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EUROPEAN PATENT APPLICATION

21 Application number: 88306904.9

51 Int. Cl.⁴: **F 15 B 15/12**

22 Date of filing: 27.07.88

30 Priority: 30.07.87 DE 8710450

43 Date of publication of application:
01.02.89 Bulletin 89/05

84 Designated Contracting States:
AT BE DE FR GB IT NL

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54 **Pivotable actuator.**

57 A pivotable actuator for generating rotary movement from pneumatic pressure directly in which a piston (10) is mounted on a shaft (4) and in which a seal (17) is provided around the shaft (4) so as to seal the high pressure side from the low pressure, and in which the actuator can move approximately 300° around the shaft (4).

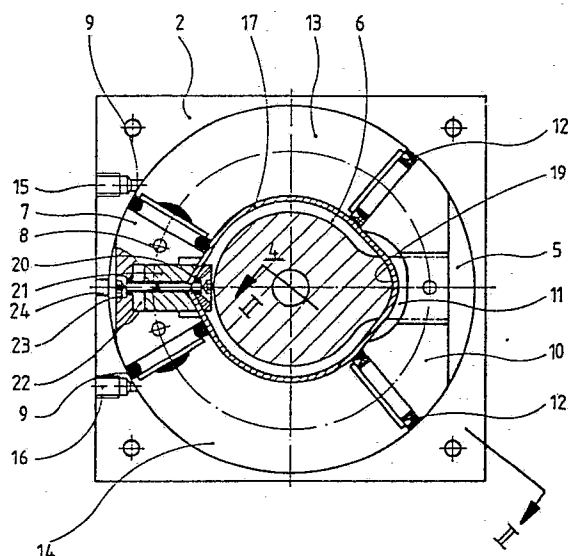


Fig. 1

Description

Pivotal Actuator

This invention relates to a pivotal actuator having a piston mounted on a shaft, said piston being sealingly movable in a pressure cavity concentric with the shaft and with connections for pressure medium.

With pivotal actuators known in practice, the pistons are formed as pivoting wings which along their periphery sealingly operate in a corresponding pressure cavity. The pressure cavity extends to the shaft or beyond the shaft, so that additional shaft seals are needed. In most cases this leads to defective sealing, because either two seals meet each other, or special seals with double sealing function have to be used.

The aim of this invention is therefore to improve the sealing in a pivotal actuator of the type initially described.

By the present invention there is provided a pivotal actuator having a piston mounted on a shaft, said piston being sealingly movable in a pressure cavity concentric with the shaft and with connections for pressure medium, characterised in that the pressure cavity is closed except for a radial slot open towards the shaft, in that a carrier connecting the shaft with the piston extends through the radial slot, in that the piston has a seal on each side of the carrier, and in that the radial slot is covered by a sealing strip which extends to the end of pressure cavity which limits the pivotal movement of the piston, said strip being taken over a saddle of the carrier in the pressure-free area between the seals of the piston.

The sealing strip may close the cross-section of pressure cavity and may be disposed in an extension of radial slot on the pressure cavity side.

The carrier saddle may have a profile matching the cross-section of sealing strip.

The saddle of the carrier may have a greater curvature longitudinally of the sealing strip than would correspond to its distance from the axis of shaft.

The pressure cavity may be of toroidal shape, with one section holding a fixed separator element sealed in both directions from the pressure cavity.

The sealing strip may extend into the pressure-free zone between the seals for the separator element.

The actuator may have a length of sealing strip whose free ends are held by a clip in the zone wherein separator element is free of pressure medium.

The clip may be radially movable in a cavity formed in the separator element, and may be adjusted to tighten the sealing strip.

The actuator may have a housing divided in the plane of the radial slot.

The pressure-medium feed connections may be disposed in one housing half and enter the pressure cavity adjacent the seals of the separator element.

The carrier and piston may be integral with each other.

The carrier, piston and shaft may all be integral with each other.

In meeting this aim, the pressure cavity is closed except for a radial slot open towards the shaft, a carrier connecting shaft and piston extends through the slot, the piston has a seal on each side of the carrier, and the radial slot is covered by a sealing strip extending to the ends of the pressure cavity which limit the pivotal movement of the piston, said strip being taken over a carrier saddle in the pressure-free area between the piston seals.

With this valve actuator, separate shaft seals are unnecessary, since the pressure cavity no longer extends to the shaft. Instead the pressure cavity ends at the radial slot, which is covered by the sealing strip. This strip not only seals the radial slot, it sealingly engages the piston seals. Since the piston seals have a non-pressurised zone between them, the carrier connecting shaft and piston can then pass through the radial slot to act as a force transmission element. In this non-pressurised zone, sealing of the radial slot is not necessary, and hence in this zone the strip can be taken over the saddle in the carrier. During pivotal movement of the piston, the non-pressurised zone, with the sealing strip raised from the radial slot, moves jointly with the piston, while in all other zones of the pressure cavity the sealing strip sealingly covers the slot.

With geometrically simple pressure cavity cross-sections, the sealing strip sealing the cavity cross-section towards the radial slot is preferably disposed in an extension of the radial slot on the pressure cavity side, so that the cross-sectional contour of the pressure cavity has no projections, undercuts or the like even in the radial slot zone.

Physical stress on the sealing strip, especially during relative movement between sealing strip and the carrier or saddle, is reduced if the carrier saddle has a profile matching the strip cross-section, and longitudinally of the strip preferably has greater curvature than corresponds to its distance from the shaft axis.

In a preferred embodiment of the invention the pressure cavity is toroidal, with one section holding a fixed separator element sealed in both directions from the pressure cavity. In particular the toroidal pressure cavity has a circular cross-section, so that ring seals can be used on the piston and the separator element. This permits use of commercial seals in the form of O-rings and/or lip seals.

The sealing strip preferably extends into the unpressurised zone between the separator element seals. If a length of sealing strip is used, its free ends can be held by a clip in the unpressurised zone of the separator. Such a clip in particular also permits tightening of the sealing strip when the clip is radially mobile in a recess in the separator element and can be adjusted to tighten the sealing strip. Since the clip is housed in the unpressurised zone between the seals for the separator element, the tightening device eg a screw can be made accessible from

outside the pressure cavity. One readily manufactured simple embodiment of the invention is characterised by a housing divided in the plane of the radial slot. This also enables the two housing halves to be almost identically made. Pressure medium terminals can be disposed in one half of the housing and enter the pressure cavity adjacent the separator element seals.

One embodiment of the invention as shown in the attached drawings will now be described. In these:-

FIGURE 1 shows half of a pivotable actuator with the other half removed showing the central shaft in section

FIGURE 2 is an axial section, in the direction of arrows II-II of the device shown by Figure 1.

The pivotable valve-actuator represented comprises a housing divided in a radial plane, with housing halves 1, 2 and a central bore 3 for a shaft 4 disposed therein. A toroidal cavity 5 of circular cross-section enclosed by the two housing halves 1, 2 is concentric with bore 3 and shaft 4. Cavity 5 is sealed from the exterior by a seal 25 between the housing halves 1, 2 and closed except for a radial slot 6 open to the shaft 4.

At one position in cavity 5 is a fixed separator element 7 affixed by screws 8 to one housing half 2. Separator element 7 is sealed from cavity 5 by seals 9 at two opposite sides. The seals 9 are O-rings.

Cavity 5 also houses a piston 10 centrally connected by a carrier 11 to shaft 4. Carrier 11 extends through the radial slot 6. At either side of carrier 11 the piston 10 is sealed from cavity 5 by seals 12. In the embodiment shown, the seals 12 are lip ring seals. Pressure chambers 13, 14 are formed between adjacent seals 9, 12 of piston 10 and of separator element 7. Pressure medium can be fed into or out of these pressure chambers 13, 14 via terminals 15, 16 disposed in the housing half 2 and ending near the seals 9 of the separator element 7.

The radial slot 6 is covered by a sealing strip 17 which also cooperates with the seals 9 of separator element 7, and seals pressure chambers 13, 14 from radial slot 6. In the embodiment shown, sealing strip 17 has an external contour matching the contour of cavity 5, so that in the region of radial slot 6 the cross-section of cavity 5 is completed by the sealing strip 17. In addition, sealing strip 17 is disposed in an extension 18 of radial slot 6 on the pressure chamber side, and has a cross-section matched thereto (Figure 2).

In the pressure-free area of the piston 10 between its two seals 12, the sealing strip 17 is carried over a saddle 19 of carrier 11, and thus lifted from radial slot 6. Saddle 19 has a profile matching that of sealing strip 17, and in the peripheral direction has a greater curvature than its distance from the shaft axis would indicate.

The free ends 20 of the sealing strip are fixed in a clip 21. Clip 21 is located in the pressure-free region of separator element 7 between the two seals 9 thereof, and is held in a radially-extending cavity 22 so that the clip 21 can move radially therein. By means of an adjustment screw 23 abutted against separator element 7 and accessible from the

housing exterior via an aperture 24, the clip 21 can be radially shift to tighten the sealing strip 17.

The pivotable actuator represented operates as follows:- When pressure medium is supplied to one of the pressure chambers 13 or 14 via the corresponding terminal 15 or 16, the piston 10 then pivots in dependence on the resulting pressure conditions, and via the carrier 11 also entrains shaft 4. During pivoting of piston 10, its seals 12 slide over the fixed sealing strip 17, which in the non-pressurised area of piston 10 between the two seals is lifted from radial slot 6 and taken over the saddle 19 of the carrier 11. The sealing for pressure chambers 13 or 14 is not affected thereby, so separate shaft seals are unnecessary.

The piston rod 4 may itself be hollow and be a cylinder. The cylinder may contain a piston which is non-rotatable relative to the cylinder so that in combination with the pivotable actuator a pick and rotate device may be easily assembled.

Claims

1. A pivotable actuator having a piston mounted on a shaft, said piston being sealingly movable in a pressure cavity concentric with the shaft and with connections for pressure medium, characterised in that the pressure cavity is closed except for a radial slot open towards the shaft, in that a carrier connecting the shaft with the piston extends through the radial slot, in that the piston has a seal on each side of the carrier, and in that the radial slot is covered by a sealing strip which extends to the end of pressure cavity which limits the pivotal movement of the piston, said strip being taken over a saddle of the carrier in the pressure-free area between the seals of the piston.

2. Actuator as in Claim 1, characterised in that the sealing strip closing the cross-section of pressure cavity is disposed in an extension of radial slot on the pressure cavity side.

3. Actuator as in Claim 1 or 2, characterised in that the carrier saddle has a profile matching the cross-section of sealing strip.

4. Actuator as in any of Claims 1-3, characterised in that the saddle of the carrier has a greater curvature longitudinally of the sealing strip than would correspond to its distance from the axis of shaft.

5. Actuator as in any of Claims 1-4, characterised in that the pressure cavity is of toroidal shape, with one section holding a fixed separator element sealed in both directions from the pressure cavity.

6. Actuator as in any of Claims 1-5, characterised in that the sealing strip extends into the pressure-free zone between the seals for the separator element.

7. Actuator as in any of Claims 1-6, with a length of sealing strip whose free ends are held by a clip in the zone wherein separator element

is free of pressure medium.

8. Actuator as in any of Claims 1-7, characterised in that the clip is radially movable in a cavity formed in the separator element, and can be adjusted to tighten the sealing strip.

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9. Actuator as in any of Claims 1-8, characterised by a housing divided in the plane of the radial slot.

10. Actuator as in any of Claims 1-9, characterised in that the pressure-medium feed connections are disposed in one housing half and enter the pressure cavity adjacent the seals of the separator element.

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11. Actuator as in any of Claims 1-10, characterised in that the carrier and piston are integral with each other.

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12. Actuator as in any of Claims 1-11, characterised in that the carrier, piston and shaft are all integral with each other.

13. Actuator as in any one of Claims 1-12 in which the shaft is hollow and forms a cylinder which contains a piston.

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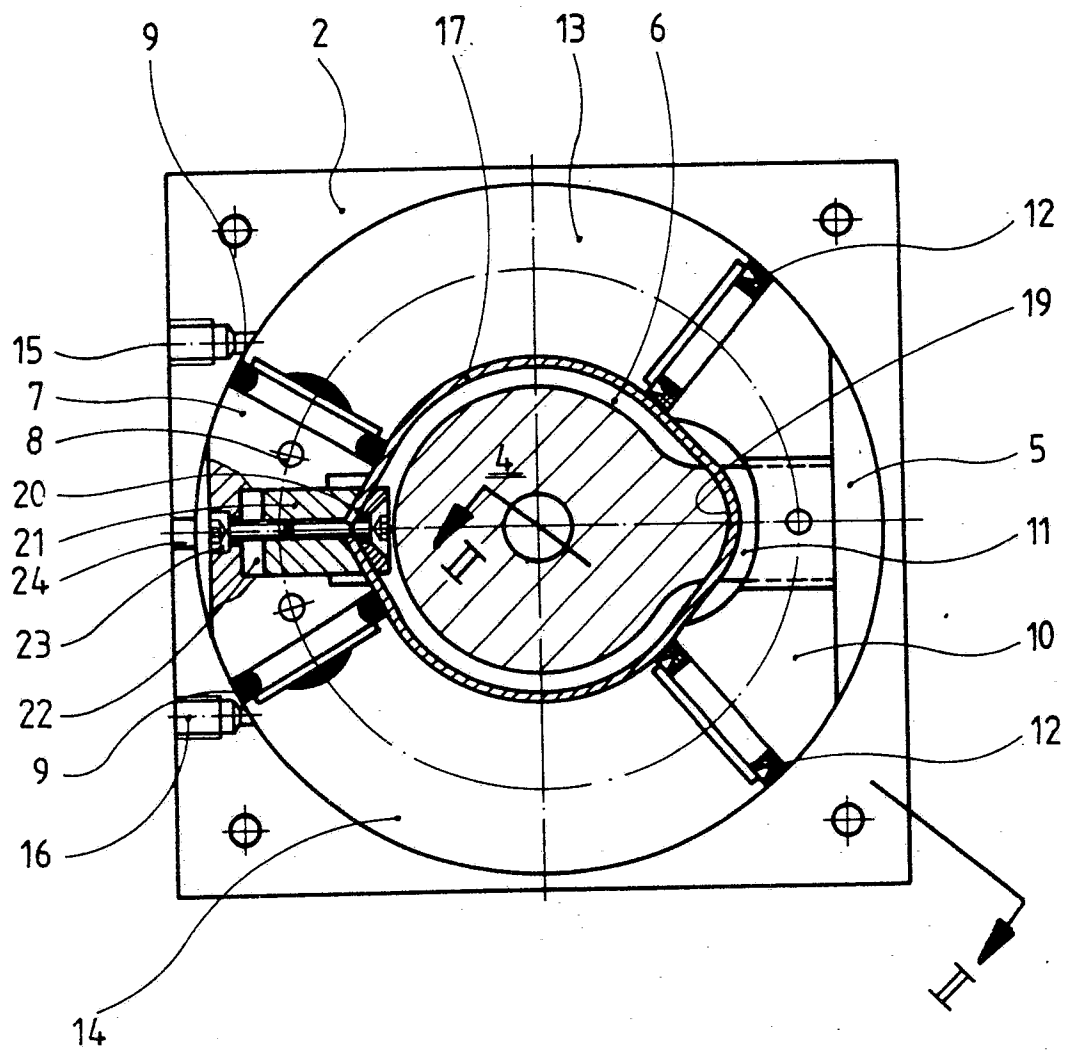


Fig. 1

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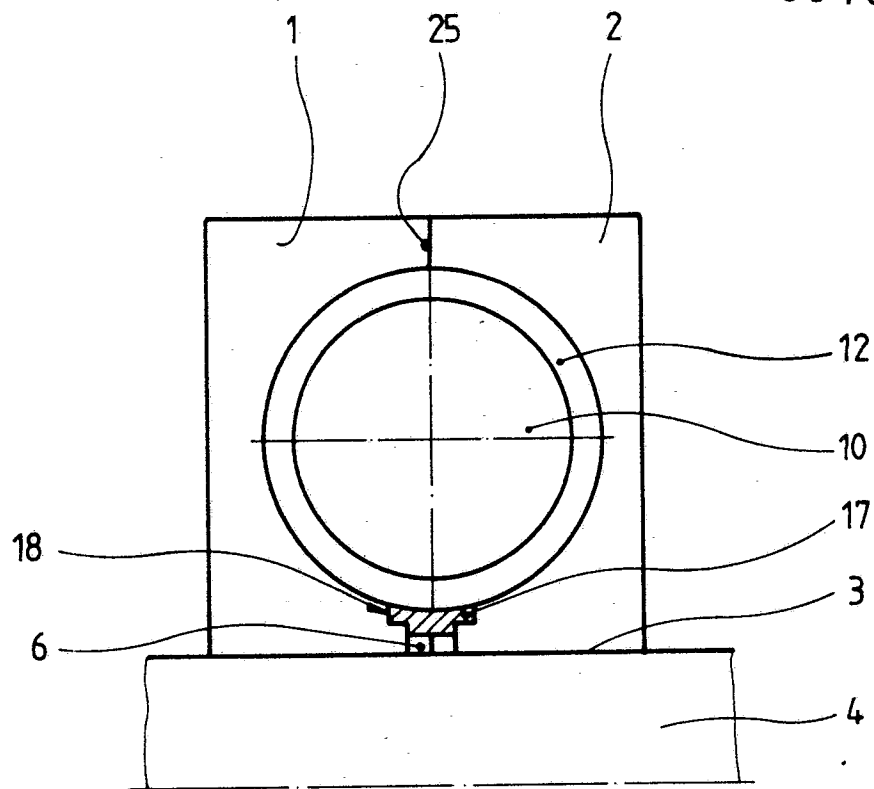


Fig. 2



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 88 30 6904

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	DE-A- 707 679 (MERZ) * Page 3, lines 9-24 * ---	1-6,9, 11,12	F 15 B 15/12
X	DE-A-2 943 505 (SCHLAFHORST) * Whole document * ---	1-6,9, 11	
A	US-A-2 864 341 (NOVAK) -----		
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			F 15 B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 12-09-1988	Examiner KNOPS J.
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