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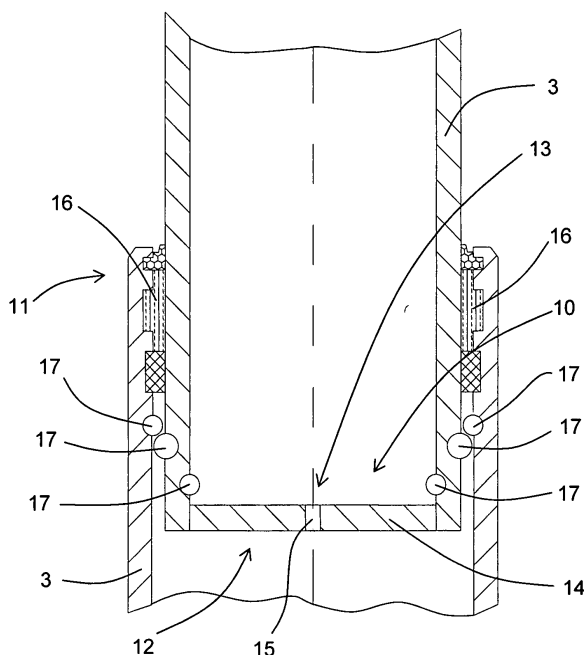
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### (54) **A telescopic cylinder**

(57) A telescopic cylinder comprises a hollow outer section (2) which can be connected to a device that supplies a pressurised operating fluid, at least one hollow intermediate section (3) slidably mounted in the outer section (2), and an inner section (4) slidably mounted in an intermediate section (3). The intermediate section (3) and the inner section (4) each being mobile between a retracted position in which it is substantially inserted in the section (2), (3) in which it is slidably mounted, and

an extended position in which it projects outwards from the section (2), (3) in which it is slidably mounted. The intermediate section (3) is fitted, close to its inner end (10), with at least one choke element (12) forming an opening (13) that allows communication between the inside of the intermediate section (3) and the inside of the outer section (2), with a gap for passage of the operating fluid smaller than the gap inside the intermediate section (3) itself.

**FIG. 4**



## Description

**[0001]** The present invention relates to a telescopic cylinder of the type described in the preamble to claim 1.

**[0002]** The present invention is designed in particular for cylinders used for tipping the bodies of industrial vehicles, that is to say, single-acting hydraulic telescopic cylinders, to which specific reference is made below. In any case the present invention may also be applied to different types of telescopic cylinders, used in various sectors, but for which similar performance is required.

**[0003]** In the sector of tipping the bodies of industrial vehicles, telescopic cylinders are normally used since the cylinder which lifts the body must be positioned under the body where the space available is very limited. The lack of space available is such that the cylinder must be made with a relatively large number of sections mounted telescopically one inside another (Figure 1).

**[0004]** However, in this way the innermost sections have a very small diameter and therefore form inside them a chamber for the operating fluid with a volume significantly smaller than the outermost sections.

**[0005]** This configuration is a significant disadvantage during the descent of the body.

**[0006]** Indeed, once the body has been emptied, to return the body to the horizontal position, the operator uses a special control to disable the pump that maintained the operating fluid pressure and to open a discharge valve which puts the telescopic cylinder in direct communication with the fluid tank.

**[0007]** At the moment when the discharge valve opens, the weight of the body is entirely discharged on the innermost section A of the cylinder B (normally consisting of a solid cylindrical rod) which can slide inside intermediate sections C of the cylinder, which are in turn inserted in an outer section D fixed to the vehicle chassis (Figure 2).

**[0008]** Since the volume and cross-section of the intermediate section C, which contains the innermost section A, are small, whilst the discharge pipe has a large cross-section, the weight of the body causes a sudden retraction of the innermost section A, resulting in a significant rebound on the entire vehicle, since during the first steps of its descent the body is practically in free fall.

**[0009]** The same problem may also occur, gradually reduced, in the successive sections, since under equal conditions of cylinder descent, as the dimensions of the section increase, the quantity of fluid which must return into the tank through the discharge pipe gradually increases.

**[0010]** The above-mentioned rebound, as well as being inconvenient for the operator, who is subject to it each time the body descends, over time may also cause a deterioration of the mechanical parts constituting the cylinder, the hinges connecting the body to the vehicle chassis, the vehicle shock absorbers, etc.

**[0011]** In addition, the sudden descent of the body may be dangerous for people close to the body.

**[0012]** An attempt to solve the problem involved fitting the discharge pipe with a choke valve designed to limit the flow of operating fluid during the descent of the body.

**[0013]** However, said solution proved unsuitable since limiting the flow of operating fluid in the discharge pipe tends to cause excessive slowing of the descent of the outermost sections of the telescopic cylinder, in which, as already indicated, the quantity of oil which must flow out gradually increases as the size of the sections increases.

**[0014]** In this situation the technical need which forms the basis of the present invention is to provide a telescopic cylinder which overcomes the above-mentioned disadvantages.

**[0015]** In particular the technical need of the present invention is to provide a telescopic cylinder that guarantees a "soft" descent, without rebound, for all of its sections, in particular the innermost sections, but which at the same time guarantees descent of the outermost sections that is sufficiently fast and safe.

**[0016]** The technical need specified and the aims indicated are substantially achieved by a telescopic cylinder as described in the claims herein.

**[0017]** Further features and the advantages of the present invention are more clearly illustrated in the detailed description which follows, with reference to the accompanying drawings, which illustrate a preferred embodiment of a telescopic cylinder, without limiting the scope of the inventive concept, in which:

- Figure 1 is a side view, partly in cross-section, of a telescopic cylinder made according to the prior art, in the retracted condition;
- Figure 2 is a side view, in cross-section, of the cylinder illustrated in Figure 1, in the extended condition;
- Figure 3 is a side view, in cross-section, of a telescopic cylinder made according to the present invention in the extended condition; and
- Figure 4 is an enlarged view of the detail indicated by arrow IV of the cylinder illustrated in Figure 3.

**[0018]** With reference to the accompanying drawings the numeral 1 denotes as a whole a telescopic cylinder according to the present invention, which has a cylindrical shape in the accompanying drawings.

**[0019]** The telescopic cylinder 1 disclosed comprises an outer section 2 one or more intermediate sections 3, and an inner section 4.

**[0020]** The outer section 2 is hollow and may be fixed to the chassis of a vehicle. It is also fitted, normally on its outer wall 5, with a connector 6 that allows it to be connected to a pump which supplies a pressurised operating fluid. In addition, the outer section 2 has an inner end 7 closed by an end wall 8, and an open outer end 9.

**[0021]** The intermediate section 3 is also hollow and is slidably mounted inside the outer end 9 of the outer section 2, and has an inner end 10 and an outer end 11,

both open.

**[0022]** The inner section 4 is, in turn, slidably mounted inside the intermediate section 3 and advantageously consists of a solid cylindrical rod.

**[0023]** Both the intermediate section 3 and the inner section 4 are mobile between a retracted position in which they are substantially inserted in the section in which they are slidably mounted (respectively the outer section 2 and the intermediate section 3), and an extended position in which they project outwards from the section in which they are slidably mounted (again respectively the outer section 2 and the intermediate section 3 - Figure 3).

**[0024]** However, in the embodiment illustrated in the accompanying drawings, the telescopic cylinder 1 comprises a plurality of intermediate sections 3 telescopically mounted one inside the other.

**[0025]** At least one of the intermediate sections 3 is fitted, close to its inner end 10, with at least one choke element 12.

**[0026]** The choke element 12 forms an opening 13 which allows communication between the inside of the intermediate section 3 and the inside of the outer section 2, with a gap for passage of the operating fluid smaller than the gap inside the intermediate section 3 itself.

**[0027]** In this way the choke element 12 is an obstacle to the fluid emptying from the intermediate section 3, and so slows at least the inner section 4 return to the retracted section.

**[0028]** In the embodiment illustrated, the choke element 12 consists of a separator 14 which closes the inner end 10 of the intermediate section 3 to which it is applied, the separator 14 having at least one through-hole 15 which allows communication between the inside of the intermediate section 3 and the inside of the outer section 2.

**[0029]** The size of the through-hole 15 made in the separator 14 must on each occasion be proportionate to the volume of the intermediate section 3 to which the separator 14 is applied. For example, as the volume of the intermediate section 3 increases, the size of the through-hole 15 may also be increased, as illustrated for example in Figure 3, for the different intermediate sections 3.

**[0030]** Although in the accompanying drawings, for the purpose of the description, all of the intermediate sections 3 have a separator 14 with a hole made in it, depending on the embodiments, the number, shape and positioning of the separators 14 may vary according to requirements.

**[0031]** However, the separators 14 are preferably applied at least to one or more of the innermost intermediate sections 3 so as to exert a braking action on their descent.

**[0032]** As illustrated particularly in Figure 4, each outer end 7, 9 of the different sections 2, 3 is fitted with a seal 16 which allows the section 3, 4 inserted inside it to slide, guaranteeing a seal for the operating fluid.

**[0033]** Moreover, in accordance with known methods, there are also end of stroke rings 17 positioned both inside and outside the various sections 2, 3, 4 and designed to couple with those of the other sections 2, 3, 4.

**[0034]** Operation of the cylinder 1 disclosed is conventional as regards the extension step in which a pump injects pressurised operating fluid into the cylinder 1 through the special connector 6.

**[0035]** In contrast, during the descent, when the cylinder 1 is directly connected to the pressurised fluid tank (not illustrated) by means of the discharge valve (also not illustrated), emptying of the various intermediate sections 3 is slowed by the choke elements which prevent the sections 3, 4 inside the section to which the damping element is connected from emptying too quickly.

**[0036]** The present invention brings important advantages, since the telescopic cylinder disclosed guarantees a "soft" descent, without rebound, of all of its sections, in particular the innermost ones, but at the same time also guarantees descent of the outermost sections that is sufficiently fast and safe.

**[0037]** It should also be noticed that the present invention is relatively easy to produce and that even the cost linked to implementing the invention is not very high.

**[0038]** The invention described may be subject to modifications and variations without thereby departing from the scope of the inventive concept.

**[0039]** All of the details of the invention may be substituted with other technically equivalent elements and in practice all of the materials used, as well as the shapes and dimensions of the various components may be any, according to requirements.

## Claims

### 1. A telescopic cylinder comprising

- a hollow outer fixing section (2) which can be connected to a device that supplies pressurised operating fluid and having a closed inner end (7) and an open outer end (9),
- at least one hollow intermediate section (3) slidably mounted in the outer section (2), and having an inner end (10) and an outer end (11) which are both open,
- and an inner section (4) slidably mounted in the intermediate section (3);
- the intermediate section (3) and the inner section (4) each being mobile between a retracted position in which it is substantially inserted in the section (2), (3) in which it is slidably mounted, and an extended position in which it projects outwards from the section (2), (3) in which it is slidably mounted;

**characterised in that** the intermediate section (3) is fitted, close to its inner end (10), with at least one choke element (12) forming an opening (13) which allows communication between the inside of the intermediate section (3) and the inside of the outer section (2), having a gap for passage of the operating fluid which is smaller than the gap inside the intermediate section (3) itself, said choke element (12) slowing the return of at least the inner section (4) to the retracted position. 5 10

2. The telescopic cylinder according to claim 1, **characterised in that** the choke element (12) consists of a separator (14) which closes the inner end (10) of the intermediate section (3), said separator (14) having at least one through-hole (15). 15

3. The telescopic cylinder according to claim 1 or 2, **characterised in that** it comprises a plurality of intermediate sections (3) telescopically mounted inside one another, at least one of them being fitted with the choke element (12). 20

4. The telescopic cylinder according to claim 3, **characterised in that** at least two intermediate sections (3) are fitted with a choke element (12). 25

5. The telescopic cylinder according to claim 4, **characterised in that** all of the intermediate sections (3) are fitted with a choke element (12). 30

6. The telescopic cylinder according to any of the claims from 3 to 5, **characterised in that** at least the innermost intermediate section (3) is fitted with the choke element (12). 35

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FIG. 4

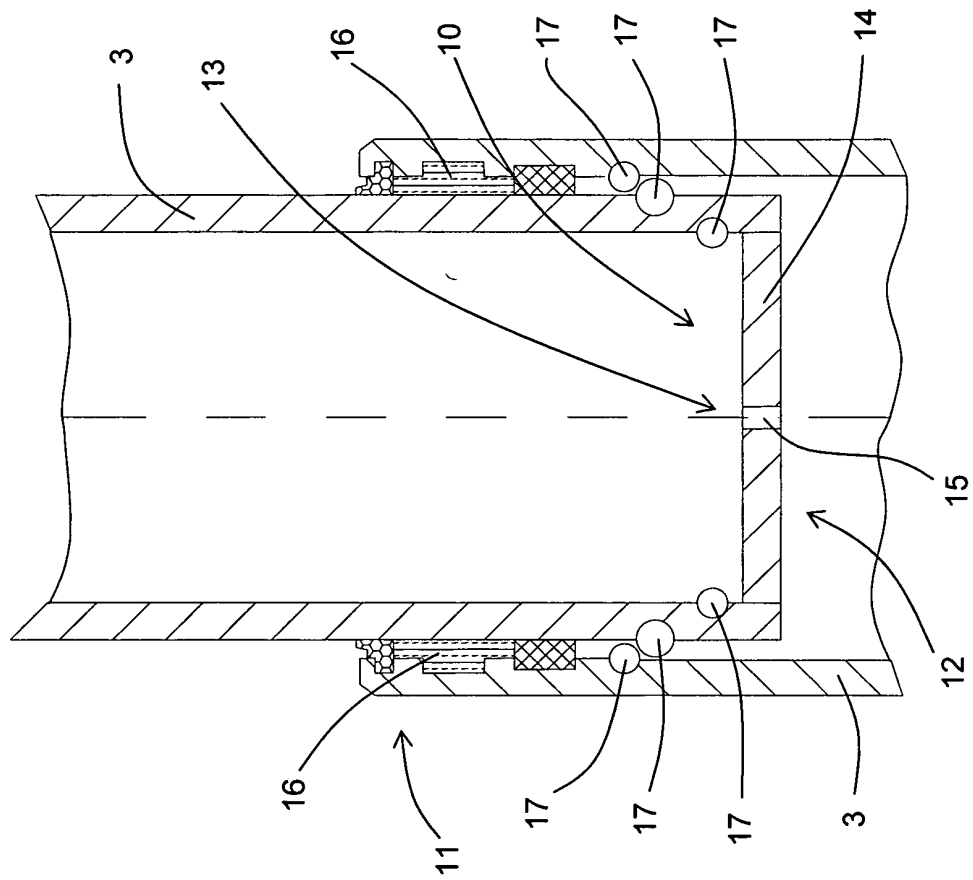


FIG. 1

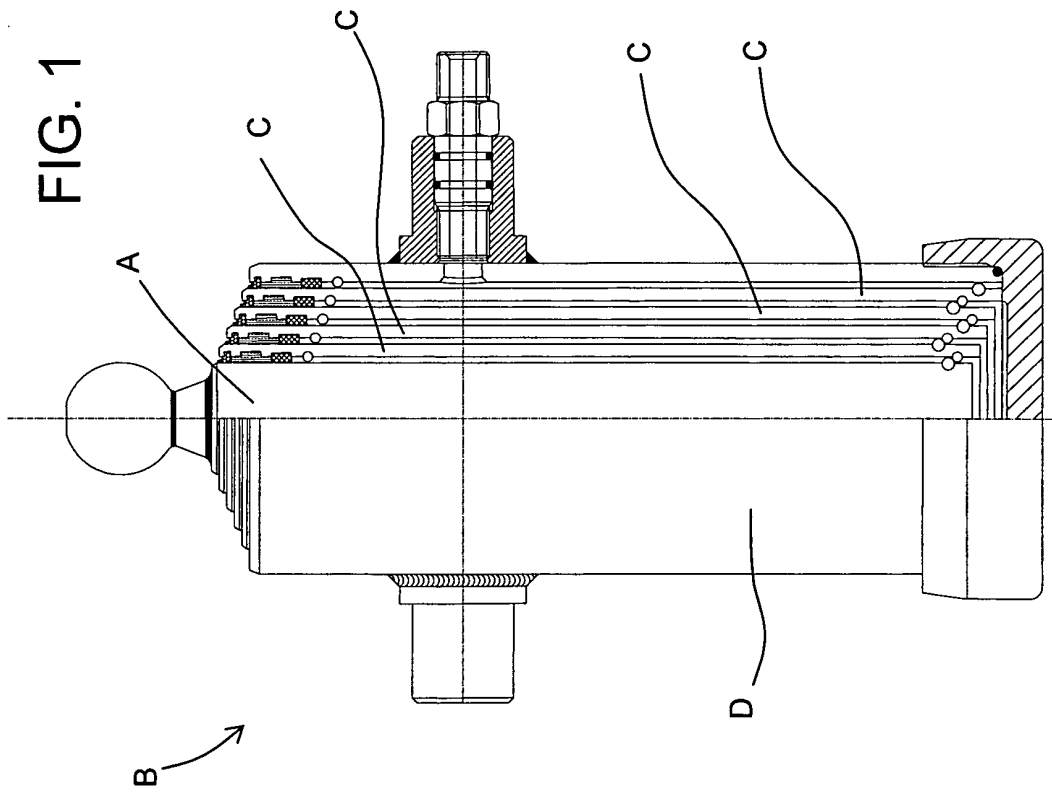


FIG. 2

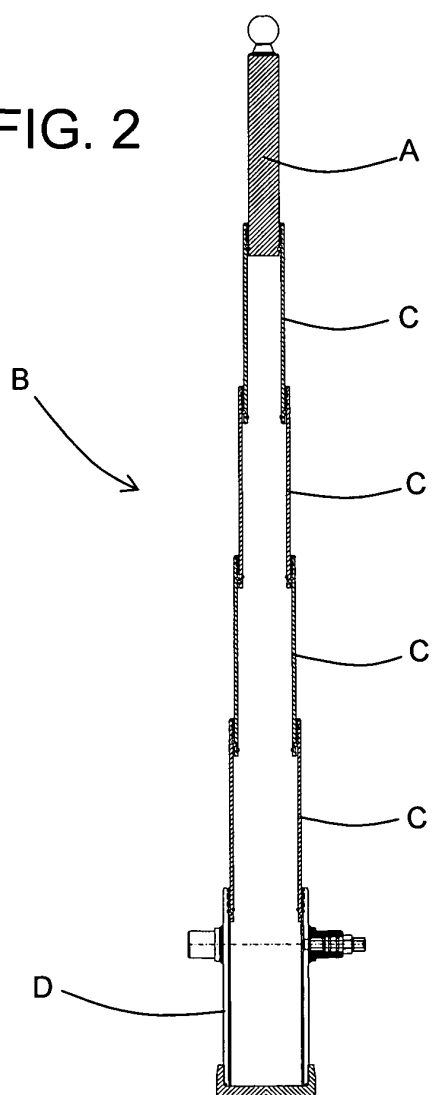


FIG. 3

