder, a piston movable axially within the cylinder, said piston including an attached imperforate flexible sleeve having a normal unexpanded configuration affording a fluid bypass between the piston and the cylinder, the sleeve being expandable by a fluid pressure differential across the piston into engagement with the cylinder to block fluid flow around the piston in the cylinder, and actuating means at said other end of the cylinder to engage the sleeve and urge it from its expanded to its normal unexpanded configuration.

2. In hydraulic apparatus, first wall means defining a cylinder, inlet port means for introducing a flow of fluid into one end of the cylinder and outlet port means for discharging fluid from the other end of the cylinder, a piston movable axially within the cylinder, said piston including an attached imperforate flexible sleeve having a normal unexpanded configuration affording a fluid bypass between the piston and the cylinder, the sleeve being expandable by a fluid pressure differential across the piston into engagement with the cylinder to block fluid flow around the piston in the cylinder, and converging wall means extending from one end of the cylinder to engage the sleeve and block the passage of fluid around the piston when said sleeve is in its normal unexpanded configuration.

3. In hydraulic apparatus, wall means defining a cylinder, inlet port means for introducing a flow of fluid into one end of the cylinder and outlet port means for discharging fluid from the other end of the cylinder, a piston movable axially within the cylinder, said piston including an attached imperforate flexible sleeve having a normal unexpanded configuration affording a fluid bypass between the piston and the cylinder, the sleeve being expandable by a fluid pressure differential across the piston into engagement with the cylinder to block fluid flow around the piston in the cylinder, actuating means at said other end of the cylinder to engage the sleeve and urge it from its expanded to its normal unexpanded configuration, and further wall means extending from the other end of the cylinder to engage the sleeve and block the passage of fluid around the piston when said sleeve is in its normal unexpanded configuration.

4. In hydraulic apparatus, wall means defining a cylinder, inlet port means for introducing a flow of fluid into one end of the cylinder and outlet port means for discharging fluid from the other end of the cylinder, a piston movable axially within the cylinder, said piston including an attached imperforate flexible sleeve having a normal unexpanded configuration affording a fluid bypass between the piston and the cylinder, the sleeve being expandable by a fluid pressure differential across the piston into engagement with the cylinder to block fluid flow around the piston in the cylinder, actuating means at said other end of the cylinder to engage the sleeve and urge it from its expanded to its normal unexpanded configuration, and converging wall means extending from said one

end of the cylinder to engage the sleeve when in its normal unexpanded configuration to prevent the flow of fluid around the piston, the sleeve expanding towards its expanded configuration as the piston moves away from said converging wall means in response to said pressure differential.

5. In hydraulic apparatus, wall means defining a cylinder, inlet and outlet means communicating with opposite ends of the cylinder for establishing a flow of fluid therethrough, a piston movable axially in the cylinder, said piston including a head portion of smaller diameter than the cylinder and an imperforate sleeve portion of flexible resilient material carried by the head portion and disposed substantially coaxially within the cylinder, said sleeve portion having a free end facing said inlet means and having a normal unexpanded configuration spaced from said wall means to permit the passage of fluid around the piston in the cylinder, convergent wall means extending from the end of the cylinder adjacent the inlet means to receive and engage said sleeve portion in its normal unexpanded configuration and block the flow of fluid around the piston in the cylinder, the resulting fluid pressure differential across the sleeve portion causing movement of the piston axially out of the convergent wall means into the cylinder, said flexible resilient sleeve portion being expanded by the fluid pressure differential thereacross into an expanded configuration to maintain engagement with said wall means as the piston is moved, and abutment means disposed at the end of the cylinder adjacent the outlet means, and means positioning said abutment means in the cylinder to engage by the sleeve portion and cause the sleeve portion to assume its normal unexpanded configuration.

6. In hydraulic apparatus as set forth in claim 5, including resilient means urging said piston in the direction of the inlet means.

7. In hydraulic apparatus, wall means defining a cylinder, inlet and outlet means communicating with opposite ends of the cylinder for establishing a flow of fluid therethrough, a piston movable axially in the cylinder, said piston including a head portion of smaller diameter than the cylinder and an imperforate sleeve portion of flexible resilient material carried by the head portion and disposed substantially coaxially within the cylinder, said sleeve portion having a free end facing said inlet means and having a normal unexpanded configuration spaced from said wall means to permit the passage of fluid around the piston in the cylinder, convergent wall means extending from the end of the cylinder adjacent the inlet means to receive and engage said sleeve portion in its normal unexpanded configuration and block the flow of fluid around the piston, the resulting fluid pressure differential across the sleeve portion causing movement of the piston axially out of the convergent wall means into the cylinder, said flexible resilient sleeve portion being expanded by the fluid pressure differential thereacross into an expanded configuration to maintain engagement with said wall means as the piston is moved, abutment sleeve means disposed at the end of the cylinder adjacent said outlet means, means positioning said abutment sleeve means in the cylinder substantially coaxially therewith to receive initially said head portion of the piston and then to receive and engage said sleeve portion of the piston to force the latter into its said normal unexpanded configuration from its said expanded configuration, and resilient means urging said piston in the direction of said inlet means.

8. In hydraulic apparatus as set forth in claim 7, means mounting said abutment sleeve means in said cylinder for limited axial movement therein.

9. In hydraulic apparatus, first wall means defining a first cylinder, inlet and outlet means communicating with opposite ends of the cylinder for establishing a flow of fluid therethrough, a piston movable axially in the cylinder, said piston including a head portion of smaller diameter than the cylinder and an imperforate sleeve portion of flexible resilient material carried by the head portion and disposed substantially coaxially within the cylinder, said sleeve portion having a free end facing said inlet means and having a normal unexpanded configuration spaced from said wall means to permit the passage of fluid around the piston in the cylinder, convergent wall means extending from the end of the cylinder adjacent the inlet means to receive and engage said sleeve portion in its normal configuration and block the flow of fluid around the piston in the cylinder, the resulting fluid pressure differential across the sleeve portion causing movement of the piston axially out of the convergent wall means into the cylinder, said flexible resilient sleeve portion being expanded by the fluid pressure differential thereacross into an expanded configuration to maintain engagement with said wall means as the piston is moved, abutment sleeve means disposed at the end of the cylinder adjacent said outlet means, means positioning said abutment sleeve means in the cylinder substantially coaxially therewith to receive initially said head portion of the piston and then to receive and engage said sleeve portion of the piston to force the latter into its said normal unexpanded configuration from its said expanded configuration, second wall means defining a second cylinder communicating with the first cylinder, and a floating piston received in the second cylinder having one side exposed to the fluid pressure in the first cylinder and its other side exposed to a reference pressure.

10. In hydraulic apparatus, first wall means defining a first cylinder, inlet and outlet means communicating with opposite ends of the cylinder for establishing a flow of fluid therethrough, a first piston movable axially in the cylinder, said piston including a head portion of smaller diameter than the cylinder and an imperforate sleeve portion of flexible resilient material carried by the head portion and disposed substantially coaxially within the cylinder, said sleeve portion having a free end facing said inlet means and having a normal unexpanded configuration spaced from said wall means to permit the passage of fluid around the piston in the cylinder, convergent wall means extending from the end of the cylinder adjacent the inlet means to receive and engage said sleeve portion in its normal unexpanded configuration and block the flow of fluid around the piston in the cylinder, the resulting fluid pressure differential across the sleeve portion causing movement of the piston axially out of the convergent wall means into the cylinder, said flexible resilient sleeve portion being expanded by the fluid pressure differential thereacross into an expanded configuration to maintain engagement with said wall means as the piston is moved, abutment sleeve means disposed at the end of the cylinder adjacent said outlet means, means positioning said abutment sleeve means in the cylinder substantially coaxially therewith to receive initially said head portion of the piston and then to receive and engage said sleeve portion of the piston to force the latter into its said normal unexpanded configuration from its said expanded configuration, second wall means defining a second cylinder communicating with the first and aligned therewith, a floating piston received in the second cylinder having one side exposed to the fluid pressure in the first cylinder, means exposing the other side of the floating piston to a reference pressure, and a coiled comprssion spring surrounding said second cylinder and passing through said abutment sleeve to urge said first piston in the direction of said inlet means.

11. In apparatus for use in bore holes comprising a carrier adapted to be lowered into the bore hole, means mounting a movable member on the carrier to engage the borehole wall and means for displacing the movable member between a bore hole wall engaging position and a retracted position, the improvement comprising a hydraulic jack including wall means defining a cylinder, inlet port means to introduce a flow of fluid into one end of the cylinder and outlet port means to discharge

fluid from the other end of the cylinder, a piston movable axially in the cylinder, said piston including an attached imperforate flexible sleeve having a normal unexpanded configuration affording a fluid bypass between the piston and the cylinder, the sleeve being expandable by a fluid pressure differential across the piston into engagement with the cylinder to block fluid flow around the piston in the cylinder, actuating means positioned at one end of the cylinder to engage and urge the sleeve from its expanded to its normal unexpanded configuration, means operatively connecting said jack and said movable member, said connecting means including a lost motion coupling member.

12. In apparatus for use in bore holes comprising a carrier adapted to be lowered into the bore hole, means mounting a movable member on the carrier to engage the bore hole wall and means for displacing the movable member between a bore hole wall engaging position and a retracted position, the improvement comprising a hydraulic jack including wall means defining a cylinder, inlet port means to introduce a flow of fluid into one end of the cylinder and outlet port means to discharge fluid from the other end of the cylinder, a piston movable axially in the cylinder, said piston including an attached imperforate flexible sleeve having a normal unexpanded configuration affording a fluid bypass between the piston and the cylinder, the sleeve being expandable by a fluid pressure differential across the piston into engagement with the cylinder to block fluid flow around the piston in the cylinder, actuating means positioned at one end of the cylinder to engage the sleeve and urge it from its expanded to its normal unexpanded configuration, means operatively connecting said jack and said movable member, said connecting means including motion modifying means for changing the mechanical advantage of said jack.

13. In apparatus for use in bore holes comprising a carrier adapted to be lowered into the bore hole, means mounting at least one movable member on the carrier and resiliently biased towards a bore hole wall engaging

position, first and second anchoring means for securing said member at spaced apart points, and means establishing relative motion between said anchoring means to displace the movable member towards a retracted position, the improvement comprising a hydraulic jack including wall means defining a cylinder, inlet port means for introducing a flow of fluid into one end of the cylinder and outlet port means for discharging fluid from the other end of the cylinder, a piston movable axially within the cylinder, said piston including an attached imperforate flexible sleeve having a normal unexpanded configuration affording a fluid bypass between the piston and the cylinder, the sleeve being expandable by a fluid pressure differential across the piston into engagement with the cylinder to block fluid flow around the piston in the cylinder, actuating means at said other end of the cylinder to engage the sleeve and urge it from its expanded to its normal unexpanded configuration, converging wall means extending from said one end of the cylinder adjacent the inlet means to receive and engage said sleeve to block the flow of fluid around the piston in the cylinder when the sleeve is in its normal unexpanded configuration, a piston rod, means connecting the piston rod to the piston, and coupling means between said piston rod and at least one of said anchoring means comprising a lost motion coupling and a motion modifying driving connection for increasing the mechanical advantage of the hydraulic jack.

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