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Remarks:
Amended claims in accordance with Rule 137(2) EPC.

(54) **Door arrester for sliding doors**

(57) The present invention relates to a door arrester for sliding doors of motor vehicles, said sliding door being movable between a closed position and an open position, the door arrester comprising: a latching member (2) being resiliently mounted on a vehicle body and acting transversely to a direction of travel of the sliding door; and a latching lever (12) being rotatably connected to the sliding door and latching with said latching member (2) in said open position of the sliding door, the rotational movement of said latching lever (12) being limited by a limit stop (7); wherein a braking device (11, 17, 18) is provided which is configured to slow down said rotational movement of said latching lever (12) in a predetermined angular range about said limit stop (7).

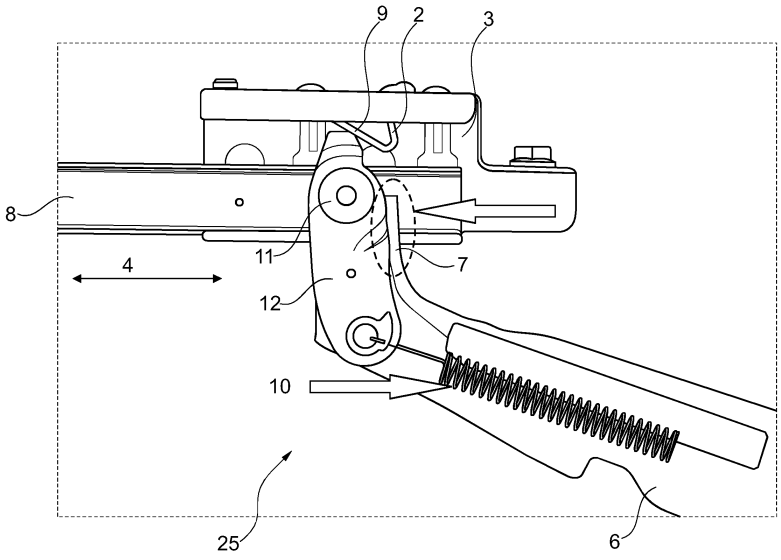

Fig. 8

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Description

[0001] The present invention generally relates to a door arrester for sliding doors being movable between a closed position and an open position and particularly to a door arrester for sliding doors of motor vehicles according to the preamble of claim 1.

[0002] During a passenger's ingress and egress of a motor vehicle having a sliding door a door stopper system should keep the sliding door in the open position with defined entry and withdrawal forces. Such a system is able to prevent a potential passenger injury that may occur if the vehicle is standing in an unfavorable way, e. g. in an inclined way such as on a ramp and the like, due to the sliding door rolling back into the closed position and hitting the passenger.

[0003] Generally, there exist two different types of door arresters: active door arresters and passive door arresters. The active door arresters include a release mechanism that is actuated from a door handle by the passenger. However, passive door arresters are operated with the opening and closing forces being applied by the passenger on the door handle.

[0004] A passive door arrester known from the prior art is described below with reference to FIGs. 1 to 4. The door arrester 1 comprises a latching member 2 being resiliently mounted on a vehicle body (not shown) by means of a mounting bracket 3 and acting transversely to a direction of travel 4 of the sliding door (not shown). Furthermore, the door arrester 1 comprises a latching lever 5 being rotatably connected to the sliding door via a holding arm 6. The rotational movement of the latching lever 5 is limited by a limit stop 7. Moreover, the latching lever 5 is guided in a guide rail 8 to allow the movement of the sliding door in the direction of travel 4. Further, in the door arrester 1 depicted in FIGs. 1 to 4 the latching member 2 acts against the spring force of a first spring element 9 which is shown in the form of a leaf spring acting transversely to the direction of travel 4 of the sliding door. Additionally, the rotatable latching lever 5 acts against the spring force of a second spring element 10 which is shown in the form of a spiral spring. The two different spring elements 9 and 10 are used to control the opening and closing forces of the sliding door separately as will be explained in further detail as follows.

[0005] In general, during the opening of the sliding door which corresponds to the direction of travel 4 towards the right hand side in FIGs. 1 to 4 the leaf spring 9 will be active, i. e. generate a spring force against the opening movement of the sliding door, whereas during the closing of the sliding door which corresponds to the direction of travel 4 towards the left hand side in FIGs. 1 to 4 the spiral spring 10 will be active and generate a spring force against the closing movement of the sliding door.

[0006] Preferably, in the door arrester 1 shown in FIGs. 1 to 4, the spring force generated by the second spring element 10 is substantially higher than the spring force generated by the first spring element 9. Thus, the force to be applied for closing the sliding door has to be substantially higher than the force to be applied for opening the sliding door.

[0007] As can be observed in FIG. 2, while the sliding door is opened (direction of travel 4 towards the right hand side in FIG. 2), the latching lever 5 pushes the leaf spring 9 backward in a direction transverse to the direction of travel 4 of the sliding door. During the opening movement of the sliding door the latching lever 5 keeps resting against the limit stop 7. Thus, only the leaf spring 9 generates a spring force against the opening movement of the sliding door. As is shown in FIG. 3, after passing the leaf spring 9, it snaps back and the latching member 2 latches with the latching lever 5 in the open position of the sliding door, thus holding the sliding door in the open position until the passenger begins to apply a force in the closing direction of the sliding door (direction of travel 4 towards the left hand side in FIG. 4) which is shown in FIG. 4. In FIG. 4, the latching lever 5 starts to rotate clockwise so that the spiral spring 10 stretches and generates a spring force against the opening movement of the sliding door. After passing the latching member 2 the latching lever 5 returns to its original position which is the position where the latching lever 5 abuts the limit stop 7.

[0008] According to the potential energy stored in the spiral spring 10 in its most elongated position the return movement of the spiral spring 10 occurs at a rather high velocity.

[0009] Thus, in the original position of the latching lever 5 it clashes with the limit stop 7 which may cause an undesirable noise, deformation of the clashing parts and/or raise a durability issue of the spiral spring 10 or the parts linked to it.

[0010] Against this background, an object of the present invention is to provide an improved door arrester for sliding doors which avoids the aforementioned drawbacks. Furthermore, the door arrester shall be as compact as possible to be able to comply with tight packaging constraints.

[0011] This object is achieved by a door arrester having the features of claim 1. Further, particularly advantageous embodiments of the invention are disclosed in the dependent claims.

[0012] It should be noted that the individual features listed in the description below can be combined in any technically meaningful way with each other and show further embodiments of the invention. The description of the invention is additionally characterized and specified particularly in connection with the figures.

[0013] According to the present invention a door arrester for sliding doors of motor vehicles, wherein the sliding door is movable between a closed position and an open position, comprises a latching member which is resiliently mounted on a vehicle body and acts transversely to a direction of travel of the sliding door and a latching lever which is rotatably connected to the sliding door and latches with the latching member in the open

position of the sliding door, wherein the rotational movement of the latching lever is limited by a limit stop. The door arrester according to the present invention further comprises a braking device which is configured to slow down the rotational movement of the latching lever in a predetermined angular range about the limit stop. As the braking device is able to slow down the velocity with which the latching lever clashes against the limit stop during the closing movement of the sliding door a noticeable noise can be prevented effectively. Furthermore, no deformations of the clashing parts of the door arrester according to the present invention are observed after many opening and closing operations of the sliding door, thus making the door arrester according to the present invention especially durable.

[0014] According to an advantageous embodiment of the present invention the braking device includes a rotationally fixed bushing rotatably supporting the latching lever thereon. Furthermore, the bushing has an outer sliding surface which frictionally interacts with an inner sliding surface of an opening of the latching lever. The sliding surfaces are configured such that an effective friction force between the sliding surfaces is dependent on a relative angle between the bushing and the latching lever. This configuration facilitates a very compact door arrester whose external dimensions substantially do not differ from the external dimensions of the door arrester described in the preliminaries of this specification with regard to FIGs. 1 to 4, yet providing an effective braking device whose friction force is dependent on the relative angle between the bushing and the latching lever.

[0015] According to yet another advantageous embodiment of the present invention the outer sliding surface of the bushing is barrel-shaped having two opposing arcuate surface sections and two opposing straight surface sections being respectively connected to said arcuate surface sections.

[0016] According to still another advantageous embodiment of the present invention the inner sliding surface of the opening of the latching lever is formed by at least two sliding tongues resiliently protruding radially inward at an acute angle from an inner periphery of the opening. Operatively, the sliding tongues rest against the outer sliding surface of the bushing.

[0017] According to yet another preferred embodiment of the present invention an elastic member, e. g. a rubber element, is inserted in the space between the inner periphery of the opening of the latching lever and a backside of the sliding tongue facing the inner periphery of the opening. Thus, the elastic member biases the sliding tongue against the outer sliding surface of the bushing creating a stronger friction force between the sliding tongue and the outer sliding surface of the bushing.

[0018] According to another preferred embodiment of the present invention the latching lever comprises a first part providing the sliding tongues in the opening and a second overmould part fitting the first part and providing the elastic member. Especially, this configuration allows a compact design of the door arrester.

[0019] According to yet another preferred embodiment of the present invention the first part is made of a plastic material and the second part is made of a rubber material.

[0020] According to still another preferred embodiment of the present invention the latching member acts against the spring force of a first spring element such as a leaf spring or a spiral spring. Thus, the maximum opening force to be applied by the passenger to fully open the sliding door is controlled by the first spring element.

[0021] According to yet another advantageous embodiment of the present invention the rotatable latching lever acts against the spring force of a second spring element. As the rotational movement of the latching lever may be reduced just in a predetermined angular range about the limit stop the maximum closing force that is to be applied to the latching lever to pass the latching member in the closing direction of the sliding door can be controlled advantageously by the second spring element. In this case, the braking device should be configured such that it is not generating a braking force in the maximum rotational displacement of the latching lever. Preferably, the spring force of the second spring element is substantially greater than the spring force of the first spring element.

[0022] As mentioned above

FIG. 1 shows an embodiment of a door arrester according to the prior art in a first operating state;

FIG. 2 shows the door arrester of FIG. 1 in a second operating state;

FIG. 3 shows the door arrester of FIG. 1 in a third operating state;

FIG. 4 shows the door arrester of FIG. 1 in a fourth operating state.

[0023] Further features and advantages of the present invention will become apparent from the following description of a non-limiting embodiment of the invention which will be explained below with reference to the drawing. In this drawing:

FIG. 5 shows an exemplary embodiment of a bushing according to the present invention;

FIG. 6 shows a first part of an exemplary embodiment of a latching lever according to the present invention;

FIG. 7 shows a second part of an exemplary embodiment of a latching lever according to the present invention;

FIG. 8 shows an exemplary embodiment of a door arrester according to the present invention in a first operating state;

FIG. 9 shows an assembly of the bushing of FIG. 5 and the first part of the latching lever of FIG. 6 in the first operating state shown in FIG. 8;

FIG. 10 shows an assembly of the bushing of FIG. 5, the first part of the latching lever of FIG. 6, and the second part of the latching lever of FIG. 7 in the first operating state shown in FIG. 8;

FIG. 11 shows the exemplary embodiment of the door arrester of FIG. 8 in a second operating state; and

FIG. 12 shows the assembly of the bushing of FIG. 5, the first part of the latching lever of FIG. 6, and the second part of the latching lever of FIG. 7 in the second operating state shown in FIG. 11;

[0024] In the different figures same parts are always provided with the same reference numerals so that they are generally described only once.

[0025] FIGs. 1 to 4 which show an embodiment of a door arrester according to the prior art in four different operating states have been described already in the preliminaries of this specification. For the sake of conciseness, the description of FIG. 1 to 4 will not be repeated at this point of the specification.

[0026] FIG. 5 shows an exemplary embodiment of a bushing 11 according to the present invention. Operatively, the bushing 11, which is rotationally fixed, rotatably supports the latching lever 12 shown in FIGs. 6 and 7. For this, as depicted in FIG. 5, the bushing 11 has an outer sliding surface 13 on which the latching lever 12 is rotatably supportable. Further, the sliding surface 13 of the bushing 11 shown in FIG. 5 is barrel-shaped having two opposing arcuate surface sections 14 and two opposing straight surface sections 15 that are respectively connected to said arcuate surface sections 14. The bushing 11 further comprises a bushing cover 16 radially extending away from the outer sliding surface 13 at one axial end of the bushing 11.

[0027] As is depicted in FIGs. 6 and 7, the exemplary embodiment of the latching lever 12 according to the present invention comprises a first part 17 (FIG. 6) and a second part 18 (FIG. 7). Preferably, the first part 17 is made of a plastic material and the second part 18 is an overmould part fitting the first part 17. Therefore, both parts 17 and 18 comprise two openings 19 and 20, respectively. The opening 19 serves for rotatably supporting the latching lever 12 on the outer sliding surface 13 of the bushing 11 shown in FIG. 5. The opening 20 serves for engaging one end of the spiral spring 10.

[0028] In the latching lever 12 shown in FIG. 6, the opening 19 provides an inner sliding surface which is formed by two sliding tongues 21 resiliently protruding radially inward at an acute angle (angle < 90 degrees) from an inner periphery 22 of the opening 19. Operatively, the sliding tongues 21 rest against the outer sliding surface 13 of the bushing 11. Thus, the outer sliding surface 13 of the bushing 11 can frictionally interact with the inner sliding surface provided by the sliding tongues 21 in the opening 19 of the latching lever 12.

[0029] Preferably, the overmould part 18 shown in FIG. 7 is made of an elastic material, e. g. a rubber material. In the opening 19 of the overmould part 18 there are provided two elastic members 23 protruding radially inward into the opening 19 from the inner periphery 22 of the opening 19. The elastic members 23 are formed such that they fit into a space 24 (FIG. 6) between the inner periphery 22 of the opening 19 of the first part 17 and a backside of the sliding tongue 21 facing the inner periphery 22 of the opening 19.

[0030] FIG. 8 shows an exemplary embodiment of a door arrester 25 according to the present invention in a first operating state. The door arrester 25 differs from the door arrester 1 shown in FIGs. 1 to 4 substantially in the latching lever 12 and the bushing 11. The operating state depicted in FIG. 8 is when the sliding door (not shown) is moved in the opening direction (towards the right hand side in FIG. 8). As can be observed in FIG. 8, the latching lever 12 is pushing the leaf spring 9 backwards to pass the latching member 2 in the opening direction. Further, the latching lever 12 rests against the limit stop 7 which herein is referred to as the original position of the latching lever 12. The spiral spring 10 is slightly pretensioned in this state.

[0031] FIG. 9 shows an assembly of the bushing 11 of FIG. 5 and the first part 17 of the latching lever 12 of FIG. 6 in the first operating state shown in FIG. 8, i. e. the original position of the latching lever 12. FIG. 10 shows an assembly of the bushing 11 of FIG. 5, the first part 17 of the latching lever 12 of FIG. 6, and the second part 18 of the latching lever 12 of FIG. 7 in the first operating state shown in FIG. 8, i. e. the original position of the latching lever 12. In FIG. 9 it can be seen that the sliding tongues 21 are touching the barrel-shaped outer sliding surface 13 of the bushing 11. Particularly, each sliding tongue 21 is resting against an arcuate surface section 14 in the original position of the latching lever 12 shown in FIGs. 9 and 10. In other words, the arcuate surface section 14 of the barrel-shaped outer sliding surface 13 of the bushing 11 pushes the sliding tongues 21 radially outward towards the inner periphery 22 of the opening 19. However, in the fully assembled state of the latching lever 12 including the first part 17, the second part 18, and the bushing 11 as shown in FIG. 10 the elastic members 23 are interposed between the backside of the sliding tongues 21 and the inner periphery 22 of the opening 19. That is to say, due to the radial force applied on the sliding tongues 21 by the bushing 11 the sliding tongues 21 are squeezing the elastic members 23 formed by the second part or overmould part 18. In other words, the elastic members 23 are resiliently pushing the sliding tongues 21 of the first part 17 against the outer sliding

surface 13 of the bushing 11, thus creating a frictional force between the sliding surface of the sliding tongues 21 and the outer sliding surface 13 of the bushing 11.

[0032] The first part 17 and the second part 18 of the latching lever 12, and the bushing 11 on which the latching lever 12 is rotatably supported form the braking device of the exemplary embodiment of the door arrester 25 according to the invention. According to the above-described configuration of the sliding surface 13 of the bushing 11 and the sliding surface formed by the sliding tongues 21 an effective friction force between said sliding surfaces can be generated which is dependent on the relative angle between the bushing 11 and the latching lever 12.

[0033] FIG. 11 shows the exemplary embodiment of the door arrester 25 of FIG. 8 in a second operating state, i. e. a displaced position of the latching lever 12. The operating state depicted in FIG. 11 is when the sliding door (not shown) is moved in the closing direction (towards the left hand side in FIG. 11). As is shown in FIG. 11, the latching member 2 pushes against the latching lever 12 such that it begins to rotate clockwise around the bushing 11 to be able to pass the latching member 2 in the closing direction. The rotational movement of the latching lever 12 stretches the spiral spring 10 so that it applies an increasing spring force on the latching lever 12. In the operating state shown in FIG. 11, the maximum rotational displacement of the latching lever 12 is reached, i. e. the spiral spring 10 is fully elongated.

[0034] This situation is further depicted in FIG. 12 which shows the assembly of the bushing of FIG. 5, the first part of the latching lever of FIG. 6, and the second part of the latching lever of FIG. 7 in the second operating state shown in FIG. 11, i. e. the rotationally displaced position of the latching lever 12. As can be observed from FIG. 12, the sliding tongues 21 are now resting against the straight surface sections 15 (FIG. 5) of the bushing 11. Thus, the sliding surface 13 (FIG. 5) of the bushing 11 is not pushing the sliding tongues 21 radially outward against the elastic members 23 of the overmould part 18. Consequently, no friction force is generated between the sliding surface of the sliding tongues 21 and the sliding surface 13 of the bushing 11. This means that in this operating state of the door arrester 25 only the spring force of the spiral spring 10 is acting on the latching lever 12. Thus, to close the sliding door from its open position only the spring force of the spiral spring 10 has to be overcome. In other words, the closing effort for closing the sliding door will be controlled just by the spiral spring 10.

[0035] After the latching lever 12 passes the latching member 2 during the closing movement of the sliding door the latching lever 12 will rotate back counter-clockwise to its original position abutting the limit stop 7. During the counter-clockwise rotation of the latching lever 12 at a predetermined relative angle between the bushing 11 and the latching lever 12 the arcuate surface sections 14 (FIG. 5) will begin to push against the sliding tongues 21 and squeeze the elastic members 23, thus creating a certain friction force between the sliding surface of each sliding tongue 21 and the sliding surface 13 of the bushing 11. This friction force will create an opposite force to the spring force of the spiral spring 10 and decelerate the rotational movement of the latching lever 12. Thus, the latching lever 12 will return slowly to its original position whereby a noticeable noise and/or deformation of the clashing parts can be avoided effectively when the latching lever 12 is abruptly stopped by the limit stop 7.

[0036] The above described door arrester according to the present invention is not limited to the specific embodiments disclosed herein, but also encompasses other embodiments having the same effect. For example, instead of the barrel-shaped form of the bushing it could also have other forms such as an elliptically shaped outer sliding surface. Furthermore, more than two sliding tongues can be provided as the inner sliding surface of the latching lever. It will be apparent to a skilled person in the art that various variations and modifications of the herein disclosed embodiments are possible within the spirit and scope of the present invention.

[0037] In a preferred embodiment the door arrester according to the present invention is used to arrest a sliding door for motor vehicles in an open position.

List of reference numerals:

[0038]

1	Door arrester
2	Latching member
3	Mounting bracket
4	Direction of travel
5	Latching lever
6	Holding arm
7	Limit stop
8	Guide rail
9	First spring element
10	Second spring element
11	Bushing
12	Latching lever
13	Outer sliding surface
14	Arcuate surface section
15	Straight surface section
16	Bushing cover
17	First part of 12
18	Second part of 12
19	Opening
20	Opening
21	Sliding tongue
22	Inner periphery
23	Elastic member
24	Space between 21 and 22
25	Door arrester

Claims

1. A door arrester for sliding doors of motor vehicles, said sliding door being movable between a closed position and an open position, the door arrester comprising:

   a latching member (2) being resiliently mounted on a vehicle body and acting transversely to a direction of travel of the sliding door; and
   a latching lever (12) being rotatably connected to the sliding door and latching with said latching member (2) in said open position of the sliding door, the rotational movement of said latching lever (12) being limited by a limit stop (7);
   characterized by
   a braking device (11, 17, 18) configured to slow down said rotational movement of said latching lever (12) in a predetermined angular range about said limit stop (7).

2. The door arrester according to claim 1, wherein said braking device includes a rotationally fixed bushing (11) rotatably supporting said latching lever (12) thereon, said bushing (11) having an outer sliding surface (13) frictionally interacting with an inner sliding surface of an opening (19) of said latching lever (12), said sliding surfaces being configured such that an effective friction force between said sliding surfaces is dependent on a relative angle between said bushing (11) and said latching lever (12).

3. The door arrester according to claim 1 or 2, wherein an outer sliding surface (13) of a bushing (11) is barrel-shaped having two opposing arcuate surface sections (14) and two opposing straight surface sections (15) being respectively connected to said arcuate surface sections (14).

4. The door arrester according to claim 2 or 3, wherein said inner sliding surface of said opening (19) of said latching lever (12) is formed by at least two sliding tongues (21) resiliently protruding radially inward at an acute angle from an inner periphery (22) of said opening (19) and operatively resting against said outer sliding surface (13) of said bushing (11).

5. The door arrester according to claim 4, wherein an elastic member (23) is inserted in the space between said inner periphery (22) of said opening (19) and a backside of said sliding tongue (21) facing said inner periphery (22) of said opening (19).

6. The door arrester according to claim 5, wherein said latching lever (12) comprises a first part (17) providing said sliding tongues (21) in said opening (19) and a second overmould part (18) fitting said first part (17) and providing said elastic member (23).

7. The door arrester according to claim 6, wherein said first part (17) is made of a plastic material and said second part (18) is made of a rubber material.

8. The door arrester according to any of the preceding claims, wherein said latching member (2) acts against the spring force of a first spring element (9).

9. The door arrester according to any of the preceding claims, wherein said rotatable latching lever (12) acts against the spring force of a second spring element (10).

Amended claims in accordance with Rule 137(2) EPC.

1. A door arrester for sliding doors of motor vehicles, said sliding door being movable between a closed position and an open position, the door arrester comprising:

   a latching member (2) being resiliently mounted on a vehicle body and acting transversely to a direction of travel of the sliding door; and
   a latching lever (12) being rotatably connected to the sliding door and latching with said latching member (2) in said open position of the sliding door, the rotational movement of said latching lever (12) being limited by a limit stop (7) through abutment therewith;
   characterized by
   a braking device (11, 17, 18) configured to slow down said rotational movement of said latching lever (12) in a predetermined angular range about said limit stop (7), wherein said braking device (11, 17, 18) includes a rotationally fixed bushing (11) rotatably supporting said latching lever (12) thereon, said bushing (11) having an outer sliding surface (13) frictionally interacting with an inner sliding surface of an opening (19) of said latching lever (12), said sliding surfaces being configured such that an effective friction force between said sliding surfaces is dependent on a relative angle between said bushing (11) and said latching lever (12), wherein the outer sliding surface of the bushing (11) is elliptically shaped or barrel-shaped having two opposing arcuate surface sections (14) and two opposing straight surface sections (15) being respectively connected to said arcuate surface sections (14).

2. The door arrester according to claim 1, wherein said inner sliding surface of said opening (19) of said latching lever (12) is formed by at least two sliding tongues (21) resiliently protruding radially inward at an acute angle from an inner periphery (22) of said

opening (19) and operatively resting against said outer sliding surface (13) of said bushing (11).

3. The door arrester according to claim 2, wherein an elastic member (23) is inserted in the space between said inner periphery (22) of said opening (19) and a backside of said sliding tongue (21) facing said inner periphery (22) of said opening (19).

4. The door arrester according to claim 3, wherein said latching lever (12) comprises a first part (17) providing said sliding tongues (21) in said opening (19) and a second overmould part (18) fitting said first part (17) and providing said elastic member (23).

5. The door arrester according to claim 4, wherein said first part (17) is made of a plastic material and said second part (18) is made of a rubber material.

6. The door arrester according to any of the preceding claims, wherein said latching member (2) acts against the spring force of a first spring element (9).

7. The door arrester according to any of the preceding claims, wherein said rotatable latching lever (12) acts against the spring force of a second spring element (10).

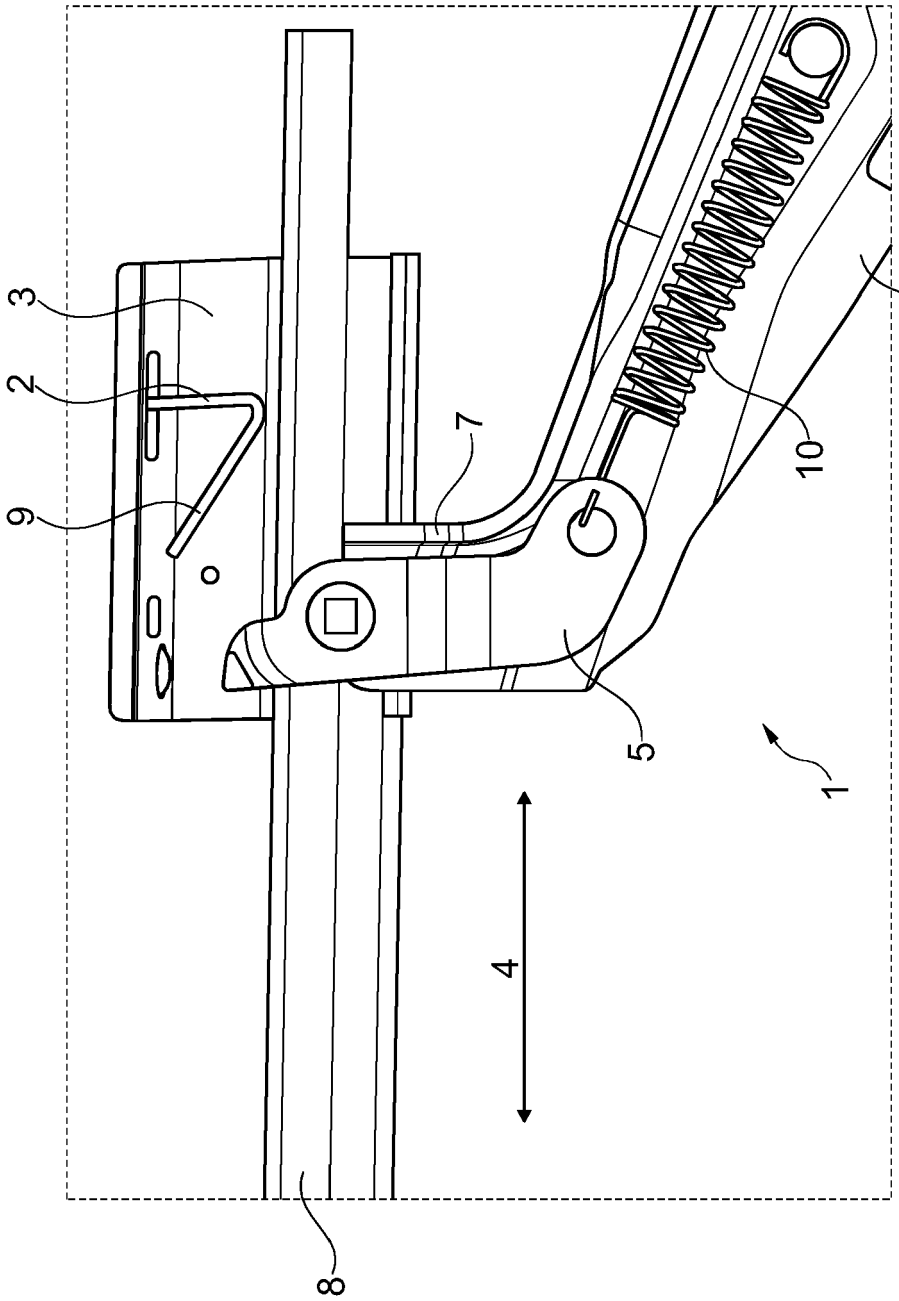

Fig. 1
PRIOR ART

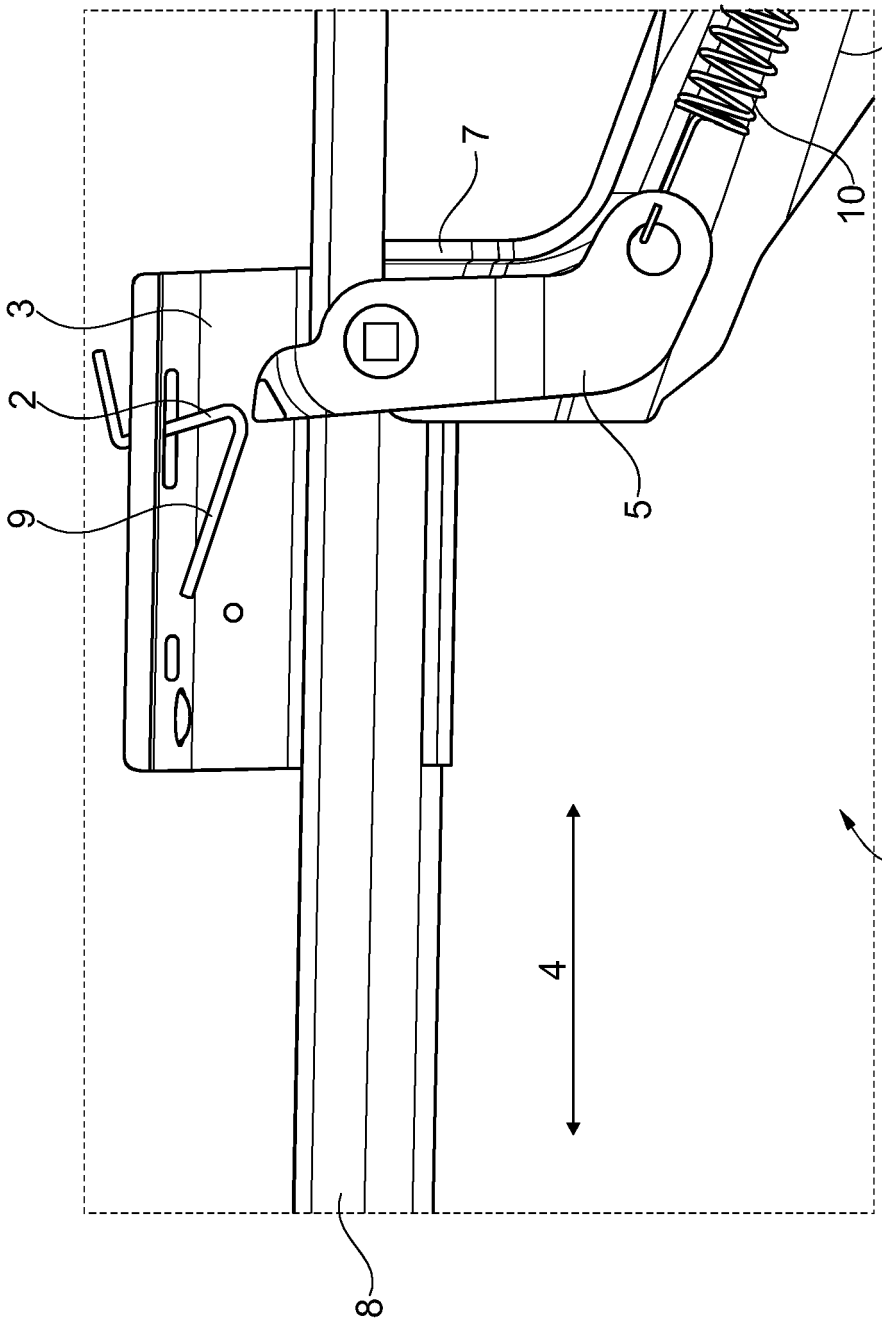

Fig. 2
PRIOR ART

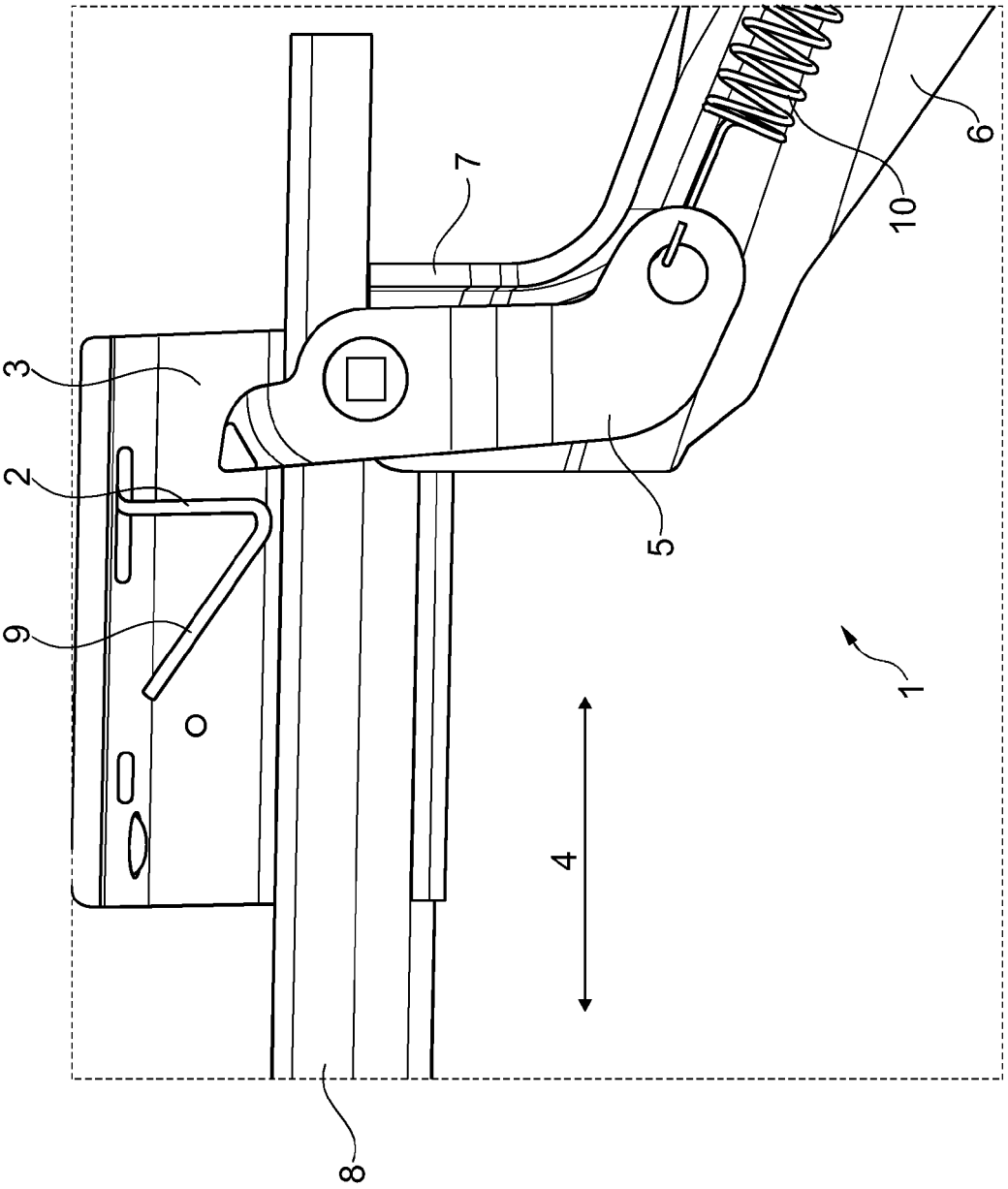

Fig. 3
PRIOR ART

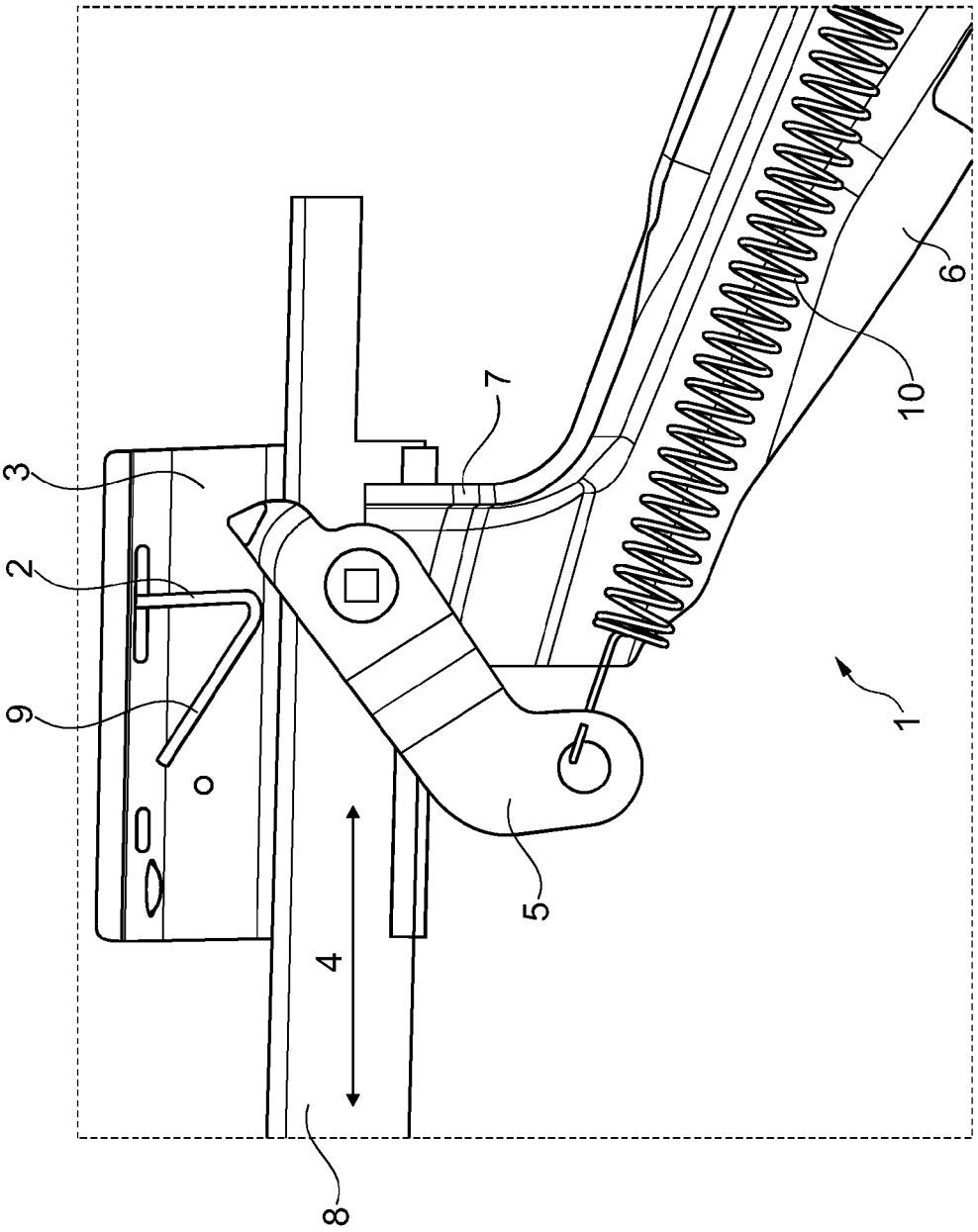

Fig. 4
PRIOR ART

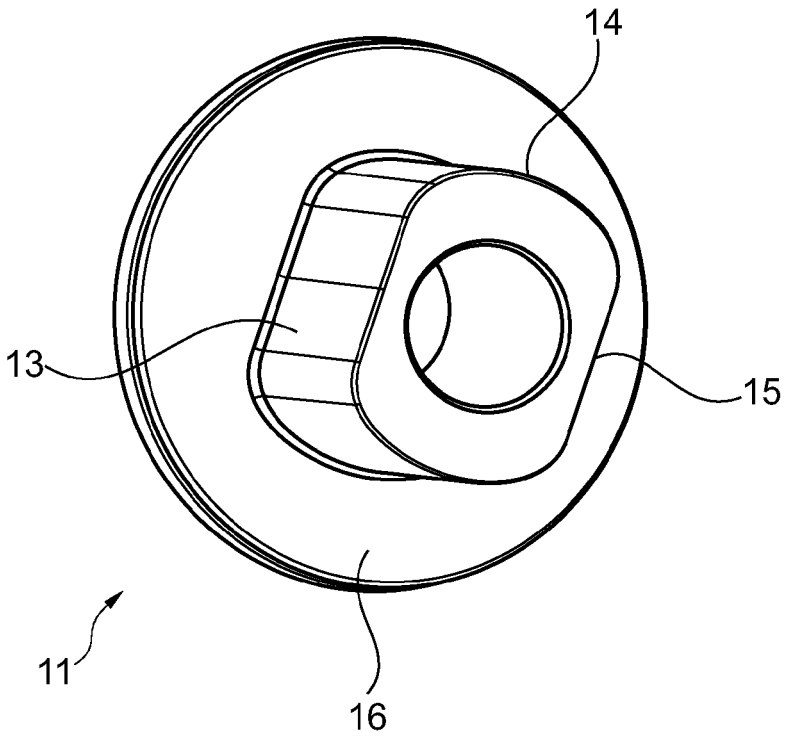

Fig. 5

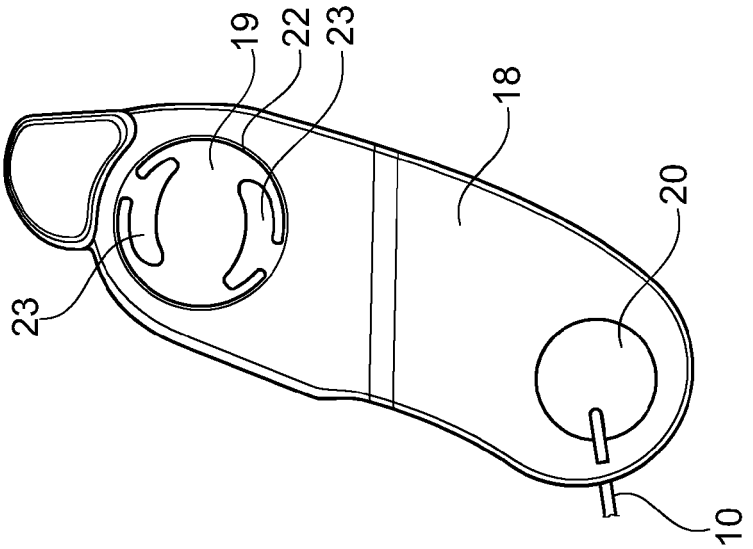

Fig. 7

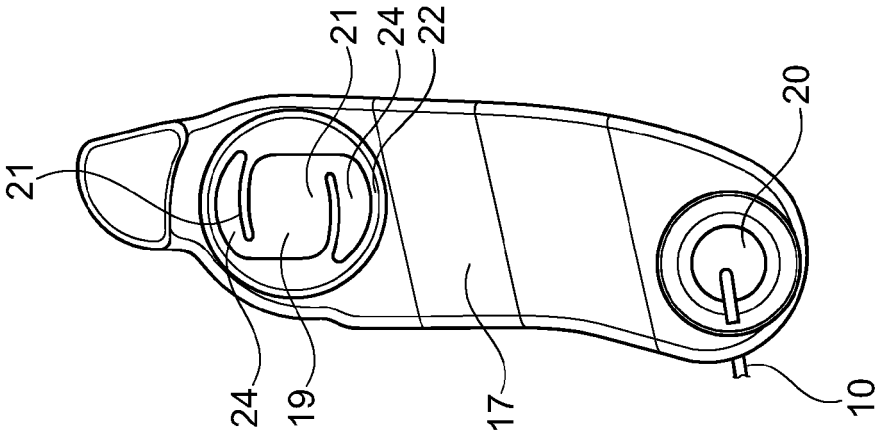

Fig. 6

12

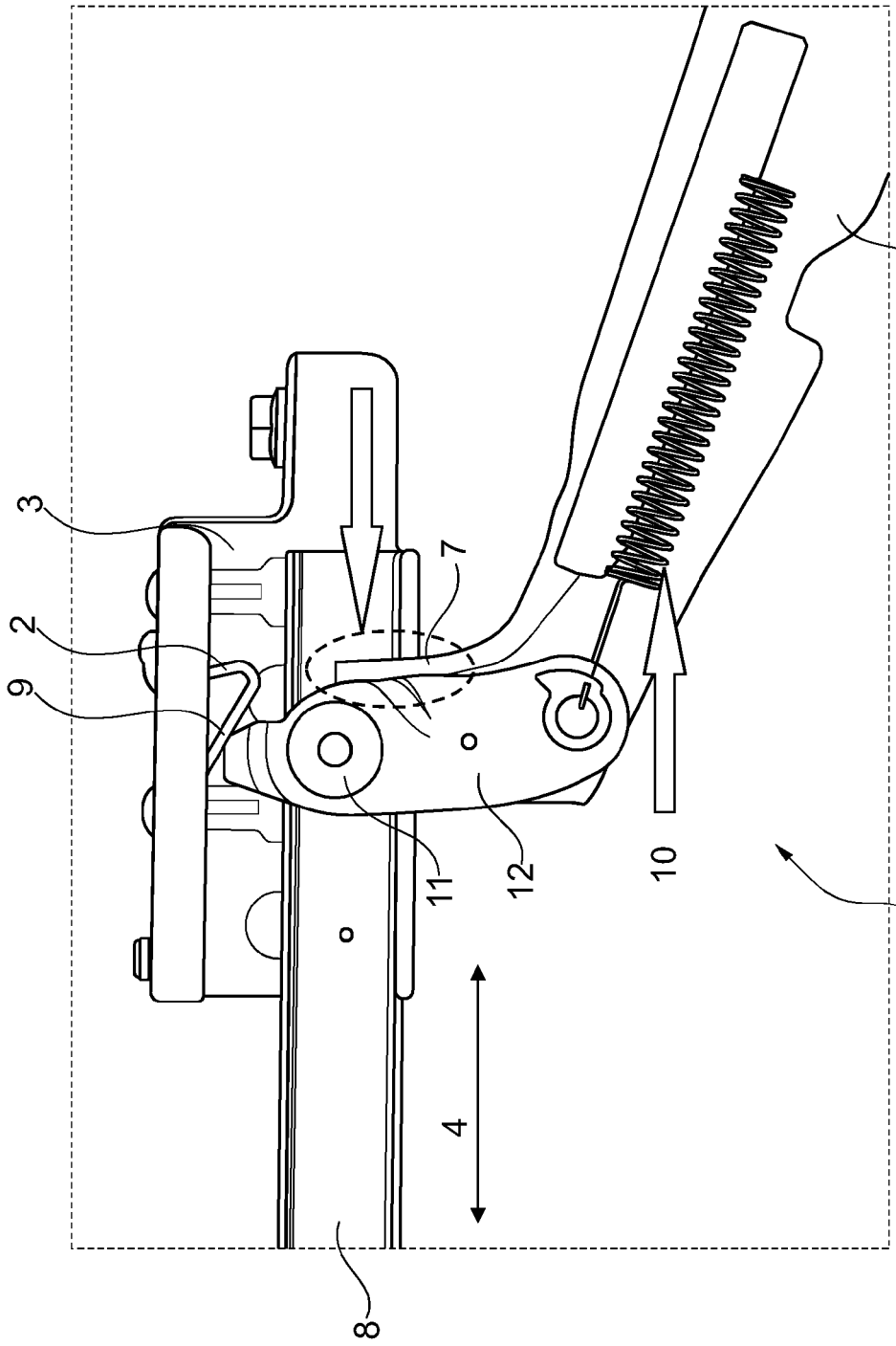

Fig. 8

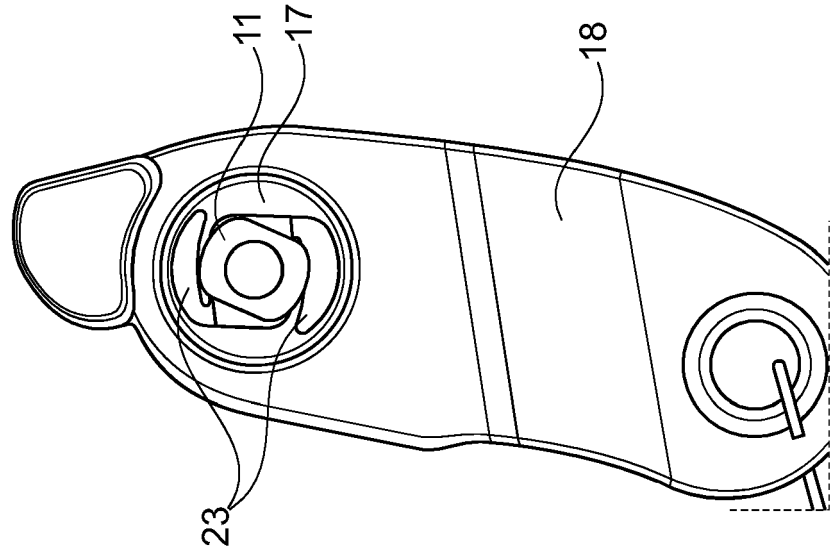

Fig. 10

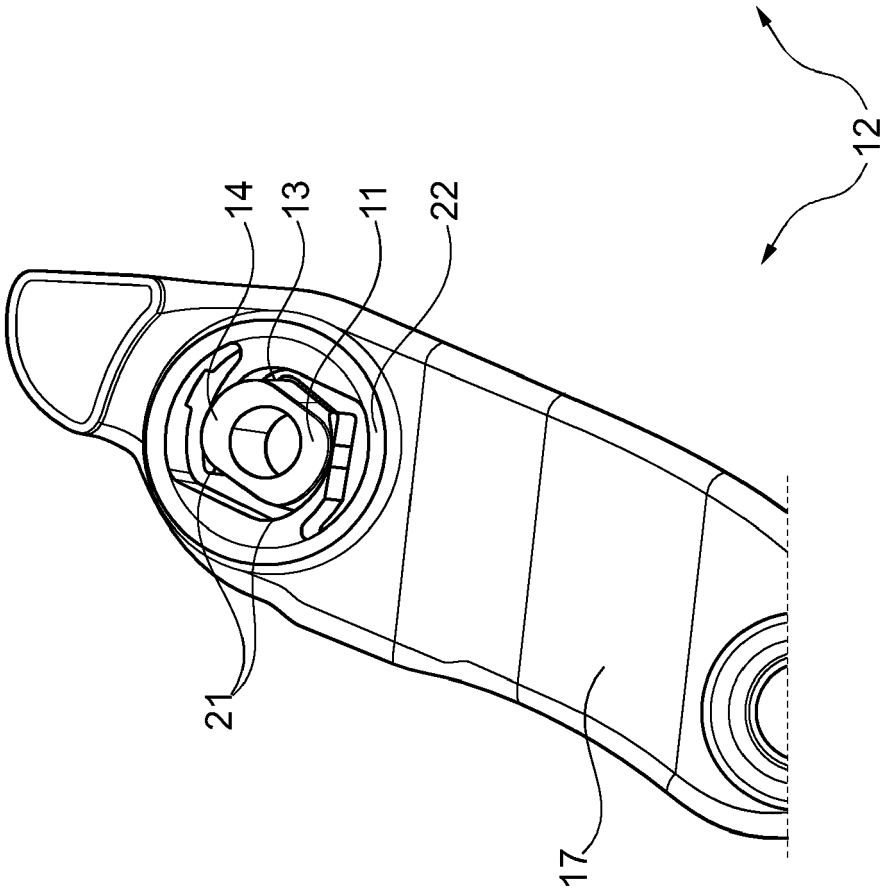

Fig. 9

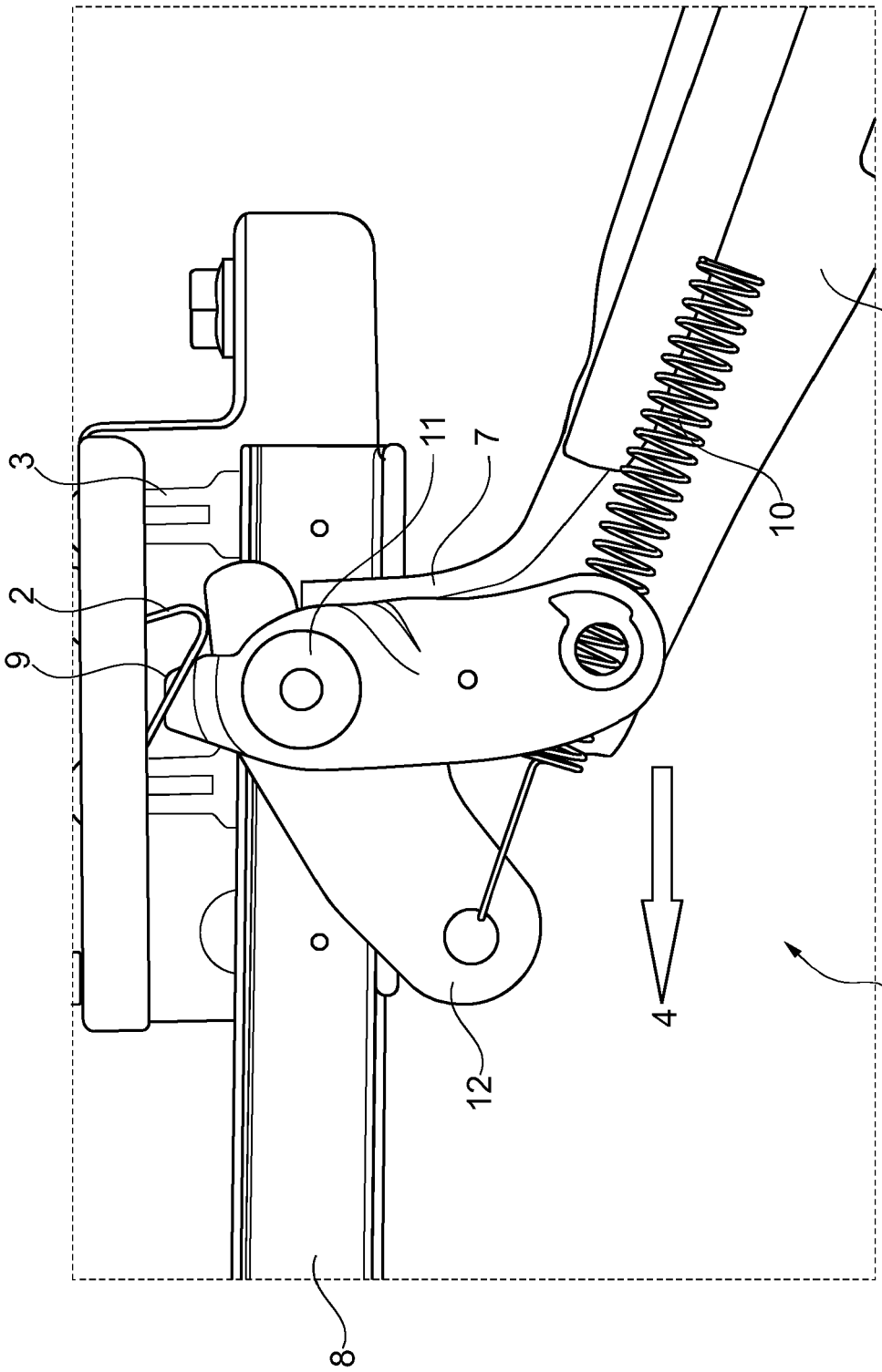

Fig. 11

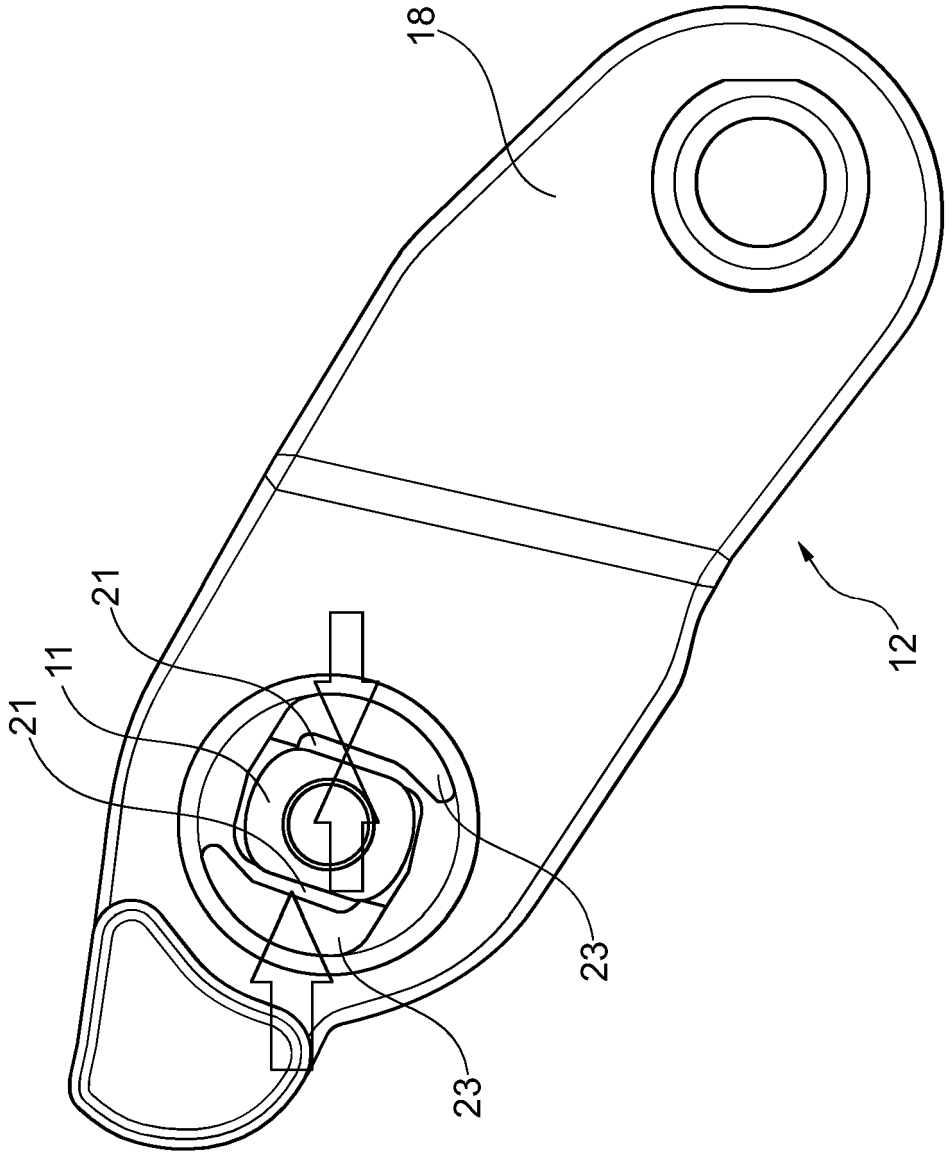

Fig. 12

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EUROPEAN SEARCH REPORT

Application Number
EP 14 16 3556

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E05D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	27 August 2014	Klemke, Beate

CATEGORY OF CITED DOCUMENTS

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