

[54] **STROKE CONTROL DEVICE FOR HYDRAULIC CYLINDERS**

[72] Inventor: Donald A. Patrick, Sergeant Bluff, Iowa

[73] Assignee: Prince Manufacturing Corporation, Sioux City, Iowa

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[58] Field of Search 91/404, 468

[56] **References Cited**

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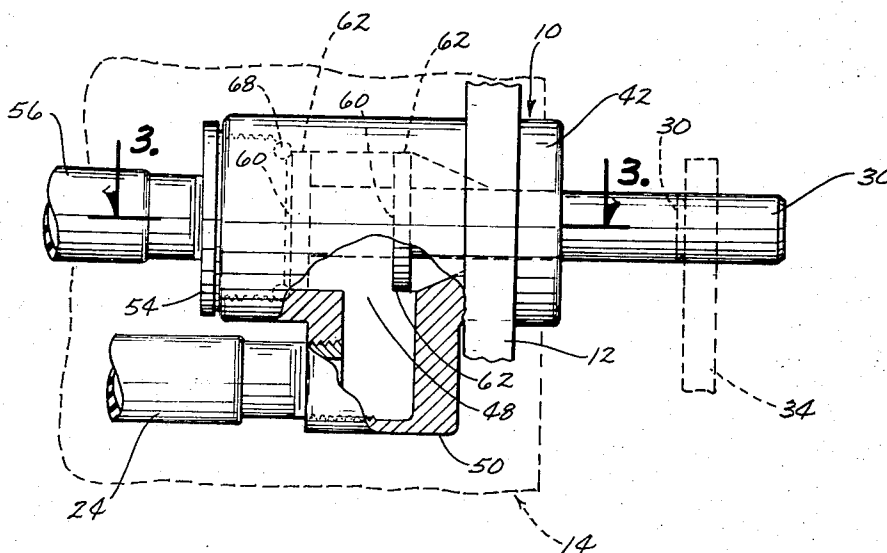
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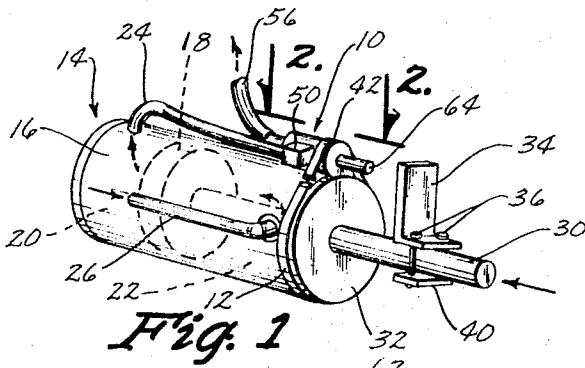
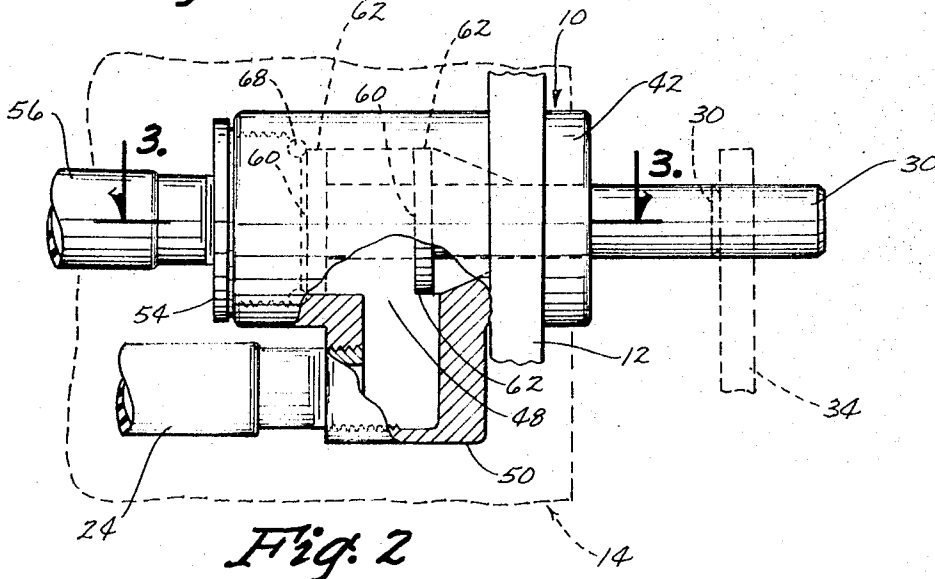
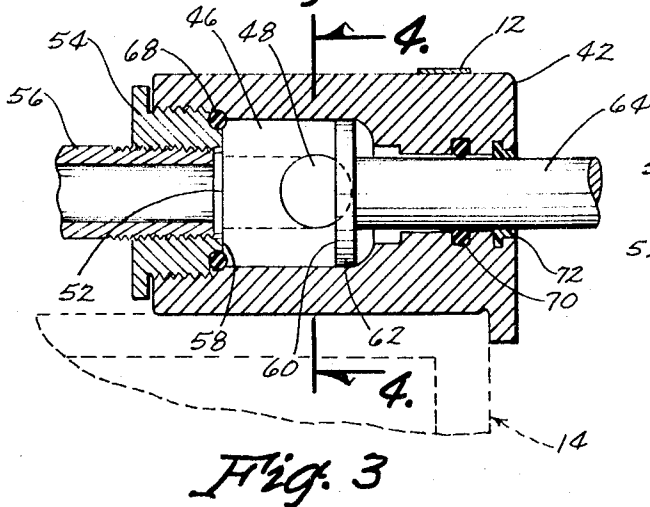
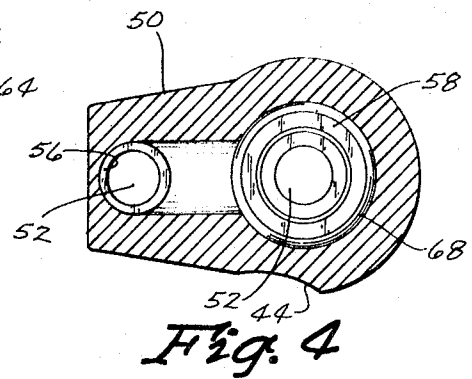
Primary Examiner—Paul E. Maslousky
Attorney—Zarley, McKee & Thomte

[57] **ABSTRACT**

A hydraulic cylinder including a piston rod extending from one end and having adjustable actuating member thereon for engaging the piston rod of a control cylinder in communication with the hydraulic cylinder such that oil is circulated from the hydraulic cylinder through the control cylinder and is shut off upon the actuating element moving the control cylinder piston rod to a closed position thereby limiting further movement of hydraulic oil within the hydraulic cylinder. A double or single acting hydraulic cylinder may be employed and upon fluid flowing in a reverse direction the control cylinder piston will be extended opening the conduit from the hydraulic cylinder through the control cylinder unit for oil circulation. The piston in the control cylinder is entirely metallic and engages an elastomeric seat seal only after the oil pressure has substantially dropped due to the inlet opening into the cylinder having been closed off by the control cylinder piston moving across the inlet opening. The control cylinder may be externally mounted on the hydraulic cylinder.

1 Claim, 4 Drawing Figures





INVENTOR
DONALD A. PATRICK
BY
Larley, McKee & Thorne
ATTORNEYS

STROKE CONTROL DEVICE FOR HYDRAULIC CYLINDERS

It is often desirable to control the length of stroke in single or double acting hydraulic pistons. The hydraulic cylinder of this invention includes a stroke control unit mounted on the housing of the hydraulic cylinder and is universal in its application to hydraulic cylinders generally. The control unit includes a piston movable past an inlet opening into the control unit chamber closing off one of the conduits into the hydraulic cylinder chamber when the control unit piston is in a retracted closed condition. Hydraulic oil flowing in the opposite direction through the control unit chamber will cause the control unit piston to be extended and allow oil to flow back to the hydraulic cylinder and continue to flow until the hydraulic cylinder piston moves to a contracted position and the actuating element on the hydraulic cylinder piston rod engages the piston rod on the control unit thereby closing off the conduit connecting the hydraulic cylinder and the control unit thus stopping further movement of the hydraulic cylinder piston. The length of the stroke may be appropriately varied by the location of the actuating element on the hydraulic cylinder piston rod and the location of the control unit on the outside of the hydraulic cylinder housing. The control unit may be mounted on either a single or double acting hydraulic cylinder.

The piston made entirely of metal closes off the inlet opening 48 by moving across it thereby causing a substantial pressure drop in the chamber at which point the piston may move into contact with a soft seat seal at the end of the chamber which at that time is subjected only to very low fluid pressures which will not have any adverse effect on the nonmetallic seal.

This invention consists in the construction, arrangements and combination of the various parts of the device, whereby the objects contemplated are attained as hereinafter more fully set forth, specifically pointed out in the claims, and illustrated in the accompanying drawings in which:

FIG. 1 is a perspective view of the hydraulic cylinder having a stroke control unit mounted thereon.

FIG. 2 is a cross-sectional view taken along line 2 — 2 in FIG. 1.

FIG. 3 is a cross-sectional view taken along line 3 — 3 in FIG. 2.

FIG. 4 is a cross-sectional view taken along line 4 — 4 in FIG. 3.

The stroke control cylinder of this invention is referred to generally by the reference numeral 10 in FIG. 1 and is shown secured by a clamp-type strap 12 to a hydraulic cylinder 14 on the housing 16. The hydraulic cylinder 14 includes a piston 18 defining oppositely disposed chambers 20 and 22 in communication with conduits 24 and 26, respectively.

The piston 18 has a piston rod 30 extending through a forward end plate 32. An L-shaped upstanding actuating element 34 is secured by a pair of bolts 36 to the piston rod 30 and may be selectively positioned therealong. A plate 40 engages the opposite side of the piston rod 30 from the L-shaped actuating element 34 and is secured thereto by the bolts 36 embracing the piston rod.

The stroke control cylinder unit 10 has a housing 42 which includes an outer concave surface 44 for matingly engaging the outer convex face of the hydraulic cylinder housing 16 as best seen in FIGS. 1 and 4. A cylinder chamber 46 includes a side opening 48 in a L-shaped portion 50 of the housing 42. An opening 52 is provided along the longitudinal center axis of the housing 42 and the chamber 46. An insert bushing 54 embraces a conduit 56 to define the opening 52 and includes an electronic O-ring seal 68 at the inner end thereof which provides an annular soft seat 58 for mating engagement by the end 60 of a piston 62 having a piston rod 64 extending outwardly through the opposite end of the housing 42. The bushing 54 is threadably received in the housing and is sealed by the O-ring seat seal 68. The conduit 56 is also threadably received in the bushing 54. The piston rod 64 is sealed by an O-ring 70 and a wiper 72 of polyurethane material which is highly abrasive-resistant to provide contamination control.

The side opening 48 is so located that when the piston 62 is in its extended position of Fig. 4, the oil flowing from the hydraulic cylinder 14 may pass through the control unit chamber 46 and out the conduit 56, however, when the piston 64 has been engaged by the actuating element 34 and the piston 62 is moved the side opening 48 is first closed and then the outlet opening 52 is completely closed off by the piston head engaging the soft seat seal 68. It is thus seen that there are substantial side forces on the all metal piston and these pressures are tending to close it once the piston has moved past the side port 48. Conversely, when the piston is in its open position, the hydraulic fluid flowing through the chamber 46 would tend to maintain the piston in its extended position. It is seen that there are no nonmetallic seats or seals under the high pressure during the restriction of the opening 48 and thus a minimum of damage can be done to the unit due to high oil pressures.

In operation it is seen that the control unit 10 is appropriately mounted on a conventional hydraulic cylinder on the outer housing wall and held in place by the adjustable clamp strap 12. Through trial and error the actuating plate 34 is adjustably positioned on the hydraulic cylinder piston rod 30 to actuate the control unit at the proper time to limit the stroke of the hydraulic cylinder piston. In FIG. 1, a hydraulic cylinder piston 18 is shown in its extended position and moving to the left toward its contracted position whereupon the upstanding actuating plate 34 will engage the control unit piston rod 64 and move it to the left causing the piston 62 to move past the side port 48 and thus close off oil leaving the hydraulic cylinder chamber 20 through the conduit 24 thereby stopping further movement of the hydraulic cylinder piston 18. Before the movement has ceased, the control piston head 62 will have moved to the left to engagement with the nonmetallic soft seat seal 58 thus completely closing the opening 52. When oil is then reversed in its direction and flows through the conduit 56 back into the compartment 46 it will tend to move the control piston 62 outwardly and then through the side port 48, the conduit 24 back into the hydraulic cylinder chamber 20 thereby moving the hydraulic cylinder piston 18 to the right to its extended position. The procedure may then be reversed starting a new cycle of operation.

It is thus seen that the stroke control unit 10 may be mounted on most hydraulic cylinders of any bore or stroke, single or double acting presently in use or to be manufactured. This includes both tie rod or bolted type cylinders and welded type cylinders. Adjustments of the actuating element may be easily made to give the desired stroke. It is also seen that the control unit provides a hydraulic stroke control with improved surge dampening characteristics since there is metal to metal restriction of the inlet opening 48 when there are high oil pressures but the piston bottoms out on a soft seat at a time when the oil pressures are low in the closed end of the cylinder. The metal to metal contact under high pressures will result in longer seal life for other seals in the control unit. Thus the hydraulic fluid restriction by the metal to metal contact eliminates the high differential pressures across any elastomer seal. The critical elastomer seal 68 functions as a static seal thus eliminating the cutting hazard of passing the seal over the porting hole 48 and decreases seal wear since it does not reciprocate.

I claim:

1. In combination,

a hydraulic cylinder having a first housing defining a first chamber with a first piston movable thereon with a first piston rod extending through one end of said housing, a first conduit in communication with said first chamber on one side of said first piston, a second conduit in communication with said first chamber on the opposite side of said first piston,

a stroke control unit comprising a second housing operatively secured to said housing and having a second chamber provided therein,

a second piston movably mounted in said second chamber, a second piston rod secured to said second piston for

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movement therewith extending outwardly from said second housing parallel to said first piston rod, said second chamber being elongated, said second housing having a first opening formed therein which communicates with said second chamber intermediate the ends thereof, 5
said second chamber being defined by a wall surface, said second conduit being in communication with said first opening,
said second housing having a second opening formed therein which communicates with said second chamber at the end thereof, 10
a third conduit in communication with said second opening, a nonmetallic annular seat embracing said second opening, said second piston being movable from a first position wherein said second piston sealably seats upon said seat to a second position wherein said second conduit is in communication with said first opening, said second 15

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chamber, said second opening and said third conduit, said second piston rod being extended from said second housing when said second piston is in its second position, actuating means on said first piston rod and being movable therewith to engage said second piston rod to move said second piston rod to its said first position to limit further flow of hydraulic fluid from said second chamber through said third conduit, the movement of said second piston rod to its said first position limiting the travel of said first piston rod in one direction,
said second piston having a metallic only outer side surface which seats upon said annular seat,
said second piston having a head portion which slidably engages said wall surface, said head portion having a thickness substantially less than the diameter of said first opening.

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