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CYLINDER WITH VARIABLE STOP MECHANISM

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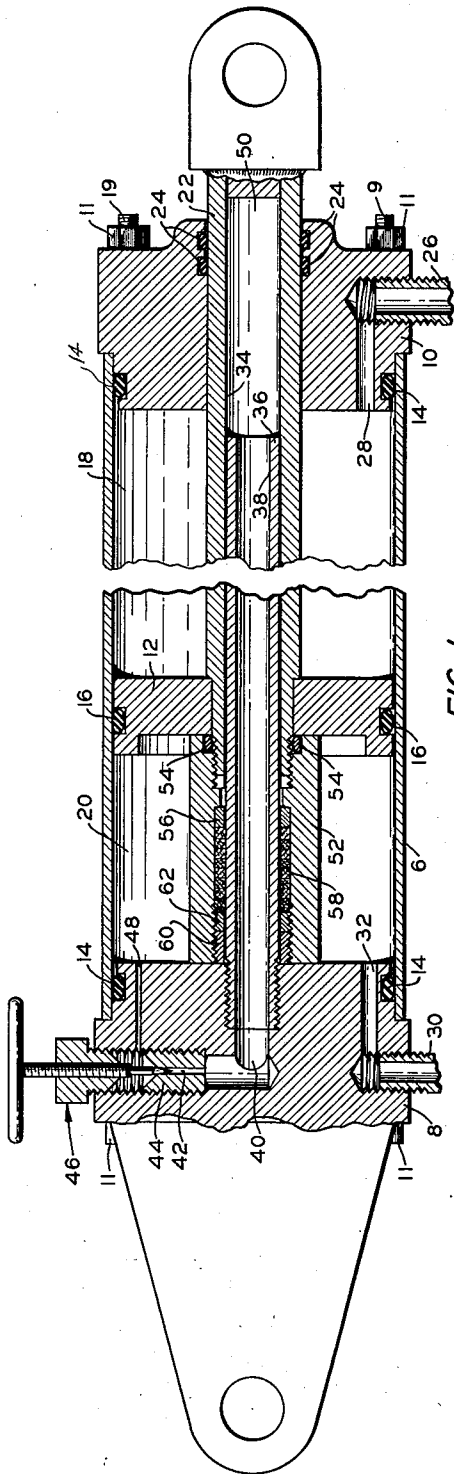


FIG. 1.

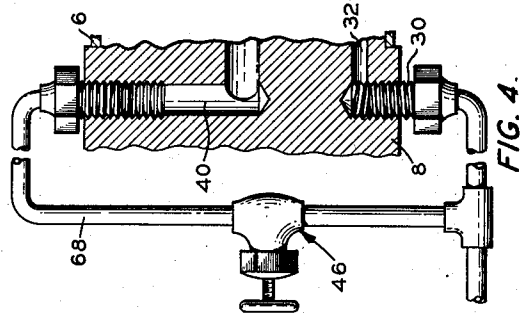


FIG. 4.

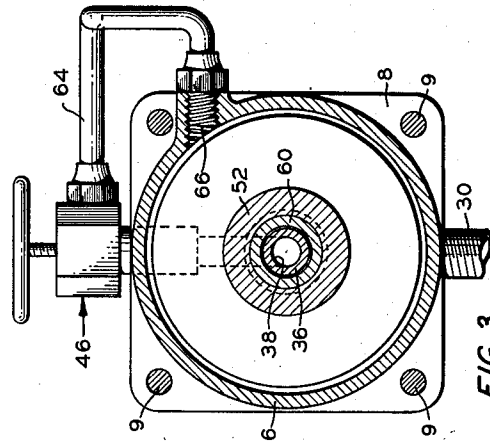


FIG. 3.

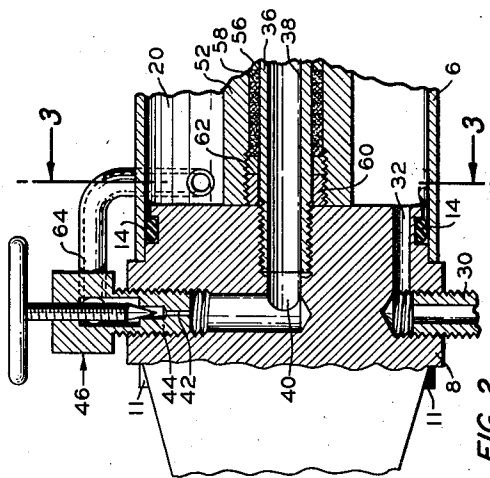


FIG. 2.

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CYLINDER WITH VARIABLE STOP
MECHANISM

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9 Claims. (Cl. 121—38)

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This invention relates to cylinders. In a more specific aspect it relates to double-acting, expansible, hydraulic cylinders with stop mechanism incorporated therein, and using the actuating fluid in operating the stop mechanism.

Hydraulic cylinders are used extensively on industrial machinery, farm machinery, etc. They are used to raise and lower plows, such as one-way disk plows, chisel plows, disk angling plows, and the like, on manure loaders, and the like, for instance, to regulate the lowest point of descent and to adjust the level of the bucket, on combines to level the platform, on land levelers, mowers, sprayers, potato diggers, corn pickers, snow plows, and the like. The tractor hydraulic system is normally used to supply the actuating fluid to the hydraulic cylinder in such uses as are set forth hereinbefore. Hydraulic cylinders are used for many lifting, pushing, pulling and adjusting jobs on industrial machinery and equipment.

In such uses in many cases, it is desired to control the stroke, that is to limit the distance the piston can go on the retracting stroke. For instance, in using a double-acting hydraulic cylinder for raising a plow out of the ground at the end of the field and lowering it again into the ground after the turn has been made, it is desirable that the plow go back into the ground each time to the same depth without having to adjust the depth each time which takes up valuable time and makes it a matter of guess-work as to whether or not the plow is at the desired depth. In many other agricultural and industrial machinery uses of hydraulic cylinders, it is desirable to provide a stop at some predetermined point in the movement of the piston. Also, it is desirable that such stop means be adjustable so that the stop can be set manually or automatically to prevent the movement of the piston past a desired location. Mechanical devices are known in the art which will do this, such devices as an adjustable stop collar and arm attached to the cylinder or a part of the equipment on which the cylinder is used, and separate cylinder means actuated by movement of the rod and/or the cylinder actuating fluid under pressure. The stop means known in the art are not satisfactory, being either too complicated and expensive to build, or subject to easily getting out of adjustment.

I have invented a very satisfactory expansible hydraulic cylinder with stop mechanism incorporated therewith. The cylinder actuating fluid is used to operate the stop mechanism. The new

cylinder of my invention is very efficient, and easily and cheaply constructed. It has a space formed in the piston rod with a plunger member extending therein, the plunger member being secured to the end of the cylinder opposite the end through which the piston rod extends. A conduit with a valve therein is formed in the plunger and partly in the end of the cylinder to which the plunger is secured. The conduit communicates with the space formed in the piston rod and the chamber of the cylinder formed by the piston, the wall of the cylinder and the end to which the plunger is secured. The cylinder and stop mechanism are adapted so that when the piston and rod are extended with the valve open, cylinder actuating fluid will flow from the chamber last-named or from an actuating fluid supply conduit or chamber, through the conduit and into the space in the piston rod. When the piston has been extended to the point desired, that is, a point where it is desired it will stop on the retraction stroke, the valve is closed, thus trapping the fluid. Then in use the piston and rod will extend as far as desired, but will only retract to the point desired, since on retraction movement of the piston is prevented by the column of trapped fluid. When the fluid is a liquid, relatively non-compressible, the piston will stop exactly at the desired point. On the extension stroke after the stop has been set, the partial vacuum formed in the space in the piston rod has been found to cause no difficulty. To readjust and set a new stop point for less retraction the valve is opened on the extension stroke, letting more fluid flow through the conduit into the space in the piston rod. To readjust and set a new stop point for greater retraction, the valve is opened on the retraction stroke and fluid in the space in the piston rod is forced out through the conduit into the cylinder chamber or into an actuating fluid supply conduit or chamber. The valve is then closed when the piston reaches the desired point. The new cylinder of my invention is easy to adjust and exacting in preventing movement of the piston past a desired and predetermined point, and is, indeed, a great step forward in the art.

It is an object of this invention to provide new cylinder means.

It is another object of this invention to provide new stop mechanism for hydraulic cylinders, utilizing the cylinder actuating fluid in operating the stop mechanism.

It is still another object of this invention to provide a new double-acting, expansible, hydraulic

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cylinder with variable stop means incorporated in the cylinder and utilizing the cylinder actuating fluid in operating the stop means.

Other objects and advantages of my invention will become apparent, to one skilled in the art, upon reading this disclosure.

In the drawings, Fig. 1 is a cross sectional view through an expansible, double-acting hydraulic cylinder, incorporating a preferred specific embodiment of the stop means of my invention. Fig. 2 is a cross sectional view through the head end of a hydraulic cylinder, like the one shown in Fig. 1, incorporating another preferred specific embodiment of the stop means of my invention. Fig. 3 is a view taken on line 3—3 of Fig. 2. Fig. 4 is a cross sectional view through the head end of a hydraulic cylinder, like the one shown in Fig. 1, incorporating another preferred specific embodiment of the stop means of my invention, wherein the stop mechanism can be adjusted from a point remote from the cylinder, for instance, from a point near the seat of a tractor.

Following is a discussion of the new hydraulic cylinder of my invention, incorporating the new stop mechanism of my invention. Reference is made to Figs. 1, 2, 3 and 4 of the drawing, and the same reference numerals are used on all the figures to indicate the same structure. It is to be understood that the following discussion is not to unduly limit the scope of my invention.

Referring now to the drawings, a conventional cylinder 6, held in a suitable manner by head end 8 and rod end 10, has a piston 12 mounted for reciprocation therein. Bolts 9 with nuts 11 are very suitable to hold cylinder 6 and end members 8 and 10 together.

Resilient O rings 14 pack and seal; so that fluid under pressure in the cylinder will not leak out, and resilient O ring 16, the piston ring, packs and seals to prevent leakage of fluid around the piston from the rod end chamber 18 to the head end chamber 20 and vice versa.

Piston rod 22 slidably extends through rod end portion 10. Member 10 is provided with resilient O rings 24 which engage piston 22 and pack and seal against leakage of fluid from chamber 18. Conduit 26 threaded into member 10 meets a conduit 28 formed in member 10. Cylinder actuating fluid supplied under pressure, for instance, from the hydraulic system on a tractor, enters chamber 18 by conduits 26 and 28 when it is desired to retract piston 12. Actuating fluid leaves chamber 18 by conduits 28 and 26 on the expansion stroke.

Conduit 30 threaded into member 8 communicates with conduit 32 formed in member 8. Cylinder actuating fluid under pressure enters chamber 20 by conduits 30 and 32 on the expansion stroke, and leaves chamber 20 by conduits 32 and 30 on the retraction stroke.

Piston rod 22 has a bore 34 formed therein. A rod 36 with a bore 38 formed therein is secured in a suitable manner to member 8 and slidably extends into bore 34 in piston rod 22. A conduit 40 is formed in member 8 which communicates with a smaller conduit 42 in plug 44 which is secured in a suitable manner to member 8 and furnishes the valve seat for valve 46. A needle valve as shown has been found to be very satisfactory. Conduit 48 is formed in member 8 and communicates with chamber 20. On the expansion stroke of piston 12 with needle valve 46 open cylinder actuating liquid flows from chamber 20 through conduits 48, 42, 40 and

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38 into space 50 formed by bore 34 in piston rod 22. Liquid will thus flow until needle valve 46 is closed. On further expansion of piston 12, a partial vacuum will be created in space 50 which has been found to cause no difficulty in operation. On the retraction stroke with valve 46 closed, piston 12 will retract to the point where valve 46 was closed on the expansion stroke, at which point conduit 42 and 40, bore 38 and space 50 will be filled with liquid, and further retraction of piston 12 is prevented.

Packing gland 52 is threadedly secured to piston rod 22 which extends through piston 12, and resilient O ring 54 packs and seals against leaking around rod 22 from chamber 20 to chamber 18 and vice versa, and also leakage from and to chamber 50 around rod 36. Bushing 56 fits around rod 36 as shown and provides the end surface against which packing 58 is compressed by packing nut 60 which fits around rod 36 and is threadedly secured to packing gland 52. Bushing 62 fits around rod 36 and provides the other end surface for compression of packing 58. Packing 58 seals against leakage either to or from the space formed by bore 34, bore 38, conduit 40 and conduit 42.

In the modification of the new cylinder of my invention shown in Figs. 2 and 3, an external conduit 64 communicating with conduit 40 in member 8 is employed instead of conduit 48 shown in Fig. 1. Conduit 64 communicates with a conduit 66 through cylinder 6 into chamber 20. Conduit 64 is suitably attached to valve 46 and cylinder 6. Threaded in attachment has been found to be satisfactory.

In the modification of my invention shown in Fig. 4, valve 46 is located at a point remote from the hydraulic cylinder. Conduit 68 with valve 46 therein communicates with conduit 40, formed in member 8, and with conduit 30, which supplies cylinder actuating liquid under pressure to chamber 20 on the expansion stroke and receives actuating liquid from chamber 20 on the retraction stroke. Conduit 68 can conveniently be flexible tubing. By a point remote from the hydraulic cylinder I mean, for instance, that valve 46 is located near the seat of a tractor and the hydraulic cylinder is used on a plow, combine, etc. pulled by the tractor, or that valve 46 is located in a control room and the hydraulic cylinder is used on industrial equipment, and the like.

In operating the stop mechanism means of my invention, incorporated in the new cylinder of my invention, to adjust so that piston 12 will stop at the desired point on the retraction stroke, actuating fluid is withdrawn from chamber 20, or conduit 30 (modification shown in Fig. 4), through valve 46, conduit 40, bore 38 and into chamber 50. Piston 12 is expanded by introducing actuating fluid under pressure into chamber 20 via conduits 30 and 32. When piston 12 has moved to a point at which it is desired it will stop on the retraction stroke, valve 46 is closed, preventing further passage of fluid into chamber 50. The piston 12 and rod 22 can then be extended farther, but on retraction it will not move past the point at which valve 46 was closed.

To adjust so that the stop point of piston 12 on retraction is nearer member 10, valve 46 is opened on the extension stroke and closed when the piston reaches the new stop point.

To adjust so that the stop point is nearer member 8, valve 46 is opened on the retraction stroke and fluid then flows from chamber 50

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through bore 38, conduit 40, valve 46 and into chamber 20, or into conduit 30 (modification shown in Fig. 4). Valve 46 is closed when piston 12 reaches the point at which it is desired it will stop on the next and subsequent retraction strokes.

As will be evident to those skilled in the art, various modifications of my invention can be made or followed in the light of this disclosure and discussion, without departing from the spirit or scope of the disclosure or from the scope of the claims.

I claim:

1. An expansible, fluid-pressure operated device with variable stop mechanism, which comprises, in combination, a cylinder and a piston mounted for reciprocation therein, a piston rod connected to said piston and extending through one end of said cylinder, a conduit for supplying fluid under pressure to a chamber in said cylinder adjacent said end of said cylinder, a conduit for supplying fluid under pressure to a chamber in said cylinder adjacent to the other end of said cylinder, a bore formed in said piston rod, a plunger member secured to said last-named end of said cylinder and extending into said bore, a conduit with an adjustable valve therein, said last-named conduit formed in said plunger and partly in said last-named end of said cylinder, said last-named conduit communicating with said bore in said piston rod and said last-named chamber, and said last-named conduit closed to the flow of the fluid into said bore when said valve is closed and adapted to transfer fluid from said last-named chamber in said cylinder to said bore on the extension stroke with said valve open and to prevent transfer of fluid from said bore to said last-named chamber in said cylinder on the retracting stroke with said valve closed.

2. The apparatus of claim 1 wherein said last-named conduit is wholly within said plunger and said last-named end of said cylinder, and said valve is a needle valve with the valve seat disposed within said last-named end of said cylinder.

3. The apparatus of claim 1 wherein said last-named conduit is formed in said plunger and partly in said last-named end of said cylinder and with an external portion, and said valve is a needle valve with the valve seat disposed within said last-named end of said cylinder.

4. The apparatus of claim 1 wherein said last-named conduit is formed in said plunger and partly in said last-named end of said cylinder and with an external portion connecting with said second-named conduit, and said valve is disposed in said external portion between said point of connection and said cylinder.

5. A double-acting, expansible, liquid-pressure operated device with variable stop mechanism, which comprises, in combination, a cylindrical member having a head end and a rod end, a piston mounted for reciprocation in said cylindrical member, a piston rod connected to said piston and extending through said rod end, a conduit in said rod end for supplying liquid under pressure to a chamber formed by said rod end, said piston and said cylindrical member, a conduit in said head end for supplying liquid under pressure to a chamber formed by said head end, said piston and said cylindrical member, a bore formed in said piston rod, a plunger secured to said head end and extending

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into said bore, a single conduit communicating with said bore formed in said plunger and partly in said head end and with an external portion, said conduit communicating between said bore and said chamber formed by said head end, said piston and said cylindrical member, an adjustable valve in said last-named conduit with the valve seat disposed in said portion of said conduit in said head end and the adjusting mechanism disposed external of said head end, and said device adapted to withdraw liquid from said chamber formed by said head end, said piston and said cylindrical member into said last-named conduit and bore on the extension stroke with said valve open and until said valve is closed and to prevent retraction past a point at which said valve is closed on said extension stroke.

6. In an expansible fluid-operated device comprising, in combination, a cylinder and a piston mounted for reciprocation therein, a piston rod connected to said piston and extending through one end of said cylinder, a conduit for supplying fluid under pressure to a chamber in said cylinder adjacent said end of said cylinder, and a conduit for supplying fluid under pressure to a chamber in said cylinder adjacent the other end of said cylinder, a variable stop mechanism which comprises, in combination, a space formed in said piston rod, a plunger member secured to said last-named end of said cylinder and extending into said space, a conduit with an adjustable valve therein, said conduit formed in said plunger and partly in said last-named end of said cylinder and communicating with said space in said piston rod and said last-named chamber, and said valve disposed at a point in said conduit to prevent flow of fluid into said space when said valve is closed.

7. A motor, which comprises, in combination, a housing, a head end mounted on said housing, said head end having a conduit therein, a piston mounted for reciprocation in said housing, a piston rod having a space therein connected to said piston, a conduit member mounted on said head end, said conduit member extending into said space in said piston rod and communicating with said conduit in said head end, a conduit communicating between said conduit in said head end and a chamber formed by said housing, piston and head end, and adjustable valve means mounted in a resulting conduit communicating between said space in said piston rod and said chamber at a point in said resulting conduit to form when closed a sealed space on said piston rod space side of said valve means, said sealed space being separated by said valve means from the portion of said resulting conduit on the chamber side of said valve means.

8. The apparatus of claim 7 wherein said conduit communicating between said conduit in said head end and said chamber is formed in said head end, and said valve means is mounted in said head end.

9. The apparatus of claim 7 wherein said conduit communicating between said conduit in said head end and said chamber has an external portion and said valve means is mounted in said external portion.

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