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(54) **Stepped door stop**

(57) The stepped door stop, as claimed by the present invention, comprise a progressive indexing rod (1) provided with a hole (a) at one end for fixing with a rivet (3) and at the other end with a bumping section (t) that is T-shaped in a horizontal plane, the progressive indexing rod being provided on two opposite faces with a channel (c) having a recess (b) for positioning during mounting, recesses (d1, d2,...,dn) for indexing during operation, a slide (2) with a relatively parallelepipedic shape, provided with an opening (f1), slots (f2) placed symmetrically towards the edges, a longitudinal cylindrical channel perpendicular to the axis of the opening (f1), said slide (2) also incorporating two heads of screws (10a) and (10b) that are positioned symmetrically for fixing to the door, two balls (4a) and (4b) for indexing, two compression springs (6a) and (6b) with progressive stiffness, two caps (8a) and (8b) provided with slots (8f) and (8f'), two U-shaped safety locks (7a) and (7b) and a fastening part (9) with an ovalized hole (o) for fixing with screws on the pillar, the progressive indexing rod (1) having a symmetric design, with progressive steps towards the bumping section (t), on two opposite sides, defining plane-parallel surfaces (s1), (s2) and (s3) containing channel (c) common to the surfaces and wherein the positioning recess (b) and indexing recesses (d1, d2, ..., dn) having a spherical or conical shape are machined.

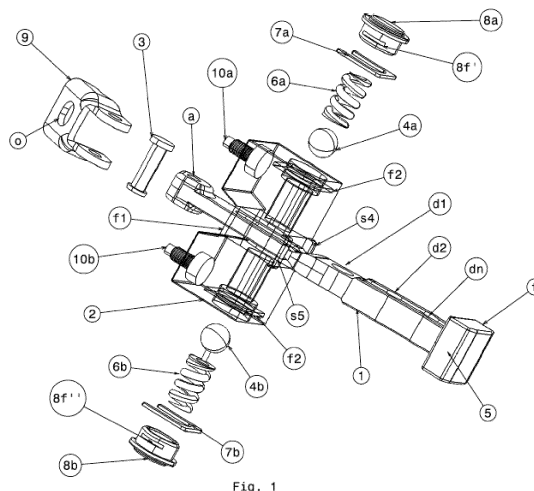


Fig. 1

Description

[0001] The present invention relates to a stepped door stop, generally designed to be used for equipping the access doors, and particularly for equipping the motor vehicles doors.

[0002] It is known that under the present conditions of more and more restrictive energy requirements, as a rule, the most of the door stops manufacturers are directed to technical simple and cost effective solutions.

[0003] The patent literature presents a relatively wide range of technical and constructive solutions for stepped door stops.

[0004] Thus, EP 0643184 (B1) relates to a door stop device of a motor vehicle, which contains a support of a hinge type, for fastening on the motor vehicle pillar and a retaining assembly placed and fixed in the door. The fastening hinge and the retaining assembly are interconnected so as to be relatively movable by means of a locking device that defines the certain rotating positions of the vehicle door.

[0005] The indexing in the various rotating positions of the door is carried out by means of a locking roller that is in permanent contact by means of springs with the shaped longitudinal edges of the stopping device.

[0006] A door stop constructive solution is presented in the patent no. FR 2852994 (B1) that discloses a mechanism used to stop the vehicle doors, said mechanism consisting of a rod provided with (cam-type) indexing profiles of a roller, placed in a housing, and having a slide function, the roller pressure on the shaped surfaces being provided by a spring made of polymer. On its exterior side the indexing roller is coated with a polymer layer having self-lubricating properties.

[0007] The patent application DE 10251174 (A1) presents a stop consisting of a rod made of a thermoplastic material with a metallic insert, provided with indexing recesses for a hemispherical body also made of thermoplastic material, driven by a spring, all placed in a retention body. The driving of the spring of the indexing body is performed by means of a threaded cap, fastened inside the retention body, namely inside the holes for sliding the spring therein.

[0008] The patent application US 2004/0251696 (A1) presents a solution for a door stop, consisting of a rod made of thermoplastic material having a metallic insert, with two non-shaped sliding planes. The retention body contains a spring that drives a metallic ovoid cam that is articulated with the possibility of symmetrically angularly swinging relatively to the vertical axis, during the door operation. The door is stopped at the moment when the spring is maximally compressed. In the neutral state, i.e. when the rod is placed with its smallest thickness between the two cams, the spring presses on the cams with a minimum force.

[0009] The patent application US 2012/0233813 (A1) presents a solution for a door stop, consisting of an indexing rod made of a thermoplastic material with metallic

insert, with two sliding planes, both being shaped with recesses and protuberances. The stopping device particularly mainly consists of the solution adopted for the retention body, wherein the compressive force on the indexing rod is provided by a pair consisting of two non-metal bodies symmetrically arranged, made of, for example, a flexible elastomeric material and of a self-lubricating thermoplastic material, respectively.

[0010] The US patent 7793387 (B1) discloses the solution for a door stop that mainly consist of, the same as the above-mentioned solutions, an arm-rod and a retention body, wherein there is located, in the upper position, a single compression spring and a single hemi-spherical body mounted on the head of the spring. The arm-rod is provided on the entire width of only its top surface with shaped indexing recesses and protuberances, the hemi-spherical body indexing being achieved when this penetrates into the indexing recesses under the action of the compression spring.

[0011] These solutions have, in some cases, the disadvantage of a high degree of complexity related to the producing and mounting of the component parts, these requiring, in the most cases, to be manufactured with a relatively high degree of manufacturing accuracy.

[0012] The technical problem to be solved by the present invention is providing a stepped door stop of an average constructive complexity of the retention mechanism, designed to provide the user with a high degree of comfort during the operation of the door during its opening and closing, while provides stable opening and closing positions of the door.

[0013] According to the claimed invention, the stepped door stop comprises:

- a progressive indexing rod provided symmetrically in each of both surfaces with a recess for positioning during the mounting operation and with indexing recesses placed in a common channel along the longitudinal axis of the progressive indexing rod.
- a slide provided with a sliding opening for the progressive indexing rod and a longitudinal channel, which is placed perpendicular to the axis of the sliding opening;
- two driving springs with variable progressive stiffness, two spherical bodies, such as bearing balls, and two caps that provide the spring compression by means of safety locks.

[0014] At one end, the progressive indexing rod is fastened, by means of a rivet and a metallic fastening body which, in its turn, is secured on the pillar, with a screw, and at the other end the progressive indexing rod has a travel limiting bumping section. The slide usually made of self-lubricating thermoplastics is provided internally with mounting screws for its securing inside the door. The progressive indexing rod is made of self-lubricating thermoplastics, provided with a metallic insert throughout its length, and also in the bumping section.

[0015] The body used to secure the assembly on the pillar has an ovalized through hole designed for the screw which provides the possibility of a vertical adjustment during the mounting operation. Similarly, the width of the sliding opening provided in the slide may provide a small tolerance in relation to the width of the progressive indexing rod during the mounting and operation.

[0016] The invention presents the following advantages:

- provides the user with the firm angular positioning of the door in opening positions with a reduced risk of being influenced by the action of the wind or air streams;
- allows the use of standardized component parts;
- represents an extremely reliable solution and does not require special maintenance operations;
- provides a wide range of applications for various fields of activity, such as: automobile, naval and aeronautical industry and/or for civil, industrial engineering or household applications.

[0017] Hereinafter are presented the embodiments of the stepped door stop according to the present invention, designed for the automobile industry, with reference to the accompanying drawings Fig. 1-14, wherein:

- Figure 1 - general view of a stepped door stop according to the present invention;
- Figure 2 - top view of the progressive indexing rod;
- Figure 3 - side view of the progressive indexing rod;
- Figure 4 - cross-section through the progressive indexing rod in the area corresponding to the recess for positioning during mounting;
- Figure 5 - cross-section through the progressive indexing rod 1 in the indexing recess area;
- Figure 6 - perspective view of the slide;
- Figure 7 - detailed view of the slide;
- Figure 8 - front view of the slide;
- Figure 9 - view of the sliding that can replace the sliding balls;
- Figure 10 - general view of a stepped door stop according to an embodiment of the present invention having the non-milled caps with protuberances;
- Figure 11 - top view of the cap with protuberances;
- Figure 12 - cross-section view through the cap with protuberances;
- Figure 13 - top view of the slide in the embodiment having the caps with protuberances;
- Figure 14 - cross-section through the longitudinal channel of the slide in an embodiment of the present invention having caps with protuberances;

[0018] As is presented in Figure 1, the stepped door stop claimed by the present invention comprises a progressive indexing rod 1 containing a metallic insert 5, a slide 2, one rivet 3 to secure the progressive indexing rod 1 in the fastening 9 for securing on the pillar, a pair

of balls 4a and 4b correspondingly driven by a pair of springs 6a and 6b with progressive stiffness, the securing thereof in the body of the slide 2 being achieved by means of a pair of caps 8a and 8b, a corresponding pair of safety locks 7a and 7b fitted in the slots f2 provided in the body of the slide 2.

[0019] The progressive indexing rod 1, as also shown in Figures 4 and 5, has a constant width and is manufactured of a metallic insert 5, placed centrally on the entire length of the progressive indexing rod 1 and also inside the bumping section t, the insert 5 being coated to the outer side with a thermoplastic material, for example, by injection molding. The progressive indexing rod 1 may, as a rule, be straight or curved according to the specific requirements of the door stop application.

[0020] The progressive indexing rod 1 is provided symmetrically on both plane-parallel sliding faces with a channel c used to guide the balls 4a and 4b, a hole a for fixing with a rivet 3, a recess b for positioning during mounting and indexing recesses d1, d2, ... dn that provide the required firm angular positioning of the door during the door closing and opening and a bumping section t as presented in Figure 2. The number of indexing recesses d is constructively limited and is defined by the number of required angular indexing positions desired by the user during closing and opening the door. Usually the number of indexing recesses is limited to 2 or 3.

[0021] The progressive indexing rod 1 presents in two of its opposite sides a symmetrical stepped configuration of three stepped plane-parallel surfaces as presented in Figure 3, denoted by s1, s2, and s3, in the order of the increasing of the progressive indexing rod 1 thickness, these surfaces having the function, as the door is being opened, to provide a firmer and firmer angular positioning of the door, due to the compressive force exerted by the springs 6a and 6b, with a progressive stiffness.

[0022] The body of the slide 2, presented in Figure 6, is made of thermoplastic material, such as glass fiber-reinforced polyamide and has a symmetrical design being provided with a sliding opening f1 having a width slightly larger than the constant width corresponding to the progressive indexing rod 1, this fact allowing a necessary horizontal plane adjustment during mounting and the operation. The body of the slide 2 embeds the heads of the fixing screws 10a and 10b placed symmetrically and used to fix the slide inside the door.

[0023] On the opposite plane to the screws 10a and 10b, the slide 2 is provided at its ends with slots f2 used to allow access for mounting the safety locks 7a and 7b in the milled areas 8f and 8f' provided in the caps 8a and 8b, these having the function of coaxially positioning the springs 6a and 6b with a progressive stiffness, in the cylindrical longitudinal channel provided therefor and the balls 4a and 4b inside the slide 2.

[0024] The cylindrical longitudinal channel, designed to place coaxially the balls 4a, 4b, the springs 6a, 6b and the caps 8a and 8b is perpendicular in respect to the axis of the sliding opening f1 cut in the slide 2.

[0025] The balls 4a and 4b having the role of the indexing parts that fit in the indexing recesses d1, d2, ... dn can be of the bearing balls type with a surface with low roughness, thereby providing a reduced friction coefficient due to rolling both along the guiding channel c and while moving in and out of the indexing recesses d1, d2, ... dn.

[0026] According to another embodiment of the present invention, the balls 4a and 4b, can be replaced by a body 4a' and 4b', respectively, consisting of a cylindrical section that is fixed on the inside diameter of the springs 6a and 6b, a circular shoulder and an hemi-spherical termination with indexing function, as presented in Figure 9.

[0027] According to Figure 1, the fastening part 9 used to fix the assembly on the pillar has a hole o with an ovalized shape in the vertical direction for passing there-through the screw used to secure to the pillar, this not being represented in the figure. The ovalized hole o provides, during the mounting operation, the possibility for a small vertically. Similarly, the width of the sliding opening f1 provided on the slide 2 allows a small mounting tolerance as against the constant width of the progressive indexing rod 1. The bumping section t provided at one end of the progressive indexing rod 1 has a T - shaped section in the horizontal plane and it provides in a maximum opening door angle, the stopping by bumping being achieved by the coplanar frontal surfaces s4 and s5 of the slide 2 vertically surrounding the sliding opening f1.

[0028] According to another embodiment of the present invention, as presented in Figure 10, the stepped door stop comprises, instead of the caps 8a and 8b, and of the safety locks 7a and 7b, caps 8a' and 8b' with protuberances, without the external milled areas 8f and 8f" as presented in the first embodiment.

[0029] The caps 8a' and 8b' are fixed in the longitudinal channel of the slide 2 by means of at least three protuberances pa, arranged radially and equally spaced, at an angle of 120° on the outer circumference of these caps as presented in Figures 11 and 12.

[0030] Each of the protuberances pa during mounting and tensioning the springs 6a and 6b enters a corresponding longitudinal guiding groove pb machined at the inlets of the longitudinal channel of the slide 2. The caps 8a' and 8b' are secured then in the slide 2 by rotating them, specifically by rotating the three protuberances pa in a radial channel pc respectively shaped to protuberances pa, the radial channel pc being arranged circumferentially inside the longitudinal channel of the slide 2, as presented in Figures 13 and 14.

[0031] The longitudinal grooves pb are arranged up to the radial channel pc, so that, during mounting the caps 8a' and 8b' in the slide 2 the protuberances pa have a initial translational motion in the grooves pb and then a rotation motion inside the radial channel pc.

[0032] In order to provide a minimum effort during mounting, the caps 8a' and 8b' are provided with driving recesses h that can have for example a rectangular or

hexagonal shape for manually or mechanically rotating them by the means of screwdrivers.

5 Claims

1. Stepped door stop **characterized in that** it comprises:

- an progressive indexing rod (1) provided at one end with a hole (a) for fixing with a rivet (3), and at the other end with a bumping section (t) that is horizontally T-shaped, the progressive indexing rod being provided on two of the opposite surfaces with a channel (c) wherein there is a recess for positioning (b) during mounting and indexing recesses (d1, d2, ..., dn);
- a substantially parallelepipedic shaped slide (2), provided with an opening (f1), and slots (f2) placed symmetrically towards to its edges, a longitudinal cylindrical channel perpendicular in respect to the axis of the opening (f1), the slide (2) having incorporated two symmetrically positioned screw heads (10a), and (10b) for fixing to the door;
- two indexing balls (4a) and (4b) ;
- two compression springs (6a) and (6b);
- two caps (8a) and (8b) provided with milled areas (8f) and (8f");
- two U-shaped safety locks (7a) and (7b);
- a fastening part (9) provided with a hole (o) for fastening with screw on the pillar.

2. Stepped door stop according to claim 1 **characterized in that** the progressive indexing rod (1) is manufactured symmetrically with progressive steps towards the bumping section (t), on two of the opposite sides, defining plane-parallel surfaces (s1, s2 and s3) comprising a channel (c) which is common to said surfaces and wherein the positioning recess (b) and the indexing recesses (d1, d2, ..., dn) are machined, the said recesses being spherical or conical shaped.

3. Stepped door stop according to the claim 1 and claim 2 **characterized in that** the progressive indexing rod (1) comprises a recess (b) for positioning during the mounting process.

4. Stepped door stop, according to claim 1 **characterized in that** the width of the opening (f1) provided in the slide (2) allows a tolerance in the horizontal plane during mounting and operating of the stepped door stop, in respect to the constant width of the progressive indexing rod (1).

5. Stepped door stop, according to claim 1 **characterized in that** the slide (2) is provided with a longitu-

dinal cylindrical channel, perpendicular to the axis of the opening (f1), wherein there are sequentially mounted the balls (4a) and (4b), springs (6a) and (6b), caps (8a) and (8b) and safety locks (7a) and (7b), that provide the compression of the springs (6a) and (6b) by mounting them in the slots (8f) and (8f'') provided in the caps (8a) and (8b). 5

6. Stepped door stop according to claims 1 and 5 **characterized in that** the springs (6a) and (6b) are of the type with variable progressive stiffness. 10
7. Stepped door stop according to claim 1 **characterized in that** the fastening part (9) is provided with a hole (o) ovalized in the vertical direction, allowing an adjustment in the vertical direction during mounting. 15
8. Stepped door stop according to claim 1 **characterized in that** the indexing balls (4a) and (4b) can be replaced by bodies (4a' and 4b'), each comprising a cylindrical section fixed on the inner diameter of the springs (6a) and (6b), an annular resting shoulder, and a hemispherical end with indexing function. 20
9. Stepped door stop according to claims 1 and 5 **characterized in that** the caps (8a) and (8b) and the corresponding safety locks (7a) and (7b) can be replaced by caps (8a') and (8b') provided at least with three protuberances (pa) radially arranged and equally spaced, at an angle of 120°, on the outer circumference of said caps (8a') and (8b') 25 30
10. Stepped door stop according to claims 1, 5 and 9 **characterized in that** the caps (8a') and (8b') are provided with driving slots (h) for being operated by the screwdriver. 35
11. Stepped door stop according to claims 1, 5 and 9 **characterized in that** the longitudinal channel of the slide (2) is provided, at its ends, with at least three grooves (pb) equally spaced along the generatrix of the longitudinal channel of the slide (2) and a radial channel (pc) arranged on the circumference inside the longitudinal channel of the slide (2). 40 45

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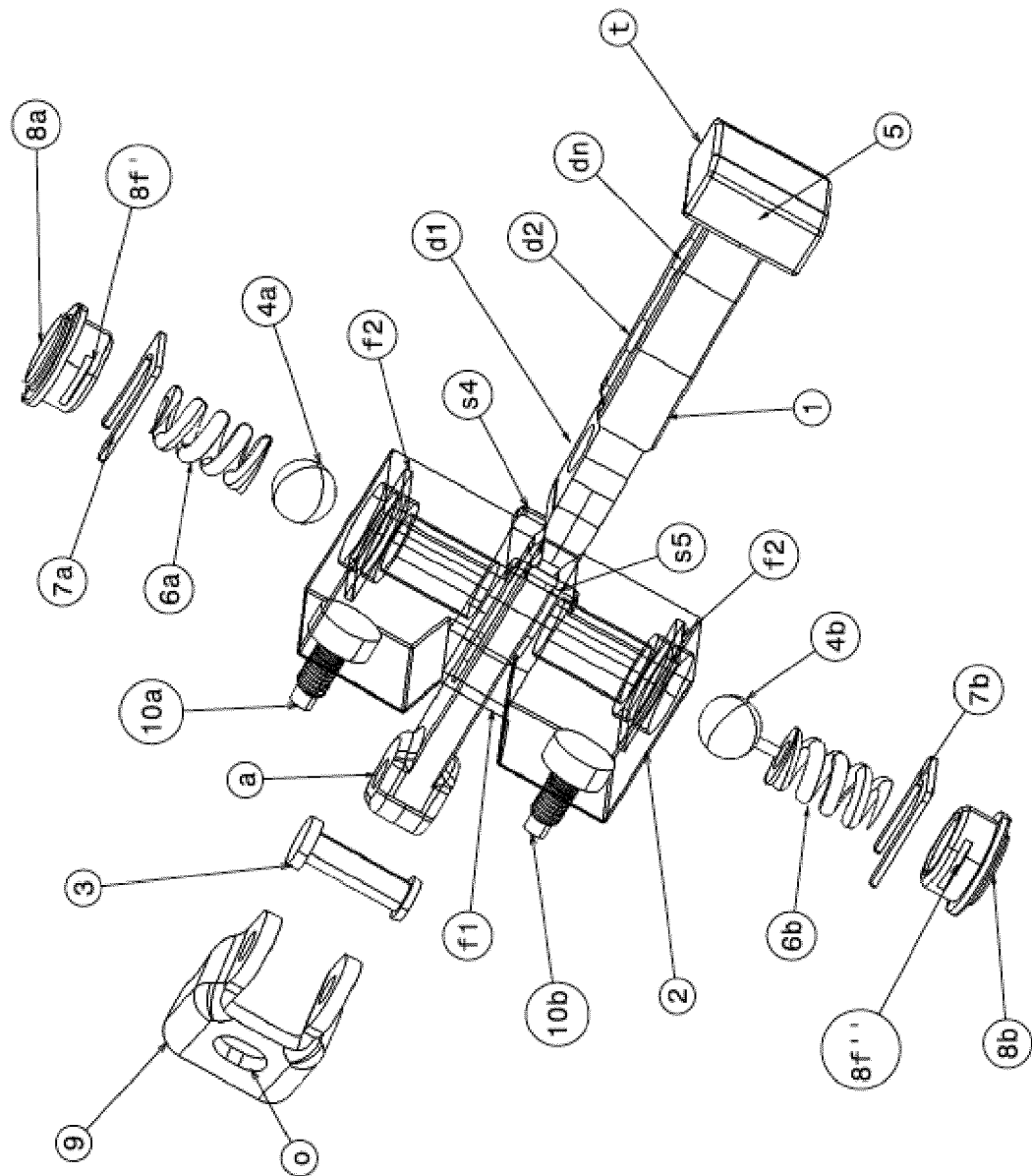


Fig. 1

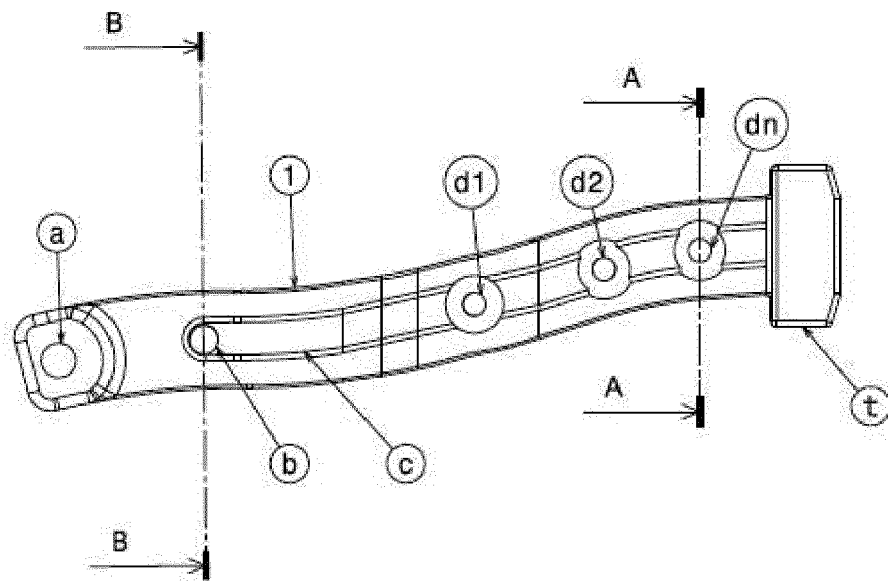


Fig. 2

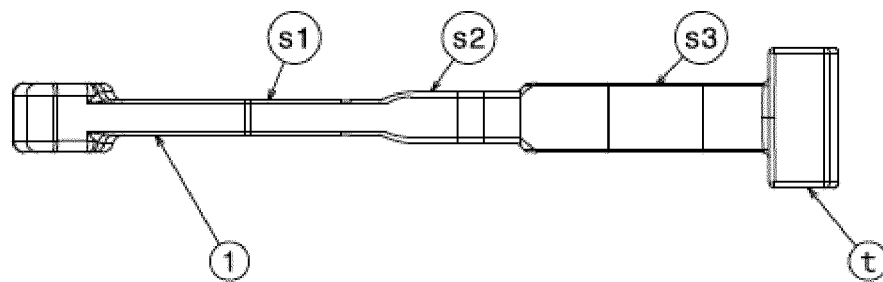


Fig. 3

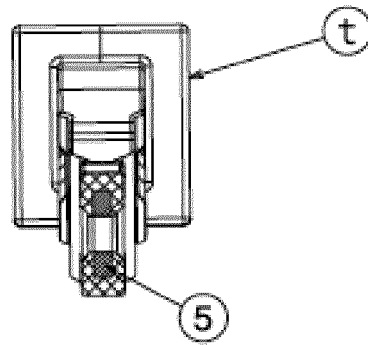


Fig. 4

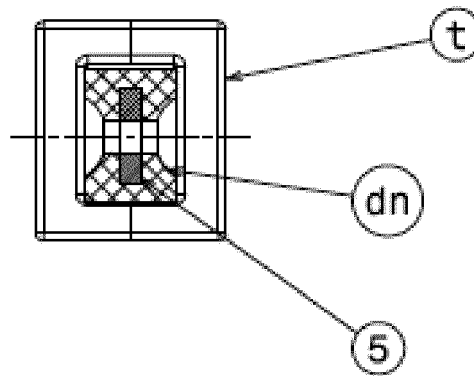


Fig. 5

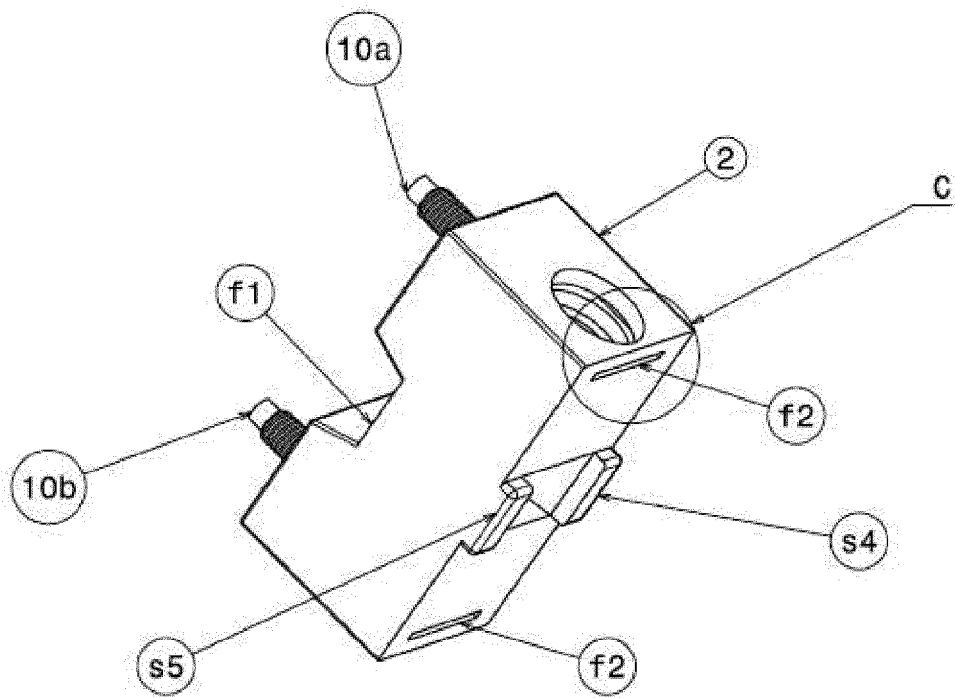


Fig. 6

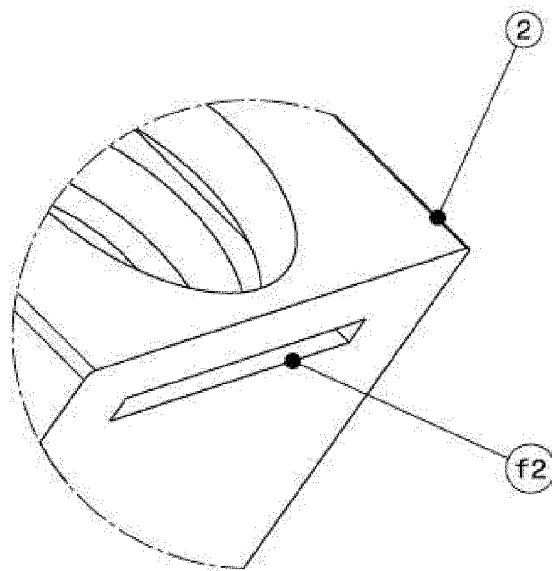


Fig. 7

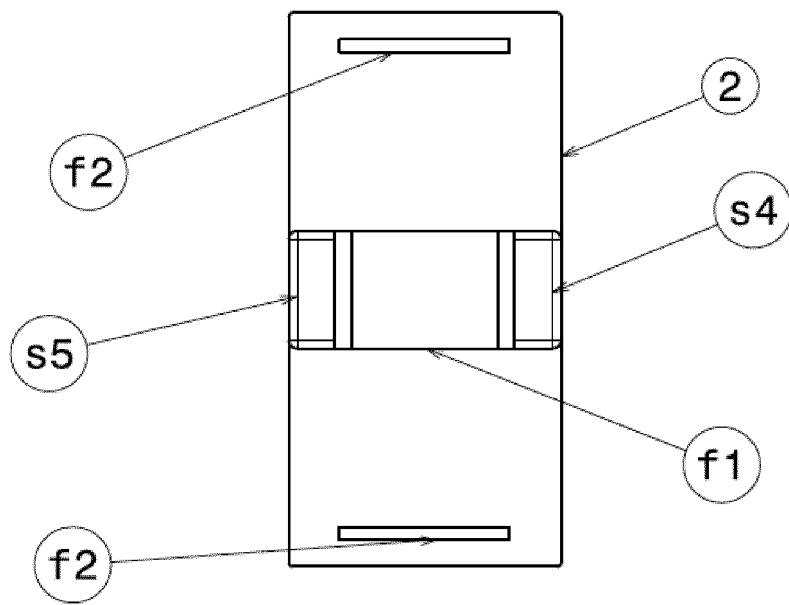


Fig. 8

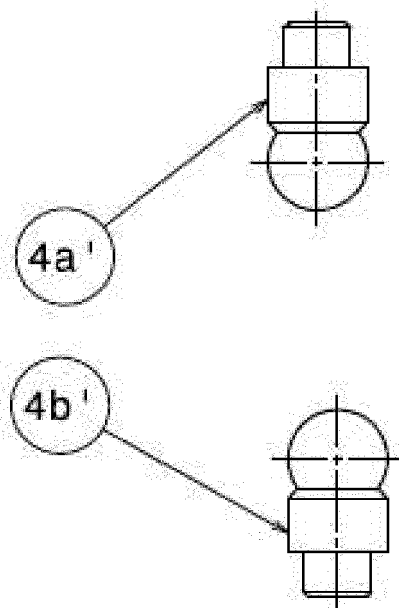


Fig. 9

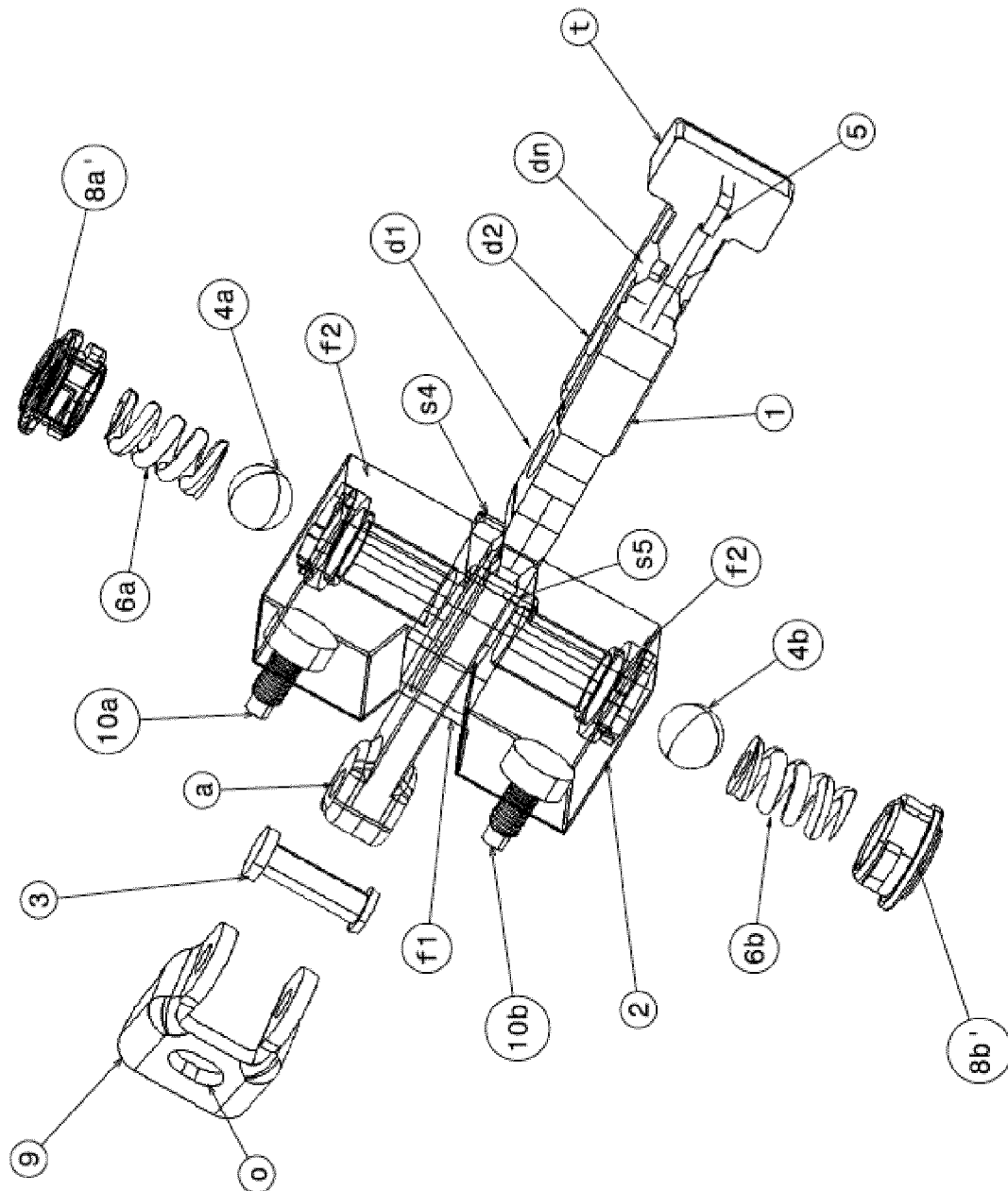


Fig. 10

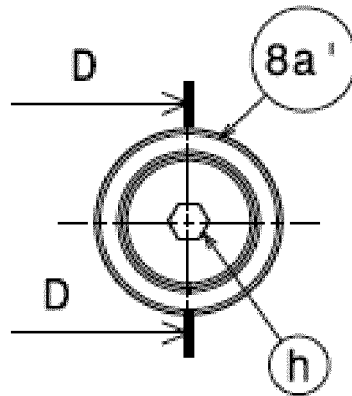


Fig. 11

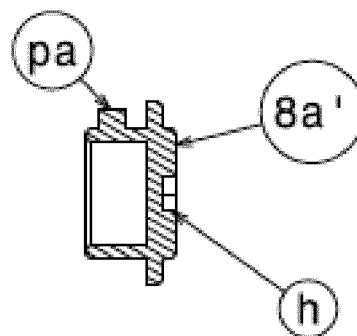


Fig 12

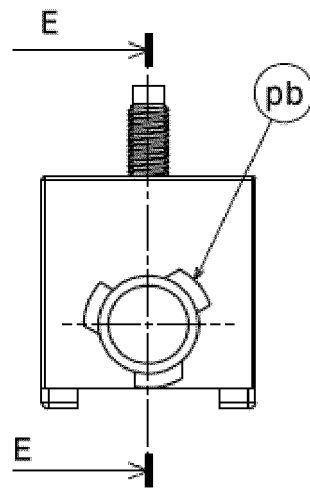


Fig. 13

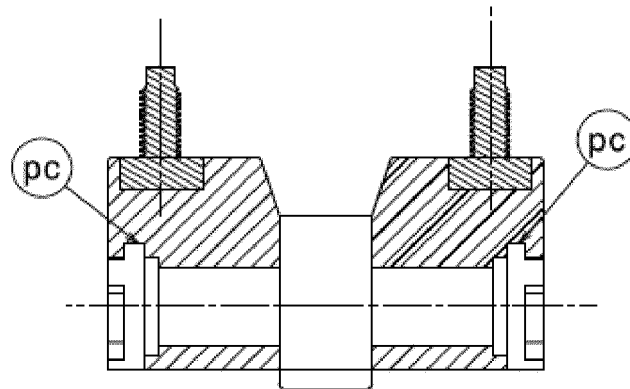


Fig. 14



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 Application Number
EP 14 15 1586

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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 24 September 2014	Examiner Pérez Méndez, José F
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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