United States Patent

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[31] **No. 46454/68**

[54] **PISTON AND CYLINDER UNIT HAVING STROKE LIMITING MEANS**
8 Claims, 3 Drawing Figs.

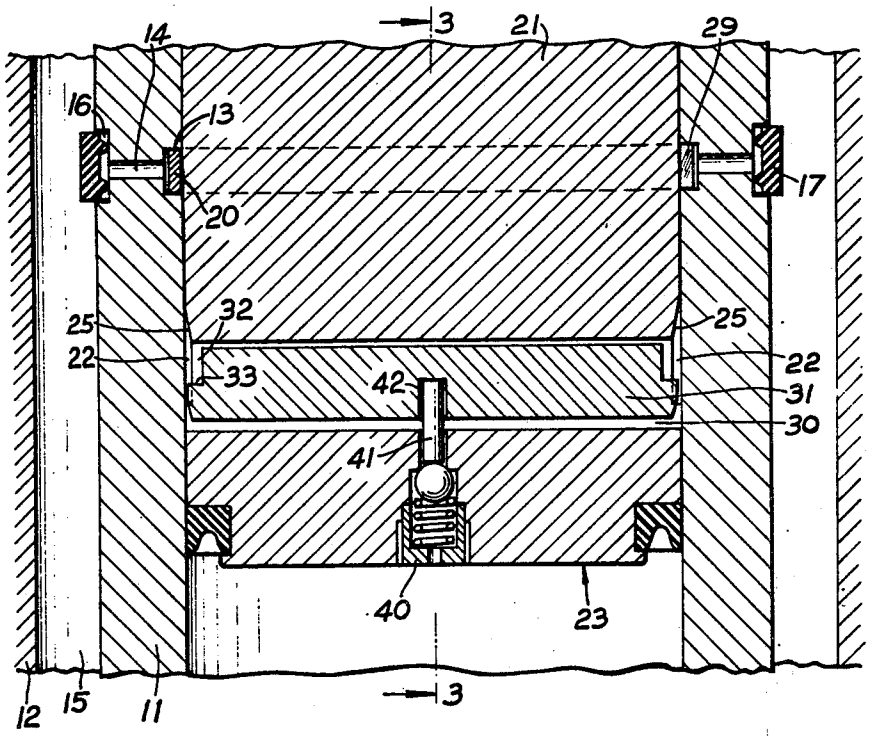
[52] **U.S. Cl.** **91/401,** 92/30
[51] **Int. Cl.** **F15b 15/22,** F16j 1/00
[50] **Field of Search** 91/401; 92/30

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ABSTRACT: A fluid-powered piston and cylinder unit provided with limit means for limiting the stroke of the piston in the cylinder, the limit means comprising a sidewall of an annular recess in the piston and a piston ring accommodated in an annular groove in the cylinder, the ring being spring-loaded radially inwardly so as to project into the piston recess with the recess and groove in register, whereby the piston ring is engageable with the sidewall of the annular rebate positively to limit the piston stroke in one direction.



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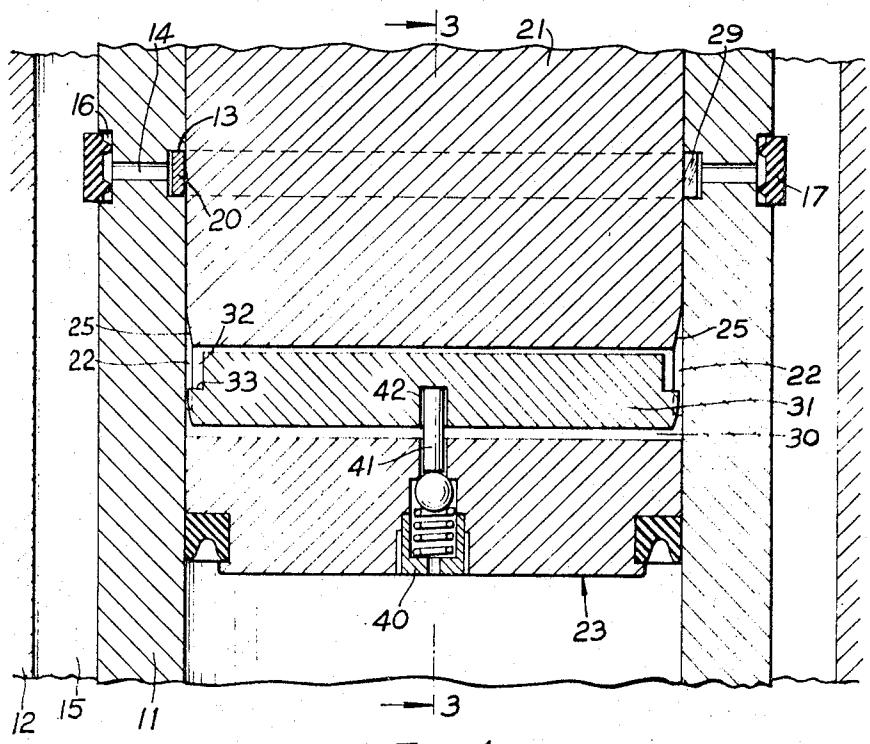


Fig. 1.

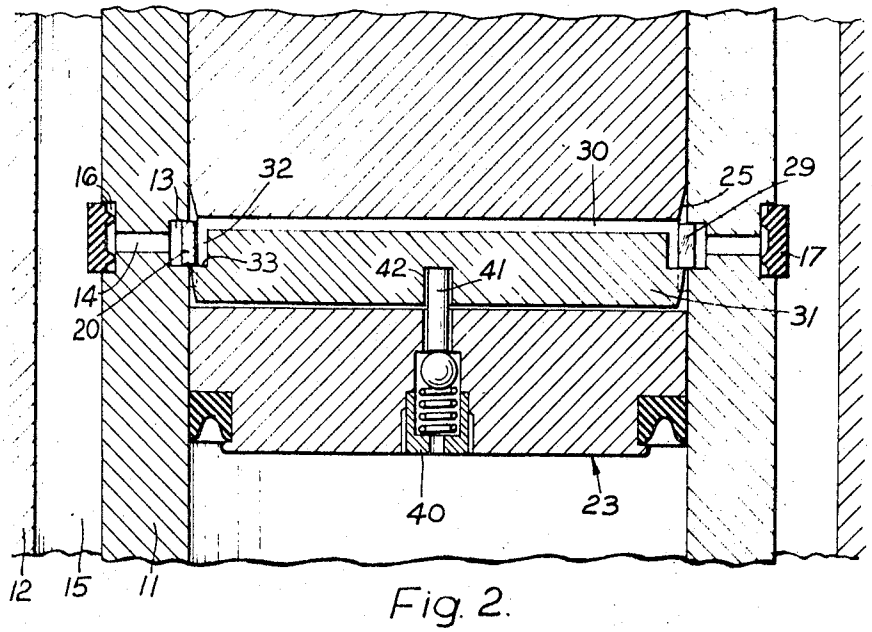


Fig. 2.

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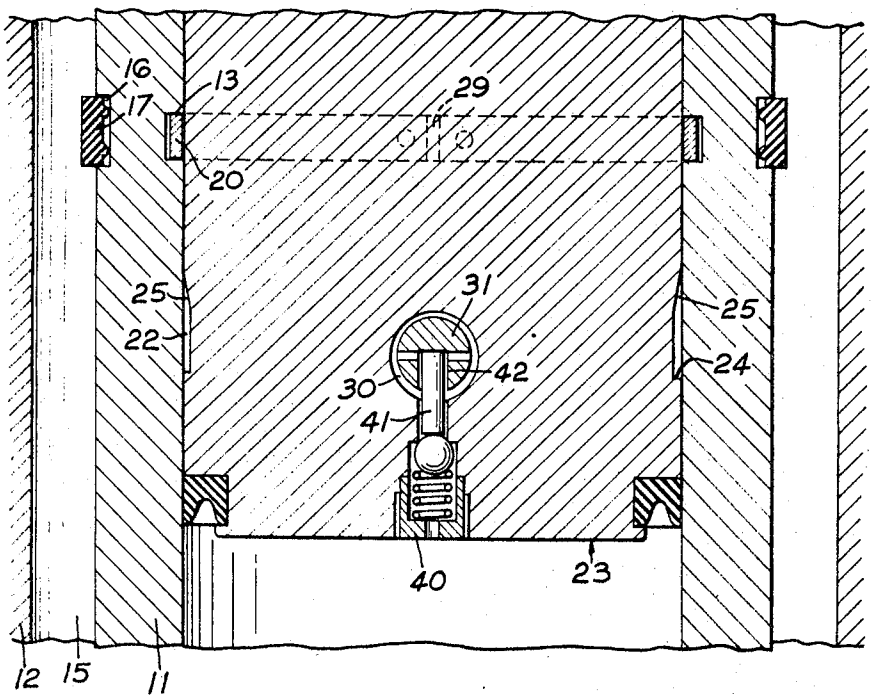


Fig. 3.

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PISTON AND CYLINDER UNIT HAVING STROKE LIMITING MEANS

This invention relates to fluid-powered piston and cylinder units of the kind wherein the cylinder and the piston have complementary abutment shoulders to limit the stroke of the piston in the cylinder.

In known units of this kind, the areas of the shoulders in abutment to limit the piston stroke are usually small, so that under conditions of rapid pumping there is a risk that one of the shoulders may shear. An object of this invention is to provide a unit of this kind which permits a more robust construction with more positive limitation of the piston stroke.

In accordance with this invention a fluid-powered piston and cylinder unit is provided with an annular internal groove in the cylinder and an annular rebate in the piston, and has a piston ring accommodated in the groove and radically inwardly spring-loaded to project into the piston rebate with the latter in register with the groove, and at least one shoulder on the piston and engageable with the inwardly projecting piston ring positively to limit the piston stroke in one direction.

Preferably, the shoulder on the piston is defined by a sidewall of the rebate so that in the stroke-limiting position, there is abutment between the shoulder and the piston ring around the major part of the piston periphery.

The invention is more particularly described with reference to the accompanying drawings, wherein:

FIG. 1 is a sectional side elevation of a piston and cylinder unit according to the invention, with the piston shown out of the stroke-limited position;

FIG. 2 is an equivalent view of the same unit with the piston shown in the stroke-limited position; and

FIG. 3 is a section on line 3—3 of FIG. 1.

Referring to the drawings, the piston and cylinder unit includes a cylinder 11 enclosed in a housing 12 defining a fluid reservoir 15 and provided with an internal annular groove 13 and with a radial passage 14 connecting the groove 13 with the fluid reservoir. The passage 14 opens into an external peripheral groove 16 in the cylinder, and an elastic garter seal 17 encircles the cylinder and is accommodated in the peripheral groove so as to close the radial passage 14 against ingress of fluid from the reservoir 15, whilst permitting fluid under pressure to pass to the reservoir from the radial passage.

A spring-metal piston ring 20, having split 29, encircles the piston 21 and is received in the cylinder annular groove 13, the ring being expanded by the piston so as to be wholly accommodated within the groove. The ring is thereby inherently, radially inwardly spring-loaded.

The piston 21 has an annular rebate defined by a recess 22 near to but spaced axially from a undersurface 23 of the piston, the sidewall 24 of the recess nearer that end extending diametrally of the piston whilst the opposite sidewall 25 is beveled. A transverse passage 30 is formed in the piston so as to interconnect diametrally opposite sides of the recess 22 and a bar member 31 of the piston is housed in the transverse passage so as to be capable of limited a axial floating movement. The bar member 31, which defines a valve actuating member, extends into the recess 22 at both diametrally opposite sides of the passage 30 so as to be just out of contact with the cylinder internal peripheral wall. A rebate 32 is formed at each end in the bar member 31 to define respective diametral abutment surface 33 facing towards the beveled sidewall 25 of the piston recess.

A relief valve 40 is housed in the piston between the transverse passage 30 and the undersurface 23 of the piston, the valve being a ball-valve, spring-urged into closed condition as shown in FIG. 1 and actuable by a pin 14 projecting into the transverse passage 30 and loosely seating in a socket 42 in the bar member 31.

Under the action of fluid pressure on the undersurface 23, the piston is movable in the cylinder, with the piston ring (as shown in FIG. 1) clamped around the piston and accommodated in the cylinder annular groove, until eventually the piston annular recess 22 registers with the groove 13. The ring

is progressively self spring-urged inwardly in its contact with the beveled sidewall 25 of the piston recess 22 so as to project into the recess and after completion of this movement, the abutment surface 33 of the bar member 31 then contacts the underside face of the projecting piston ring 20 (as shown in FIG. 2), whereby the member is moved relative to the other parts of the piston with accompanying movement of the valve pin 41, to open the relief valve. Under high piston loading, opening of the relief valve suffices to arrest piston movement, the fluid being turned to the reservoir 15 through the relief valve, the transverse passage 30, the split 29 in the piston ring, the cylinder groove 13 and the radial passage 14 in the cylinder. Under relatively low piston loading, however, the piston may continue to move after the relief valve has been opened until the diametric diametral sidewall 24 of he recess abuts the underside face of the piston ring 20 positively to arrest movement of the piston. The diametral sidewall 24 of the recess extends almost around the entire periphery of the piston and is broken by transverse passage 30. Hence the piston is positively arrested by contract contact between the piston and the piston ring around almost the entire periphery of the piston.

On reversal of the stroke of the piston, the piston ring is progressively urged back into the cylinder groove by the beveled side 25 of the piston recess and the relief valve is spring-urged into close condition as the bar member 31 loses contact with the piston ring.

The above described embodiment of the invention is particularly suited to applications where high piston loading occurs, but for applications where only light piston loading occurs, the relief valve can be omitted so that the piston is always mechanically arrested by the piston ring.

The piston and cylinder unit may form part of a hydraulic lifting jack incorporating a reciprocating pump to drive the piston and a release valve to permit return of the piston.

I claim:

1. A fluid-powered piston and cylinder unit wherein the piston is formed with an annular rebate and a piston ring is disposed in an internal annular groove in said cylinder, said ring being spring-loaded radially inwardly so as to project into said annular rebate when said rebate is opposite said groove, a pressure relief valve in said piston, an actuating member for said valve movably mounted on and with respect to said piston, and piston stroke limiting means comprising cooperating abutment surfaces on said ring and member engageable when said ring projects inwardly into said rebate during piston movement in one direction whereby said member is displaced to operate said valve.

2. In the piston and cylinder unit defined in claim 1, means defining a further abutment surface on said moving piston adapted to engage said ring after the valve has been operated, to sequentially provide a positive stop for said piston.

3. In the piston and cylinder unit defined in claim 1, cooperating means on said piston and ring engageable for radially spreading the ring out of said rebate to disengage said abutment surface during movement of the piston in the opposite direction.

4. A piston and cylinder unit according to claim 1, wherein the piston is provided with a transverse passage accommodating the valve actuating member for movement of the latter axially of the cylinder with the passage.

5. A piston and cylinder unit according to claim 1, wherein the piston ring and an adjacent part of the cylinder are provided with apertures to permit passage of fluid out of the cylinder from the relieve relief valve.

6. A piston and cylinder unit according to claim 5, including an elastic garter seal mounted on the cylinder to encircle the apertured part of the latter, whereby passage of fluid from the exterior to the interior of the cylinder is prevented.

7. A fluid-powered piston and cylinder unit as defined in claim 6, wherein said valve actuating member extends across said piston within said passage which is large enough to permit axial displacement of said member relative to the moving

piston. and said abutment surface comprise an axial end of said ring and opposite ends of said member.

8. A piston and cylinder unit according to claim 1, wherein

the piston ring is split and is made of spring metal to provide inherent radial inward spring-loading of the ring.