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(54) **SAFETY DEVICE FOR THE CONTROL OF THE DESCENT DURING CLIMBING**

(57) Safety device (1) for the control of the descent during climbing comprising: a frame (2) provided with a groove (13), a first pulley (3), a second pulley (3'), a third pulley (4), whose pin (14) is misaligned with the pin (16) of the first pulley (3) and with the pin (16') of the second pulley (3'), a spring (5) connected to said third pulley (4), a hook (17) for the attachment to a wall; said device (1) being characterised in that said third pulley (4) is mobile, the pin (14) of said third pulley (4) being positioned inside said at least one groove (13) and the pin (14) of said third pulley (4) being translatable inside said at least one groove (13) under the action of the force exerted by said spring (5) and of the weight force exerted by a user of said device.

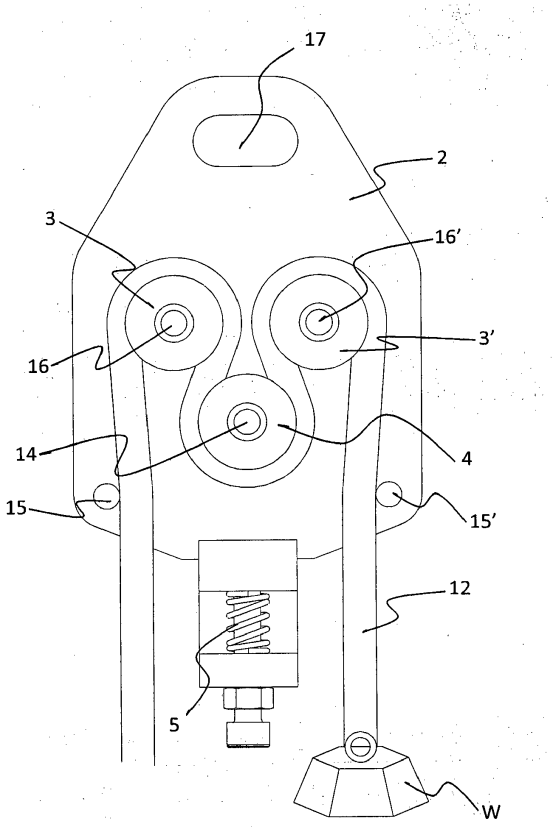

Fig.6

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Description

[0001] The present invention relates to a safety device for the control of the descent, preferably but not exclusively during the activities of sports climbing.

[0002] During the activities of sports climbing devices are normally used which allow control of the descent of the climber, so as to avoid a fall thereof or to make sure that the descent does not take place at too high a speed.

[0003] These devices are basically made up of an external covering or casing and a mechanism of control of the rope wherefrom the user of the device, i.e. the climber, is hanging. Said control mechanism comprises, usually, two or three pulleys around which a rope passes, at one end whereof the climber is suspended. The end of the rope wherefrom the climber is hanging will henceforth be referred to as first end. The other end of the rope, henceforth referred to as second end, is instead controlled by a person or, alternatively, is connected to a system, attached to the ground, which controls the sliding of said rope. More particularly the person who controls the second end exerts a control force F_c which opposes the weight force F_a exerted in the same direction but in an opposite way by the climber. By regulating the intensity of the control force F_c, it is possible to slow down the descent of the climber.

[0004] The devices of the prior art provide therefore a control mechanism comprising a set of two or more pulleys, around which the rope is to be passed. The purpose of these pulleys or, more generally, of the control mechanisms, is that of facilitating the operations of braking of the descent of the climber, said braking operations being however always performed by a person who exerts the control force F_c. These devices also have a system of blocking of the rope which means that the descent of the climber can be interrupted in the case wherein the person who controls the second end of the rope loses control of the same.

[0005] An explanatory example of the functioning of these devices of the prior art is described in the patent application FR2804421A1. This application relates, in particular, to a device for the control of the descent during the activities of climbing, whose control mechanism comprises three pulleys: a braking/blocking pulley, a control pulley and a command pulley, whose pin can slide inside a groove or guide of tapered shape. In the device described in FR2804421A1, the braking/blocking pulley and the control pulley are connected by means of an arm which, in turn, is attached to the casing wherein the entire control mechanism is housed, by means of a spring. The rope, restrained at a first end by the person assigned control of the speed of the descent, passes, in succession, on the control pulley and, then, on the command pulley, to then be used by the climber at the second end.

[0006] The sliding of the rope and, therefore, the descent of the climber are controlled by the resultant of the force exerted by the spring and of the force exerted by the rope on the control pulley which, in turn, depends on the control force F_c. More particularly the expansion of the spring entails the rotation of the arm which connects the braking/blocking pulley with the control pulley. The rotation of the arm in turn means that the braking/blocking pulley is pushed towards the command pulley so as to brake the sliding of the rope on the latter. Therefore according to the control force F_c the rope is varyingly braked and the descent of the climber varyingly slowed down. If the person who exerts the control force F_c does not exert it sufficiently, or even lets go of the rope, the spring expands completely, the arm rotates, and the braking/blocking pulley comes into contact with the command pulley so that the pin of the latter translates inside the guide. As mentioned above the latter is tapered, having in the end part dimensions smaller than the diameter of the pin. When the pin arrives at said end part it remains therefore blocked like the command pulley itself. The rope therefore remains jammed between the braking/blocking pulley and the command pulley, thus preventing the sudden fall of the climber.

[0007] Another example of device of the prior art is instead described in the patent application FR2951952A1. The control mechanism of the device described in FR2951952A1 comprises a control pulley, a command pulley and a braking/blocking pulley. The device which is the object of the application FR2951952A1 comprises, moreover, a pivoting element, and a support element connected to a spring, whose degree of compression can be regulated by means of a bolt and a screw. The control pulley is placed between the support element and the pivoting element and two contrasting forces act thereon, one directed upwards, exerted by the spring, and a force directed downwards, exerted by the rope on the control pulley. The latter force depends, obviously, on the control force F_c exerted on the second end of the rope by the person assigned with control of the latter or on the system attached to the ground whereto said second end is connected. As in the preceding case, according to the control force F_c, the rope is varyingly braked and the descent of the climber varyingly slowed down.

[0008] Both devices described in the prior art documents cited above provide for there to be a person other than the climber who controls the second end of the rope or, alternatively, a system of ground attachment of said second end.

[0009] The object of the present invention is, therefore, that of providing a safety device for the control of the descent, preferably during the climbing activities, which does not need any person or attachment system controlling the second end of the rope, said second end being the end of the rope other than the end wherefrom the climber is suspended.

[0010] A second object of the present invention is, moreover, that of providing a safety device for the control of the descent during the activities of climbing with a reduced number of components, thus diminishing the structural complexity of the assembly of the entire device and making maintenance of the same simpler.

[0011] These objects are achieved by a safety device for the control of the descent during the activities of climbing comprising a casing or frame containing the mechanism of control of the descent of the rope.

[0012] Said control mechanism comprises in turn:

- two command pulleys;
- a control pulley;
- a spring.

[0013] The two command pulleys are positioned at the same height, while the control pulley is positioned below the other two, so as to form a triangle. The frame which contains in its interior the control mechanism is, moreover, provided with at least one vertical guide or groove. The pin of the control pulley, and therefore the pulley itself, can translate vertically in said at least one groove. The frame can also be provided with a further two horizontal guides or grooves, inside whereof the pins of the command pulleys can translate.

[0014] The control pulley is connected to a braking system made up of a spring, a screw and a bolt. The braking system is made up of a spring, screw and bolt, which generates a force directed downwards, said force being applied to the control pulley. Therefore a potential load hanging from the first end of the rope pulls the control pulley upwards while the force exerted by the braking system tends to pull this pulley downwards. The braking effect on the descent of the load, i.e. on the descent of the climber who is hanging from the first end of the rope, depends on the resultant of the weight force exerted by the load and of the force exerted by the braking system. In order to guarantee a safe descent of the climber the application of any force to the second end of the rope is not therefore necessary, so that there is no need for a person who controls this first end.

[0015] These and further aspects will be made clearer by the following detailed description of a preferred embodiment of the invention, to be read by way of a non-limiting example of the more general concepts claimed.

[0016] The description refers to the accompanying drawings, in which:

- Figure 1 shows a front view of the safety device according to the present invention;
- Figure 2 shows a side view of the safety device according to the present invention;
- Figure 3 shows a front view of a detail of the device according to the present invention, said detail being made up of said device without one of the two faces of the frame;
- Figure 4 shows a front view of a detail of the device according to the present invention, said detail being made up of said device without one of the two faces of the frame, wherein the grooves wherein the pins of the pulleys can be translated are shown with a dotted line;
- Figure 5 shows a front view of a detail of the device according to the present invention, said detail being made up of said device without one of the two faces of the frame and of the three pulleys;
- Figure 6 shows a front view of an assembly comprising: a detail of the device according to the present invention, said detail being made up of said device without one of the two faces of the frame, a rope for climbing mounted on said device and a load hanging from the second end of said rope.

[0017] Referring to Figures 1, 2, 3, 4 and 5 the safety device (1) for the control of the descent during the activities of climbing comprises:

- a casing or frame (2),
- a mechanism of control (3, 3', 4, 5, 6, 7) of the descent of the rope (12).

[0018] Said control mechanism (3, 3', 4, 5, 6, 7) comprises:

- a first pulley (3);
- a second pulley (3');
- a third pulley (4), the pin (14) of said third pulley (4) being misaligned with the pin (16) of said first pulley (3) and with the pin (16') of said second pulley (3');
- a braking system (5, 6, 7),
- a hook (17) for attachment to a wall.

[0019] Said braking system (5, 6, 7) is connected to the pin (14) of the third pulley (4) and comprises in turn a spring (5), a bolt (6) and a screw (7).

[0020] The first pulley (3) and the second pulley (3') are to be denoted henceforth, respectively, by the expressions "first command pulley (3)" and "second command pulley (3')" and the third pulley (4) to be denoted, henceforth, also by the expression "control pulley (4)".

[0021] The two command pulleys (3, 3') are positioned at the same height, while the control pulley (4) is positioned below said command pulleys (3, 3') so as to form a triangle at whose vertices said pulleys (3, 3', 4) are positioned. Said triangle is preferably isosceles. The braking system (5, 6, 7) is placed below the control pulley (4).

[0022] Said casing or frame (2) comprises:

- a front face (9);
- a rear face (9');
- an upper support element (10) of said spring (5);
- a lower support element (10') of said spring (5);
- a front connection element (11) which connects said upper support element (10) and said lower support element (10') with said front face (9); and
- a rear connection element (11') which connects said upper support element (10) and said lower support element (10') with said rear face (9').

[0023] Both faces (9, 9') of the frame (2) are provided

with a vertical groove (13) inside of which the pin (14) of the control pulley (4) can translate, so that the same control pulley (4) translates. Both faces (9, 9') of the frame (2) are moreover provided with a first horizontal groove (18) and with a second horizontal groove (19), inside of which the pin (16) of the first command pulley (3) and the pin (16') of the second command pulley (3') can translate, respectively. The frame (2) comprises, moreover, a slot (17) for the attachment to the climbing wall by means of a snap hook.

[0024] Referring to Figure 6, said frame (2) comprises, moreover, two spacer elements (15, 15'), preferably cylindrical in shape, placed between said front face (9) and said rear face (9'), said spacer elements (15, 15') being positioned below said command pulleys (3, 3'). More particularly said frame (2) is to comprise a first spacer element (15) positioned below the first pulley (3) and a second spacer element (15') positioned below the second pulley (3').

[0025] The device of the present invention is, obviously, used together with a rope (12) which passes inside the frame (2) so as to cover at least partially the perimeters of said pulleys. More particularly, considering the direction of the distance which goes from the first end of the rope (12) to the second end of the rope (12), said rope (12) passes, in succession:

- above said first pulley (3), so as to surround completely its upper semi-perimeter and partially the lower semi-perimeter.
- below said third pulley (4), so as to surround completely its lower semi-perimeter and partially the upper semi-perimeter;
- above said second pulley (3), so as to surround completely its upper semi-perimeter and partially the lower semi-perimeter.

[0026] The rope (12), before passing above the first pulley (3), will pass to the right of the first spacer element (15) and, after having been passed below said third pulley (4) and, then, above said second pulley (3') will pass to the left of the second spacer element (15'). Said spacer elements (15, 15') have, therefore, also a function of containment of the rope (12) inside the frame (2).

[0027] The functioning of the control mechanism (3, 3', 4, 5, 6, 7) of the rope (12) is the following: supposing that the frictions are overlooked, three forces act in vertical direction on the control pulley (4), a first force F_A directed upwards, a second force F_{A1} directed upwards and a third force F_E directed downwards. The first force and the second force F_A and F_{A1} are both of the same intensity and are exerted by the rope (12), while the third force F_E is the force of return of the spring (5).

[0028] The first force and the second force F_A and F_{A1} depend in turn on the weight force Fw exerted by the load W, i.e. by the climber, hanging from the second end of the rope (12). The force F_E exerted by the spring (5) tends to drag downwards the control pulley (4), while the weight force F_w tends to drag the control pulley (4) upwards.

[0029] The translation of the pin (14) of the control pulley (4) in the vertical groove (13) and therefore the braking effect exerted by the device (1) on the descent of the climber hanging at the second end of the rope (12) depends on the resultant between the two forces F_A and F_{A1} exerted by the rope (12) on the control pulley (4) and the force F_E exerted by the spring (5).

[0030] It is important to underline that the device (1) described above is completely symmetrical from both the structural and the functional viewpoint. In fact the functioning of the device (1) is the same whether the climber uses the first end of the rope or the second one. Independently of which end of the rope wherefrom the climber is hanging there will not be a need for any person who controls the other end so that the descent of the climber takes place safely.

[0031] The invention described above achieves the objects set, overcoming the disadvantages defined in the prior art.

[0032] Thanks, in fact, to the particular control mechanism and braking system described above, it is not necessary to apply any force to the first end of the rope, i.e. there is no longer the need for a person who controls this first end. The control mechanism and the braking system described above are, moreover, made up of a few components, giving rise, in this way, to a device of high structural simplicity.

Claims

1. Safety device (1) for the control of the descent, preferably during the activities of climbing, comprising:

   - a frame (2) provided with at least one vertical groove (13);
   - a first pulley (3);
   - a second pulley (3');
   - a third pulley (4), the pin (14) of said third pulley (4) being misaligned with the pin (16) of said first pulley (3) and with the pin (16') of said second pulley (3');
   - a spring (5) connected to said third pulley (4);

   characterised in that said pulley (4) is mobile, the pin (14) of said third pulley (4) being positioned inside said at least one groove (13) and the pin (14) of said third pulley (4) being translatable inside said at least one groove (13) under the action of the force exerted by said spring (5) and of the weight force exerted by a user of said device.

2. Device (1) according to the preceding claim, wherein the frame (2) is provided with a first horizontal groove (18) and with a second horizontal groove (19).

3. Device (1) according to the preceding claim, wherein

the pin (16) of the first pulley (3) is translatable inside said first horizontal groove (18) and the pin (16') of the second pulley (3') is translatable inside said second horizontal groove (19).

4. Device (1) according to any one of the preceding claims, wherein the third pulley (4) is placed at a lower height with respect to the height at which said first pulley (3) is placed and to the height at which said second pulley (3') is placed.

5. Device (1) according to the preceding claim, wherein the first pulley (3), the second pulley (3') and the third pulley (4) are placed in such a way as to form a triangle, the pin (16) of the first pulley (3) and the pin (16') of the second pulley (3') being aligned.

6. Device (1) according to the preceding claim, wherein the first pulley (3), the second pulley (3') and the third pulley (4) are placed in such a way as to form an isosceles triangle.

7. Device (1) according to any one of the preceding claims, wherein said frame (2) comprises a front face (9), a rear face (9'), a lower support element (10) of said spring (5) and an upper support element (10') of said spring (5).

8. Device (1) according to the preceding claim, wherein said frame (2) comprises a front connection element (11) which connects said upper support element (10) and said lower support element (10') with said front face (9) and a rear connection element (11') which connects said upper support element (10) and said lower support element (10') with said rear face (9').

9. Device (1) according to any one of the preceding claims, wherein said frame (2) comprises a first spacer element (15) and a second spacer element (15'), placed between said front face (9) and said rear face (9').

10. Device (1) according to any one of the preceding claims, wherein said first spacer element (15) is positioned at a height lower than that of said first pulley (3) and said second spacer element (15') at a height lower than that of said second pulley (3').

11. Device (1) according to any one of the preceding claims, **characterised in that** it is axially symmetrical.

12. Device (1) according to any one of the preceding claims, wherein said frame (2) comprises a slot (17) for the attachment to a wall by means of a snap hook.

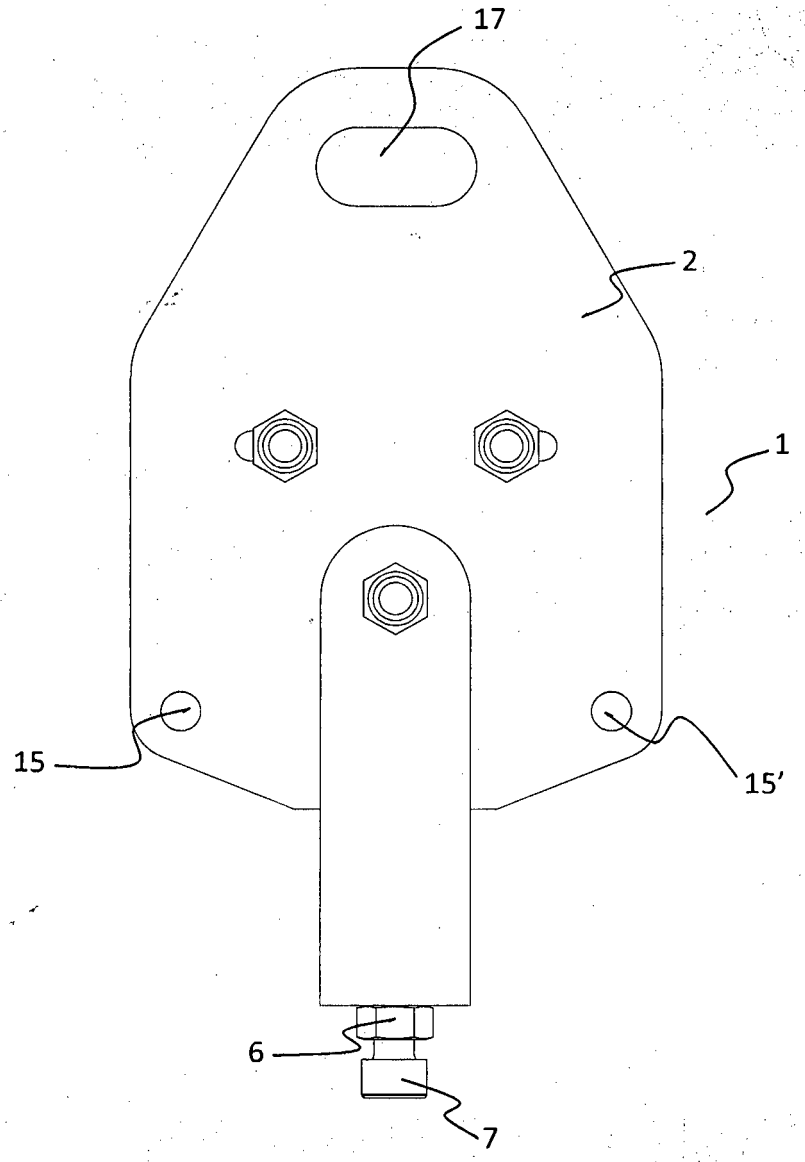

Fig.1

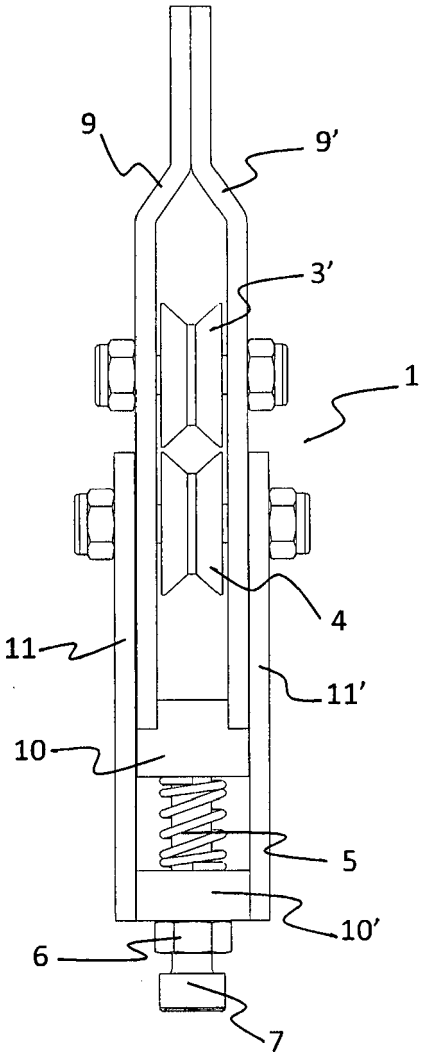

Fig.2

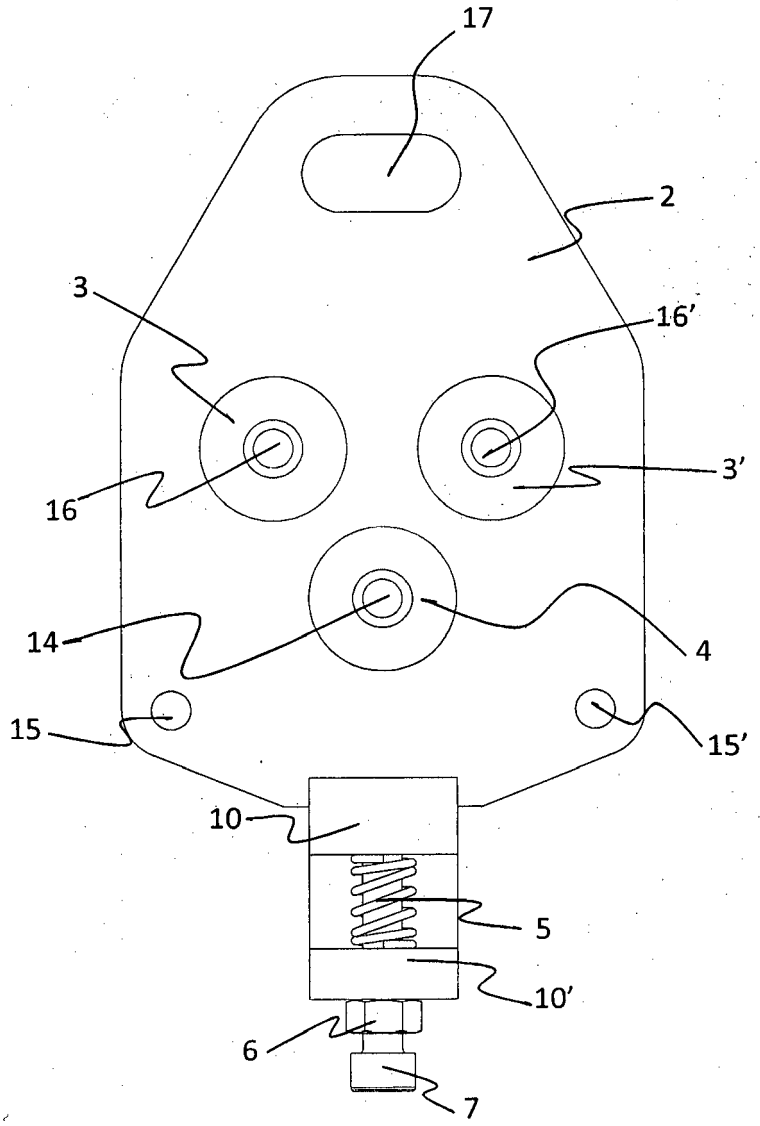

Fig.3

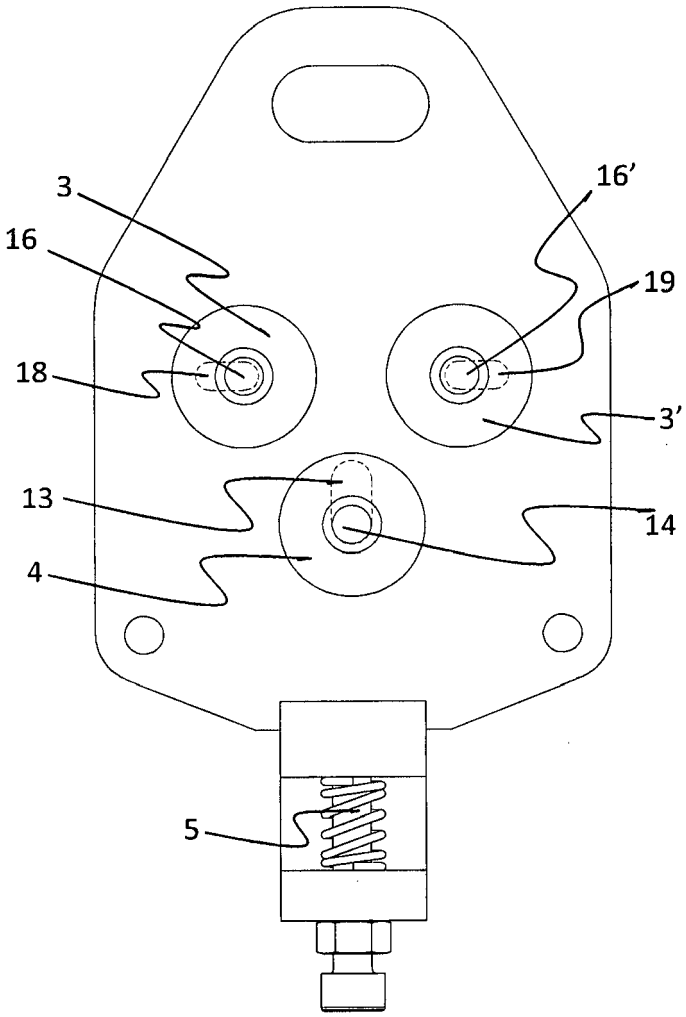

Fig.4

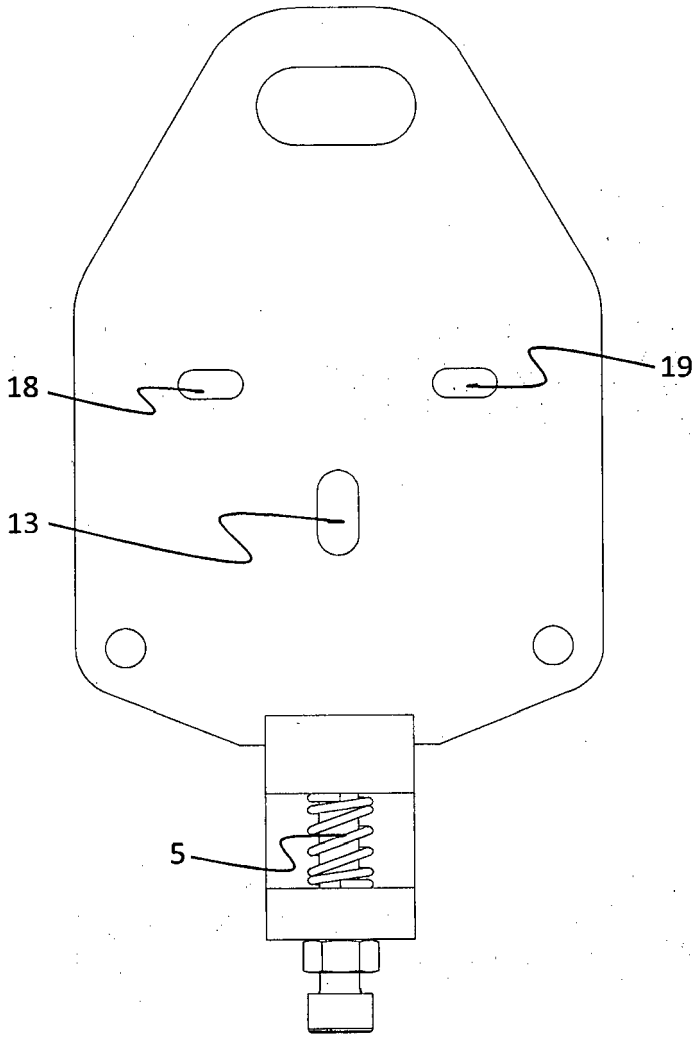

Fig.5

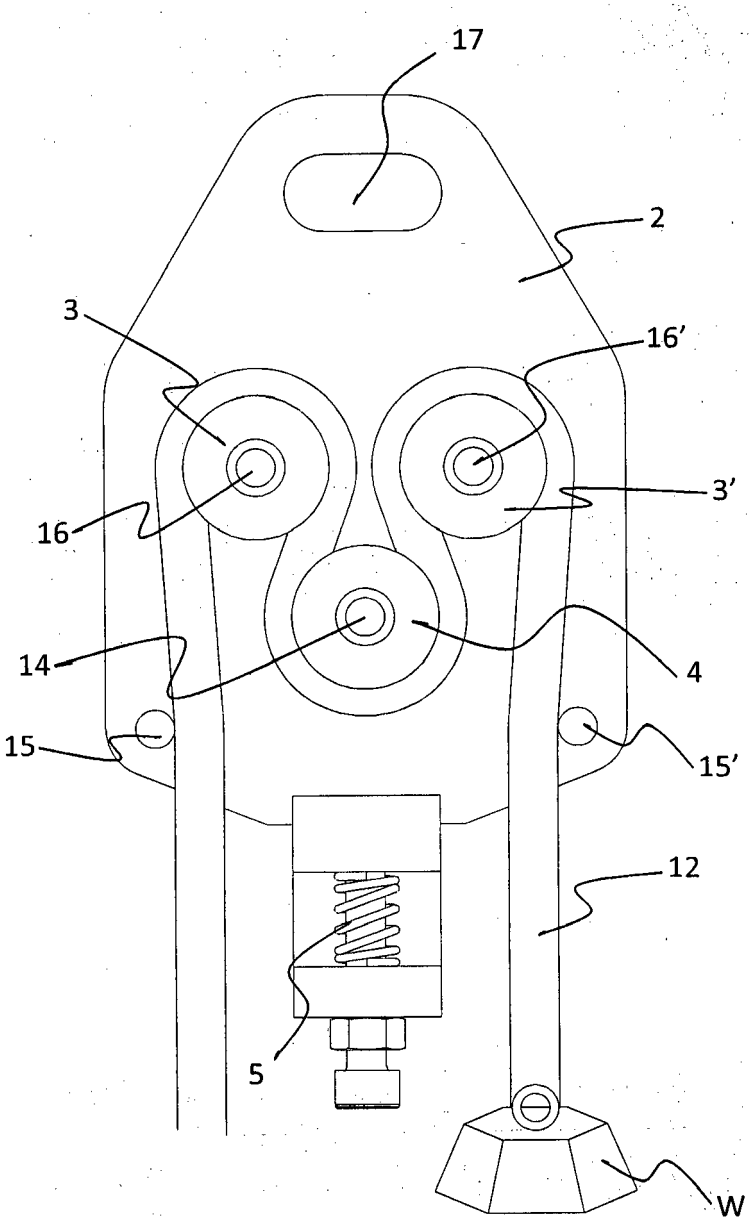

Fig.6

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EUROPEAN SEARCH REPORT

Application Number
EP 16 42 5065

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A	US 2014/299411 A1 (ALDRED JEFFREY KENT [US] ET AL) 9 October 2014 (2014-10-09) * paragraph [0005] - paragraph [0011]; figures *	1-12	

TECHNICAL FIELDS SEARCHED (IPC)

A62B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	24 November 2016	Vervenne, Koen

CATEGORY OF CITED DOCUMENTS

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24-11-2016

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- FR 2951952 A1 **[0007]**