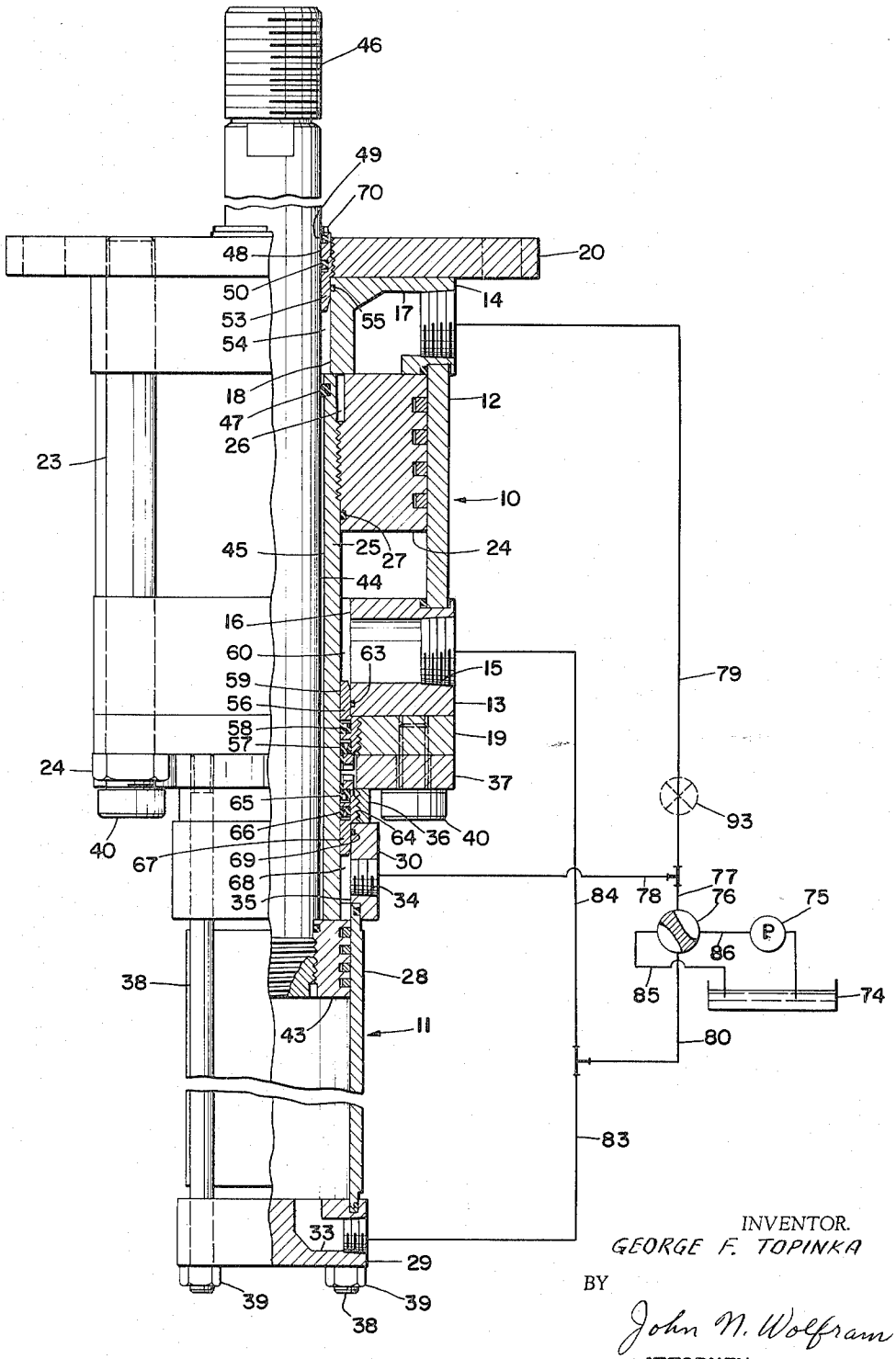
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FLUID PRESSURE MOTOR

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FLUID PRESSURE MOTOR

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This invention relates to fluid pressure motors and more particularly to a dual motor having both a large diameter piston and a small diameter piston for actuation of a single piston rod.

In various types of installations it is necessary to have a large force available to move a part for a relatively small distance and thereafter it is only necessary to have a small force available for moving the part an additional distance. For example, in certain types of molding equipment a large force is required to initiate opening of a mold and thereafter only a small force is required for continuing the opening movement.

An object of the invention is to provide a dual piston motor of the type described of compact design which is of minimum size for the functional requirements.

It is another object to provide a motor of the type described in which the fluid receiving chambers for the large and small pistons are isolated from each other so as to adapte the motor for various modes of operation.

It is another object to provide a dual piston motor in which either one or both of the pistons may be actuated by fluid pressure for moving a piston rod attached to one of the pistons.

It is another object to provide a large cylinder and a small cylinder which can be attached to each other endwise for operating a single piston rod, with packing cartridges at the joined ends of the cylinders also serving as a bearing for one of the sliding elements.

Other objects of the invention will be apparent from the following description and from the drawing in which:

The figure is a view of the dual cylinder, partly in longitudinal cross-section, and with the fluid pressure supply system therefor shown schematically.

The dual motor comprises a large cylinder generally designated 10 and a small cylinder generally designated 11. Large cylinder 10 has a cylindrical tube 12 with end plates 13 and 14 attached thereto. End plate 13 has a port 15 leading to a circular opening 16 through the end plate and plate 14 has a port 17 which leads to the interior of tube 12. Plate 14 also has a circular opening 18 therethrough. Adjacent plate 13 is a mounting plate 19 and adjacent end plate 14 is a mounting plate 20. These end plates 13 and 14 and mounting plates 19 and 20 are preferably square in end view outline and are held in position by a series of tie rods at the corners of the square plates, one tie rod being illustrated at 23. One end of the tie rods is threaded to plate 20 and the other end is secured by nuts 24.

Mounted within cylinder tube 12 for axial reciprocation is a large diameter piston 24 which is threaded onto a reduced diameter portion 25 and locked thereto by a pin 26. A packing ring 27 of resilient material seals the threaded joint between these parts.

Small diameter cylinder 11 has a cylinder tube 28 of smaller diameter than tube 12 and there are end plates 29, 30 for closing the ends of tube 28. Plate 29 has a port 33 leading to the interior of tube 28 and end plate 30 has a port 34 leading to a circular opening 35 through the plate.

Adjacent plate 30 is a mounting plate 36 and between the latter and mounting plate 19 is a spacer plate 37. A series of tie rods 38 are threaded into spacer plate 37 and pass through plates 36, 30, and 29, the latter being retained in position by nuts 39. Spacer plate 37 is attached to mounting plate 19 by a series of bolts 40 for holding cylinders 10 and 11 together in axial alignment. Plates 29, 30 and 36 are square in end view outline and plate 37 is circular with suitable notches for clearing nuts 24.

Mounted for reciprocation in small cylinder 11 is piston 43 of smaller diameter than piston 24. Small piston 43 includes a rod 44 which extends through bore 45 in reduced diameter portion 25 of piston 24 and through large cylinder 10 and plate 20 to the exterior of the motor and it has a thread 46 for suitable attachment to a part to be actuated. A resilient ring 47 in a groove in reduced diameter portion 25 makes sealing contact with rod 44.

Threaded into mounting plate 20 is a packing gland or cartridge 48 having wiping and sealing rings 49 and 50 respectively, of resilient material carried by grooves in the gland and in wiping and sealing contact with rod 44. An annular extension 53 of the gland extends into a clearance space 54 between circular opening 18 and rod 44 and provides sliding bearing support for rod 44. The outer face of annular extension 53 is sealed within bore 18 by a resilient packing ring 55.

A similar packing gland or cartridge 56 is threaded into mounting plate 19 and has resilient wiping and sealing elements 57, 58 in contact with the outer surface of reduced diameter extension 25 and it has an annular extension 59 extending into annular clearance 60 between opening 16 of plate 13 and reduced diameter portion 25 to provide bearing support for the latter. Gland 56 is sealed within opening 16 by packing 63.

Another gland 64, identical to gland 56, is threaded into mounting plate 36 and has resilient wiping and sealing elements 65, 66 in contact with reduced diameter portion 25 and annular extension 67 projecting within annular clearance space 68 between opening 35 and reduced diameter portion 25 to provide additional bearing support for the latter. Extension 67 is sealed within opening 68 by resilient packing 69. All of the glands are slotted at their outer ends as at 70 to facilitate threading into the respective mounting plate.

To actuate the dual cylinder it may be hooked up to a reservoir 74 for hydraulic fluid as shown. This installation includes a pump 75 and a four way directional control valve 76. One port of the latter is connected to a pipe 77, one branch 78 of which connects to port 34 of small cylinder 11 and other branch 79 of which connects to port 17 of large cylinder 10. Another port in valve 76 has a line 80 connected thereto. One branch 83 of line 80 connects to port 33 of small cylinder 11 and another branch 84 connects to port 15 of large cylinder 10. A return line 85 connects an exhaust port of valve 76 back to reservoir 74.

To actuate the dual cylinder, valve 76 is actuated to a position for connecting line 86 leading from pump 75 to line 77. Fluid under pressure from branch line 78 will then enter port 34 and annular clearance 68 to act on the upper side of small piston 43 to urge it downward for retracting rod 44. At the same time, fluid under pressure from branch line 79 enters port 17 to act on the upper side of large piston 24 and the latter transmits thrust to small piston 43 by means of reduced diameter portion 25. Thus rod 44 is moved downward to a retracted position by the force of fluid pressure acting on both the small and large pistons.

When large piston 24 reaches the end of its stroke by bottoming on end plate 13, fluid pressure entering port 34 and acting on small piston 43 continues to move the latter downward through the remainder of its stroke until it bottoms on end plate 29, or until downward movement of rod 44 is otherwise stopped by some external limit to its travel. It is understood, of course, that the stroke of small piston 43 is longer than that of large piston 24.

During the retracting movement of rod 44 as just described, any fluid on the lower side of large piston 24 will be expelled through clearance 60, port 15, and branch line 84 to line 80 where it will be joined with fluid being expelled from the lower side of piston 43 through port 33 and line 83 and return through valve 76 and line 85 to reservoir 74.

To extend piston rod 44, valve 76 is moved to a position where it connects line 86 with line 80 and connects line 77 with line 85. Fluid is then delivered from pump 75 and line 86 to line 80 and then through branch line 83 and port 33 to the lower side of piston 43 to move the latter upwardly. Fluid from line 80 also passes through line 84 to port 15 and clearance 60 to the lower side of large piston 24 for moving the latter upwardly.

During this extending movement of rod 44, fluid from the upper side of piston 24 is expelled through port 17 and line 79 to line 77 where it is joined by fluid being expelled from the upper side of small piston 43 through clearance 68, port 34 and line 78 and then passes through valve 76 and line 85 to reservoir 74.

Piston rod 44 has a close clearance within reduced diameter portion 25 of piston 24, thus permitting the cylinders to be of smaller diameter than would otherwise be the case. In addition, this clearance is sealed by packing 47 so that there is no fluid communication through the clearance between the upper side of piston 24 and the upper side of piston 43. Likewise, sealing rings 58 and 66 prevent fluid communication between the lower side of piston 24 and the upper side of piston 43. With the pistons being isolated from each other within the motor housing in this manner, an on-off valve 93 may be installed in line 79 and when closed will prevent fluid from being delivered through line 79 to the upper side of piston 24 while fluid is being delivered through line 78 to the upper side of small piston 43. As a result, large piston 24 is not actuated downwardly and small piston 43 is retracted only by the force of fluid delivered to its upper side. Thus by closing or opening valve 93 rod 44 may be retracted only by the small piston or it may be actuated by both pistons during the initial part of its retracting movement and by the small piston alone during the final portion of its retracting movement.

I claim:

1. A motor comprising a housing having large and small diameter chambers, a large diameter piston in the large chamber and a small diameter piston in the small chamber, a bore through the large piston, the small piston including a rod extending through the large piston to the exterior of the large chamber, means for sealing said bore around the rod, said large piston being otherwise imperforate, and port means in the housing for selectively introducing pressure fluid to each chamber on like sides of said pistons for selectively moving said pistons in the same direction, said large piston being engageable with said small piston for imparting force thereto through at least a portion of said movement of the small piston.

2. The fluid motor of claim 1 in which said port means comprises a first port through a wall of said large chamber and a second port through a wall of said small chamber.

3. The fluid motor of claim 1 in which said bore is a close fit with said rod.

4. The fluid motor of claim 1 in which said large piston has a reduced diameter portion extending into said small chamber, a seal between the reduced portion and the wall of said small chamber, and said port means for introducing fluid to the small chamber comprising a port through the housing between said seal and said small piston.

5. The motor of claim 1 in which there is also port means for introducing fluid under pressure to the other side of each piston for moving said pistons in the opposite direction.

6. A motor comprising a housing having large and small diameter chambers, a large diameter piston in the large chamber and a small diameter piston in the small chamber, a bore through the large piston, the small piston including a rod extending through the large piston to the exterior of the large chamber, means for sealing said bore around the rod, said large piston having a reduced diameter portion extending into the small cylinder and engageable with the small piston, the reduced portion being radially spaced from the cylindrical wall of the small chamber to provide an annular clearance therebetween, one end of said clearance being in communication with one side of said small piston, closure means for closing the other end of said clearance, a port in said housing for introducing pressure fluid to said large chamber for moving said large piston into engagement with said small piston, and a port through the wall of said small chamber in communication with said clearance for introducing pressure fluid to said small chamber for continuing movement of the small piston after the large piston has reached the end of its stroke.

7. The motor of claim 6 in which said closure means also serves as a bearing for said reduced diameter portion.

8. The fluid motor of claim 6 in which said closure means includes a sealing ring in sealing contact with said reduced portion.

9. The fluid motor of claim 6 in which there is another port in the small chamber on the side of the small piston opposite the large piston through which pressure fluid may be introduced for returning both pistons.

10. A fluid motor comprising a large diameter cylinder and a small diameter cylinder attached to each other in endwise axial alignment, the large cylinder having first and second end plates each with an opening therethrough, a large piston in the large cylinder having a reduced diameter portion extending through the opening in said second plate with an annular clearance therebetween and also extending into the small cylinder, a small piston in the small cylinder and including a rod extending through the large piston and through the opening in the first end plate to the exterior of the large cylinder, said reduced diameter portion being engageable with said small piston for imparting force thereto through at least a portion of the small piston stroke, an annular gland of rigid material extending into said clearance and providing bearing support for said reduced portion, means for sealing the inner and outer diameters of said gland, a port in said large cylinder for introducing fluid under pressure to said large piston for driving it into engagement with the small piston, and a port in said small cylinder between said gland and said small piston for introducing pressure fluid to said small piston for driving it away from said large piston.

11. The motor of claim 10 in which there is a mounting plate attached to the large cylinder adjacent the second end plate, said gland being fixed to said mounting plate.

12. The fluid motor of claim 10 in which there is another annular clearance between the reduced diameter portion and a cylindrical wall of the small cylinder, and there is another gland extending into said another annular clearance and providing additional bearing support for said reduced diameter portion.

13. A fluid motor comprising a large diameter cylinder and a small diameter cylinder attached to each other in endwise axial alignment, the large cylinder having a large end plate and the small cylinder having a small end plate spaced from the large end plate, a large mounting plate adjacent the large end plate and a small mounting plate adjacent the small end plate, a spacer plate between said mounting plates, openings through all of said plates, a large piston in the large cylinder having a reduced diameter portion extending through all of said openings and having an annular clearance with each, said reduced diameter portion extending into the small cylinder, a small piston in the small cylinder and including a rod

extending through the large piston and through the large cylinder to the exterior thereof, said reduced diameter portion being engageable with said small piston for imparting force thereto through at least a portion of the small piston stroke, a first packing gland carried by the large mounting plate and extending into the clearance between the large end plate and said reduced diameter portion, a second gland carried by the small mounting plate and extending into the clearance between the small end plate and said reduced diameter portion, each of said glands being sealed on its inner and outer diameters, and ports in said large and small cylinders on each side of said pistons for admitting and exhausting pressure fluid from each side of each piston.

14. The motor of claim **13** in which said glands are threaded to their respective mounting plates.

15. The motor of claim **13** in which said spacer plate is bolted to said large mounting plate and said small cylinder is bolted to said spacer plate.

16. The motor of claim **13** in which the outer ends of said glands are received within the opening of the spacer

plate so as to be inaccessible when said small cylinder is attached to said large cylinder.

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