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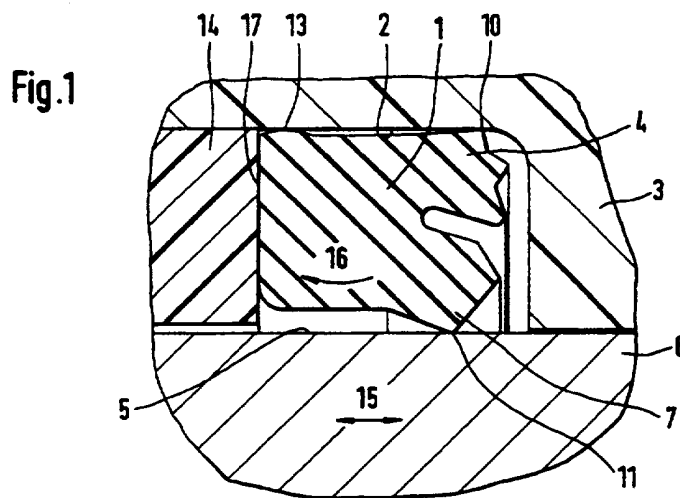
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(56) Documents Cited  
**GB 2085983 A** **GB 0974751 A** **GB 0811485 A**  
**GB 0810625 A** **EP 0014905 A** **WO 89/03954 A**

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(54) Abstract Title  
**Sealing ring**

(57) A sealing ring 1 is adapted to seal between complementary cylindrical surfaces such as a housing 3 and an axially movable piston 6. The ring 1 has a first sealing lip 4 engaging the housing 3 and a second sealing lip 7 engaging the piston 6. In order to prevent the ring 1 tilting about a circumferential axis extending centrally round the ring 1, a bead 12 is provided on the outside diameter of the sealing ring 1 to engage the housing 3 at a point 13 spaced axially from the first lip. This gives the ring 1 a stable position which resists tilting, and improves sealing. The sealing ring 1 is intended for use in master cylinders and slave cylinders of vehicle hydraulic systems.



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Fig.1

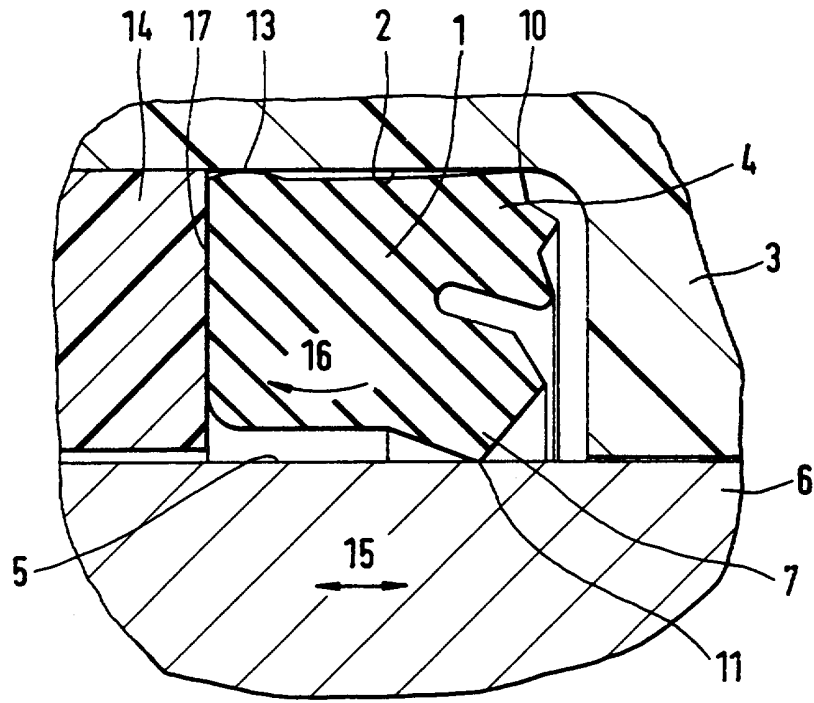
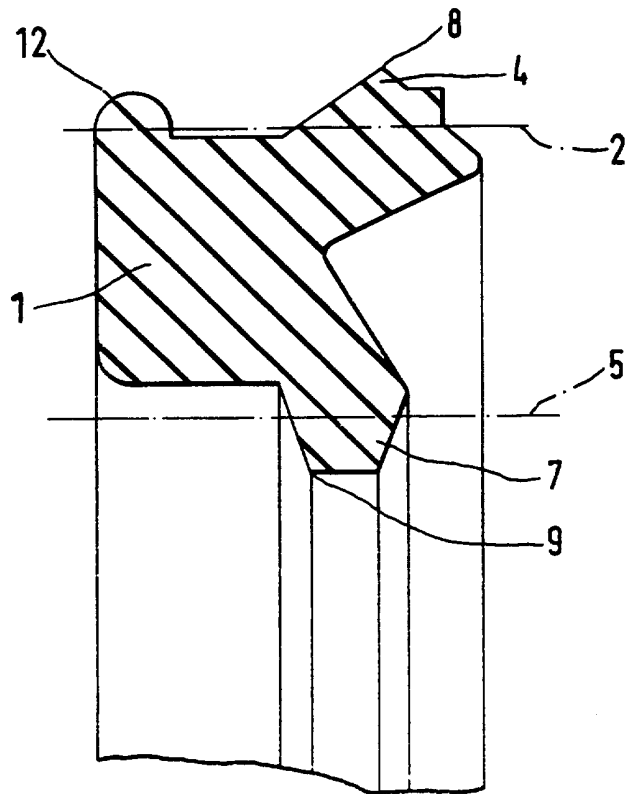


Fig.2



## SEALING RING

The invention relates to a sealing ring of the kind adapted to seal between complementary cylindrical surfaces formed on a housing and a piston movable axially relative to the housing, the sealing ring being adapted to be accommodated in the housing and having on its outside diameter a first sealing lip adapted to engage the housing at a first sealing contact point and on its inner diameter a second sealing lip adapted to engage the piston at a second sealing contact point between chambers having different media and/or pressures. Such sealing rings are particularly useful in master and slave cylinders in hydraulic vehicle systems.

DE-A-195 23 011 shows an hydraulic withdrawal mechanism for a friction clutch having a housing in the central bore of which, to achieve a reduced structural length, there is arranged a telescopic piston formed by a primary piston and a secondary piston. The primary piston has on its annular end face a sealing ring which has inwardly directed and outwardly directed sealing lips, the ring being mounted on the primary piston in an annular groove in the face of the primary piston and held in position. This location of the ring is necessary to neutralise tilting movements which arise through the differently directed movements of the two cylindrical surfaces which the sealing ring seals.

However, a sealing ring of the kind set forth has a smaller ratio of its inside diameter to its outside diameter, which means it is not possible to secure the ring in position in an annular groove to eliminate tilting movements which arise through the displacement of the piston with respect to the housing in which the sealing ring is arranged. Furthermore, if a sealing ring has no reinforcement, it will tend to behave in an unstable manner under the continuously varying pressure relationships and react with

tilting movements about a circumferential axis extending round the centre of the cross-section of the ring.

5 It is accordingly an aim of the invention to provide a construction of a non-reinforced sealing ring of the kind set forth, which prevents tilting movements about a circumferential axis extending round the centre of the cross-section of the ring caused by translatory movements and varying pressure relationships.

10 According to the present invention, in a sealing ring of the kind set forth, the sealing ring has on its outside diameter a bead adapted to engage the housing at a third sealing contact point axially spaced from the first sealing contact point.

15 The bead forming the third sealing contact point locates the sealing ring in a stable manner against tilting about a circumferential axis extending round the centre of the cross-section of the ring.

20 Preferably the bead is at a maximum axial spacing from the first sealing lip. This ensures that the sealing ring is located in the most stable manner. Preferably, the first sealing lip is adjacent one axial end of the sealing ring, while the bead is adjacent the other axial end.

25 Conveniently the bead is of semi-circular cross-section. It may be provided continuously round the outside diameter of the sealing ring. This construction means that the bead is compressed substantially when it is installed in the housing, adding to the stability of the arrangement. Thus, in the installed position the sealing ring is held in a force-balanced position by the loads at the three sealing contact points.

30

An embodiment of a sealing ring according to the invention is illustrated by way of example in the accompanying drawings, in which:

5 **Figure 1** shows a sealing ring in its installed position in a groove in a housing having a longitudinally displaceable piston, the view being a partial section; and

**Figure 2** is a partial section of the sealing ring of Figure 1 before installation.

10

The sealing ring 1 shown in the Figures is adapted to seal between complementary cylindrical surfaces formed by a housing 3 and an axially movable piston 6. The sealing ring 1 is accommodated in a cylindrical groove 2 in the housing 3.

15

The sealing ring 1, as shown in Figure 2, has an outwardly directed first sealing lip 4 on its outside diameter and an inwardly directed second sealing lip 7 on its inner diameter. The first lip 4 has an outer sealing edge 8 and the second lip 7 has an inner sealing edge 9. As shown in

20 Figure 1 the sealing ring 1 is secured in the housing 3 by a stop ring 14 having an annular stop face 17 which is in contact with a flat axial end face of the sealing ring 1. The sealing lips 4, 7 are at the opposite axial end of the ring 1. The housing 3 has a bore in which the piston 6 is mounted for axial reciprocation, as shown by the arrow 15.

25

It can be seen from Figure 2 that the first sealing lip 4, in its unstressed state, projects radially outwardly far beyond the cylindrical groove 2 of the housing. Similarly the second sealing lip 7 extends radially inwards far beyond the cylindrical surface 5 of the piston 6. When the

30 sealing ring 1 is installed in the groove 2 the first sealing lip 4 is displaced

inwards and the second sealing lip is displaced outwards in such a way that the outer sealing edge 8 forms with the cylindrical groove 2 of the housing 3 a first sealing contact point 10. The second sealing lip 7 forms, in a manner analogous to the first lip 4, a second sealing contact point 11 with its inner sealing edge 9, the forces which arise on the deformation of the sealing lips 4 and 7 cancelling one another out to some extent. The second sealing lip 7 seals between chambers having different media and/or pressures.

10           When pressure increases in the space around the sealing lips 4 and 7 on movement of the piston 6 in one of the two directions shown by the arrow 15, the sealing ring 1 tends to be tilted as shown by the arrow 16, because of the external shape of the sealing ring 1 and the movements of the piston 6 in relation to the housing 3. The tilting movement is about a circumferential axis lying in the centre of the cross-section of the ring and is in a clockwise direction, the pressure relationships in the region of the sealing lips 4 and 7 and the axial movement of the piston having an influence on the tilting movement.

20           To minimise or eliminate the tilting in the direction of arrow 16 a supporting bead 12 is provided on the outside diameter of the sealing ring 1. The bead 12 has a semi-circular cross-section and extends continuously round the entire periphery of the sealing ring 1. The supporting bead 12 is arranged close to the flat end face of the ring 1, so that axial distance from the first sealing lip 4 is maximised. In the installed position the supporting bead 12 forms a third sealing contact point 13 with the cylindrical groove 2 of the housing 3, which improves sealing. The supporting bead 12 is strongly compressed in the installed position by the load on the sealing ring 1 in the cylindrical groove 2 of the housing 3. In this way the sealing ring 1 is located in a stable manner in the cylindrical groove 2 of the

housing 3 by two sealing contact points 10 and 13 and at the cylindrical surface 5 of the piston 6 by one sealing contact point 11, against tilting about a circumferential axis extending around the centre of the sealing ring 1. In fact, in the installed position the sealing ring 1 is held in a force-balanced position by the loads at the three sealing contact points. This prevents the tilting of the sealing ring 1 with increased pressure in the housing 3 which urges the ring 1 against the stop face 17, and the tilting back with a drop in pressure. As the sealing ring 1 is subjected to a large number of changes in load, continuous tilting leads to an increase wiping leakage between the sealing edges 8 and 9, which causes medium to move slowly from one chamber to the other chamber.

The advantage of the supporting bead 12 lies in its dual function, firstly the formation of a third sealing contact point 13 with respect to the cylindrical groove 2 of the housing 3 and secondly in preventing the tilting movement of the sealing ring 1 about its circumferentially extending central axis.

**CLAIMS**

1. A sealing ring of the kind set forth, in which the sealing ring has on its outside diameter a bead adapted to engage the housing at a third sealing contact point axially spaced from the first sealing contact point.  
5
2. A sealing ring as claimed in Claim 1, in which the bead is at a maximum axial spacing from the first sealing lip.
- 10 3. A sealing ring as claimed in Claim 2, in which the first sealing lip is adjacent one axial end of the sealing ring, while the bead is adjacent the other axial end.
4. A sealing ring as claimed in any preceding claim, in which the bead  
15 is of semi-circular cross-section.
5. A sealing ring as claimed in any preceding claim, in which the bead runs continuously round the outside diameter of the sealing ring.
- 20 6. A sealing ring as claimed in any preceding claim, in which in its installed position the sealing ring is held in a force-balanced position by the loads at the three contact sealing points.
7. A sealing ring of the kind set forth substantially as described herein  
25 with reference to and as illustrated in the accompanying drawings.





Application No: GB 9807582.3  
Claims searched: 1 - 6

Examiner: Tom Sutherland  
Date of search: 25 August 1998

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:  
UK Cl (Ed.P): F2B  
Int Cl (Ed.6): F16J 15/32  
Other:

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2085983 A (FREUDENBERG) The Fig.	1, 4, 5
X	GB 0974751 (PARKER-HANNIFIN) See Fig. 13.	1-3, 5
X	GB 0811485 (RENAULT) Figs 7 and 8.	1 - 5
X	GB 0810625 (PARKER-HANNIFIN) Fig. 4.	1 - 5
X	EP 0014905 A (PRÄDIFA) Fig. 3.	1, 4, 5
X	WO 89/03954 A (AUTOMOTIVE PRODUCTS) Fig. 8.	1 - 5

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.