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(71) Applicant: **Automotive Products France S.A.**
45520 Chevilly (FR)

(72) Inventors:
- **Desbois, Patrick**
  45160 Olivet (FR)
- **Christiaens, Yannick**
  45400 Chanteau (FR)

(74) Representative: **Morrall, Roger**
Automotive Products Group Ltd.
Patent Department
P.O. Box 2085
Tachbrook Road
Leamington Spa, Warwickshire, CV31 3ZL (GB)

(54) Hydraulic actuator with retainer

(57) An hydraulic actuator (10) having a housing (11) with a piston (13) slideable in the housing and a push rod (15) extending from one end of the housing a bellows (40) encircles the push rod and is secured at one perimeter (41) to the housing and at a second perimeter (43) engages a formation on the push rod (15) to retain the push rod in a predetermined extension position relative to the housing (11) during delivery of the actuator from the manufacturer to the end user. Actuation of the actuator after connection to an associated hydraulic circuit is arranged to disengage the second periphery (43) of the bellows from the formation (44) on the push rod (15) to allow free movement of the push rod relative to the housing thereafter

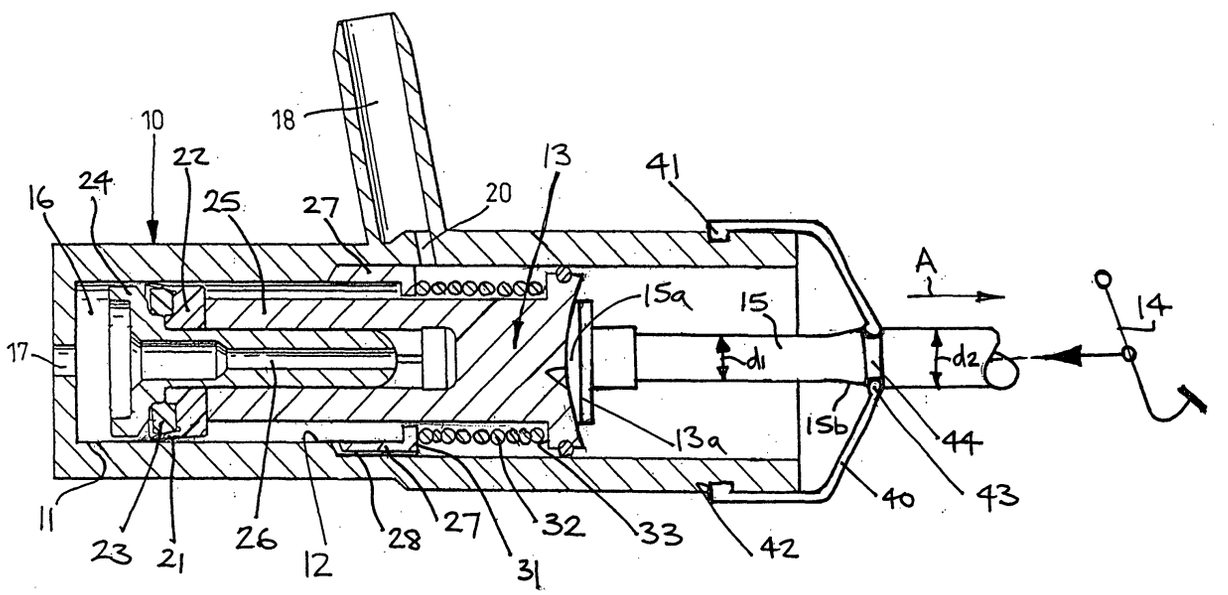

Fig. 1

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Description

[0001] This invention relates to hydraulic actuators and in particular, though not exclusively, to an actuator for use as a master cylinder for the operation of a vehicle clutch.

[0002] The object of the present invention to provide an improved form of hydraulic actuator which is particularly easy to install as a clutch operating master cylinder.

[0003] Thus according to the present invention there is provided an hydraulic actuator comprising a housing with a piston slideable in the housing and a push rod extending from one end of the housing, a bellows encircles the push rod and is secured at one perimeter to the housing and at a second perimeter engages the push rod, the actuator being characterised in that the second perimeter of the bellows engages a formation on the push rod to retain the push rod in a predetermined extension position relative to the housing during delivery of the actuator from the manufacturer to the end user, actuation of the actuator after connection to an associated hydraulic circuit being arranged to disengage the second periphery of the bellows from the formation on the push rod to allow free movement of the push rod relative to the housing thereafter.

[0004] Preferably the bellows retains the push rod in a concentric arrangement with the piston bore so that the push rod can be easily connected with its mating portion of the clutch actuation system for example, the push rod may be provided with a ball end which snaps into a ball socket associated with an associated operating pedal.

[0005] In addition to ensuring axial alignment of the push rod with the piston bore the bellows may also be arranged to hold the push rod either in an extended or in a retracted position depending on the design parameters of the clutch actuating system.

[0006] One embodiment of the present invention will now be described, by way of example only, with reference to the accompanying drawings in which:-

Figure 1 shows, partially diagramatically, in section a master cylinder embodying the present invention in its retracted condition;

Figure 2 shows the cylinder of figure 1 in its extended condition; and

Figure 3 shows details of part of figure 1 on a larger scale.

[0007] Referring to the drawings a hydraulic master cylinder 10 for use in the operation of a vehicle clutch comprises a body 11 having a bore 12 in which a piston 13 is in sealed sliding contact. Piston 13 is connected with an associated clutch pedal shown diagramatically at 14 by a push rod 15 having a part-spherical head portion 15a which bears on a complementary part-spherical portion 13a of piston 13. A working chamber 16 is provided ahead of piston 13 which has an outlet 17 connected via a conduit (not shown) with a clutch operating slave cylinder.

[0008] The master cylinder also has an inlet 18 which is connected with a fluid reservoir (not shown) and also a larger diameter portion 19 of bore 12 via a passage 20. Piston 13 carries a main seal 21 which is of plastics material being an integral part of an annular component 22 (see figure 3). The plastics main seal 21 is energised against bore 12 by an elastomeric (e.g. rubber) annulus 23 which ensures that the seal 21 remains in contact with the associated bore etc. This sealing arrangement is the subject of the Applicant's co-pending European Patent Application No. EP 0894687 A1. A normal separate rubber seal can alternatively be used to seal piston 13 to bore 12.

[0009] The component 22 and rubber annulus 23 are held in place on the remainder of the piston by a central member 24 which is pressed into, welded or otherwise secured to the main body 25 of the piston 13. In the construction shown the central member 24 has an axial bore 26 which is provided for manufacturing reasons (to reduce shrinkage) since the central member 24 is produced by an injection moulding technique from plastics material. The central member may alternatively, for example, be of a shorter construction which may not necessarily include the shrinkage bore 26.

In a preferred arrangement both the body 11 and piston 13 etc. are all formed from plastics material by injection moulding techniques.

[0010] An annular sleeve 27 is provided in the larger diameter portion 19 of bore 12. Sleeve 27 includes axially extending grooves 28 which in combination with bore portion 19 define passages which emerge into the smaller diameter portion 29 via openings 30 (see figure 3). Sleeve 27 also includes an annular shoulder 31 against which a return spring 32 reacts. The other end of spring 32 reacts against a shoulder 33 provided on piston 13 to ensure that the piston always returns to the fully extended position shown in figures 1 and 2 when the associated pedal is released.

[0011] As can be seen from figure 2, when the piston is in the fully extended position, the main seal 21 is in contact with the internal diameter 34 of sleeve 21 and the openings 30 in the sleeve are no longer sealed allowing communication between the inlet 18 and the working chamber 16 via passage 20 and grooves 28 (see arrows X). Thus in the fully extended position of the piston the reservoir connected with inlet 18 is in communication with working chamber 16 allowing recouperation of fluid into the working chamber 16 to take account any increase in working stroke of the piston necessary due to the wear of the associated clutch or any leakage of fluid from the working chamber.

[0012] When pedal 14 is pushed, piston 13 is moved to the left from its fully extended position shown in figure

2 so that main piston seal 21 moves to the left of openings 30 to cut-off flow through grooves 28 and allow pressurisation of working chamber 16 in the normal manner.

[0013] In accordance with the present invention the master cylinder is transported from its place of manufacture to the vehicle manufacturers assembly line in its fully retracted condition shown in figure 1. An elastomeric sealing bellows 40 has an outer bead 41 which engages in a groove 42 in housing 11 and also has an inner bead 43 which engages in a groove 44 formed in a larger diameter d2 of push rod 15 when the master cylinder is in the retracted position. Thus the bead 43 on bellows 40 serves to hold the piston 13 in its fully retracted condition and also holds the push rod 15 in axial alignment within the housing 11 thus facilitating the attachment of the push rod to the associated operating pedal 14 via a snap-in ball joint or other suitable attachment.

[0014] When the master cylinder has been installed in its operating position the push rod 15 is moved outwardly of the body 11 in the direction of arrow A of figure 1 thus disengaging the bead 43 from groove 44 so that the bellows now assumes its natural condition (see Figure 2) and the bead 43 slides up and down the smaller diameter d1 of push rod 15 for the remainder of its operating life. The diameter d1 and d2 are connected via a taper 15b which facilitates the initial engagement of bead 43 in groove 44.

[0015] Although the present invention has been described above in relation to a particular master cylinder design the basic concept of using the protective bellows to hold the pushrod and piston in their retracted condition can be used on any type of pushrod master cylinder. Also, although described above in relation to a construction in which the pushrod/piston is held in its retracted (figure 1) condition the bellows arrangement of the invention can also be used to hold the pushrod/piston in its extended (figure 2) condition by appropriately axially positioning groove 44 in pushrod 15.

Claims

1. An hydraulic actuator (10) comprising a housing (11) with a piston (13) slideable in the housing and a push rod (15) extending from one end of the housing, a bellows (40) encircles the push rod and is secured at one perimeter (41) to the housing and at a second perimeter (43) engages the push rod, the actuator being **characterised in that** the second perimeter (43) of the bellows engages a formation (44) on the push rod (15) to retain the push rod in a predetermined extension position relative to the housing (11) during delivery of the actuator from the manufacturer to the end user, actuation of the actuator after connection to an associated hydraulic circuit being arranged to disengage the second periphery (43) of the bellows from the formation (44) on the push rod to allow free movement of the push rod relative to the housing thereafter.

2. An actuator according to claim 1 **characterised in that** the bellows (40) retains the push rod (15) in a concentric arrangement with the piston bore (12).

3. An actuator according to claim 1 or 2 **characterised in that** the push rod (15) is provided with a ball end or other fastener which snaps into a ball socket or other cooperating fastener associated with an associated operating pedal (14).

4. An actuator according to any one of claims 1 to 3 **characterised in that** bellows (40) is arranged to hold the push rod (15) either in an extended or in a retracted position.

5. An actuator according to any one of claims 1 to 4 for use as a master cylinder in a clutch actuating system.

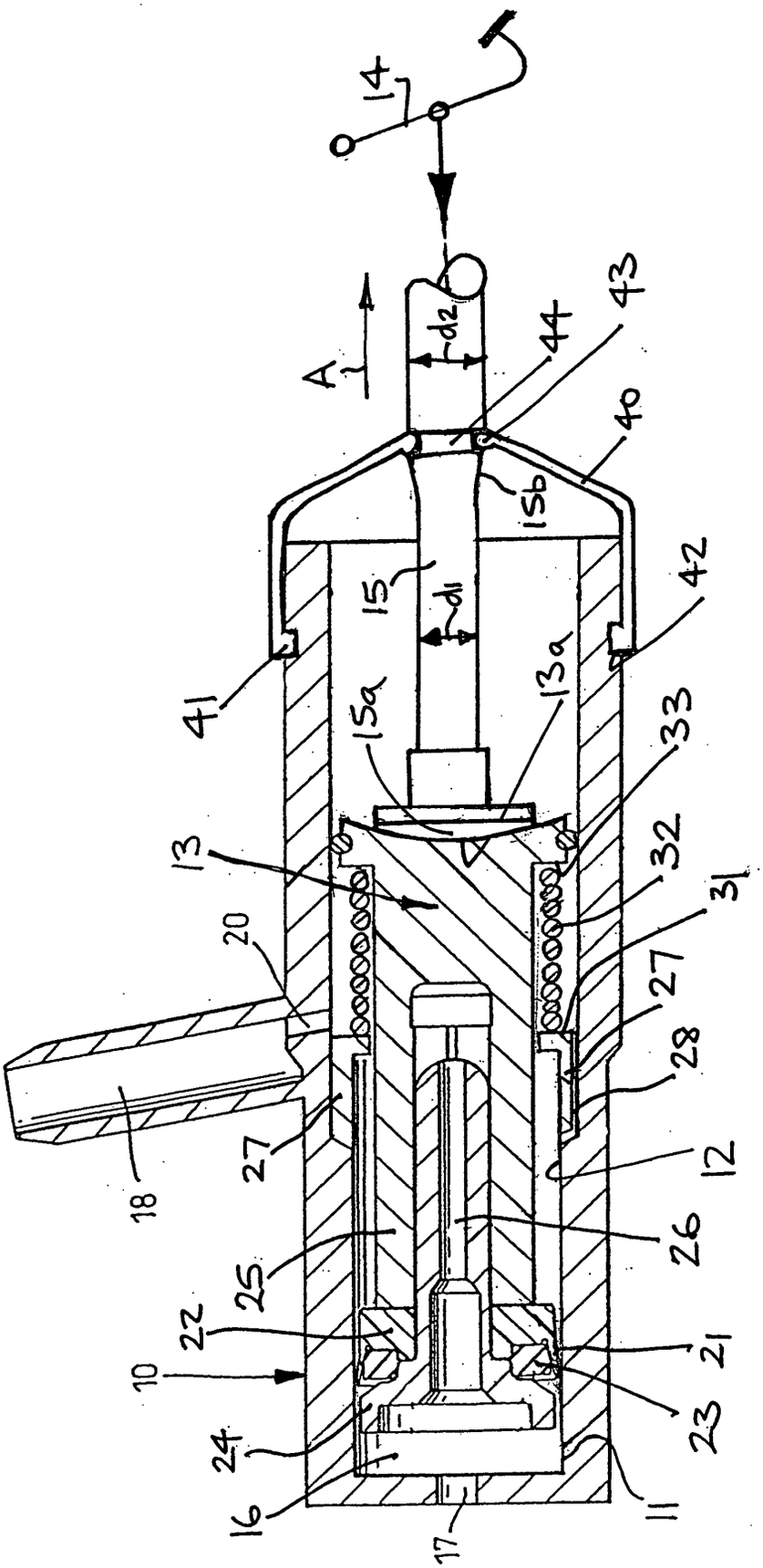
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Fig. 1

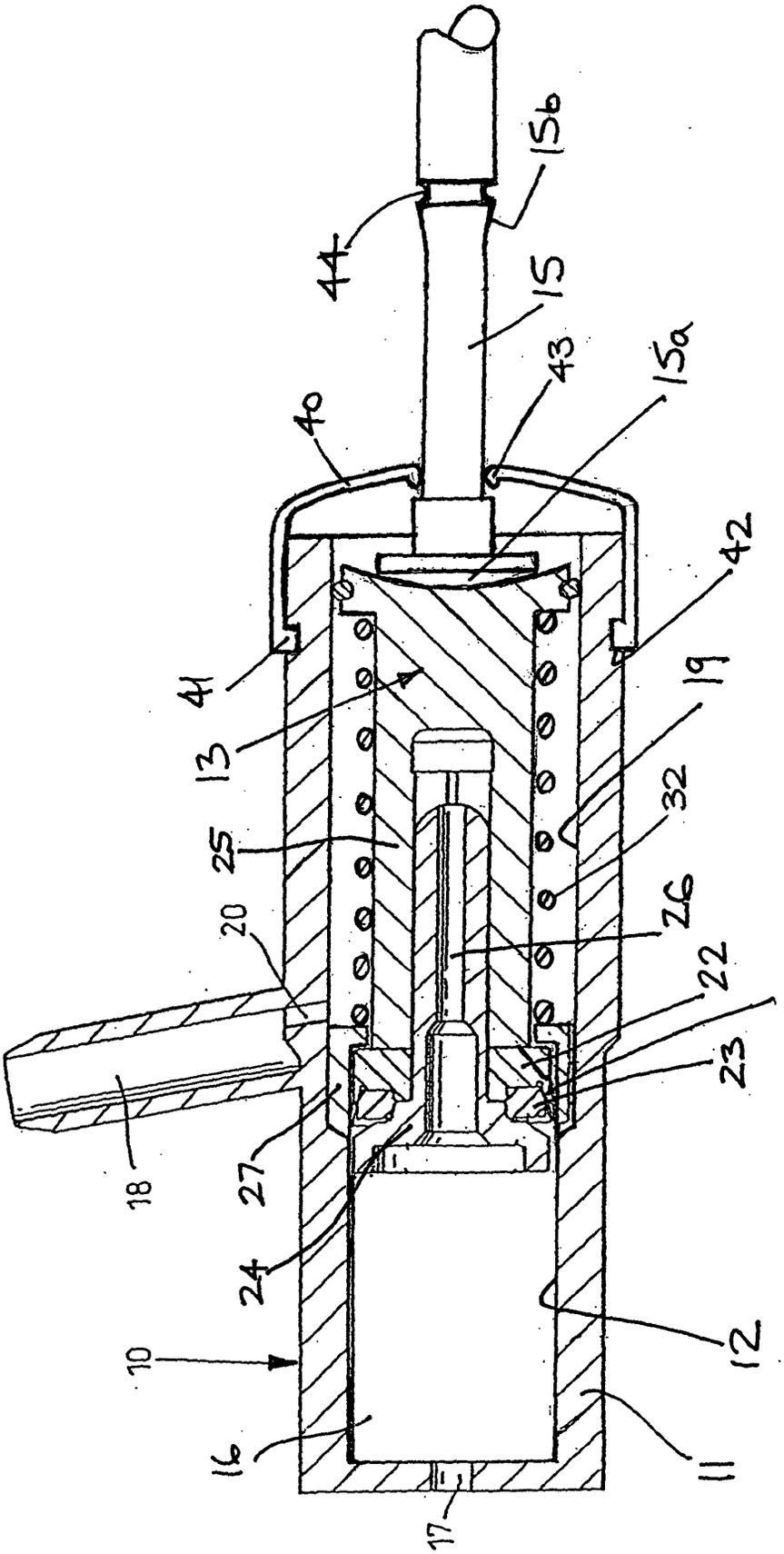
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Fig. 2

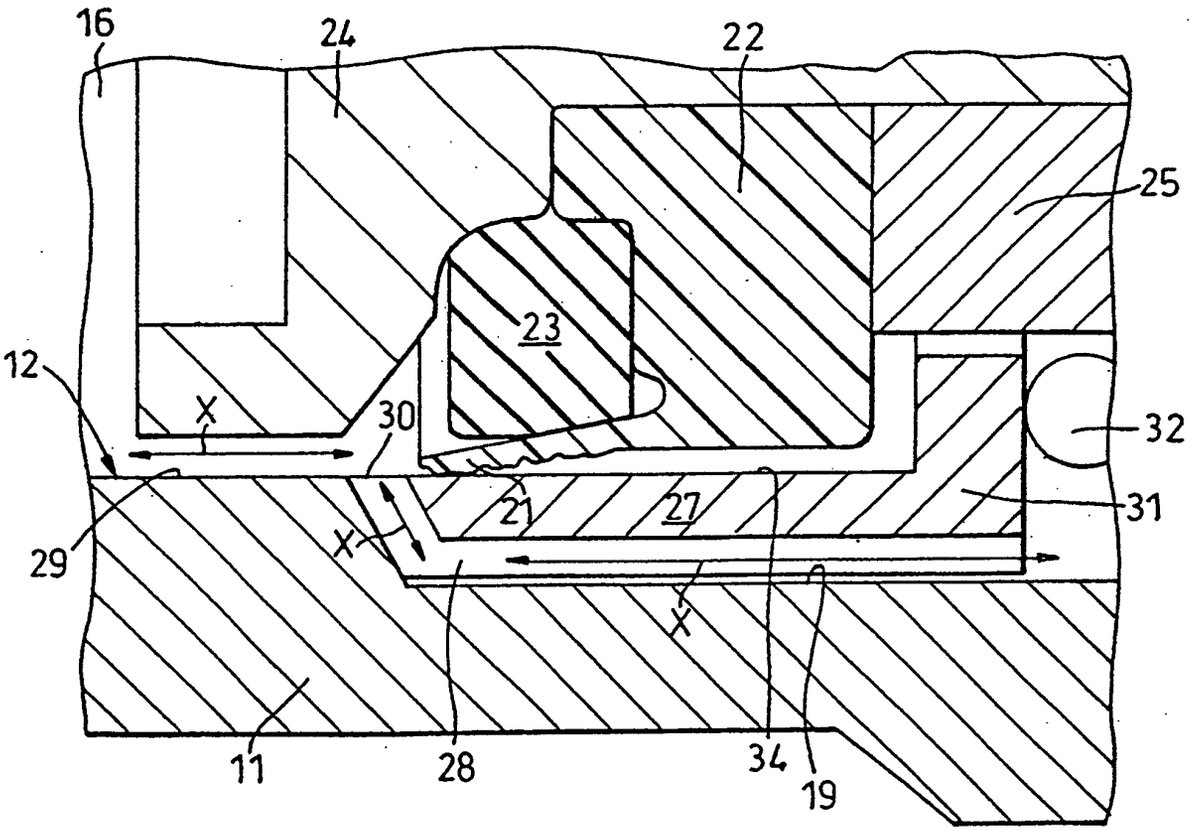

Fig. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 02 02 2504

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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TECHNICAL FIELDS SEARCHED (Int.Cl.7)

F15B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	14 November 2002	Sbaihi, M

CATEGORY OF CITED DOCUMENTS

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82