Feb. 9, 1965 R. PRINCE 3,168,853

HYDRAULIC CYLINDER DEVICE

Filed Oct. 8, 1962 2 Sheets-Sheet 1

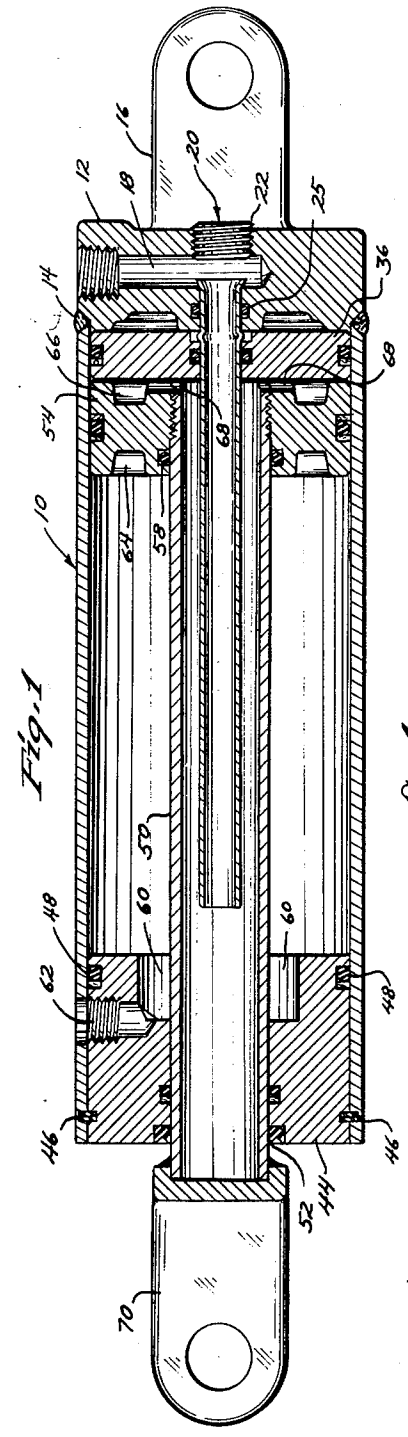

Fig. 1

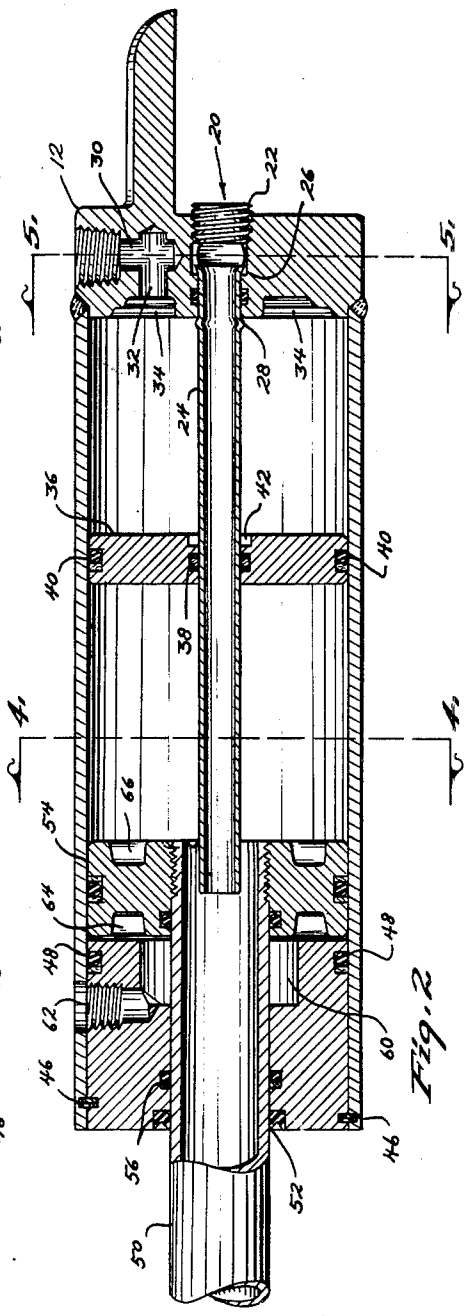

Fig. 2

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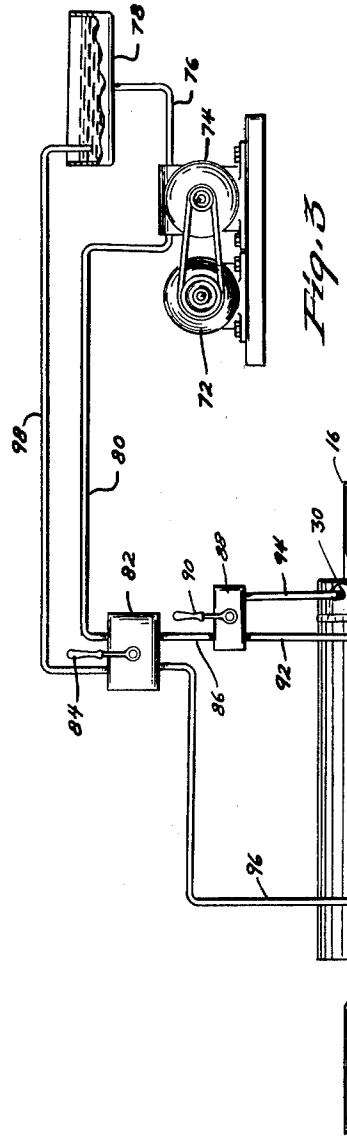

Fig. 3

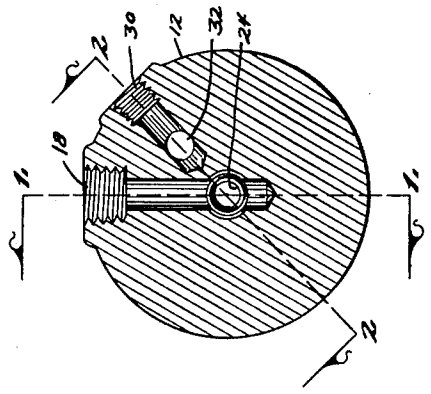

Fig. 5

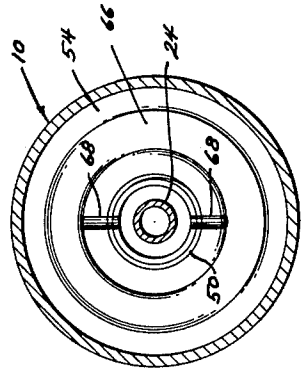

Fig. 4

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3,168,853

Patented Feb. 9, 1965

3,168,853

HYDRAULIC CYLINDER DEVICE

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Filed Oct. 8, 1962, Ser. No. 228,848

6 Claims. (Cl. 91—167)

My invention relates to hydraulic cylinders and more particularly to a hydraulic cylinder wherein the stroke of the piston rod can be selectively adjusted. The ability to vary the stroke of the piston in hydraulic cylinders permits such a cylinder to be adapted to a greater variety of equipment. However, the employment of mechanical means to accomplish this result is expensive and requires time, energy, and sometimes skill on the part of the operator. In addition, special tools are sometimes needed to complete this task.

Therefore, a principal object of my invention is to provide a hydraulic cylinder device where the stroke of the piston therein can be selectively adjusted by hydraulic power.

A further object of my invention is to provide a hydraulic cylinder device wherein the stroke of the piston therein can be selectively adjusted by the same source of hydraulic power that operates the conventional structure of the piston.

A still further object of my invention is to provide a hydraulic cylinder device wherein the stroke of the piston therein can be selectively adjusted without the use of tools.

A still further object of my invention is to provide a hydraulic cylinder device wherein the stroke of the piston therein can be selectively adjusted to a plurality of different increments.

A still further object of my invention is to provide a hydraulic cylinder device wherein the stroke of the piston therein can be selectively adjusted from one position to another very easily and very quickly.

A still further object of my invention is to provide a hydraulic cylinder device wherein the stroke of the piston therein can be selectively adjusted and which will not appreciably affect the size of the cylinder.

A still further object of my invention is to provide a hydraulic cylinder device wherein the stroke of the piston therein can be selectively adjusted without adversely affecting the normal functioning of the cylinder.

Still further objects of my invention are to provide a hydraulic cylinder device that is economical in manufacture, durable in use, and refined in appearance.

These and other objects will be apparent to those skilled in the art.

My 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 my claims, and illustrated in the accompanying drawing, in which:

FIGURE 1 is an elongated sectional view of my device taken on line 1—1 of FIGURE 5 and shows the master piston in its position of maximum withdrawal into the cylinder casing;

FIGURE 2 is a sectional view of my device taken on line 2—2 of FIGURE 5 and shows the slave piston moved to an alternate position to shorten the allowable displacement of the master piston;

FIGURE 3 is a schematic view showing the hydraulic circuitry of my device;

FIGURE 4 is a sectional view of my device taken on line 4—4 of FIGURE 2; and

FIGURE 5 is a sectional view of my device taken on line 5—5 of FIGURE 2.

I have used the numeral 10 to generally designate a hollow cylinder casing. A rear casting 12 is secured to the rearward open end of casing 10 by weldment 14. Clevis elements 16 extend rearwardly from casting 12 to permit attachment of the entire unit to the desired supporting surface. As shown in FIGURES 1 and 5, a bore 18 extends radially inwardly towards the center of casting 12 from the outer periphery thereof to communicate with an axial bore 20. The outer end of bore 18 is threaded and serves as a port for attachment to a hydraulic line. The rearward end of bore 20 is threaded and receives threaded plug 22. The rearward end of bore 20 has a greater diameter than the forward end thereof. An elongated hollow tube 24 is adapted during assembly to be inserted through bore 20 into casing 10. The rearward end of tube 24 is flared adjacent shoulder 26 in bore 20, and tube 24 is also flared at 28 adjacent the forward center portion of casting 12. This structure holds tube 24 against longitudinal displacement with respect to the casting. Sealing ring 25 is located in a suitable recess in casting 12 to embrace tube 24 which serves to prevent any passage of fluid through bore 20 outside of tube 24.

As shown in FIGURES 2 and 5, a bore 30 extends partially towards the center of casting 12 and terminates in a longitudinal bore 32 which in turn communicates with a circular well 34 on the inner face of the casting. The outer end of bore 30 is threaded and serves as a port for connection to a hydraulic line. A slave piston 36 is slidably mounted on the portion of tube 24 within casing 10. Sealing rings 38 and 40 are mounted in suitable recesses within piston 36 to slidably seal the piston with respect to the outer surface of tube 24 and the inner surface of casing 10. An indentation 42 in the rearward face of piston 36 is capable of receiving the flared portion 28 of tube 24 to enable the rearward face of the piston to engage the forward face of casting 12 as shown in FIGURE 1.

A head casting 44 is mounted in the forward open end of casing 10 by means of oval ring 46 which is positioned in registering slots in the casting and casing according to the teachings of my earlier Patent No. 2,890,917 issued June 16, 1959. Sealing ring 48 is received in a suitable recess in casting 44 to effect a seal between the casting and the casing 10. A hollow piston rod 50 slidably extends inwardly through a center bore 52 in casting 44, and a master piston 54 is threadably secured to the inner or rearward end thereof within casing 10. Tube 24 is of such length and of such diameter that at least a portion of its length will always extend into rod 50. Tube 24 has a reduced diameter which leaves an open space between its outside surface and the inside surface of rod 50. Sealing rings 56 and 58 appear in suitable recesses in casting 44 and piston 54, respectively, to prevent the passage of hydraulic fluid between these elements and tube 24. The rearward end 60 of bore 52 is enlarged in diameter and communicates with a radial bore 62 in casting 44 which is threaded at its outer end and registers with an aperture in casing 10 to serve as a port for connection to a hydraulic line. Circular wells 64 and 66 appear in opposite faces of piston 54, and radial conduits 68 in the rearward face of the piston connect well 66 with the interior of piston rod 50. Conventional clevis elements 70 are secured to the outer end of rod 50.

In FIGURE 3, I have shown the schematic hydraulic circuit whereby my device is operated. A motor 72 is connected in conventional manner to hydraulic pump 74. Hydraulic line 76 extends from pump 74 to hydraulic reservoir 78, and line 80 extends from the pump to one side of conventional three-position hydraulic valve 82, which is operated by lever 84. Lever 84 normally is held in a neutral or closed position. Line 86 connects valve 82 with a conventional two-position valve 88 which

is operated by lever 90. Lever 90 is normally held in one of two open positions as will be described hereafter. Lines 92 and 94 connect valve 88 with bores or ports 18 and 30, respectively, in rear casting 12. Line 96 connects valve 82 with bore or port 62 in head casting 44, an line 98 connects valve 82 with reservoir 78.

The normal operation of my device is as follows: With the master piston 54 and slave piston 36 in the positions shown in FIGURE 1, the master piston is permitted its maximum displacement within casing 10. Thus, when motor 72 is energized to cause pump 74 to deliver fluid under pressure from reservoir 78 to valve 82, lever 84 thereon can be moved to the "right" as viewed in FIGURE 3 to allow the fluid to move into or against the fluid in line 86. Valve 88 is normally open to allow fluid to immediately pass from line 86 into line 92. Fluid thereupon enters into bore 18 of casting 12, and thence forwardly and out the forward end of tube 24 into the interior of a piston rod 50. The fluid thereupon moves rearwardly inside rod 50 and outside tube 24, and thence moves forwardly against the rear face of the master piston 54 by passing through conduits 68 and into the well 66 on the rear face of the piston. This causes the piston 54 and rod 50 to move forwardly in casing 10, and the fluid forwardly of the piston is forced out bore 62 into line 96, back through valve 82, and thence through line 98 to reservoir 78. As the position of lever 84 is moved to the "left," as viewed in FIGURE 3, the fluid under pressure is diverted from line 80 to line 96 and the flow of fluid within casing 10 as described above is reversed as piston 54 is moved rearwardly in the casing. Fluid then being exhausted from the lines 92 and 86 is diverted through valve 82 back to reservoir 78 through line 98. The above procedure governs the normal use of the master piston 54.

When it is desired to change the stroke of rod 50 and piston 54, the piston 54 is moved adjacent the slave piston 36 as shown in FIGURE 1. The lever 90 on valve 88 is moved to the "right" as viewed in FIGURE 3 and lever 84 on valve 82 is similarly moved to cause fluid under pressure to enter line 94, conduits 18 and 32, and thence to move into well 34 in casting 12 to move forwardly against the rearward surface of slave piston 36. This pressure causes both pistons 36 and 54 to move forwardly in casing 10, and the fluid forwardly of piston 54 is exhausted in the manner described above. When the slave piston 36 has been moved forwardly the desired distance in casing 10, such as is shown in FIGURE 2, the lever 90 is allowed to resume its initial position which will divert pressure flow towards the cylinder through line 92 instead of line 94. This will exert pressure against the rearward side of master piston 54 in the usual manner discussed above, and slave piston 36 will then be stationary because the fluid therebehind will become static. However, the captive fluid behind slave piston 36 will prevent any rearward movement of this piston, so the master piston can be freely moved between the extreme positions defined by the rearward surface of casting 44 and the forward surface of the slave piston 36. By causing master piston 54 to move rearwardly in the manner described, and by moving lever 90 to the right as viewed in FIGURE 3, the fluid behind slave piston 36 can be exhausted and the slave piston will move rearwardly. This is normally done at a time when the two pistons are in engagement with each other.

Thus, it is seen that my device accomplishes at least all of its stated objectives, and specifically provides for the selective stroke adjustment of a hydraulic cylinder by a remote hydraulic control means.

Some changes may be made in the construction and arrangement of my hydraulic cylinder device without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claims, any modified forms of structure or use of mechanical equivalents which may be reasonably included within their scope.

I claim:

1. In a hydraulic cylinder,
an elongated hollow casing,
an elongated hollow tube mounted on the longitudinal axis of said casing and extending into said casing from one end thereof,
a slave piston slidably mounted on said tube,
a hollow piston rod slidably extending through the other end of said casing,
a master piston rigidly secured to the inner end of said piston rod,
the outer diameter of said tube being less than the inner diameter of said piston rod so that said rod can movably receive said tube,
a first hydraulic port in said one end of said casing in communication with the interior of said casing adjacent one side of said slave piston,
a second hydraulic port in said casing in communication with said tube,
a third hydraulic port in said other end of said casing and in communication with the interior of said casing,
a bore in one end of said casing,
a shoulder in said bore,
said tube extending partially into said bore in said one end of said casing and terminating adjacent said shoulder in said bore, said tube being flared adjacent said shoulder to prevent movement of the tube with respect to said casing,
said tube being flared adjacent the inner end of said bore to prevent movement of the tube with respect to said casing in a direction opposite to said first direction,
and a detachable plug in the outer end of said bore, the outer end of said bore having a greater diameter than the diameter of said tube.

2. The structure of claim 1 wherein an indented well portion appears on the inner face of said one end of said casing, said well portion being in communication with said first hydraulic port.

3. The structure of claim 1 wherein an indented well portion appears in the face of said master piston adjacent said slave piston, said well portion being in communication with the interior of said piston rod.

4. The structure of claim 1 wherein an indented well portion appears on the inner face of said one end of said casing, said well portion being in communication with said first hydraulic port, and a second well portions appears in the face of said master piston adjacent said slave piston, said second well portion being in communication with the interior of said piston rod.

5. In a hydraulic cylinder,
an elongated hollow casing,
an elongated hollow tube mounted on the longitudinal axis of said casing end extending into said casing from one end thereof,
a slave piston slidably mounted on said tube,
a hollow piston rod slidably extending through the other end of said casing,
a master piston rigidly secured to the inner end of said piston rod,
the outer diameter of said tube being less than the inner diameter of said piston rod so that said rod can movably receive said tube,
a first hydraulic port in said one end of said casing in communication with the interior of said casing adjacent one side of said slave piston,
a second hydraulic port in said casing in communication with said tube,
a third hydraulic port in said other end of said casing and in communication with the interior of said casing,
a source of hydraulic power,
a hydraulic circuit interconnecting said source of hydraulic power and said first, second and third ports,

control means in said hydraulic circuit to selectively supply hydraulic fluid under pressure to either said second or third ports, and

alternate control means in said hydraulic circuit to divert hydraulic fluid from said second port to said first port,

said control means including a three position hydraulic valve, means connecting said valve to said source of hydraulic power, means connecting said valve to said third port and said alternate control means, a control element on said valve capable of diverting hydraulic fluid under pressure to said third port, said alternate control means to preclude the passage of fluid through the valve, said control element being normally in a position to preclude the passage of fluid through said valve.

6. The structure of claim 5 wherein said alternate control means includes a two position hydraulic valve, a control element on said two position hydraulic valve normally directing hydraulic fluid for passage through said second port.

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