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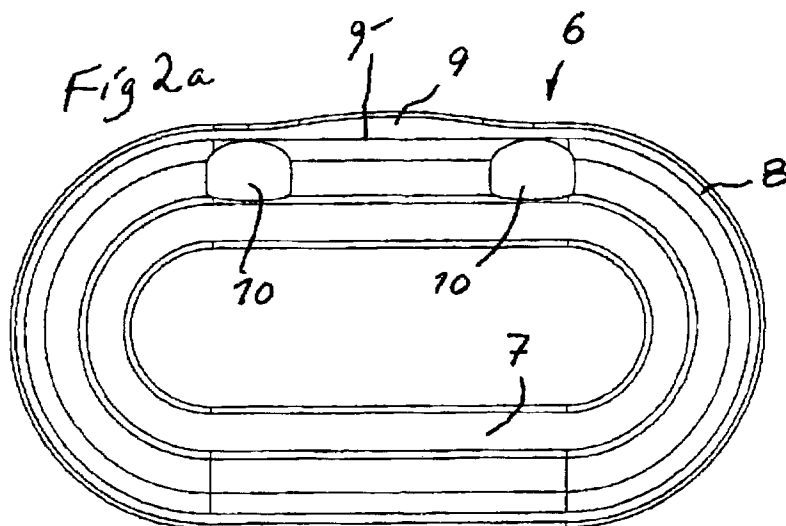
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### (54) **Piston seal**

(57) A piston seal (6) for a piston of a rodless slotted cylinder, having an oblong cross section, wherein an inner sealing band (3) is provided on the inside of the slot, and wherein the seal (6) has an oblong ring-shape corresponding to the cross section of the cylinder (Fig. 1a) with an inner holding portion (7) and a surrounding seal-

ing lip (8). The invention is distinguished by the sealing lip (8) comprising a radially outwardly directed protrusion (9) in the area of the inner sealing band (3), in order to ensure sealing contact of the sealing lip (8) with the inside of the sealing band (3) when the latter is allowed to be deformed when pressurising the cylinder.



**EP 0 957 269 A2**

## Description

**[0001]** This invention concerns a piston seal according to the preamble of claim 1. It also concerns a rodless cylinder having a piston, which is provided with two such seals.

**[0002]** In rodless cylinders of the kind having an inner sealing band of a deformable material, such as an elastomeric material or the like, a deformation of the band in a radial outward direction results from pressurising the cylinder. In order to seek to minimize this deformation it has been suggested to provide the band with reinforcing metal strips or provide the axial outside of the band with shoulders, being arranged to find support against corresponding abutments in the slot.

**[0003]** It has, however, proved that a certain deformation is desirable when the band is effected by an inner overpressure inside the cylinder, since it brings along better contact between the sealing strips of the sealing band and the corresponding surfaces of the cylinder. A certain deformation is thus achieved more or less intentional, also of the central part of the band, resulting in an "outward bending" of the sealing band in the slot. This bending which results in something that could be compared to a shallow groove in the inner surface of the band, tend to bring about a certain leakage between the sealing lip of the piston seal and the sealing band in this area, particularly if the bending is relatively prominent.

**[0004]** It has been suggested to increase the stiffness of the piston seal in the region of the sealing strips of the sealing band, by supporting the piston seal in regions corresponding to the outer edges of the sealing band with the aid of support protrusions, which have been placed between the holding portion and the sealing lip of the seal. These efforts have, however, not resulted in any improvement with respect to sealing cooperation between the sealing lip of the seal and the inside of a deformed sealing band when pressurising the cylinder in question.

**[0005]** Its an aim of this invention to provide a solution of the above problem so that safe seal is obtained between the piston seal and the inside of the cylinder also in the event of plastic deformation of the inner sealing band.

**[0006]** This aim is obtained in a piston seal as above through the characterizing feature of claim 1.

**[0007]** By this way providing the sealing lip of the piston seal with an outwardly directed protrusion, safe sealing contact with the inside of the deformed sealing band is ensured. Further, advantages are achieved by the invention, such as that an inner sealing band may be constructed and dimensioned, so as to provide optimal seal between the sealing strips of the sealing band, and the corresponding regions on the inside of the cylinder tube, without having to consider that the deformation of the sealing band has to be limited when the cylinder is pressurised. The sealing band may instead be shaped and material therefore chosen resulting in a relatively prom-

inent inward bending or depression, while nevertheless a very good piston seal is ensured through the invention.

**[0008]** Further advantages are achieved through the invention and through the features in the other claims, which is made clear from the following description of an embodiment, described at the background of the annexed drawing, wherein:

Fig. 1a shows diagrammatically a detail of a rodless cylinder in a section, illustrating the sealing band appearance in a relieved and a pressurised condition,

Fig. 1b shows, in a reduced scale, a cross section through a cylinder tube of a cylinder making use of the invention,

Fig. 2a shows, in a plane view, a piston seal according to the invention,

Fig. 2b shows the piston seal of Fig. 2a in a vertical central section, and

Fig. 3 shows the piston seal of Figs. 2a and b in a perspective view.

**[0009]** The detail of a rodless slotted cylinder shown in Fig. 1 includes a part of a cylinder tube 1 with a slot 2, in the inside of which an inner sealing band 3 is inserted. The sealing band 3 is arranged to abut a support abutment 4 in the slot at pressurising and is further provided with sealing lips or sealing strips 5 in order to ensure an adequate seal between the pressurised cylinder part and the outside. These details are well known for the person skilled in the art and are not further described here. For further understanding of these parts it is referred to the applicant's many other patent documents within the area. A indicates a straight line which is the continuation of a linear portion of an oblong cross section of the slot cylinder (see detail in Fig. 1a), and which illustrates the extension of the band in a relieved condition. This linear extension in a relieved condition is desirable since an imagined shape with for example a protrusion of the band inwardly into the cylinder room would result in undesired intervention into the cylinder room. B indicates the inner surface of the sealing band 3 in a pressurised condition, wherein the band during the elastic deformation is, thus, allowed to be pressed into the slot for ensuring good seal between the sealing strips 5 and the inside of the cylinder tube, resulting in a shallow grow in this region.

**[0010]** Fig. 1b shows the profiled section of a cylinder tube having an oblong cross section, wherein the invention is particularly useful.

**[0011]** From 2a the shape of a piston seal 6 according to the invention is clear, wherein the piston seal comprises an inner holding portion for fixing it on a piston, and a sealing lip 8. The oblong seal comprises two linear

portions, whereof one, at 9, comprises a protrusion which is arranged to correspond to the above-mentioned outward bending of the inner sealing band of the rodless cylinder. The inside 9' of the protrusion 9 here has a linear extension, meaning that the sealing lip centrally on the protrusion 9 comprises a greater thickness than otherwise on the circumference.

[0012] 10 indicates stiffening elements, which, as has been mentioned above, intends to ensure a contact pressure in the area of the outer edges of the sealing band.

[0013] The cross section of the piston seal in a vertical cut is shown in Fig. 2b and its construction in other respects by the perspective view in Fig. 3, wherein 11 indicates a guide pin for simplifying adequate mounting of the seal in the piston. On the contact side of the sealing lip, a number, here three, surrounding sealing groves 12 are arranged in order to increase the sealing effect.

[0014] The invention may be modified within the scope of the annexed claims. The mutual relations between the holding portion and the sealing lip of the piston seal may be different as well as the construction of the protrusion 9 and provision or lack of stiffening elements 10. It is, however, important that the protrusion has such flexibility that it can reach the position shown in the figures as well as a position corresponding to a relieved sealing band. The piston seal is preferably manufactured from a per se known material such as a polyurethane material.

in that the sealing lip (8) includes at least one surrounding sealing groove (12) on the contact side, which is intended for co-operation with the inside of the cylinder.

5. Seal (6) according to any of the previous claim, **characterized** in that the protrusion (9) provides a curved, preferably partly circular contour.

6. Rodless slotted cylinder with a piston having an oblong cross section being movable in a cylinder tube (1), wherein an inner sealing band (3) is arranged to be elastically deformed when the cylinder is pressurised, **characterized** in that the piston is provided with two piston seals (6) according to any of the claims 1 - 5.

## Claims

1. Piston seal (6) for a movable piston of a rodless slotted cylinder having an oblong cross section, wherein an inner sealing band (3) is provided on the inside of the slot, and wherein the seal (6) has an oblong ring shape corresponding to the cross section of the cylinder (Fig. 1a) with an inner holding portion (7) and a surrounding sealing lip extending therefrom for co-operation with the inside of the cylinder (8), **characterized** in that the sealing lip (8) comprises a radially outwardly directed protrusion (9) in the area of the inner sealing band (3) in order to ensure sealing contact of the sealing lip (8) with the inside of the sealing band (3) when the latter is allowed to be deformed when pressurising the cylinder.
2. Seal (6) according to claim 1, **characterized** in that the protrusion is located in an otherwise linear portion of the sealing lip.
3. Seal (6) according to claim 1 or 2, **characterized** in that the sealing lip (8) is supported by stiffening elements (10) in the outer areas of the protrusion (9) as seen in the circumference direction.
4. Seal (6) according to claim 1, 2 or 3, **characterized**

