

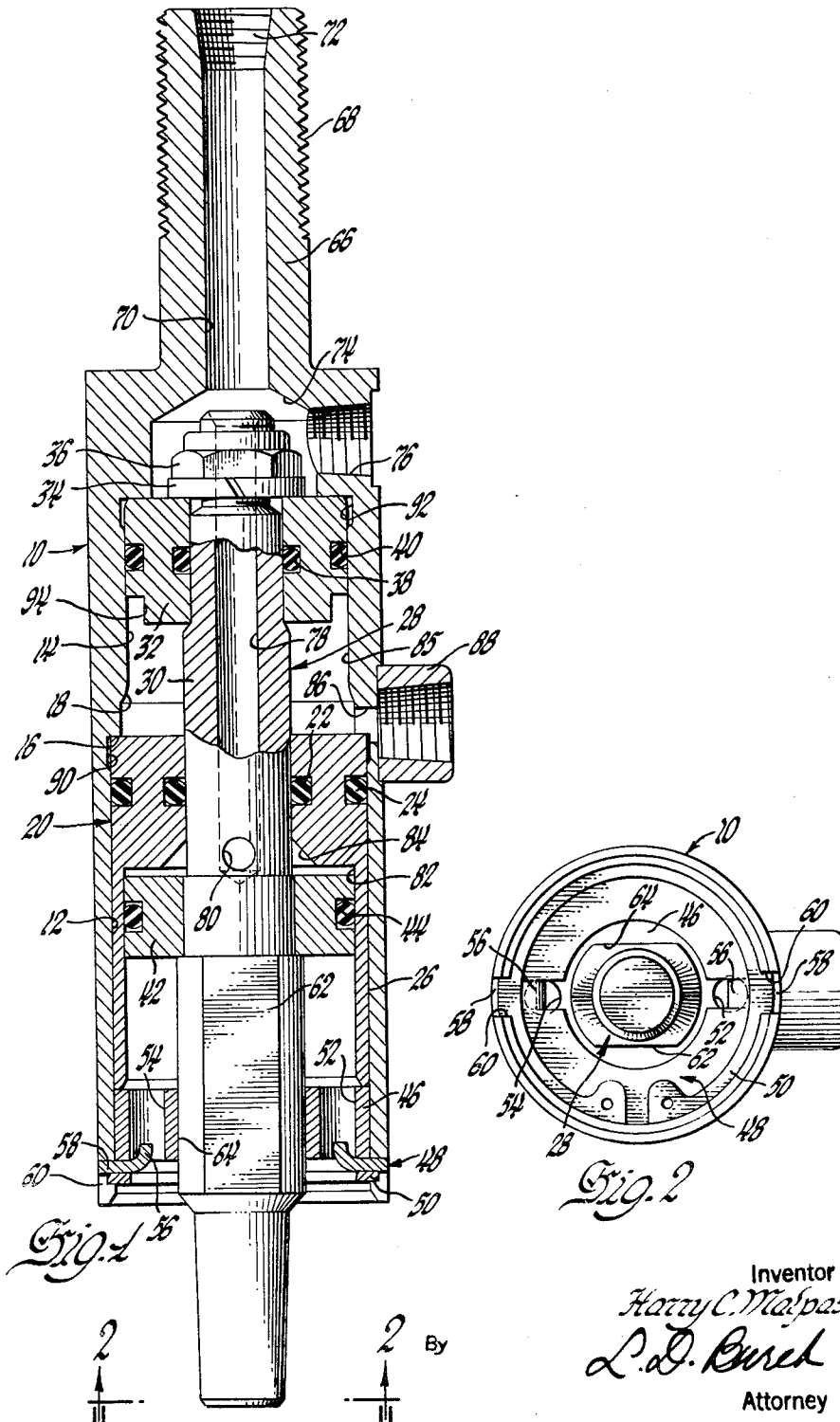
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DUAL PISTON CYLINDER

2,956,549

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2 Sheets-Sheet 1



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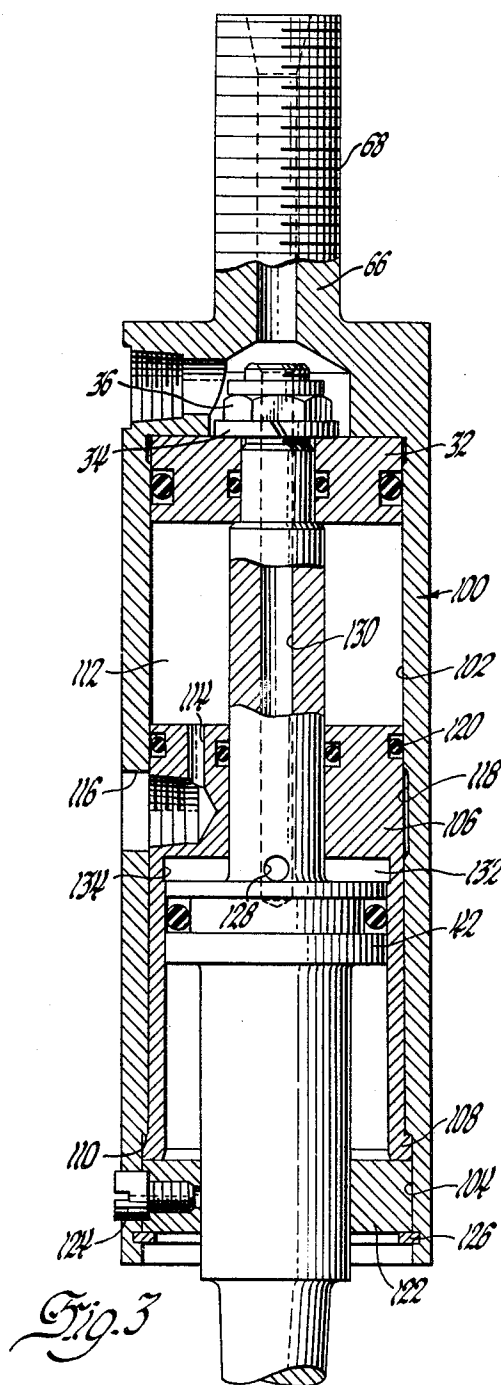
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DUAL PISTON CYLINDER

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This invention relates to dual piston cylinders in general and more particularly to hydraulically actuated dual piston control cylinders.

The use of cylinder means including a pair of piston heads secured to a single shaft and disposed in separate work chambers is well known and accepted as a means for providing a control cylinder having an increased work capacity without appreciably changing the cylinder's dimensions. In the past, such dual piston cylinders have been actuated by pneumatic fluids. The adaptation of such cylinders for use with hydraulic fluids has not proven very successful in view of problems incident to achieving an immediately responsive advance and a full retraction despite the incompressible nature of the hydraulic fluid.

It is now proposed to provide a compact dual piston cylinder assembly adaptable for use within a hydraulic fluid control system as well as a pneumatic fluid control system. It is proposed to provide a simple and effective means for introducing the working fluid simultaneously to each working area in order to provide dual piston cylinder means immediately responsive to a full working pressure. It is further proposed to include means providing against the trapping of hydraulic fluids such as would retard or prevent a full advancing stroke of the piston means due to the incompressible nature of a hydraulic fluid. It is still further proposed to provide means for a more responsive return stroke of the piston means than has previously been provided in similar piston control means.

In the drawings:

Figure 1 is a cross-sectional side view of a dual piston hydraulic control cylinder embodying the present invention.

Figure 2 is an end view of the dual piston hydraulic cylinder shown in Figure 1 taken in the plane of line 2—2 and viewed in the direction of the arrows thereon.

Figure 3 is a cross-sectional side view of a modified form of the proposed dual piston hydraulic control cylinder.

Referring first to Figures 1 and 2, the present invention is shown embodied within a hydraulically actuated welding gun head which is adapted to have secured to one end thereof a welding electrode, which is not here shown. There is provided a cylinder 10 having an enlarged bore 12 provided near one end thereof and a smaller bore 14 near the other end thereof. Stepped shoulders 16 and 18 are provided between the enlarged and smaller bores. A gland member 20 is disposed within the end of the enlarged bore 12 and abuts against the one shoulder 16 to lie adjacent the end of the smaller bore 14. The gland member 20 is formed to receive internal and external O-rings 22 and 24 for fluid sealing. The gland member 20 includes integrally therewith a sleeve portion 26 extended within the enlarged bore 12.

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Dual piston means 28 are provided within the cylinder 10 and include a piston rod 30 having a first piston head 32 secured to one end thereof by a lock washer 34 and nut means 36 threaded upon the one end thereof. The piston head 32 is formed to receive internal and external O-rings 38 and 40 for fluid sealing. The first piston head 32 is disposed within the smaller cylinder bore 14. A second piston head 42 is provided upon the piston rod 30 within the enlarged bore 12 and is formed to receive an external O-ring 44 for fluid sealing.

The gland member 20, which forms a dividing wall between piston heads 32 and 42, is secured within the enlarged bore 12 by means of a bushing member 46, bushing retainer 48 and snap ring 50. The bushing member 46 includes apertures 52 and 54 provided therein and adapted to receive ears 56 formed from the bushing retainer member 48 and bent inwardly. The bushing retainer member 48 also includes external ears 58 received within slots 60 provided in the end of the cylinder member 10. The internal and external ears 56 and 58 of the bushing retainer member 48 provide means for holding the bushing member 46 in fixed position.

The outer end of the piston rod member 30 is formed to provide flat surfaces 62 which are engaged within the bushing member 46 having an opening 64 formed therethrough which is complementary to the shape of the end of the piston rod. The bushing member 46 being retained itself is adapted to restrain rotation of the piston rod member 30.

The cylinder member 10 is provided at its other end with a necked portion 66 having threads 68 formed externally near the end thereof to provide means for securing the cylinder to a supporting structure, not here shown. The necked portion 66 is formed to provide a passage 70 which is internally threaded near one end as at 72 to receive a hydraulic fluid line, not here shown. The passage 70 communicates with a first work chamber 74 formed above the first piston head 32 which is adapted to receive the nut and washer fastening means 34 and 36 therewithin. A secondary or auxiliary inlet passage 76 is formed through one side of the cylinder 10 in communication with the first work chamber 74 and is internally threaded, as the other passage 70, to receive a hydraulic fluid line, not here shown. Either fluid passage 70 or 76 may be used depending upon which is the more accessible when the cylinder 10 is installed in a welding jig; the other opening then being closed.

The piston rod 30 is formed to provide a passage 78 centrally therethrough which communicates through an aperture 80 with the second work chamber 82 between the second piston head 42 and the gland member 28. The gland member 28 is undercut as at 84 about the piston rod and directly over the second piston head to provide more direct communication through aperture 80 with the second work chamber 82. This, as will be described, enables simultaneous pressure application in both work chambers.

The space or chamber 85 between the first piston head 32 and the gland member 28 is, in the present instance, adapted to receive a working fluid for backing off or retracting the piston means 28. For this reason an opening 80 is formed through the side of cylinder 10 and a fitting 88 is provided thereover. The fitting 88 is threaded to receive a fluid line, not here shown. During the advance stroke of the piston means 28 fluid is exhausted from chamber 85 and during the retraction stroke fluid pressure is built up therein.

The second piston head 42 is secured to the piston rod so that there is a space provided between the second

piston head and the gland when the first piston head is in the fully retracted position. This space enables more direct communication with the passage 78 provided in the piston rod 30 and allows more ready escape of the hydraulic fluid from such space through aperture 80 in communication therewith when the piston means are being retracted.

The grooves 90 and 92 at the ends of the enlarged bore 12 and smaller bore 14 are incident to machining operations. The groove 94 about the underside of piston head 32, however, is provided to accommodate the working fluid when the piston head is in its advance position and ready to be retracted. That is, fluid entering opening 86 has direct access to the annular space provided by groove 94 and the pressure is immediately built up against piston 32 to start the retraction of the piston means and upon a breaking away of the piston 32 from gland 20 the entire underside of the piston is acted upon by the retracting work fluid.

Referring now to Figure 3, there is shown a modified hydraulic dual piston structure. Those parts which are basically similar to the cylinder means of Figures 1 and 2 are not redescribed.

The cylinder member 100 includes a bore 102 enlarged near the lower end thereof as at 104. The gland and sleeve member 106 is received within bore 102 and is formed to provide a flange or collar 108 about the end of the sleeve which engages the shoulder 110 formed at the end of the bore 104. The chamber 112 between the first piston head 32 and the gland member 106 is exhausted by passage means 114 formed within the gland member and communicating with an opening 116 formed through the side of the cylinder member. The annular groove 118 provided around the gland member 106 facilitates assembly of the external O-ring 120 provided about the gland member and the O-ring provided about piston head 32. The bushing member 122 is retained within the end of the cylinder member by set screw means 124 and a snap ring 126.

In the embodiment of Figure 3, the second piston head 42 is spaced sufficiently apart from the gland member 106 to provide communication between the aperture 128 provided at the end of the piston passage 130 and the second work chamber space, designated 132. The sleeve portion of gland member 106 is undercut as at 134 in the course of machining a square corner edge at the end of chamber 132.

The operation of the proposed dual piston hydraulic control cylinder is essentially the same for the embodiments shown by Figures 1 and 3. The operation of the embodiment of Figure 1 will be described in detail with specific differences as to the structure of Figure 3 mentioned generally.

A working fluid is received within the first work chamber 74 and, by means of passage 78 provided through the piston rod 30, within the second work chamber 82. The working fluid is immediately available for work upon both piston heads 32 and 34. Fluid access to the second work chamber is provided by undercutting the gland, as at 84, to provide direct communication with piston rod passage 78 in the structure of Figure 1, and in the embodiment of Figure 3, by spacing the second piston head 42 to permit direct communication between piston rod passage 130 and chamber 132.

The pressure of the working fluid advances the piston means 28 while the working fluid in chamber 85, used to retract the piston means, is exhausted through opening 86 and the air within the space below the second piston head 42 is exhausted through the apertures 52 and 54 provided in bearing member 46. In the structure of Figure 3, air vents may be provided in the bushing member or the fit between the end of the piston rod and the bushing member may be such as will allow the escape of such air.

To prevent an undesirable build-up of pressure within

chamber 85 as the first piston head 32 nears the end of its stroke, the first piston head may be undercut as at 94 to provide increased communication with the passage means permitting the exhaust of fluid from such chamber space.

The piston means are retracted by exhausting the working fluid from chambers 74 and 82, in the reverse manner as applied, and by introducing fluid under pressure through opening 86 into chamber 85 to act against the under surface of piston head 32.

I claim:

1. A dual piston hydraulic cylinder comprising a cylinder member having a closed end, a sleeve member disposed within the open end of said cylinder and having a transverse annular wall provided at one end thereof and dividing said cylinder into spaced chambers, a piston shaft disposed within said cylinder and extended through said wall, piston heads secured to said shaft in each of said chambers, fluid passage means formed centrally through said piston shaft and in open communication with each of said chambers on similar sides of said piston heads, means provided between said transverse wall and said piston head in said chamber adjacent said open end of said cylinder member to prevent cutting off said fluid passage means when said last named piston head is in a position adjacent said transverse wall, first fluid inlet means disposed in the closed end of said cylinder and communicating directly with the adjacent face of one of said piston heads and communicating with the corresponding face of a second of said piston heads through said fluid passage means in said piston shaft for pressurizing said piston heads simultaneously and advancing said piston heads and said piston shaft in the direction of the open end of said cylinder member, second fluid inlet means disposed in the side wall of said cylinder member and communicating with the chamber formed between said transverse annular wall and said piston head disposed in said chamber adjacent said closed end of said cylinder member to allow fluid to enter said chamber and pressurize only the face of said piston head adjacent said transverse wall to retract said piston heads and said piston shaft in the direction of the closed end of said cylinder member and means for retaining and locating said transverse wall within said cylinder.

2. The dual piston hydraulic cylinder of claim 1 wherein said means between said transverse wall and said piston head in said chamber adjacent the open end of said cylinder member includes an undercut in the face of said transverse wall adjacent said last named piston head to permit direct communication between said work chambers via said passage means in said piston shaft when said piston heads are in a retracted position.

3. The dual piston hydraulic cylinder of claim 1 having said piston head adjacent the closed end of said cylinder member undercut to permit pressurizing said piston head when said piston head is in a fully advanced position.

4. A dual piston hydraulic cylinder comprising a cylinder member having one end closed, a sleeve member disposed within the open end of said cylinder and having a transverse annular wall provided at one end thereof and dividing said cylinder into opposite chambers, a piston shaft disposed within said cylinder and extended through said wall, piston heads secured to said shaft in each of said chambers, fluid passage means formed centrally through said piston shaft and in open communication with each of said chambers on similar sides of said piston heads, first fluid inlet means disposed in the closed end of said cylinder and communicating directly with the adjacent face of one of said piston heads and communicating with the corresponding face of a second of said piston heads through said fluid passage means in said piston shaft for providing entrance of fluid to pressurize said piston heads and move said piston heads and said piston shaft toward the open end of said cylinder member, a fluid inlet opening through the side wall of said cylinder member and in

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said transverse wall, fluid passage means between said fluid inlet opening and said chamber adjacent the closed end of said cylinder member, said fluid inlet opening and said last named passage providing for the entrance of fluid into said last named chamber and between said transverse wall and said one piston head for pressurizing the face of said piston head adjacent said transverse wall and moving said piston heads and said piston shaft toward the closed end of said cylinder member, said piston head received within the chamber adjacent the open end of said cylinder spaced apart from said transverse wall to prevent cutting off said fluid passage means upon full retraction of said piston shaft, and a bushing member secured in the opened end of said cylinder member and abutting said sleeve member to retain said sleeve member in said cylinder member and to locate said transverse wall within said cylinder member.

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