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(54) Spring fracture safety device

(57) A spring break protection mechanism for a sectional door comprising a base plate (2) with a pawl (3) pivotably connected thereto, which is coupled to an input member (5) for cooperation with a balancing spring. The spring break protection mechanism further comprises a ratchet wheel (6) for cooperation with a balancing axle. The pawl (3) is pivotable between a first position, in which the ratchet wheel (6) is free-running, and a second position in which the pawl (3) blocks the ratchet wheel (6). The pawl (3) is biased by an operating spring (7) to the second position against the force of the balancing spring. The spring break protection mechanism is characterized in that the pawl (3) is provided with a crumple zone (12) which, with the pawl (3) in the second position, plastically deforms from a predetermined threshold value of a blocking force.

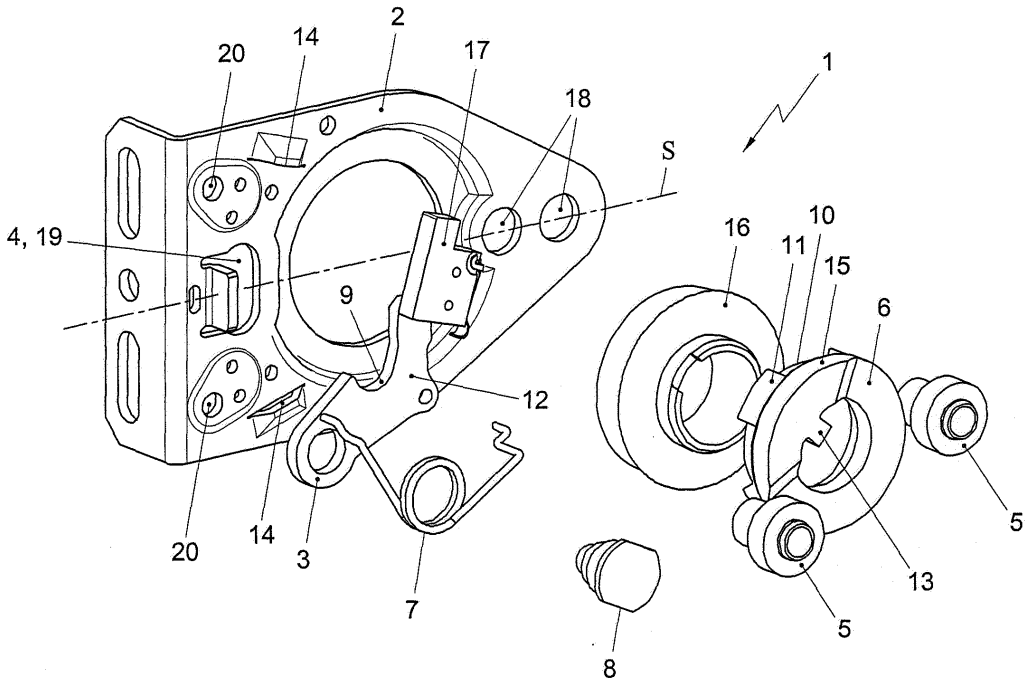

Fig. 1

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Description

[0001] The invention relates to a spring break protection for a sectional door. As a rule, a spring break protection mechanism ("drop catch mechanism") comprises a base plate with a pawl pivotably attached thereto, which is coupled to an input member for cooperation with a balancing spring, further comprising a ratchet wheel for attachment to a balancing axle, while the pawl is pivotable between a first position, in which the ratchet wheel is free-running and a second position in which the pawl blocks the ratchet wheel, and wherein the pawl is biased by an operating spring to the second position against the force of the balancing spring.

[0002] Sectional doors or overhead doors are much used in industrial as well as in residential uses. As a rule, sectional doors have a door leaf that is composed of a number of segments interconnected so as to be pivotable relative to a substantially horizontal axis. The door leaf is coupled, at the upstanding sides, to a hoisting means, for instance a hoisting cable with which the door is raised or lowered. As a rule, the hoisting means cooperate with a balancing device for compensating the weight of the door segments suspended from the hoisting means.

[0003] As a rule, the balancing device comprises a balancing spring for compensating the weight of the door segments. As a rule, the balancing device further comprises a balancing axle which extends at the top of a doorway between the two sides of the doorway.

[0004] In order to prevent the door leaf from dropping as a result of it own weight in the event of breakage of the balancing spring, the balancing axle and the balancing spring are typically connected to the fixed world via a spring break protection mechanism. The fixed world may be a wall of the doorway.

[0005] Such a spring break protection mechanism is known from, for instance, EP 1 213 428 and WO 2006/017931. With these mechanisms, the pawl of the spring break protection mechanism is biased for blocking rotation of the ratchet wheel as soon as the compensating force of the balancing spring drops out. During the sudden engagement of the pawl on the ratchet wheel as a result of the spring force dropping, the falling door leaf exerts great forces on the spring break protection mechanism. In order to absorb these great blocking forces, these spring break protection mechanisms are of relatively heavy design. As a result, such a spring break protection mechanism is relatively expensive.

[0006] Further, the known spring break protection mechanisms are relatively complex, have many parts and are, consequently, difficult to assemble and to mount, which increases the risk of mistakes during mounting.

[0007] The invention contemplates a spring break protection, with which the drawbacks mentioned can be prevented while maintaining the advantages.

[0008] To that end, the invention provides a spring break protection mechanism according to claim 1, and a sectional door system with spring break protection according to claim 13.

[0009] By providing the spring break protection mechanism or sectional door system with a structural part having an intentional weakening which is constructed to plastically deform in a controlled manner in the second position when a predetermined threshold value of the blocking force to be transmitted is exceeded, while, always, the blocking function of the mechanism is maintained, the remaining parts of the construction can be of less heavy design. As a result, the remaining parts of the spring break protection can be of less heavy design so that cutbacks on weight and costs can be realized.

[0010] It is preferred that the structural part comprises the pawl of the spring break protection mechanism, while, at the location of the weakening involved, the pawl comprises a crumple zone.

[0011] The crumple zone can be designed as a predefined area in the structural part, with a different choice in material and/or form and/or construction than other areas in the structural part.

[0012] The threshold value of the blocking force to be transmitted is defined by the choice in material and/or form and/or construction of the crumple zone in the structural part. By selecting the material and/or form and/or construction of the crumpling zone with respect to the material and/or form and/or construction of the rest of the structural part to be such that the crumple zone forms an area with an intentional weakening, plastic deformation occurs in the crumple zone when the threshold value is exceeded. The mechanism in which the structural part with the crumple zone is located maintains the blocking function upon plastic deformation of the crumple zone. Through the use of a crumple zone, the structural part can plastically deform in a controlled manner at a predetermined location, and the blocking force can be absorbed gradually.

[0013] The base plate to which the pawl is pivotably connected preferably also comprises a stop that defines an extreme position of the pawl in the second position. As a result, the pawl can be prevented from rushing, in deformed condition, past the ratchet wheel and from thus, removing the blocking again. As the pawl in deformed condition can abut against the stop, the ratchet wheel remains blocked in the second position.

[0014] The pawl is coupled to the input member via a coupling mechanism. As a rule, the input member cooperates, via a coil plug, with the balancing spring. The input member may be designed as two distancing bushes which are mounted on the base plate of the spring break protection mechanism. Via the input member, the force of the balancing spring of the spring break protection mechanism is supplied.

[0015] In an elegant manner, the coupling mechanism can be designed as a slot or a recess in the pawl. Via the slot and the recess in the pawl, the input member is coupled to the pawl. Due to the force of the balancing spring dropping out, the input member uncouples from

the recess in the pawl, and the input member moves upwards in the slot and consequently releases the pawl from the first position. As a result, the pawl moves, under the force of the operating spring, to the second position. By placing the coupling mechanism, via the input member and the operating means of the pawl together on one side of the base plate, an elegant and simple spring break protection mechanism is realized. As a result, fewer parts are necessary, rendering the spring break protection mechanism easier to mount.

[0016] Further advantageous embodiments are represented in the subclaims.

[0017] The invention further relates to a sectional door provided with a spring break protection mechanism and to a kit of parts for assembling a spring break protection mechanism.

[0018] The invention will be further elucidated on the basis of an exemplary embodiment represented in a drawing.

In the drawing:

[0019]

Fig. 1 shows a schematic exploded view of a spring break protection mechanism;
Fig. 2 shows a schematic front view of the spring break protection mechanism of Fig. 1 with the pawl in the first position;
Fig. 3 shows a schematic front view of the spring break protection mechanism of Fig. 1 with the pawl in the second position;
Fig. 4 shows a schematic perspective view of a sectional door system.

[0020] The Figures involve only schematic representations of preferred embodiments of the invention, and are given by way of non-limitative exemplary embodiment. In the Figures, identical or corresponding parts are represented with the same reference numerals.

[0021] Fig. 1 shows a spring break protection mechanism 1 for preventing the sectional door from dropping down when the force of the balancing spring drops out. To this end, the spring break protection mechanism 1 comprises a base plate 2 with a pawl 3 pivotably connected thereto. As a rule, the base plate 2 is attached to the fixed world, for instance to a wall. In Fig. 1 it is shown that the pawl 3 is attached, via a pawl axle 8, to the base plate 2 and is pivotable relative to the pawl axle 8, about the pivot 20. The pawl 3 is coupled via a coupling mechanism 4, to an input member 5. The input member 5 cooperates, via a coil plug (not shown), with a balancing spring (not shown either here). The balancing spring is usually designed as a torsion spring. In this exemplary embodiment, the input member 5 is designed as a distancing bush. In this exemplary embodiment, the coupling mechanism 4 comprises a slot 19 in the base plate 2 and a recess 9 in the pawl 3. The spring break protection mechanism 1 further comprises a ratchet wheel 6 for cooperation with a balancing axle (not shown either). In this exemplary embodiment, the ratchet wheel 6 is provided with a connecting projection extending towards the balancing axle. With the spring break protection mechanism 1 in mounted condition, this connecting projection 13 cooperates with a slot recessed in the balancing axle. As a result, the ratchet wheel 6 is secured against rotation with the balancing axle.

[0022] The pawl 3 is pivotable between a first position I, as shown in Fig. 2 and a second position II, as shown in Fig. 3. In the first position I, the ratchet wheel is free-running and, in the second position II, the pawl 3 blocks the ratchet wheel.

[0023] In the first position I, the pawl 3 is biased by an operating spring 7 shown in Fig. 1, to the second position II against the force of the balancing spring. The operating spring 7 is detachably connected to the base plate 2 and to the pawl 3. At one end, the operating spring 7 is placed in an opening intended thereto in the base plate 2, in this exemplary embodiment pivot 20, and, at another end, the operating spring 7 is placed in an opening in the pawl 3. This simplifies the mounting of the operating spring 7.

[0024] As shown in Fig. 2, in the first position I, the ratchet wheel 6 is free-running. The balancing spring exerts a force on the input member 5. Due to the force of the balancing spring, the input member 5 is located on the side of the slot 9 where the pawl 3 is located. In this exemplary embodiment, the pawl 3 is coupled to the input member 5 by means of slot 19 and recess 9. Due to the force the balancing spring exerts on the input member 5 and which the input member 5 exerts, in turn, on the pawl 3, the pawl 3 remains coupled to the input member 5 by means of the recess 9.

[0025] Upon breakage of the balancing spring, the force exerted on the input member 5 drops out, and the input member 5 will uncouple from the recess 9 and will pivot in the slot 19 in a direction away from the pawl 3. As a result, the pawl 3 is no longer coupled to the input member 5 and, owing to the bias of the operating spring 7, the pawl 3 will pivot to the second position II. In the second position II, the pawl 3 blocks the ratchet wheel 6, as shown in Fig. 3. As the ratchet wheel 6 is secured against rotation with the balancing axle, the rotation of the balancing axle is blocked too and, consequently, the sectional door is prevented from dropping down.

[0026] In the second position II, the pawl 3 engages an engagement surface 10 of the ratchet wheel 6. In this exemplary embodiment, the engagement surface 10 is provided with a number of projections 11, behind which the pawl 3 can be caught. The pawl 3 is provided with a crumple zone 12 which plastically deforms in the second position II from a predetermined threshold value of a blocking force. Through the use of the crumple zone 12, there is a predefined area of the pawl 3 that can plastically deform in a controlled manner, that is, from a predetermined threshold value of the blocking force exerted by the falling door. The blocking force is produced by the

weight of the dropping door leaf. Due to the breakage of the balancing spring, the weight of the door segments suspended from the hoisting cables is no longer compensated. As a result, the door leaf will drop downwards while the balancing axle starts rotating. As the pawl 3 engages the ratchet wheel 6 in the second position II, the rotation of the balancing axle is blocked. Through the great force the weight of the falling door leaf exerts on the pawl 3, this can plastically deform at the location of the crumple zone 12, when the blocking force is greater than a predetermined threshold value.

[0027] In this embodiment, the pawl 3 has a smaller cross section at the location of the crumple zone 12. Through the use of the locally reduced cross section in the pawl 3, thus, an area is defined where plastic deformation is allowed from a predetermined threshold value.

[0028] Optionally, the crumple zone 12 can be designed by providing the pawl 3 locally with a different material, in particular a material with a lower yield point than the remaining material of the pawl 3.

[0029] The threshold value of the blocking force to be transmitted is defined by the choice of material and/or form and/or construction of the pawl 3 and can be adapted to, for instance, the weight of a segment of the sectional door.

[0030] As controlled plastic deformation of the pawl 3 at the location of the crumple zone 12 is allowed in the second position II, a part of the energy that is released through the balancing force dropping out is absorbed by the crumple zone 12. As a result, the pawl 3 can be of less heavy design. Consequently, remaining parts of the spring break protection mechanism 1 too can be of less heavy design too as they have to transmit a lower peak force. This produces a cutback on material and, thus, a cutback on costs.

[0031] In a preferred embodiment, the base plate 2 comprises a stop 14 that defines a farthest position of the pawl 3 in the second position II. In Fig. 3, it can be seen that although the pawl 3 blocks the ratchet wheel, it does not yet abut against the stop 14. With a great blocking force, the stop 14 serves to prevent plastic deformation of the pawl 3 at the location of the crumple zone 12 occurring to such an extent that the pawl would rush past the ratchet wheel 6 and were to thus release the blocking of the ratchet wheel 6 again. By providing a stop 14, the pawl 3 blocks the ratchet wheel 6 in the second position II.

[0032] Referring to Fig. 1, in this exemplary embodiment, the ratchet wheel 6 is provided with a flange edge 15. In the second position II, the pawl 3 engages the engaging surface 10 which, in mounted condition, is confined between the base plate 2 and the flange edge 15. By providing the flange edge 15 on the ratchet wheel 6, the pawl 3 can engage the engaging surface 10, in the second position II, and the pawl 3 is prevented from rushing past the ratchet wheel 6 through plastic deformation of the crumple zone 12.

[0033] Preferably, the spring break protection mechanism 1 comprises a bearing 16 as shown in Fig. 1. The bearing 16 is connected to the base plate 2 for support of the balancing axle. In this exemplary embodiment, the ratchet wheel 6 is fixedly attached to the bearing 16 via an attachment, for instance a pin. In this manner, the ratchet wheel 6 can be axially fixed relative to the mechanism, and is axially slideable relative to the balancing axle. This means that in spite of axial displacement of the balancing axle, the axial position of the ratchet wheel 6 remains unchanged. Thus, the pawl 3 and the ratchet wheel 6 are each time substantially in the same plane and, in the second position II, the pawl 3 will engage the engaging surface 10 of the ratchet wheel 6.

[0034] In this exemplary embodiment, the spring break protection mechanism 1 also comprises a switch 17 for detecting the position of the pawl 3. The switch 17 is activated when the pawl 3 is pivoted from the first position I to the second position II. Here, the signal of the switch 17 is transmitted to an electric motor which drives the sectional door, for switching off the second motor after a breakage of the balancing spring.

[0035] In Fig. 1 it can be seen that the slot 19 and the recess 9 of the coupling mechanism 4 are in the proximity of the operating means of the pawl 3. The operating means comprise the operating spring 7 and the pawl axle 8. In mounted condition, the pawl axle 8 is located in a pivot 20 about which the pawl 3 can pivot. The operating spring 7 is also located around this pivot 20. By arranging the coupling mechanism 4 and the pivot 20 to be in each others proximity, the base plate 2 can be designed so as to be symmetrical relative to an axis of symmetry S. Here, the coupling mechanism 4 and the pivot point 20 are on the same side of the base plate 2. In this manner, the actuation of the pawl 3 via the coupling mechanism 4, and the operating means of the pawl 3 at the location of the pivot point 20 are placed together, thereby obtaining a simple spring break protection mechanism 1. This allows for use of the spring break protection mechanism 1 both on the left hand side and on the right hand side of the sectional door. Here, a spring break protection mechanism 1 that can be used on the left as well as on the right hand side can suffice, which yields an advantage in mounting and cutbacks in costs.

[0036] The base plate 2 is provided on one side with two side-by-side openings 18 for cooperation with the input member 5. When mounting, the input member 5 is placed in one of the two openings. By providing two side-by-side openings 18, the base plate 2 is suitable for use with different balancing devices with a different distance between the parts of the input member 5. This renders the base plate 2 suitable for sectional doors of different weight categories. The input member 5 is thus coupled to the base plate 2 by means of an opening 18 on one side of the base plate 2 and a slot 19 on an opposite side of the base plate 2.

[0037] Fig. 4 shows a view of a sectional door system. The sectional door system 21 comprises a door leaf composed of pivotably interconnected segments 22. The sys-

tem 21 also comprises a balancing device 24 for compensating the weight of a door segment 22. The balancing device 24 comprises a balancing axle 34 and a balancing spring 25 for cooperation with an input member of a spring break protection mechanism 1. The sectional door system also comprises a hoisting mechanism 26 with a carrier frame 27. The carrier frame 27 is provided with guide profiles 28 in which guide rollers run (not show here), attached to the door segments. The hoisting mechanism comprises the hoisting cables 29.

[0038] The hoisting cables are wound on a cable reel 30 and returned via a return pulley 31. The sectional door system 21 further comprises an end post 32 and a floor bracket 33. At least one of the structural parts of the sectional door system 21 selected from a group comprising door segment 22, end post 32, floor support 33, cable reel 30, balancing axle 34, shaft coupling, bearing plate, suspension construction to the wall, has an intentional weakening whereby, when a predetermined threshold value of the blocking force is exceeded, plastic deformation can occur. Upon breakage of a balancing spring, the pawl 3 will move towards the second position. The plastic deformation at the location of the intentional weakening in the structural part will absorb the blocking force to a large extent.

[0039] The invention is not limited to the exemplary embodiment represented here. For instance, the weakening or crumple zone can be realized in many manners, for instance by a combination of choice of material and/or construction and/or form of the pawl. Many forms of the pawl are possible, for instance, the pawl can be designed as a bow attached at both ends to the parts of the input member and provided with a tooth that can engage the ratchet wheel. At the location of the crumple zone, the pawl can be designed with a smaller cross section and/or a thinner thickness, or the material of the pawl can be locally weakened in another manner, by using, for instance, grooves or holes, or by using a different material.

[0040] Also, the engaging surface of the ratchet wheel can be designed differently than with projections, for instance with a rough surface so that the pawl blocks the ratchet wheel by means of friction. Also, several openings in the base plate or even a slot for receiving the input member are possible.

[0041] The ratchet wheel can be fastened to the bearing via a pin, however, other fastenings are possible too, such as for instance a clamping coupling or a secured screw connection. The bearing and the pawl can also be manufactured in one piece.

[0042] It is noted that a spring break protection mechanism 1 according to the preamble of claim 1, wherein the ratchet wheel is fastened to the bearing, can also be considered as an invention.

[0043] It is further noted that a spring break protection mechanism according to the preamble of claim 1, wherein the ratchet wheel is attached to the balancing axle so as to be axially slideable, can also be considered as an invention.

[0044] As a further invention, also, a spring break protection mechanism according to the preamble of claim 1 can be considered wherein the coupling mechanism and the operating means of the pawl are arranged on the base plate on the same side of the opening for the balancing axle.

[0045] Such variants will be clear to the skilled person and are understood to fall within the scope of the invention as set forth in the following claims.

Claims

1. A spring break protection mechanism comprising a base plate with a pawl pivotably connected thereto, which is coupled to an input member for cooperation with a balancing spring, further comprising a ratchet wheel for cooperation with a balancing axle, wherein the pawl is pivotable between a first position, in which the ratchet wheel is free-running, and a second position in which the pawl blocks the ratchet wheel, and wherein the pawl is biased by an operating spring to the second position against the force of the balancing spring, **characterized in that** the spring break protection mechanism comprises a structural part with an intentional weakening constructed to plastically deform, in a controlled manner, when a predetermined threshold value of a blocking force to be transmitted is exceeded, while always completely maintaining the blocking function of the mechanism.

2. A spring break protection mechanism according to claim 1, wherein the structural part comprises the pawl.

3. A spring break protection mechanism according to claim 1 or 2, wherein the base plate comprises a stop that defines an extreme position of the pawl in the second position.

4. A spring break protection mechanism according to any one of the preceding claims, wherein the ratchet wheel is provided with a flange edge.

5. A spring break protection mechanism according to any one of the preceding claims, wherein the ratchet wheel is attached to a bearing.

6. A spring break protection mechanism according to any one of the preceding claims, wherein the ratchet wheel is axially slidable relative to the balancing axle.

7. A spring break protection mechanism according to any one of the preceding claims, wherein, in the first position, the pawl is coupled to the input member via a coupling mechanism.

8. A spring break protection mechanism according to

any one of the preceding claims, wherein the coupling mechanism comprises a slot.

9. A spring break protection mechanism according to any one of the preceding claims, wherein the input member is attached to the base plate via a slot and a hole.

10. A spring break protection mechanism according to any one of the preceding claims, wherein the coupling mechanism and the operating means of the pawl are arranged near each other on the same side of the base plate.

11. A sectional door, comprising a door leaf composed of pivotably interconnected segments, a spring break protection mechanism according to any one of claims 1- 10, further comprising a balancing device for compensating the weight of the door leaf, which balancing device comprises a balancing spring for cooperation with the input member and comprises a balancing axle for cooperation with the ratchet wheel.

12. A kit for assembling a spring break protection mechanism for a sectional door according to any one of claims 1- 10, comprising an input member for cooperation with a balancing spring, a ratchet wheel for cooperation with a balancing axle, a base plate with a pawl pivotably attached thereto and an operating spring for biasing the pawl, wherein the pawl comprises a crumple zone.

13. A sectional door system, comprising:

- a door leaf composed of a number of door segments connected so as to be pivotable relative to a substantially horizontal pivot,
- hoisting means coupled to the door leaf, which cooperate with a balancing device with a balancing spring coupled to a balancing axle for compensating the weight of the door segments suspended from the hoisting means, wherein the balancing axle and the balancing spring are connected to the fixed world via a spring break protection mechanism, **characterized in that** the sectional door system further comprises a structural part with intentional weakening which is constructed to plastically deform, in the second position, when a predetermined threshold value of a blocking force to be transmitted is exceeded, while always completely maintaining the blocking function of the mechanism.

14. A sectional door system according to claim 13, wherein the spring break protection mechanism comprises a base plate with a pawl pivotably attached thereto, which is coupled to an input member for cooperation with a balancing spring, further comprising a ratchet wheel for cooperation with a balancing axle, wherein the pawl is pivotable between a first position in which the ratchet wheel is free-running, and a second position in which the pawl blocks the ratchet wheel, and wherein the pawl is biased by an operating spring to the second position against the force of the balancing spring.

15. A sectional door system according to claim 13 or 14, wherein the structural part with intentional weakening is chosen from the group of: door segment, end post, floor bracket, cable reel, balancing axle, shaft coupling, bearing plate, suspension construction to the wall.

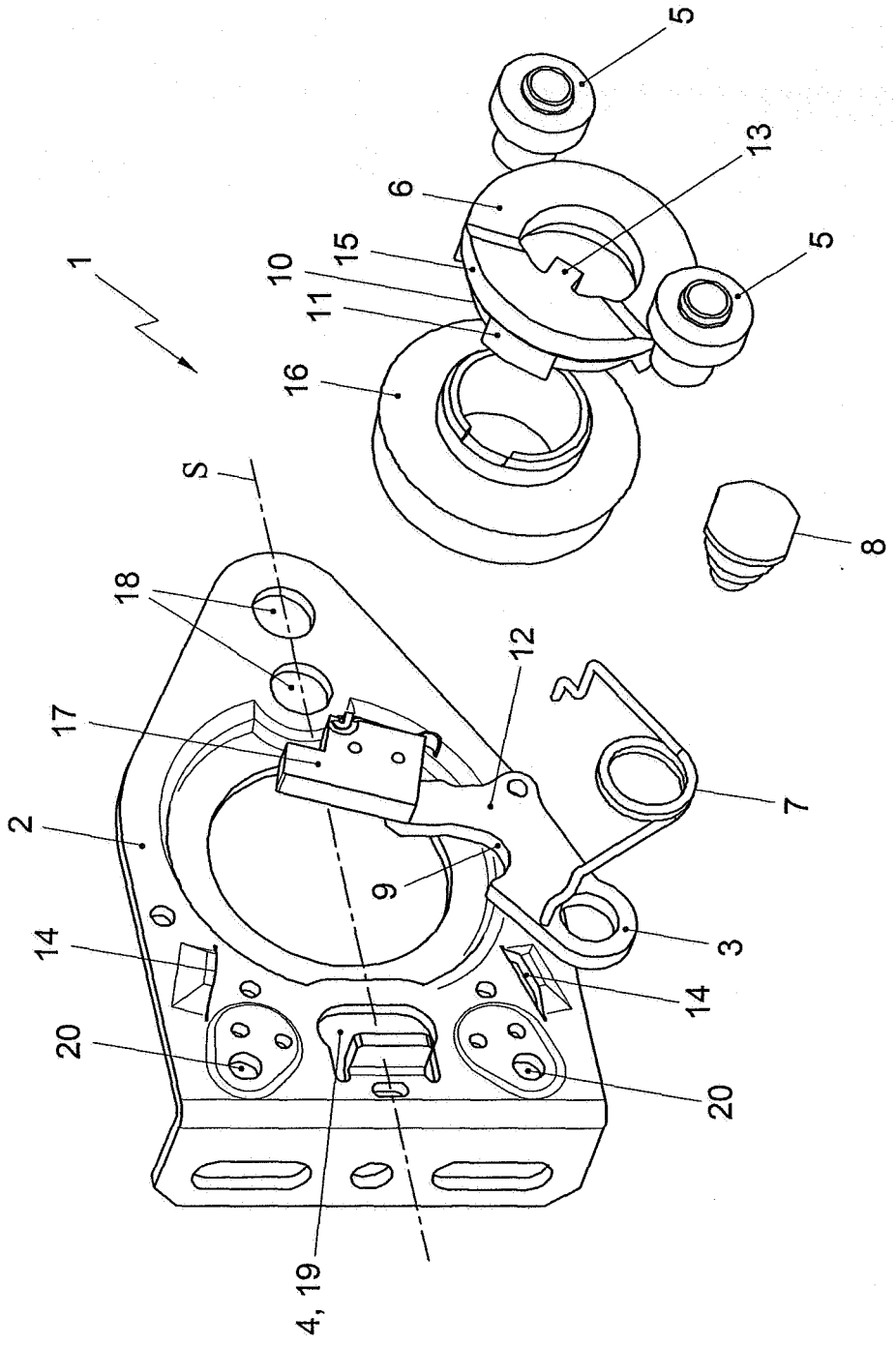

Fig. 1

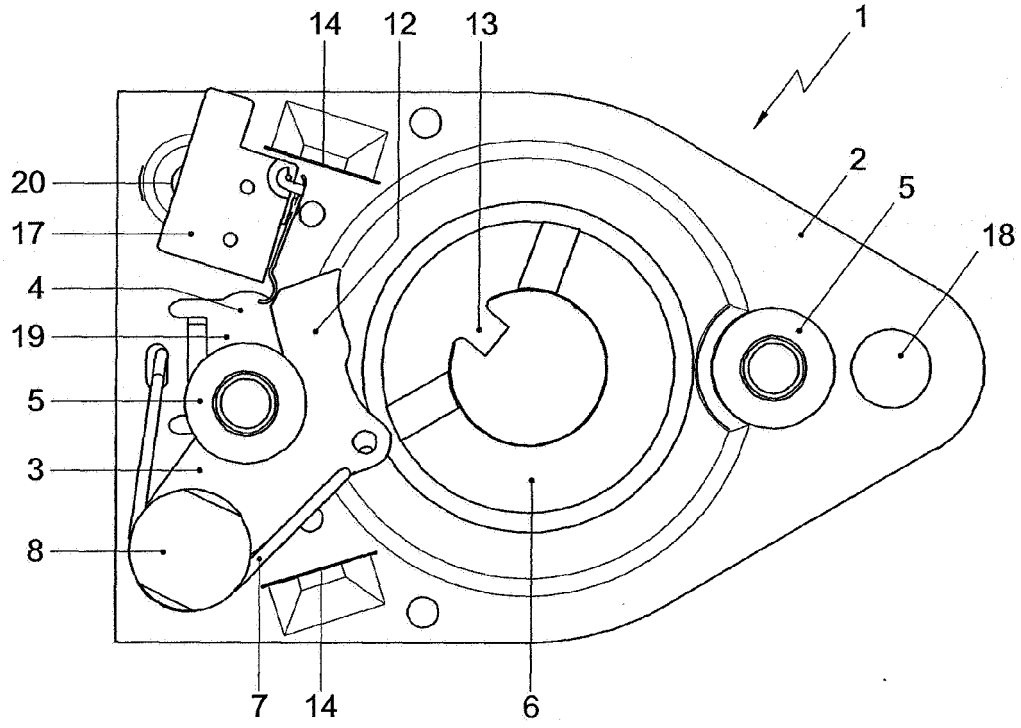

Fig. 2

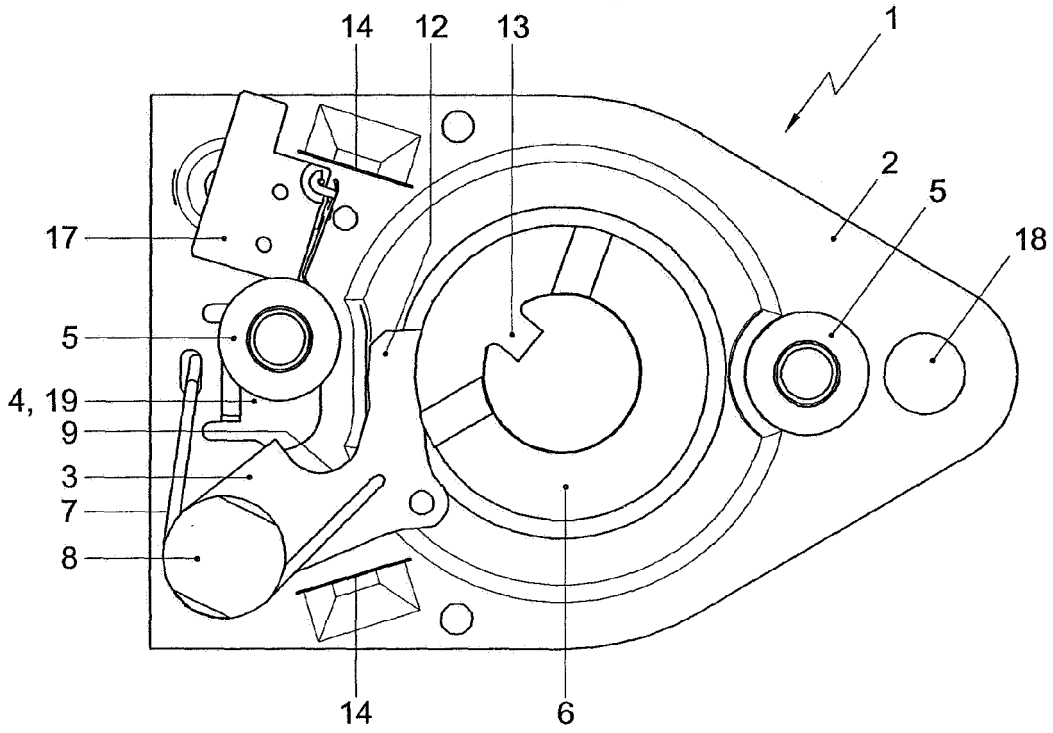

Fig. 3

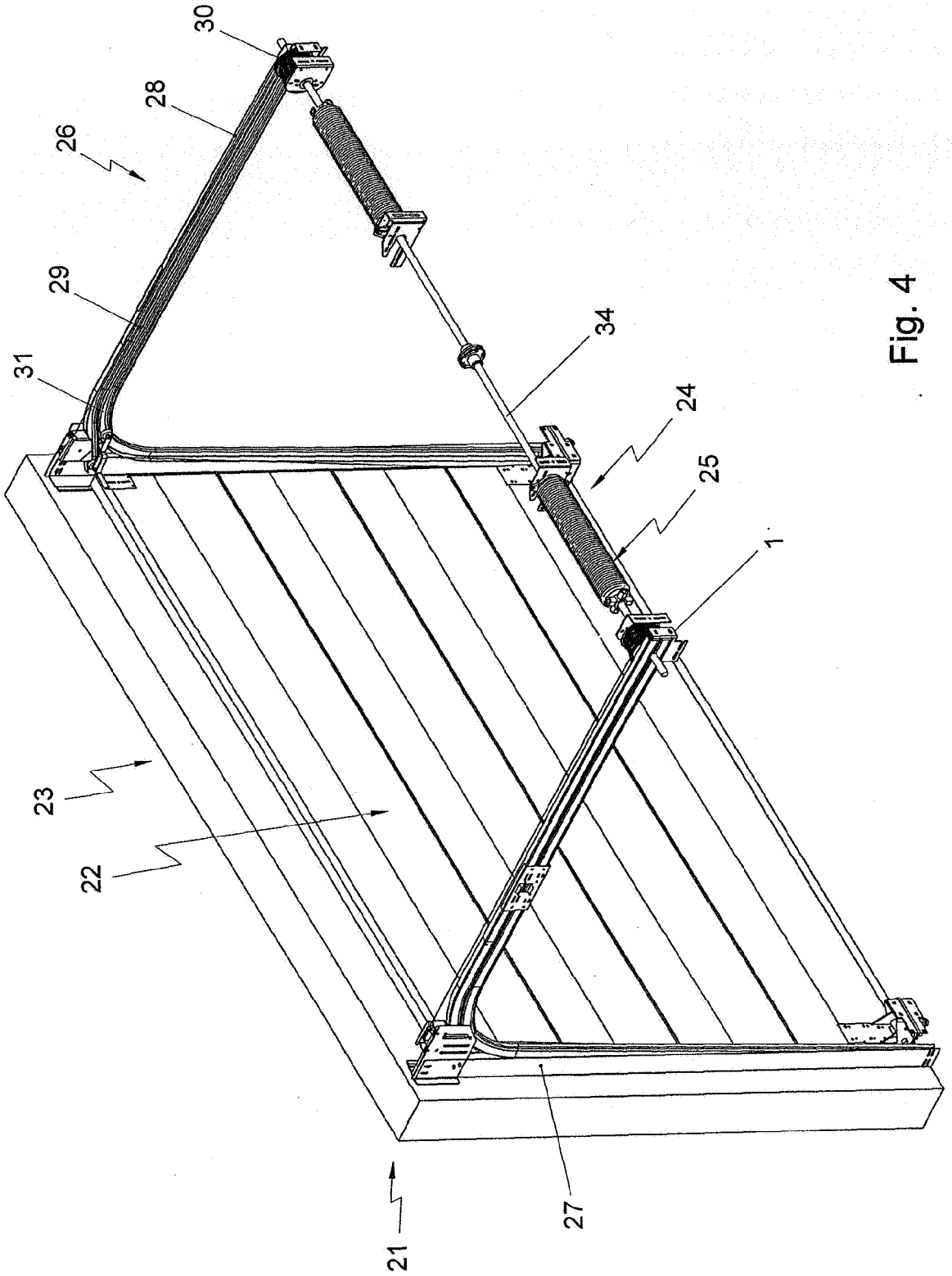

Fig. 4

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Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	26 November 2007	Van Kessel, Jeroen

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 07 11 4733

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