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Title: "Sealing Rings"

Description of the Invention

This invention relates to sealing rings of the kind used to establish a peripheral seal between a piston and a cylinder in which the piston slides. More particularly, the invention is concerned with a sealing ring in or for an hydraulic damper, especially but not exclusively in or for use in a door closer.

5 Such sealing rings are commonly of circular shape in radial section (i.e. O-rings) but often other sectional shapes are employed. However, it is usual for the axial dimension of the sealing ring to be rather less than the corresponding dimension of the seating groove of the piston in which the ring is located. This enables swelling of the ring which tends to take place on
10 prolonged exposure to hydraulic fluid to be accommodated without radial expansion.

In an hydraulic damper, the use of a sealing ring which has a degree of axial clearance in this way can give rise to an undesirable deviation from the intended damping characteristic at the point where the direction of movement
15 of the piston changes. For example, in the context of a door closer, a damper may include a piston which is movable relative to a cylinder in one direction with little resistance as the associated door is opened, whilst a significant resistance is established when the opposite movement occurs, as the door moves towards its closed position under the influence of spring or other
20 actuating means. Movement of the sealing ring axially in its seating groove at the beginning of such closure movement, whilst only slight, nevertheless allows the door initially to move without any damping through a distance which at the free edge may amount to several centimetres. During such movement, the door gathers speed and when the damper becomes effective it can impose a sudden restriction on the rate of movement, which causes the
25 door to jolt or jerk, thereby setting up undesirable strain in the hinges, the closer, and the door itself.

It is one of the objects of the invention to provide a novel seal which can be fitted into its seating groove without axial play, so as to enable a
30 damper to be substantially free from such initial undamped movement.

According to one aspect of the invention we provide a sealing ring which affords axially directed projections on one radially extending face at circumferentially spaced positions, wherein the projections are of generally conical form.

5 According to a further aspect of the invention we provide a piston and cylinder assembly including a sealing ring located in a seating groove wherein the sealing ring affords axially spaced radially extending faces which are spaced apart by a distance less than the axial width of the seating groove, and a plurality of axially directed projections are provided on one of said
10 faces at circumferentially spaced positions so that the ring is held against axial movement within the groove, the projections being of generally conical form.

The radial faces of the sealing ring are preferably otherwise flat apart from the projections and the inner face is preferably of cylindrical form, with
15 the inner face and each radial face meeting substantially at right angles.

The outer face of the ring may include a chamfered portion adjacent to one or both radial faces, and a central cylindrical surface. Desirably, the outer diameter of the ring is controlled to a high degree of tolerance and may, for example, be machined to the required diameter.

20 The invention further resides in an hydraulic damper incorporating such a piston and cylinder assembly, and a door closer incorporating such a damper.

The invention will now be described by way of example with reference to the accompanying drawings wherein:-

25 FIGURE 1 shows one embodiment of sealing ring in accordance with the invention in end view;

FIGURE 2 shows a corresponding diametral section.

In accordance with the invention a sealing ring 10 is formed with a plurality of circumferentially spaced axially extending projections 20 on one
30 side thereof. As illustrated, there are eight equally spaced pojections of circular shape in transverse section, each of substantially conical form on one otherwise flat radial face 11 of the ring. The other radial face 12 is likewise of flat form, and the inner face 13 is of cylindrical form so as to meet the radial faces 11 and 12 substantially at a right angle. The outer face 14 of the
35 ring includes a central, cylindrical portion 15 and chamfered portions 16 and 17 adjacent to the radial faces.

The sealing ring 10 may be formed as a moulding of a suitable synthetic

rubber, such as a nitrile rubber, but the outer surface may be ground down so that the external diameter is maintained in production to a high tolerance.

5 In use, the ring is fitted into a rectangular section seating groove having an axial width such that the ring is received as a tight fit without axial movement. Thus, the projections 20 engage one side wall of the groove whilst the opposite radial face 12 engages the other side wall. The inner surface 13 of the ring seats against the bottom wall of the groove, and the outer surface 14 projects beyond the piston to the extent required to establish an effective seal with the interior surface of the cylinder within which the piston slides.

10 It will therefore be seen that as the piston reverse its direction of movement within the cylinder, the sealing ring has no freedom to move axially, and accordingly where the piston and cylinder assembly forms part of an hydraulic damper, movement of the piston is at all times controlled in accordance with the desired characteristic of the damper.

15 In particular, where the damper is uni-directionally operative, the required damping characteristic is imposed immediately the piston commences to move in the appropriate direction.

20 The gaps between the projections 20 allow the ring 10 to swell axially at intermediate positions and in this way, any tendency of the ring to swell radially is eliminated, so that the resistance to movement of the piston afforded by contact between the sealing ring and the cylinder is maintained substantially constant despite ageing of the ring over an extended period of use.

25 Maintenance of an accurate external diameter is particularly important where the damper is of a type which allows for undamped movement of the piston at one end of its stroke by means of a locally counterbored end portion of the cylinder as described for example in British Patent specification No. 2044840. In that specification, there is described a door closer in which
30 spring actuated closure of a door is controlled by means of an hydraulic damper. One end of the cylinder of the damper is of somewhat increased internal diameter so as to allow hydraulic fluid to flow freely past the outer face of the piston as the associated door finally moves into its position of closure, thereby enabling the door to accelerate and overcome the frictional
35 resistance of any latch or lock which might otherwise prevent the door closing fully.

To enable such final acceleration to be achieved reliably over an extended period of use, it is essential that the external diameter of the sealing ring which is carried by the piston is maintained constant during the working life of the damper. Any increase in the external diameter of the sealing ring will impose an undesired restriction on the flow of fluid past the outer face of the ring at the widened portion of the cylinder so that the effectiveness of the final closing action will be reduced.

The chamfered portions 16 and 17 serve to minimise damage to the sealing ring as it passes repeatedly over the junction between the main portion of the cylinder in which the central portion 15 of the outer face engages the interior of the cylinder sealingly and the widened end portion of the cylinder which affords a radial clearance relative to the central portion 15 of the outer face.

The generally rectangular section of the sealing ring serves to ensure that it cannot twist within the seating groove.

Where the seal is used in a uni-directional hydraulic damper, as for example shown in Patent specification 2044840, the projections 20 preferably face towards the higher pressure side of the piston, so that the prevailing pressure which is exerted on the piston tends to force the radial face 12, which is not provided with projections, against the corresponding side wall of the seating groove.

By forming the projections of substantially conical shape, rather than for example cylindrical, the volume available for axial swelling of the ring is maximised. However, the projections may have either a flat or radiused end, or in some case may be substantially part-spherical or domed form.

The features disclosed in the foregoing description, or the accompanying drawing, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, may, separately or in any combination of such features, be utilised for realising the invention in diverse forms thereof.



CLAIMS:-

1. A sealing ring affording axially directed projections on one radially extending face at circumferentially spaced positions wherein the projections are of generally conical form.
- 5 2. A sealing ring according to Claim 1 wherein the radially extending faces are otherwise flat apart from said projections.
3. A sealing ring according to either of the preceding claims wherein the inner face is of cylindrical form, the inner face and each radially extending face meeting substantially at right angles.
- 10 4. A sealing ring according to any one of the preceding claims wherein the outer face includes a central cylindrical surface and chamfered portions adjacent to one or both radially extending faces
5. A sealing ring according to any one of the preceding claims wherein the outer diameter of the ring is machined to the required diameter.
- 15 6. A piston and cylinder assembly including a sealing ring located in a seating groove wherein the sealing ring affords axially spaced radially extending faces which are spaced apart by a distance less than the axial width of the seating groove, and a plurality of axially directed projections are provided on one of said faces at circumferentially spaced positions so that the ring is held against axial movement within the groove, the projections
20 being of generally conical form.
7. A piston and cylinder assembly according to Claim 6 wherein the cylinder includes a locally counterbored end portion at one end of the stroke of the piston.
- 25 8. An hydraulic damper incorporating a piston and cylinder assembly as claimed in Claim 6 or Claim 7.



9. A door closer incorporating an hydraulic damper as claimed in Claim 8.
 10. A sealing ring having axially directed projections of generally conical shape substantially as shown in Figures 1 and 2 of the accompanying drawings.
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