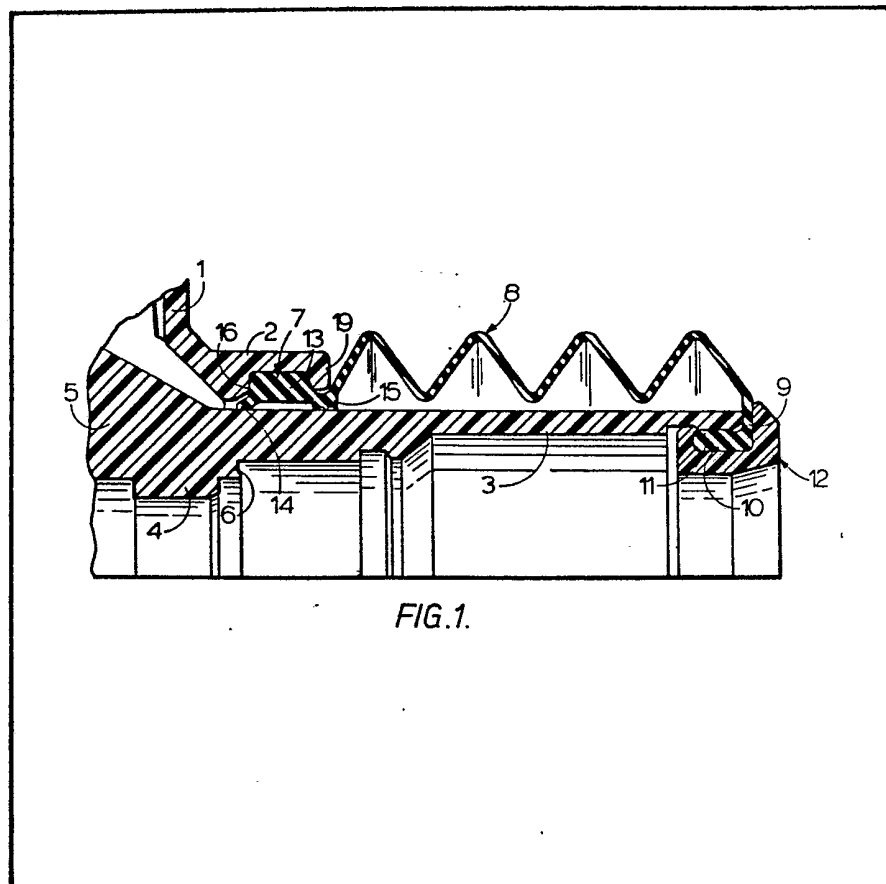


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(56) Documents cited  
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**(54) Sealing a Servo Booster for a Vehicle Braking System**

(57) In a servo booster of the kind comprising a housing 1 locating a diaphragm subject to differential pressures controlled by a valve a tubular valve body 4 is slidably sealed to the housing. Conventionally a separate flexible boot protects the seal but in previous arrangements the boot has prevented inspection of the seal.

An integral seal and boot 8 is now provided having a sealing portion 13 located in an annular recess 16 adjacent the free end 19 of the booster housing 1 and a bead portion 10 secured to the free end of the valve body 4. The proximity of the sealing portion 13 to the free end 19 of the booster housing 1 enables the adjacent outer portion 26 of the boot to be depressed and the seal portion 13 inspected.



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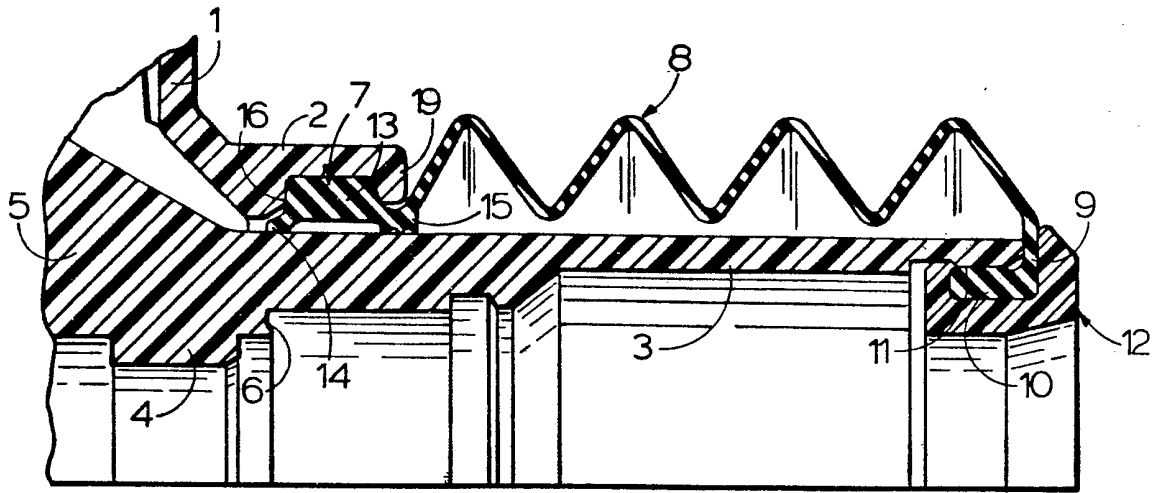


FIG. 1.

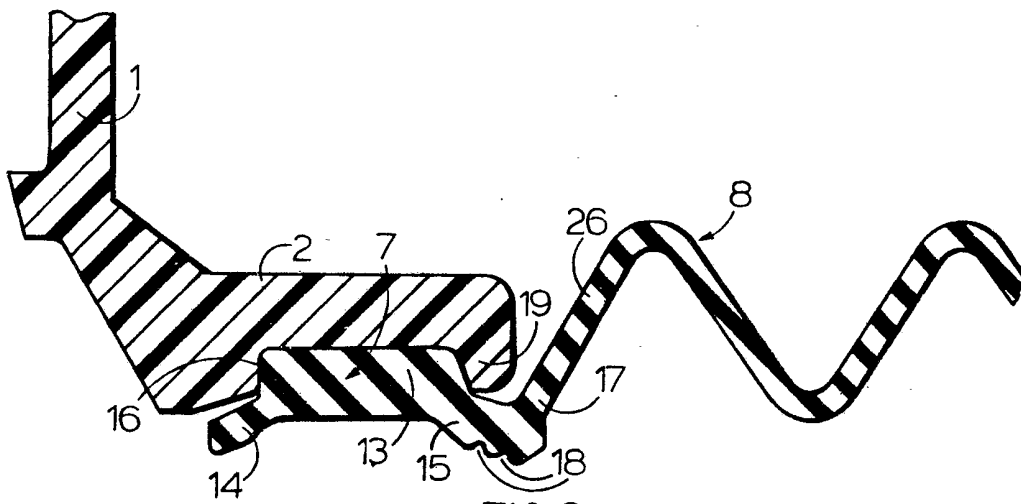


FIG. 2.

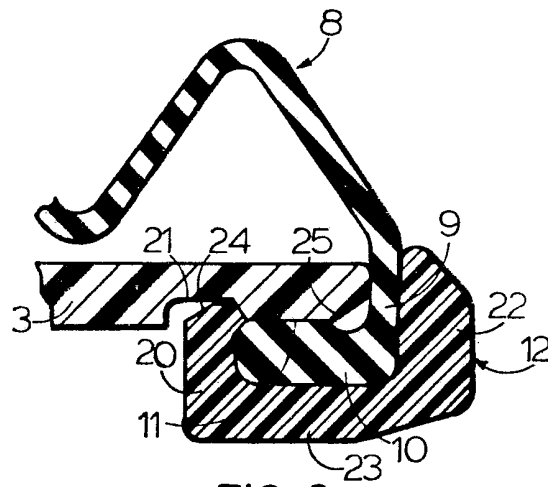


FIG. 3.

## SPECIFICATION

**Servo Boosters for Vehicle Braking Systems**

This invention relates to servo boosters for vehicle braking systems of the kind comprising a housing in which is located a movable wall subject to a differential pressure controlled by a valve means for augmenting the force applied to an output member by an input member, the valve means including a substantially tubular valve body which projects rearwardly through an aperture in the rear of the housing. Examples of known servo boosters of this kind are shown in British Patent Specifications 1,433,739 and 1,464,867. Such servo boosters will hereinafter be referred to as servo boosters of the kind defined.

Usually the rear of the housing is provided with a tubular extension defining the aperture, and the valve body is slidably guided in and sealed to the tubular extension by an annular seal and guide assembly located radially between the radially inner surface of the tubular extension and the radially outer surface of the valve body by a retaining ring or garter. In order to protect the seal and guide assembly from dirt a flexible boot is secured at its forward end on the radially outer surface of the tubular extension and at its rear end to the rear of the valve body or to the input member extending therethrough. This arrangement has the disadvantage that the boot prevents inspection of the security of the retaining ring or garter for the guide and seal assembly in the fully assembled booster. It is very desirable that an inspection of the retaining ring or garter should be possible since the seal must closely follow any lateral movement of the valve body relative to the housing, otherwise consequent leakage would result in failure of the booster.

According to the invention in a servo booster of the kind defined the valve body is sealed to the rear of the housing by an annular seal located radially between the wall defining the aperture in the housing and the valve body, and the seal is integral with the front end of a flexible boot, the rear end of which is secured to the valve body or to the input member.

Preferably the wall of the housing is provided with an internal annular recess in which the seal is located, and the annular recess is closely spaced axially from the rear end of the housing wall to enable the position of the seal to be readily inspected.

Preferably the seal is provided with two axially spaced annular sealing lips which engage with the valve body.

At least one of the sealing lips may be provided with one or more annular grooves forming a labyrinth seal to retain lubricant between the two axially spaced lips.

Preferably the boot is secured to the rear end of the valve body by a retaining ring which is adapted to have a snap engagement with a formation formed internally of the valve body at or adjacent to its rear end.

The invention will now be further described, by way of example only, with reference to the accompanying drawings in which:—

Figure 1 is a longitudinal cross-sectional view of the rear end of a servo-booster in accordance with the invention but omitting a poppet valve assembly and input rod;

Figure 2 is a view on a larger scale of the front end of the seal and boot assembly shown in Figure 1, with the seal being shown in a relaxed condition; and

Figure 3 is an enlarged view of part of Figure 1.

In the following description any reference to the front or rear shall be taken to mean the front or rear of the booster as related respectively to the output and input members thereof.

With reference to Figure 1 the rear shell 1 of a moulded plastics booster housing is provided with a rearwardly extending tubular extension 2 defining an aperture through which projects the rear part 3 of a substantially tubular valve body 4 the front end 5 of which is sealingly secured in conventional manner to a movable wall or diaphragm, (not shown). The valve body 4 is provided internally with an annular rearwardly facing valve seat 6 for engagement by the head of a poppet valve assembly (not shown) which is normally located within the bore of part 3. The poppet valve assembly does not form part of the present invention and will not be described.

The valve body 4 is slidably guided in and sealed to the housing extension 2 by a rubber seal 7 made integral with a flexible concertina boot 8. The boot extends rearwardly and is provided at its rear end with a radially inwardly extending flange 9 integral with a sealing bead 10, the sealing bead 10 being held in sealing engagement with the internal surface 11 of the rear end of part 3 by a plastics annular retaining ring 12.

The seal 7 comprises an annular seal body 13 of substantially oblong-rectangular transverse cross-section located in an internal annular recess 16 of complementary shape in the extension 2, and axially spaced sealing lips 14 and 15 which effect a seal with the outer surface of valve body part 3.

As shown in Figure 2 the rear sealing lip 15 effects a connection between the seal body 13 and the front end 17 of boot 8 and is provided with two annular grooves 18 which form a labyrinth seal. When both lips 14 and 15 are so provided, the labyrinth seals act to retain lubricant between the lips 14 and 15. In the relaxed condition of the seal 7, shown in Figure 2, the lips 14 and 15 are radially inwardly directed, and are also directed away from each other. The forward half-convolution 26 of the boot 8 is so dimensioned that it exerts a radially inward force on the adjacent rear sealing lip 15, so that prior to assembly of the boot to the booster the lip is disposed radially inward of its assembled position and when assembled the lip is under compression. In some applications this eliminates the need for a garter spring to locate the annular seal.

Since the seal 7 is spaced from the free end of the extension 2 only by the thickness of a radially inwardly directed flange 19 it is easy to inspect the location of the seal 7 by manually depressing boot 8 adjacent to the flange 19.

With reference to Figure 3 the retaining ring 12 is of generally U-shape in transverse cross-section and the free end of the front limb 20 is adapted to have a snap engagement in an internal annular recess 21 spaced from the free end of the part 3. The flange 9 of the boot 8 is then trapped axially between the free end of part 3 of the valve body and rear limb 22 of the ring 12, and the sealing bead 10 is trapped radially between an intermediate limb 23 of the retaining ring 12 and the internal surface 11. The front limb 20 of the retaining ring 12 and the rear part 3 of the valve body 4 are provided with complementary bevelled edges 24 and 25 respectively which engage one with the other when the retaining ring is forced inwardly of the valve body on assembly of the ring and boot to the valve body part 3. As the bevelled edge 24 is forced against the bevelled edge 25 the front limb 20 is compressed and rides over the surface 11 until it finally snaps into the recess 21 to retain the seal 10 in position as aforementioned.

It will be appreciated that during assembly of the booster the seal body 13 is located in position in the recess 16 before the valve body part 3 is passed rearwardly through extension 2, the sealing bead 10 then being located on retaining ring 12, and the ring 12 being secured in position.

In a modified arrangement the rear end of the flexible boot is secured to the shaft of the input member by any suitable clamping means such as a circlip or split clamp.

#### Claims

1. A servo booster for vehicle braking systems of the kind comprising a housing in which is located a movable wall subject to a differential pressure controlled by valve means for augmenting the force applied to an output member by an input member, the valve means including a substantially tubular valve body which

projects rearwardly through an aperture in the rear of the housing, wherein the valve body is sealed to the rear of the housing by an annular seal located radially between the wall defining the aperture in the housing and the valve body, and the seal is integral with the front end of a flexible boot, the rear end of which is secured to the valve body or to the input member.

2. A servo booster as claimed in claim 1, wherein the wall of the housing is provided with an internal annular recess in which the seal is located, and the annular recess is closely spaced axially from the rear end of the housing to enable the position of the seal to be radially inspected.

3. A servo booster as claimed in claim 1 or claim 2, wherein the seal is provided with two axially spaced annular sealing lips which engage the valve body.

4. A servo booster as claimed in claim 3, wherein the sealing lips are provided with one or more annular grooves to retain lubricant.

5. A servo booster as claimed in any one of the preceding claims, wherein the flexible boot is secured to the rear end of the valve body by a retaining ring which is adapted to have a snap engagement with a formation formed internally of the valve body at or adjacent to its rear end.

6. A servo booster as claimed in any one of claims 2 to 5, wherein the seal comprises an annular seal body of substantially oblong-rectangular transverse cross-section located in the internal annular recess which is of complementary shape.

7. A servo booster as claimed in any one of claims 3 to 6, wherein the flexible boot is convoluted and the forward half-convolution of the boot adjacent to the annular seal is so dimensioned that it exerts a radially inward force on the adjacent sealing lip so that when the boot is assembled in the booster the adjacent sealing lip is under compression.

8. A servo booster of the kind hereinbefore defined and substantially as hereinbefore described with reference to the accompanying drawings.