

[54] POWER CYLINDER CONSTRUCTION

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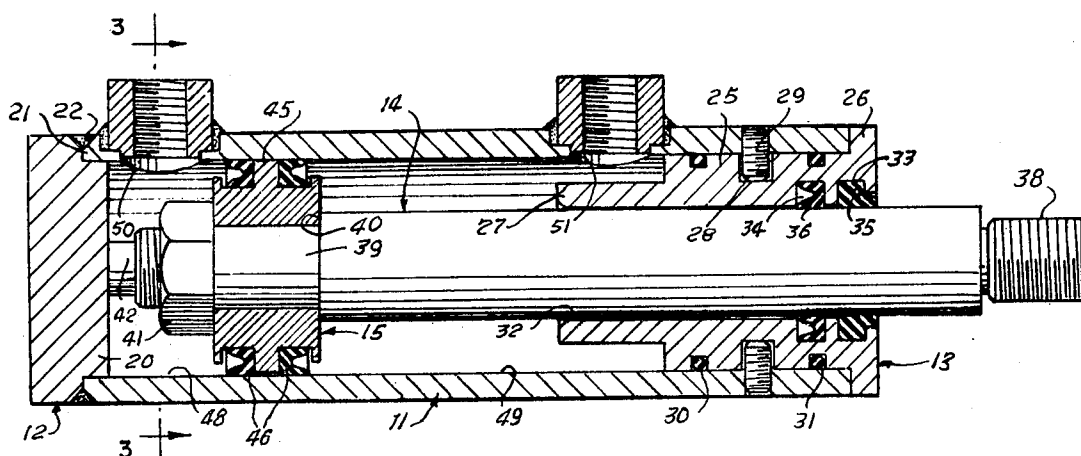
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[57]

ABSTRACT

A double-acting power cylinder for use with hydraulic fluid or air includes a barrel having a cylindrical bore closed at one end by a fixed end cap, and at the other end by an end cap having a cylindrical body received in the bore, and retained in the bore by screws extending through the body into the end cap. The removable end cap includes a piston rod passage and a suitable seal for the piston rod. An annular piston is fixed to a reduced diameter end of the piston rod which includes an integral extension for limiting movement of the piston toward the fixed end cap. The removable end cap includes a boss for limiting piston movement in the opposite direction of reciprocation.

5 Claims, 3 Drawing Figures



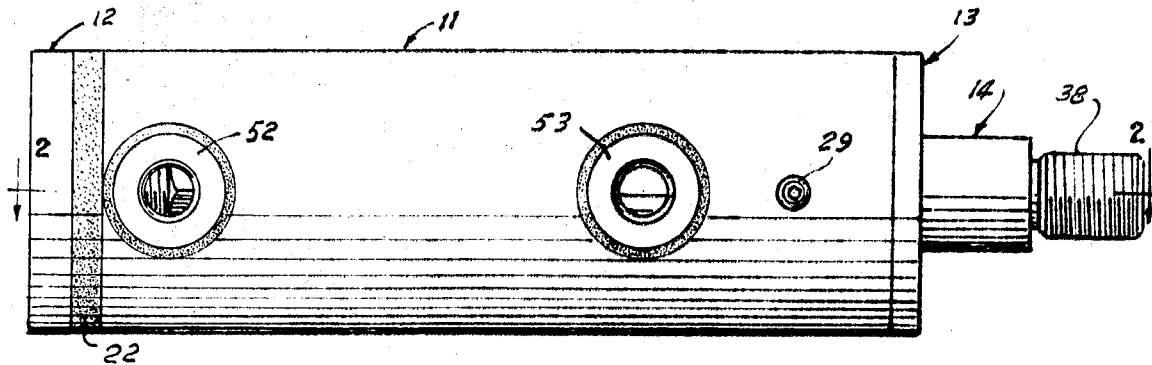


Fig. 1

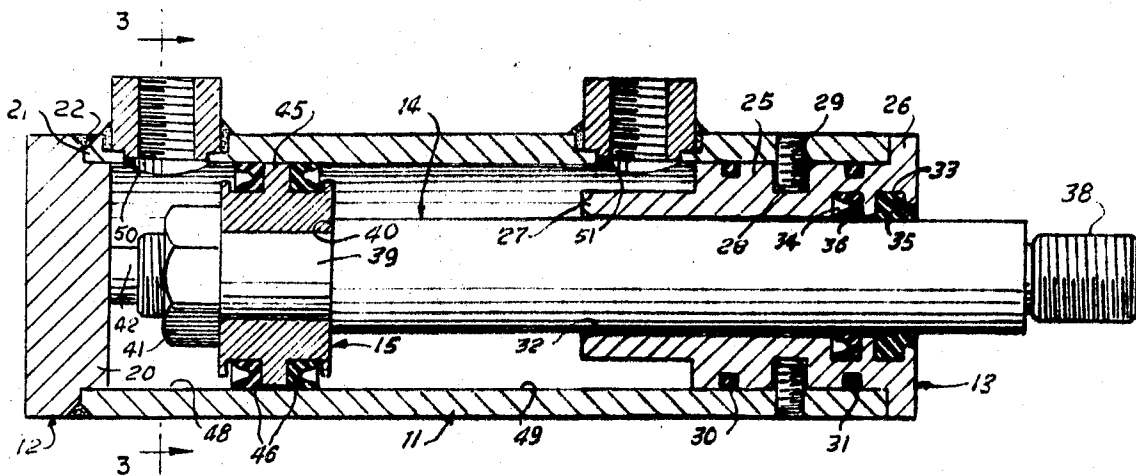


Fig. 2

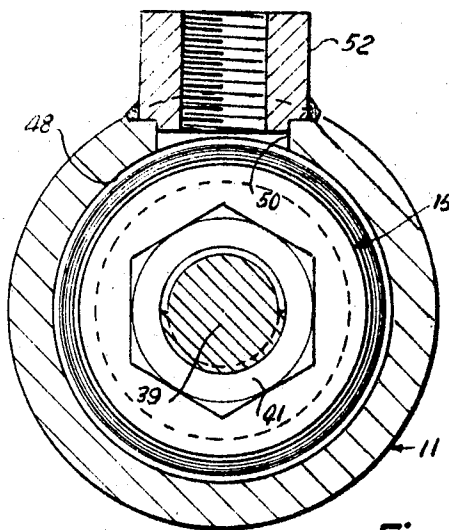


Fig. 3

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POWER CYLINDER CONSTRUCTION

BACKGROUND AND SUMMARY OF THE INVENTION

This invention relates to the construction of power cylinders; and more particularly to an improved design of a power cylinder facilitating manufacture and assembly.

An important object of this invention is to provide an improved power cylinder which is simple in construction, economical in manufacture and assembly, efficient in operation, and which provides optimum characteristics of durability and accuracy of operation.

Another important object of this invention is to provide an improved power cylinder construction which is rugged in construction and yet which may be readily disassembled and reassembled when necessary for cleaning or replacement of parts such as seals.

A further object of this invention is to provide an improved power cylinder construction which is rugged and durable and of compact design for economy of manufacturing and convenience in handling.

These objects are accomplished in a power cylinder, including a body having a cylindrical bore closed at one end by a fixed end cap and at the other end by a gland end cap having a cylindrical body slidably received in the bore. The end cap is axially confined in the cylinder body by means of radial screws threaded through the cylinder body and received in an annular groove in the end cap body. The gland end cap includes an axial bore for accommodating the piston rod and is suitably sealed relative to the cylinder body and the piston rod. More particularly, the cylinder body is defined by a cylindrical tube closed by the gland end cap and the fixed end cap which is welded to the tube; with the inlet and outlet ports being defined by radial passages in a tube and associated fittings welded to the tube.

The novel features of the invention, as well as additional objects thereof, will be understood more fully from the following description when read in connection with the accompanying drawings.

DRAWINGS

FIG. 1 is a plan view of a power cylinder according to the present invention;

FIG. 2 is a longitudinal sectional view of the power cylinder taken in the plane 2—2 of FIG. 1; and

FIG. 3 is a transverse sectional view of the power cylinder taken in the plane 3—3 of FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The drawings illustrate a power cylinder which may be used either with a hydraulic fluid or with a pressure fluid such as air. As seen in the drawings, the principal parts of the power cylinder construction and assembly include a body which is made up of a tubular cylindrical barrel 11, a fixed end cap 12 and a removable end cap 13 which will be referred to as a gland end cap. The gland end cap 13 is provided with an axial bore for accommodating the piston rod 14 upon which is mounted the piston 15.

Referring to the power cylinder body in more detail, the barrel 11 is preferably fabricated of a cylindrical tube fabricated of a suitable metal and cut to the desired length defining a cylindrical bore and an exterior cylindrical surface.

The fixed end cap 12 is a disc-shaped member having a cylindrical boss 20 provided on one face which is dimensioned to be closely received within the internal bore of the barrel 11, with the boss 20 defining an axially facing shoulder 21 for abutting against the end of the barrel 11. The abutting faces of the barrel and of the end cap shoulder 21 are chamfered at the outer periphery to provide a V-shaped groove between these members providing increased area for weld metal 22 for joining these members together.

The gland end cap 13 includes a cylindrical body portion 25 having an exterior diameter slightly less than that of the interior barrel diameter to be closely received within the barrel 11.

The gland end cap may include a radial flange 26 at its outer end, defining an axially facing shoulder for abutting the end of the barrel 11 and locating the gland end cap relative to the barrel. An axially projecting boss 27 extends from the inner end of the end cap. For retaining the gland end cap within the barrel, the body portion is provided with a peripheral annular groove 28, and the barrel 11 is provided with angularly spaced radial holes which are internally threaded to accommodate set screws 29, the set screws extending into the annular groove 28 to prevent axial movement of the gland end cap relative to the barrel. To seal the end cap 13 relative to the barrel, a pair of annular grooves are provided adjacent to the opposite ends of the body portion 25 for accommodating annular resilient seal rings 30 and 31 fabricated of a rubber-like material for example. These seal rings are dimensioned relative to the respective grooves to obviate leakage of fluid between the barrel and the gland end cap.

The piston rod 14 is made up of a rod of uniform diameter having a reduced diameter threaded portion 38 at its outer end, outside of the cylinder body, and a reduced diameter portion 39 at its inner end for supporting the piston 15. The outer threaded end 38 is adapted to receive a coupling for joining the piston rod 14 to another reciprocating member which is either driven by the power cylinder or which drives the power cylinder.

The piston rod extends through a central axial bore 32 in the gland end cap which has a diameter somewhat greater than that of the piston rod to permit free sliding movement of the piston rod relative to the end cap.

The gland end cap is provided with a pair of axially spaced annular grooves 33 and 34, adjacent to the flange end thereof, which open to the axial bore 32. The inner groove 34 is dimensioned to accommodate a V-type annular sealing or packing 36 for preventing loss of the operating fluid along the piston rod 14; and the outer groove 33, adjacent to the flange end of the cap, is dimensioned to accommodate an annular wiper seal member 35 for wiping the piston rod as it enters the cylinder body and obviating entrance of contaminating material into the cylinder chamber.

The inner reduced diameter end portion 39 includes a shank having a smooth cylindrical surface and defining, with the piston rod body, an axially facing shoulder 40. The outer end of the reduced diameter portion 39 is threaded to accommodate a nut 41; and the piston rod includes a further reduced diameter projection or boss 42 defining an abutment for engagement with the fixed end cap 12.

The piston 15 is a disc-like member, fabricated of metal for example, having a central bore dimensioned to be received in close fitting sliding relation over the reduced diameter shank 39, and to be secured on the piston rod 14 by the nut 41 which seats the piston against the shoulder 40. The piston includes a central peripheral rib 45 having a diameter slightly less than that of the bore of the cylinder barrel 11 and defining peripheral annular grooves on opposite sides thereof for accommodating oppositely facing V-type annular seal or packing members 46. The piston divides the cylinder chamber into a first working chamber 48 at the closed end and a second working chamber 49 at the gland end.

The power cylinder illustrated is a double-acting cylinder and the operating ports for the power cylinder are provided by radial holes 50 and 51 provided in the wall of the barrel 11 adjacent to the fixed end cap 12 and to the inner end of the gland end cap 13 respectively. The port holes 50 and 51 are provided with suitable counterbores; and the fittings 52 and 53 are provided with axially projecting bosses so that the fittings may be seated within the counterbores with the bosses projecting into the respective port holes 50 and 51. The fittings 52 and 53 are then permanently welded to the barrel 11 to define the operating ports for the power cylinder.

In the drawings, the piston-piston rod assembly is shown in the retracted position wherein the piston rod boss 42 is abutting the inner wall of the fixed end cap 12. This limits the inward movement of the piston 15 to always maintain a

minimum chamber 48 in communication with the port fitting 52 and thereby enabling drive of the piston-piston rod assembly to the extended position through ingress of operating fluid.

Similarly, movement of the piston-piston rod assembly toward the gland end of the power cylinder is limited by the boss 27 of the gland end cap to define a minimum chamber 49 in communication with the port fitting 53 to enable return of the piston-piston rod assembly to the retracted position by ingress of operating fluid through the port fitting 53.

What has been described is a power cylinder suitable for use as a power unit operated by either a hydraulic fluid or a pressure fluid such as air. The unit is particularly designed for double-acting operation wherein the port fittings 52 and 53 function alternatively as inlet and outlet ports under the control of a suitable four-way valve to alternatively shift the piston-piston rod assembly in opposite directions of movement. Alternatively, the power cylinder may be operated as a single-acting cylinder wherein the port fitting 52, for example, functions alternatively as an inlet and outlet port for the cylinder chamber 48, while the port fitting 53 functions merely as a vent port for the cylinder chamber 49.

A feature of the cylinder construction is that the cylinder body is fabricated from a simple tubular member defining the barrel 11, closed at one end by the end cap 12 welded to the barrel. The gland end cap 13 is securely retained within the other end of the barrel in a manner to provide appropriate sealing, yet in a manner to be readily disassembled for the purpose of cleaning or for replacing worn seals for example.

Another feature of the construction is the port fittings suitably located and welded in holes provided in the barrel 11 to define rugged fittings to which may be secured suitable conduits for the operating fluid.

The power cylinder structure is a simple compact and rugged design providing for efficiency and accuracy in operation.

While a preferred embodiment of the invention has been illustrated and described, it will be understood by those skilled in the art that changes and modifications may be resorted to without departing from the spirit and scope of the invention.

What is claimed is:

1. In a power cylinder

- a body fabricated from a cylindrical tube of uniform cross section having a cylindrical bore; said body having a fixed end cap at one end;
- a gland end cap having an elongated cylindrical body slidable fitted within said cylindrical bore at the open end of said tubular body; said cylindrical body having axially separated external annular grooves adjacent to its respective ends; annular seal means in said grooves for sealing said gland body relative to said tubular body;

said gland cylindrical body having a third outward facing annular groove; said tubular body having one or more radial threaded holes for communication with said third annular groove; screw means threaded into said holes and extending into said third annular groove to retain said gland end cap;

said gland end cap having a central axial bore for accommodating a piston rod, and including two axially spaced annular grooves opening to said piston rod bore; V-type annular seal means in the axially inner groove producing a sliding pressure seal between said gland and said piston rod; and annular wiper means in said axially outer groove for cleaning the piston rod surface;

a piston rod having a reduced diameter end section defining a shoulder for accommodating an annular piston assembly attached thereto for reciprocation within said cylindrical bore; a piston assembly comprising a unitary annular disk-like member having a central bore dimensioned to be fitted over the reduced diameter end section of said piston rod, and having axially spaced peripheral annular grooves, and V-type annular piston packing members in said grooves for engagement with the cylindrical bore of said tubular body.

2. A power cylinder as set forth in claim 1

including first and second radial ports extending through said tubular body adjacent to said fixed end cap and said gland end cap respectively;

said piston rod including an axial extension projecting beyond the piston mounted thereon for engagement with the fixed end cap to define a minimum cylinder chamber communicating with said first port;

and said gland end cap including an axial boss projecting toward said fixed end cap, for engagement by said piston, to define a minimum cylinder chamber communicating with said second port.

3. A power cylinder as set forth in claim 2

wherein said ports are defined by bores formed in the tubular body wall, and internally threaded fittings including axially extending reduced diameter bosses dimensioned to be received in said bores; said fittings being welded to the tubular body.

4. A power cylinder as set forth in claim 1

wherein said body is fabricated of a metallic cylindrical tubular member; and wherein said fixed end cap comprises a metallic disc welded to said tubular member.

5. A power cylinder as set forth in claim 4

wherein said tubular body is provided with radial holes defining inlet and outlet ports of the power cylinder; and tubular metallic fittings fitted into said holes and welded to said tubular member for connecting fluid carrying conduits to said power cylinder ports.

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