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54 **Device for limiting, and drive system comprising a device for limiting**

57 The invention provides a device for limiting a movement of a member driven by a motor, comprising at least one switch functionally couplable to the motor, at least one movable actuating element, driven by the member driven by the motor and co-acting with the at least one switch, and a mechanical lock for engaging said actuating element for mechanically locking said actuating element when it is at or past at least one set limit position.

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Device for limiting, and drive system comprising a device for limiting

5 Field of the invention

The invention relates to a device for limiting, and to a drive system comprising a device for limiting.

Background of the invention

10 US5299678 according to its abstract describes “an adjustable limit switch mechanism for controlling the operation of an electric motor of a garage door opener over a selected range of movement including a motor driven threaded shaft supporting at least one switch actuator which is adjustably positionable and restrained from rotary movement while being axially translated by rotation of the shaft. A limit switch is
15 mounted adjacent the threaded shaft so as to be actuated as the switch actuator is translated axially on the shaft.”

DE3003636 according to its abstract describes “a motor which has a gear mechanism for driving a coil shaft and at least one microswitch as end-position detector set from the outside. Each end-position detector has a second microswitch in
20 parallel with it and acting as safety switch. A switching finger on the switching arms of both switches in any one pair moves when the coil shaft rotates. The two switches in each pair are staggered. The switching finger has an element for setting the directions of displacement. The element engages the switching arm of one of the two switches in each pair. The switching finger may have a nut travelling along a threaded spindle
25 rotated by the coil shaft. The mechanism is used in venetian blinds.

WO0201588 according to its abstract describes “a device for limiting a movement of a member driven by a motor, comprising at least two switches connected to a circuit of the motor and movable actuating elements driven by the motor and co-acting with the switches, which actuating elements are movable substantially
30 independently of each other. A normal end switch and an emergency end switch can hereby be actuated without the danger of unintentional actuation of the emergency switch. The actuating elements can be movable by a joint drive element connected to the motor and can be resiliently deformable. The actuating elements can form part of a

single resiliently deformable actuating member and have a different thickness, and thereby a differing stiffness. The actuating member can herein be a leaf spring, which has an incision from an outer end which mutually separates the actuating elements.“

5 **Summary of the invention**

A disadvantage of prior art is that a known limiting device was found to allow a motor to run beyond its set limit. A further or additional disadvantage of a known limiting device is that it can be reset from a distance.

Hence, it is an aspect of the invention to provide a limiting device which at least partly obviates one or more of above-described drawbacks. It is a further or additional aspect of the invention to provide a limiting device that provides an additional safety measure. Furthermore or in particular, a limiting device is provided that requires visual inspection when it reaches a limit position.

It is therefore provided a device for limiting a movement of a member driven by a motor, comprising at least one switch functionally couplable to the motor, at least one movable actuating element, driven by the member driven by the motor and co-acting with the at least one switch, and a mechanical lock for engaging said actuating element for mechanically locking said actuating element when it is at or past at least one set limit position.

It is further provided a drive system comprising such a limiting device.

It is further provided a method for limiting a movement of a member driven by a motor, comprising providing a limiting device provided above.

It was found that a mere electronical indication of a limit often is not sufficient. An example of such an electronic indication, more in particular an electronic limiting provision, is a switch that provides an indication to a motor control system that a limit is reached or even passed. In an example of such an electronic limiting system, an electric circuit is broken and the motor is prevented from continuing beyond a set limit. It was found that in practise, often a system reset is given, and the drive system continues operating. In order to prevent such an operation, it was found that an additional mechanical blocking should provided that requires an operator to physically go to the drive system, and manually unlock the limiting system. The manual unlocking in this manner forces the operator to visually inspect the drive system.

In an embodiment, the device for limiting a movement of a member driven by a motor comprises at least two switches connected to a circuit of the motor and movable actuating elements driven by the motor and co-acting with the switches. Such a limiting device is marketed by applicant under the name "end switching system", and is for instance used in drive systems for ventilating glasshouses.

A precisely controlled climate must be maintained in glasshouses in order to ensure optimal conditions for growth of the products cultivated therein.

In addition, the cost of setting and maintaining such a climate must be minimal. The opening and closing of ventilating openings, such as windows, is therefore centrally controlled by a climate computer. This is also the case for the opening and closing of insulating energy screens arranged in the top of the glasshouse.

The climate computer herein actuates a drive system for the ventilation which consists of rack-pinion combinations which are connected to the windows and driven by shafts, which are connected in turn to drive motors, usually via a motor reductor. In addition, the computer actuates a drive system for the energy screens.

This drive system is formed by winding shafts, onto which the screens are wound or from which they are unwound, and which are likewise driven by motors, optionally via drive shafts and reductors.

When the windows and/or the energy screens reach an end position, and are therefore fully opened or closed, the drive system has to be switched off. For this purpose the motor reductors are provided with end switches. These switches are connected to an external relay which is arranged in the circuit of the motor.

In order to prevent damage to the drive system and/or the windows and/or energy screens driven thereby, the end switches in an embodiment take a dual form. In addition to the operation end switch, which during normal use stops the motor, and thereby also the whole drive, via its external relay, in such an embodiment there is also provided a safety end switch which is arranged a small distance from the operation end switch and likewise co-acts with an external relay. This safety relay ensures an interruption of the power supply to the motor, so that the driving will still come to a stop.

In an embodiment of the limiting device, the actuating elements are movable substantially independently of each other. A greater distance between the actuating

elements can hereby be created, so that the safety end switch is not actuated unintentionally, even if the drive system "runs on" after the motor has been stopped.

A structurally simple embodiment of the limiting device is obtained when the actuating elements are movable by a joint drive element connected or coupled to the motor. In fact, the joint drive element can be coupled to the motor, coupled to for
5 instance a transmission that is coupled to the motor, or even to both.

The movability of an actuating element can be achieved in simple manner by giving it a resiliently deformable form. In order to create sufficient distance between the moment of actuation of two end switches, actuating elements can be used that have
10 a differing stiffness.

The limiting device further comprises a housing holding or housing said at least one switch, said at least one actuating element and said mechanical lock. In an embodiment, the housing comprising an access opening for providing access to a part of said mechanical lock for allowing unlocking.

In an embodiment the mechanical lock comprises a mechanical lock element provided for engaging actuating element for said locking. In a particular embodiment, the lock element snaps behind said at least one actuating element.
15

In an embodiment, the mechanical lock comprises a mechanical lock element fixed to the housing, in an embodiment co-formed with at least part of said housing.

20 In was found to provide a simple alignment for production, and at minimal costs.

In an embodiment, the at least one actuating element is movable by a joint drive element coupled to at least one selected from said motor and said member driven by said motor.

In an embodiment, the at least one actuating element is resiliently deformable, in particular said actuating element comprises a leaf spring. This provides a simple and secure element for actuating.
25

In an embodiment, the actuating element comprises a locking member and said mechanical lock comprises a mechanical lock element provided for snappingly engaging one another when said actuating element is at or past said at least one set
30 limit position.

In an embodiment, the limiting device comprises at least two switches. In an embodiment thereof, the at least one actuating element is provided for operating said at least two switches. In a further embodiment, the switches and the actuating element are

provided with respect to one another for allowing said actuating element to operate one switch after the other. Thus, various levels of control may be provided. In a particular embodiment, the actuating element and the switches are positioned to leave previously operated switches operated. In this respect, operating can relate to closing a switch, or to opening a switch. In this respect, a switch can for instance relate to a micro switch.

In an embodiment, the mechanical lock is provided for engaging said actuating element for mechanically locking said actuating element when or after a last one of said at least two switches is operated. Thus, the mechanical lock can be provided as a failsafe is the other, electronically operated means failed of are ignored.

In an embodiment, the actuating element extends in an extension direction, and said at least two switches are provided along said extension direction. In a particular embodiment, the at least two switches are provided at subsequent positions along said extension direction. Thus, an easy to realize sequence of events can be generated.

In an embodiment, when comprising said joint drive element, said joint drive element comprises a threaded spindle and at least one nut running on said threaded spindle. In an embodiment, the at least one nut comprises a travel cam and the limiting device further comprises a guiding rail for engaging said travel cam for allowing or urging said nut to travel in a longitudinal direction of said threaded spindle on said threaded spindle. The nut can for instance travel until an end of said guiding rail where said nut subsequently couples with said threaded spindle to co-rotates with said threaded spindle. In an embodiment, the nut comprises an operating cam for engaging said at least one actuating element when said nut co-rotates with said threaded spindle.

In an embodiment, a ring can be provided on the nut, and the ring can be provided with the cams. It should be clear that the ring is rotationally fixed onto the nut.

In an embodiment, the actuating element is positioned for being engaged by said operating cam when said nut is at an end of said threaded spindle. In a particular embodiment, said actuating element extends functionally parallel to said threaded spindle. A travel path of a nut thus directly relates to the amount of rotations of the motor.

In an embodiment, the at least one nut further comprises an adjustment part allowing it to be positioned at a start position on said threaded spindle. In an embodiment, the start position is at a distance from an end of said spindle.

In an embodiment, the limiting device comprises:

- at least two sets of said at least one switches, each set of switches functionally couplable to said motor;

5 - at least two of said movable actuating elements, driven by the member driven by the motor and each co-acting with a set of said switches, and

- at least two of said mechanical locks, each for engaging a said actuating element for mechanically locking its actuating element when it is at or past its set limit position, thus providing at least two set limit positions.

In an embodiment, each set of switches comprises at least two switches. In an embodiment thereof, each said at least one actuating element is provided for operating 10 a set of switches, wherein said switches of a set of switches and said corresponding actuating element are provided with respect to one another for allowing said actuating element to operate one switch after the other of said set of switches. In an embodiment thereof, each previously operated switch is left operated.

15 Furthermore in an embodiment, each of said mechanical locks is provided for engaging a said actuating element for mechanically locking said actuating element when or after a last one of said at least two switches of said set of switches is operated. In an embodiment, said actuating element extends in an extension direction, and said at least two switches of said set of switches are provided along said extension direction. 20 In an embodiment, said at least two switches of said set of switches are provided at subsequent positions along said extension direction. In an embodiment, first the switch physically closes to an end of the threaded spindle is operated, and subsequently the next switch until the switch most remote from that threaded spindle end.

The invention further pertains to a drive system comprising a motor, a 25 transmission functionally coupled to said electromotor, and a limiting device according to any one of the preceding claims, wherein said motor comprises an electromotor. In an embodiment, the electromotor is a self-commutated AC or DC motor. The limiting device is in particular beneficial for an AC or DC that have mechanically commutated motor. In particular, the limiting device is used for an AC electromotor with 30 mechanical commutator. Such an electromotor with a rotor and a stator is simple in construction, and using the limiting device can be provided with a simple, failsafe and cost effective control.

The invention further comprises a device for limiting a movement of a member driven by a motor, comprising at least one switch functionally couplable to the motor, at least one movable actuating element, driven by one selected of the member driven by the motor and the motor and a combination thereof and co-acting with the at least one switch, and a mechanical lock for engaging said actuating element for mechanically locking said actuating element when it is at or past at least one set limit position.

The invention also relates to an actuating element for use in a limiting device as described above.

The term “substantially” herein, such as in “substantially consists”, will be understood by the person skilled in the art. The term “substantially” may also include embodiments with “entirely”, “completely”, “all”, etc. Hence, in embodiments the adjective substantially may also be removed. Where applicable, the term “substantially” may also relate to 90% or higher, such as 95% or higher, especially 99% or higher, even more especially 99.5% or higher, including 100%. The term “comprise” includes also embodiments wherein the term “comprises” means “consists of”.

The term “functionally” will be understood by, and be clear to, a person skilled in the art. The term “substantially” as well as “functionally” may also include embodiments with “entirely”, “completely”, “all”, etc. Hence, in embodiments the adjective functionally may also be removed. When used, for instance in “functionally parallel”, a skilled person will understand that the adjective “functionally” includes the term substantially as explained above. Functionally in particular is to be understood to include a configuration of features that allows these features to function as if the adjective “functionally” was not present. The term “functionally” is intended to cover variations in the feature to which it refers, and which variations are such that in the functional use of the feature, possibly in combination with other features it relates to in the invention, that combination of features is able to operate or function. For instance, if an antenna is functionally coupled or functionally connected to a communication device, received electromagnetic signals that are received by the antenna can be used by the communication device. The word “functionally” as for instance used in “functionally parallel” is used to cover exactly parallel, but also the embodiments that are covered by the word “substantially” explained above. For instance, “functionally

parallel" relates to embodiments that in operation function as if the parts are for instance parallel. This covers embodiments for which it is clear to a skilled person that it operates within its intended field of use as if it were parallel.

Furthermore, the terms first, second, third and the like in the description and in the claims, are used for distinguishing between similar elements and not necessarily for describing a sequential or chronological order. It is to be understood that the terms so used are interchangeable under appropriate circumstances and that the embodiments of the invention described herein are capable of operation in other sequences than described or illustrated herein.

The devices or apparatus herein are amongst others described during operation. As will be clear to the person skilled in the art, the invention is not limited to methods of operation or devices in operation.

It should be noted that the above-mentioned embodiments illustrate rather than limit the invention, and that those skilled in the art will be able to design many alternative embodiments without departing from the scope of the appended claims. In the claims, any reference signs placed between parentheses shall not be construed as limiting the claim. Use of the verb "to comprise" and its conjugations does not exclude the presence of elements or steps other than those stated in a claim. The article "a" or "an" preceding an element does not exclude the presence of a plurality of such elements. The invention may be implemented by means of hardware comprising several distinct elements, and by means of a suitably programmed computer. In the device or apparatus claims enumerating several means, several of these means may be embodied by one and the same item of hardware. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage.

The invention further applies to an apparatus or device comprising one or more of the characterising features described in the description and/or shown in the attached drawings. The invention further pertains to a method or process comprising one or more of the characterising features described in the description and/or shown in the attached drawings.

The various aspects discussed in this patent can be combined in order to provide additional advantages. Furthermore, some of the features can form the basis for one or more divisional applications.

Brief description of the drawings

Embodiments of the invention will now be described, by way of example only, with reference to the accompanying schematic drawings in which corresponding reference symbols indicate corresponding parts, and in which:

Figure 1 is a partly cut-away perspective view of a drive system with a limiting device;

Figure 2 is top view of the limiting device of figure 1;

Figure 3 is a bottom view of figure 2, with a lower part of the housing removed;

Figure 4 shows a side view of the limiting device of the previous drawings, with the housing removed, and

Figures 5A-5F schematically depicts various working steps of the limiting device.

The drawings are not necessarily on scale.

Description of preferred embodiments

Figure 1 schematically depicts a drive system 1 (figure 1) comprises an electric motor 2, a reductor/transmission 4 and a limiting device 3 connected thereto. The reductor/transmission 4 here forms the member driven by the motor.

From reductor 4 the slowed rotational movement of motor 2 is transmitted to a shaft, which may comprise a pinion (not shown), which is connected in turn to drive shafts, drive rods or drive chains which transmit the movement to rack-pinion combinations for air windows or winding shafts for energy screens (all not shown).

Limiting device 3 serves to stop motor 2 at one or more set limit positions when the windows and/or screens controlled or operated by drive system 1 have reached an extreme position, for instance their start and/or end positions. Limiting device 3 comprises a housing 5, here arranged on a casing of reductor 4. Further details of the limiting device 3 are explained with reference to figures 2-5.

In the example, the joint drive element comprises a threaded spindle 6 with nuts 8, 8'.

The threaded spindle 6 is mounted rotatably in housing 5. This threaded spindle 6 is here driven by reductor/transmission 4 via a gear transmission with a transmission

shaft 7 (figures 3, 4) driving in turn the threaded spindle 6. The transmission shaft 7 is also rotatably held in housing 5

The currently discussed embodiment that is detailed in the drawings provides two limits. Identical parts (identical but mirrored) are indicated with an accent ' where they are visible. Thus, accented parts combine to one active element similar to the un-
5 accented parts.

Reference is now made to figures 2-5. Arranged on threaded spindle 6 are in this embodiment two nuts 8, 8' which each define an extreme position of drive system 1. Usually, in the current embodiment these nuts 8, 8' are manually positioned on the
10 threaded spindle 6.

Around each nut 8, 8' (on an extension indicated with dotted lines in figure 4) is provided a ring 9, 9' which is fixed to its nut 8, 8' by means of adjusting screws 10, 10'.

In the current embodiment, the limiting device has a connector 13 for connecting
15 switches to for instance a control device for controlling the motor, or for instance directly to a power supply or a motor.

In figure 3 and 4, more details of the limiting device 3 can be seen and will be explained.

The limiting device 3 has in this embodiment a circuit board 14.

In this embodiment, in order for the nuts 8, 8' with the rings 9, 9' to displace
20 when the threaded spindle 6 rotates, each ring 9, 9' is provided with at least one travel cam 11, 11', respectively. Preferably, two opposite travel cams are provided on each ring 9, 9'. Furthermore, a guiding rail 15 is provided functionally parallel to the threaded spindle 6. In operation, when the threaded spindle 6 rotates about its
25 longitudinal axis, one the cams 11, 11' will engage a guiding rail 15 (see figure 3), and the respective nut 8, 8' with its ring 9, 9' will travel in longitudinal direction of the threaded spindle 6. In the current embodiment, both nuts and rings 8, 9 and 8', 9' will travel in the same direction.

The limiting device 3 in the current embodiment further comprises two sets of
30 two switches 17, 18, 17', 18' that are provided on the circuit board 14. In an embodiment, switches 17, 17' are connected to an external relay (not shown here), whereby in normal operation the motor 2 is stopped when an end position is reached. Switch 18, 18' form an additional safety, and is only actuated if drive system 1

continues to run when this is not intended. This may be the result of a malfunction in one of the switches 17, 17' or the relay connected thereto, of an incorrect connection or of any other cause. The safety switches 18, 18' are likewise connected to a relay (not shown) which interrupts the power supply to motor 2.

5 Each of the switches 17, 18 and switches 17', 18' are functionally coupled with a respective movable actuating element 16, 16'. In the shown embodiment these actuating elements 16, 16' take a resiliently deformable form. In particular, pieces of spring steel may be used, forming leaf springs. Here, the actuating elements 16, 16' extend functionally parallel to the threaded spindle 6. The actuating elements 16, 16'
10 have ends that can move cross with respect to the threaded spindle 6. In particular, here an end is positioned at or near each end of the threaded spindle 6.

The leaf springs of the actuating elements 16, 16' extend functionally parallel to a longitudinal axis of the threaded spindle 6. One end of each of the leaf springs is fixed, the other, free end is positioned at or near the ends of the threaded spindle 6. The
15 leaf springs are in the current embodiment biased downward, towards switches 17, 17', 18, 18'. The (free) ends of the leaf springs is provided with an engagement hook 19, 19' for engaging an operating cam 12, 12' on the ring 9, 9'. Here, an end part of the actuating element 16, 16' is formed into the engagement hook 19, 19'.

Furthermore, another end part for the actuating element 16, 16' is formed into a
20 locking end 20, 20' for engaging and locking with the mechanical lock, here comprising the locking hook 21, 21'.

The actuating element 16, 16' is formed in such a way that when the free end is manipulated, first the most remote (i.e., most closely to an end of the threaded spindle 6) switch is operated, and when the free end is manipulated further, the next switch is
25 operated. In the current example, the leaf spring first releases switch 17, 17', and then releases switch 18, 18', leaving the earlier released switches released. In the current embodiment, the mechanical lock is activated after the last switch is operated.

In the current embodiment, the threaded spindle 6 is functionally coupled with the motor 2 or the reductor 4 via spindle drive 7. Usually, for easy setting, the limiting
30 device 3 will be coupled to the reductor 4.

As explained, the rings 9, 9' are provided with travel cams 11, 11'. Here, for each ring 9, 9' one travel cam 11, 11' is depicted, but each ring can have opposite travel cams. The travel cams will engage the guiding rail 15, causing the nuts 8, 8'

together with the rings 9, 9' to travel in longitudinal direction along a longitudinal axis of the threaded spindle 6. At or near the ends of the threaded spindle 6, the guiding rails 15 end. There, a respective nut 8, 8' with its attached ring 9, 9' will no longer travel in longitudinal direction. At that location, the limiting device 3 comprises a nut engagement provision for engaging the respective nut 8, 8' and forcing it to co-rotate with the threaded spindle 6. In a simple embodiment, at that position the thread of the threaded spindle 6 ends, thus forcing the nut 8, 8' to enter into co-rotation with the threaded spindle 6. When the ring 9, 9' starts to co-rotate with threaded spindle 6, the operating cam 12, 12' is also going to rotate and to operate the actuating element 16, 16'. Here, the operating cam 12, 12' engages the actuating element 16, 16'.

The operation of a limiting device can be as follows, with particular reference to drawings fig 5A-5F.

Before the drive system 1 is operational, an operator sets the longitudinal positions of the nuts 8, 8' and mounts the rings 9, 9' on the respective nuts 8, 8'.

When the motor 2 is running, the threaded spindle 6 is rotated, here by reductor/transmission 4.

Nuts 8, 8' herein perform a rectilinear movement along the longitudinal direction of the treaded spindle 6, because the travel cams 11, 11' are guided between the respective guiding rails 15. These guiding rails can for instance be co-formed with parts of the housing 5 of the limiting device 4. In figure 5A, the travelling of operating cam 12, 12' is indicated.

When one of the nuts 8, 8' arrives at the end of its guiding rail 15, the respective nut 8, 8' will also reach the end of the thread of the threaded spindle 6, or via another, similar provision, it begins to co-rotate with threaded spindle 6. In figure 5B, the moment just before that happens is indicated.

At the moment the nut 8, 8' co-rotates with the threaded spindle 6, the operating cam 12, 12' engages the actuating element 16, 16'. In the current embodiment, operating cam 12, 12' enters engagement hook 19. The engagement of the engagement hook 19 is indicated in figure 5C.

In the current embodiment, during its rotation the operating can 12, 12' pulls or lifts the actuating element 16, 16' up, against its biasing force that here presses the actuating element onto both switches 17, 18. A start of this is indicated in figure 5C.

While pulling the actuating element 16, 16' up, first the most remote switch 17, 17' will be de-activated as indicated in figure 5C. When the motor 2 continues to run, the operating cam 12, 12' will rotate further and lifts the actuating element 16, 16' even further, releasing the second switch 18, 18'. This is indicated in figure 5D. In the
5 current embodiment, this will cut the power to the motor 2.

Then, at the same time or shortly after, operating cam 12 will rotate even further. The locking end 20 of the actuating element 16, 16' will lock behind the locking hook 21. As indicated in figure 5E. In this embodiment, the locking end 20 locks behind locking hook 21 when the operating cam 12 lifts the actuating element 19 even further
10 after the indication in figure 5D. In an alternative embodiment, the locking can also take place at the same time the second switch 18 gets released. In figure 5F, the operating cam 12 is freed from the engagement hook 19 of the actuating element 16. The actuating element 19, however, stays locked in its position and switches 17 and 18 remain free. This will keep the motor blocked, for instance. Actual physical action and
15 inspection is needed to mechanically reset the limiting device.

Here in the current embodiment, an end of the lip 20 will lock with the cam on locking hook 21. It is evident that many similar engaging elements that can for instance flex with respect to one another are conceivable in order to perform the function of engaging and locking the actuating element 16, 16' in its set limit position.
20 The actuating element 16, 16' is locked with respect to further motion of the ring 9, 9' and thus the threaded spindle and thus with respect to further motion of the motor 2.

Here in the current embodiment the switches 17, 18 are activated and become de-activated. It should be clear that that this could work reversed, having switches that become activated. In stead of switches, other elements can be used that provide the
25 same functional signals.

A structurally simple, reliable and rapid action limiting device 4 is thus obtained with the embodiment of actuating elements 16, 16' presented above.

The invention is not limited to the shown embodiment, but can be varied in many ways. Using elements and parts performing similar functions. The actuating elements
30 could thus for instance be pivotable instead of deformable. Forms of movement other than bending, for instance torsion, could also be envisaged. In the current embodiment, the actuating element is biased for actuating one or more switches 17, 17', 18, 18', and in the set end position these switches 17, 17', 18, 18' become de-activated. This may

for instance be reversed. The current proposed limiting device may also be combined for instance with the delimiting device of the earlier application WO02/01588 referenced above. The separate actuating elements of that disclosure that each operate one switch can for instance each be provided with a mechanical lock.

5 In the current embodiment, the mechanical lock, or specifically at least one of the parts locking end 20 and/or locking hook 21 is physically accessible for a human operator through an opening in the housing. Using for instance a (specific) tool, the mechanical lock can be mechanically reset, i.e., both ends (locking end 20/locking hook 21) can be made to disengage. This forces visual inspection.

10 It will also be clear that the above description and drawings are included to illustrate some embodiments of the invention, and not to limit the scope of protection. Starting from this disclosure, many more embodiments will be evident to a skilled person. These embodiments are within the scope of protection and the essence of this invention and are obvious combinations of prior art techniques and the disclosure of
15 this patent.

Reference numbers

- 1 drive system
- 2 motor
- 3 limiting device
- 5 4 transmission/reductor
- 5 limiting device housing
- 6 treaded spindle
- 7 spindle drive
- 8 , 8' setting nut
- 10 9, 9' ring
- 10, 10' adjustment screw
- 11, 11' travel cam
- 12, 12' operating cam
- 13 connector
- 15 14 circuit board
- 15 guiding rail
- 16, 16' actuating element
- 17, 17' first (micro)switch
- 18, 18' second (micro)switch
- 20 19 engagement hook
- 20 locking end
- 21 locking hook

Conclusies

1. Een inrichting voor het beperken van een beweging van een onderdeel dat aangedreven wordt door een motor, omvattende:
 - 5 - ten minste een schakelaar die functioneel koppelbaar is met de motor;
 - ten minste een beweegbaar bedieningselement, aangedreven door het onderdeel dat aangedreven wordt door de motor en dat samenwerkt met de ten minste ene schakelaar, en
 - 10 - een mechanische grendel voor aangrijpen van het bedieningselement voor mechanisch vergrendelen van het bedieningselement wanneer het bij of voorbij ten minste een ingestelde limit positie is.

2. De beperkingsinrichting volgens conclusie 1, verder omvattende een behuizing voorzien van de ten minste ene schakelaar, de ten minste ene mechanische grendel,
15 de behuizing omvattende een toegangsopening voor het verschaffen van toegang tot een deel van de mechanische grendel voor het mogelijk maken van ontgrendeling.

3. De beperkingsinrichting volgens conclusie 1 of 2, waarbij de mechanische grendel
20 een mechanisch grendelement omvat dat voorzien is voor het aangrijpen van bedieningselement voor het vergrendelen, in het bijzonder snappen achter het ten minste ene bedieningselement.

4. De beperkingsinrichting volgens conclusie 2, waarbij de mechanische grendel een
25 mechanisch grendelement bevestigd aan de behuizing omvat, in een uitvoeringsvorm gevormd samen met ten minste deel van de behuizing.

5. De beperkingsinrichting volgens een of meer der voorgaande conclusies, waarbij het ten minste ene bedieningselement beweegbaar is middels een
30 gemeenschappelijk aandrijfelement dat gekoppeld is met ten minste een gekozen uit de motor en het onderdeel aangedreven door de motor.

6. De beperkingsinrichting volgens een of meer der voorgaande conclusies, waarbij het ten minste ene bedieningselement veerkrachtig vervormbaar is, in het bijzonder omvat het bedieningselement een bladveer.
- 5 7. De beperkingsinrichting volgens een of meer der voorgaande conclusies, waarbij het bedieningselement een grendelonderdeel omvat en de mechanische grendel een mechanisch grendelement omvat voor snappend aangrijpen op elkaar wanneer het bedieningselement bij of voorbij het ten minste ene ingestelde limiet positie is.
- 10 8. De beperkingsinrichting volgens een of meer der voorgaande conclusies, omvattende ten minste twee schakelaars, waarbij het ten minste ene bedieningselement verschafft is voor het in werking stellen van de ten minste twee schakelaars waarbij de schakelaars en het bedieningselement ten opzichte van elkaar voorzien zijn zodat het bedieningselement een schakelaar na de andere kan
15 bedienen, waarbij in het bijzonder de tevoren bediende schakelaar bediend blijft, en de mechanische grendel is voorzien voor het aangrijpen van het bedieningselement voor mechanisch vergrendelen van het bedieningselement wanneer of nadat een laatste van de ten minste twee schakelaars is bediend.
- 20 9. De beperkingsinrichting volgens conclusie 8, waarbij het bedieningselement zich uitstrekt in een uitstrekdirichting, en de ten minste twee schakelaars voorzien zijn langs de uitstrekdirichting, in het bijzonder zijn de ten minste twee schakelaars voorzien op opvolgende posities langs de uitstrekdirichting.
- 25 10. De beperkingsinrichting volgens een of meer der voorgaande conclusies, waarbij wanneer omvattende het gemeenschappelijke aandrijfelement, het aandrijfelement een draadspindel omvat en ten minste een moer heeft die op de draadspindel loopt, de ten minste ene moer omvattende een verplaatsingsnok en de
30 beperkingsinrichting omvattende een geleiderail voor het aangrijpen van de verplaatsingsnok zodat de moer toegestaan wordt zich in de langsrichting van de draadspindel te verplaatsen op de draadspindel tot een eind van de geleiderail waar de moer vervolgens koppelt met de draadspindel om met de draadspindel mee te roteren met, en een bedieningsnok voor het aangrijpen van het ten minste ene

bedieningselement wanneer de moer mee roteert met de draadspindel.

11. De beperkingsinrichting volgens conclusie 10, waarbij het bedieningselement is
gepositioneerd voor aangrijping door de bedieningsnok wanneer de moer bij een
5 eind is van de draadspindel, in het bijzonder strekt het bedieningselement zich
functioneel parallel uit ten opzichte van de draadspindel.
12. De beperkingsinrichting volgens conclusie 10 of 11, waarbij de ten minste ene
moer verder omvat een versteldeel voor het positioneren bij een startpositie op de
10 draadspindel, en waarbij de startpositie op afstand is van een eind van de spindel.
13. De beperkingsinrichting volgens een of meer der voorgaande conclusies,
omvattende
- ten minste twee sets van de ten minste ene schakelaar, elke set schakelaars
15 functioneel koppelbaar met de motor;
 - ten minste twee van de beweegbare bedieningselementen, aangedreven door het
onderdeel aangedreven door de motor en elk samenwerkend met een verzameling
van de schakelaars, en
 - ten minste twee van de mechanische grendels, elk voor het aangrijpen van een
20 van de bedieningselementen voor mechanisch vergrendelen van zijn
bedieningselement wanneer het bij of voorbij zijn ingestelde limietpositie is,
hierdoor verschaffende ten minste twee ingestelde limietposities.
14. De beperkingsinrichting volgens een of meer der voorgaande conclusies, waarbij
25 elke set schakelaars ten minste twee schakelaars omvat, waarbij elke van het ten
minste ene bedieningselement is voorzien voor bedienen van een set schakelaars,
waarbij de schakelaars van een set schakelaars en het corresponderende
bedieningselement ten opzichte van elkaar opgesteld zijn zodat het
bedieningselement een schakelaar na de andere van de set schakelaars kan
30 bedienen, in het bijzonder eerder bediende schakelaars bediend latend, en elke
mechanische grendel is voorzien voor aangrijpen van een van de
bedieningselementen voor het mechanisch vergrendelen van het bedieningselement
wanneer of nadat een laatste van de ten minste twee schakelaars van de set

schakelaars bediend is, in het bijzonder waarbij het bedieningselement zich uitstrekt in een extensierichting, en de ten minste twee schakelaars van de set schakelaars zijn opgesteld langs de extensierichting, in het bijzonder zijn de ten minste twee schakelaars van de set schakelaars opgesteld op opvolgende posities langs de extensierichting.

5

15. Een aandrijfsamenstel omvattende een motor, een overbrenging die functioneel gekoppeld is met de elektromotor, en een beperkingsinrichting volgens een of meer der voorgaande conclusies, waarbij de motor een elektromotor is.

10

-O-O-O-O-O-

Fig. 1

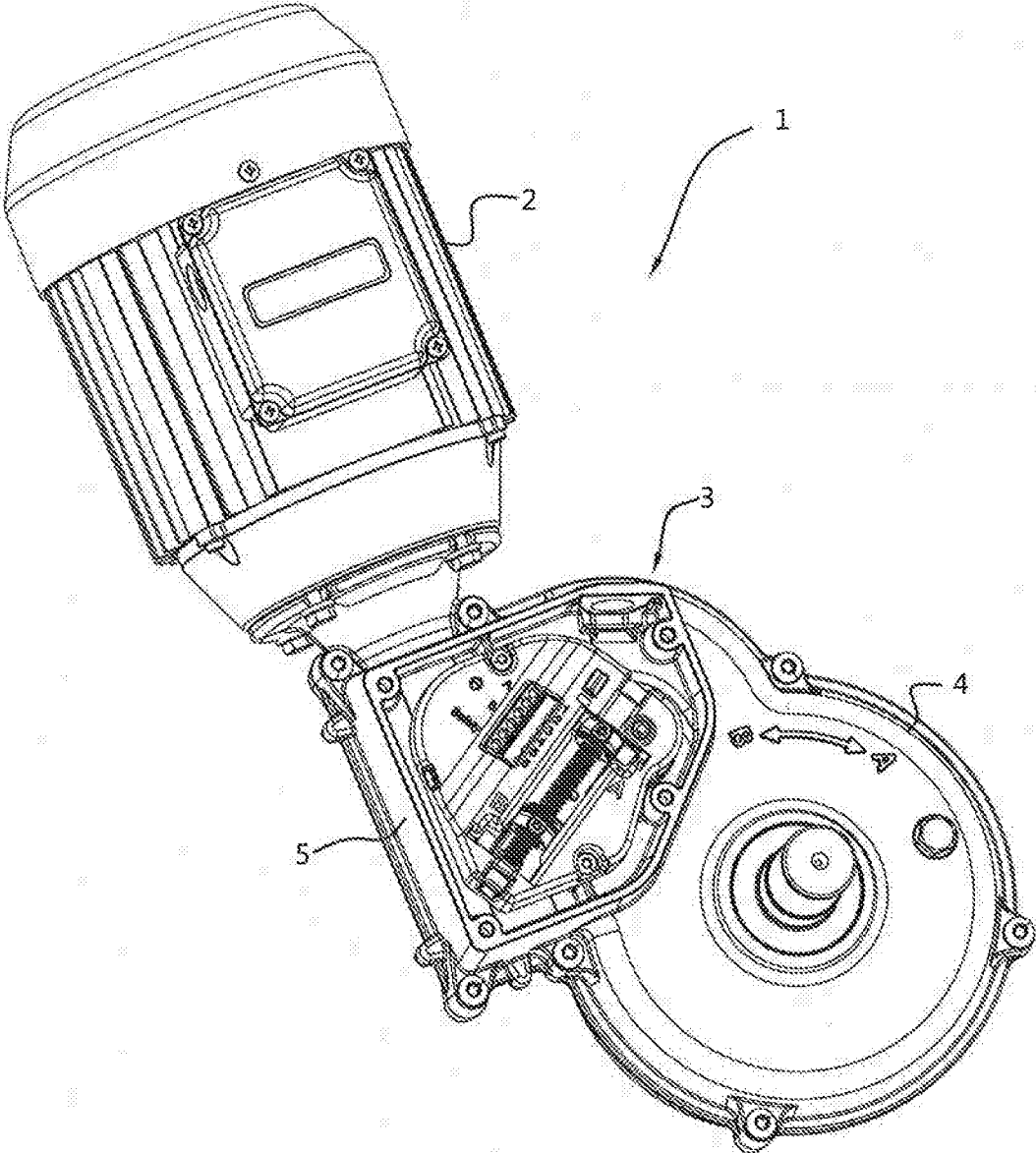


Fig. 2

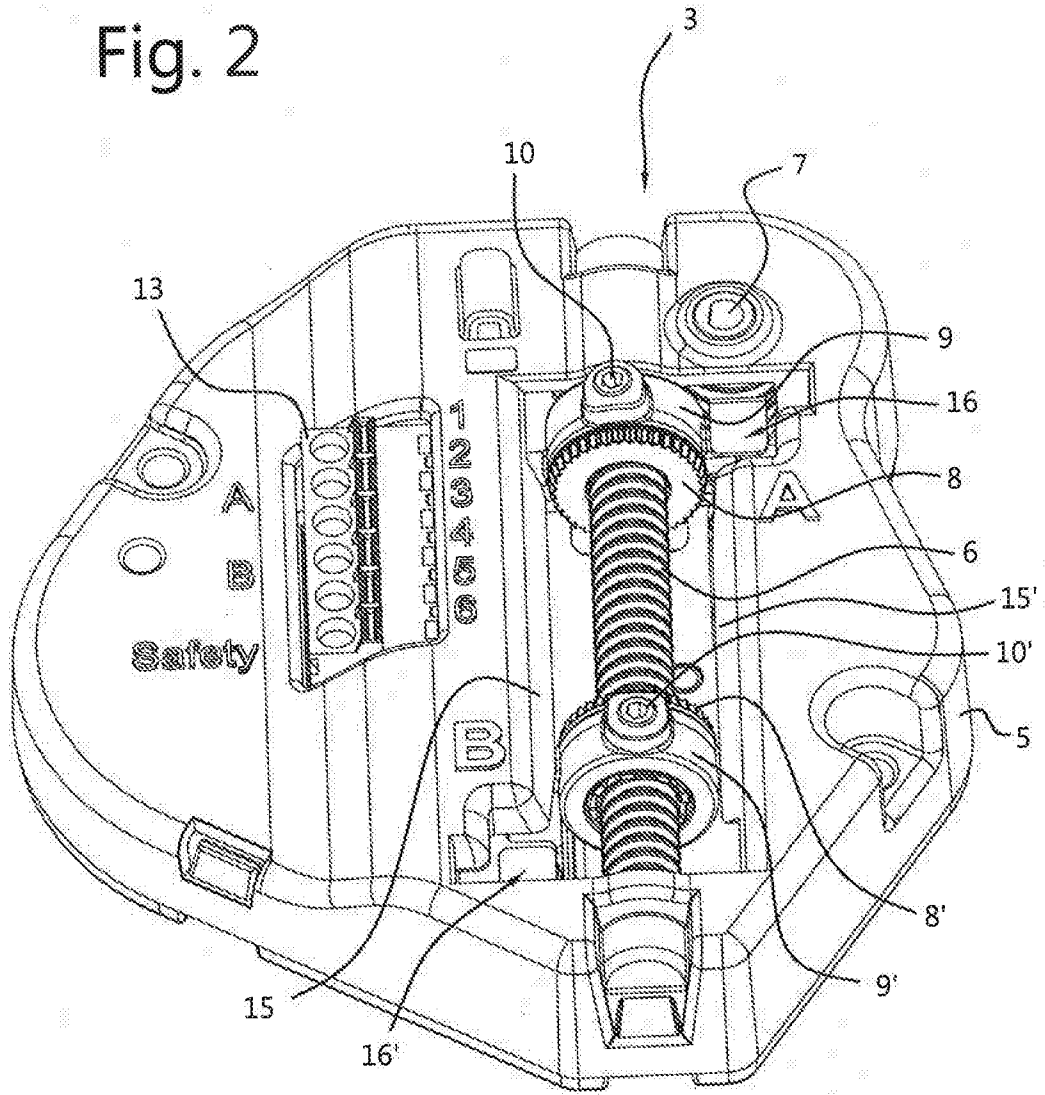


Fig. 3

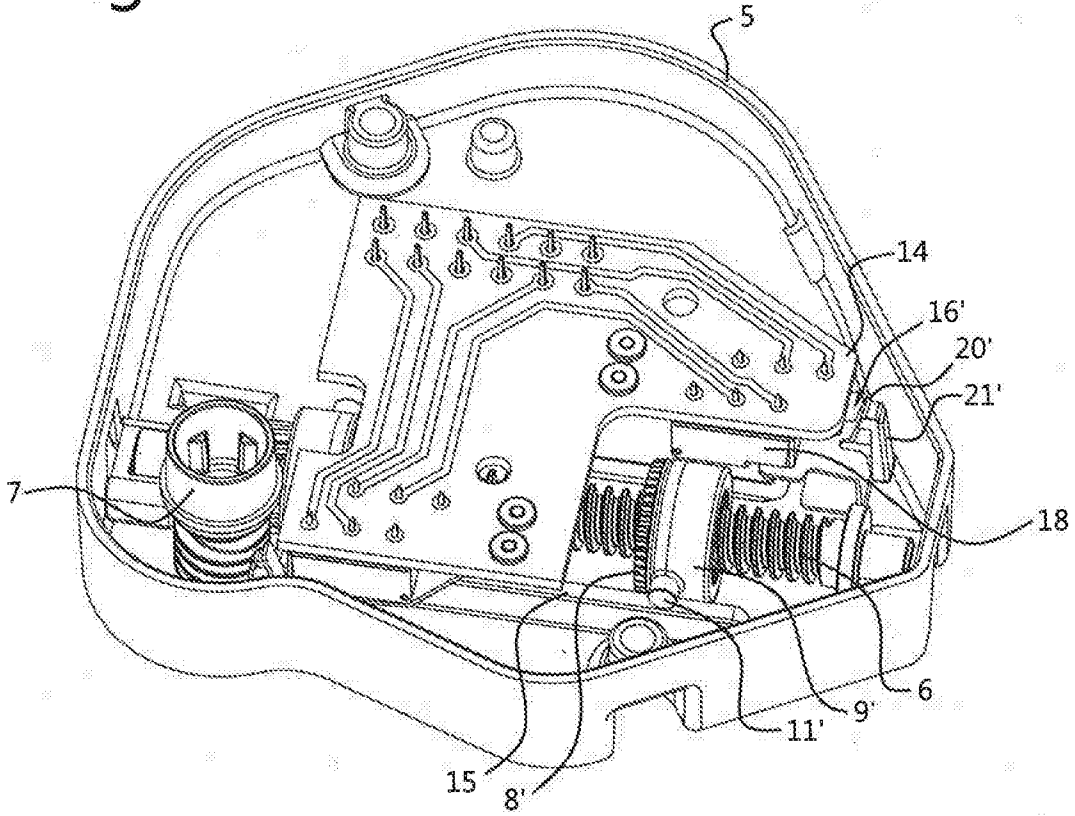


Fig. 4

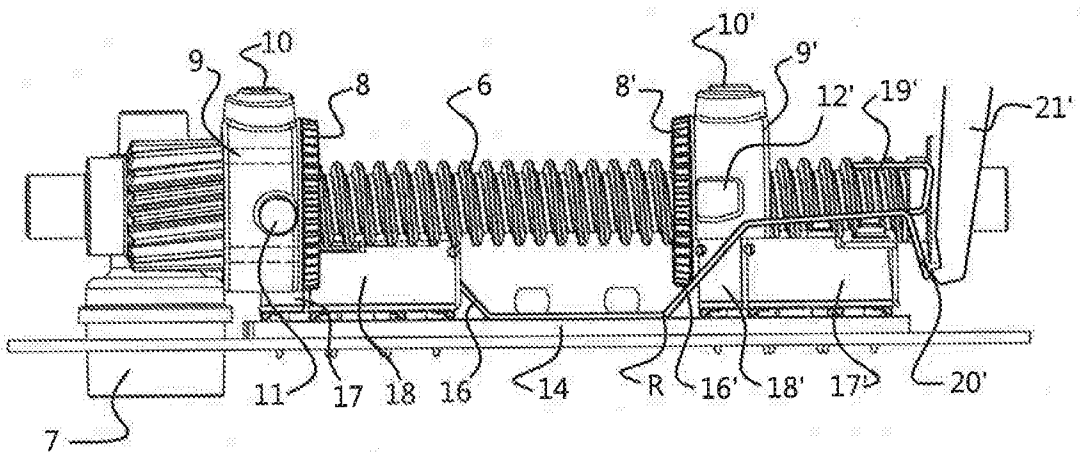


Fig. 5A

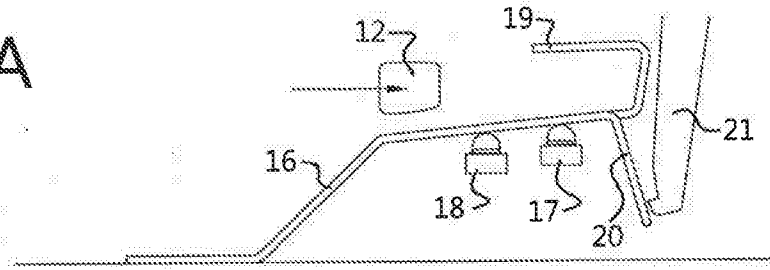


Fig. 5B

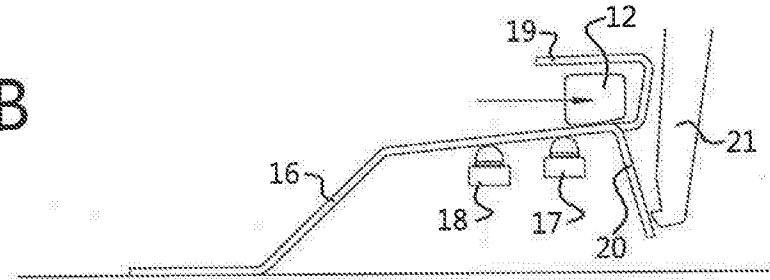


Fig. 5C

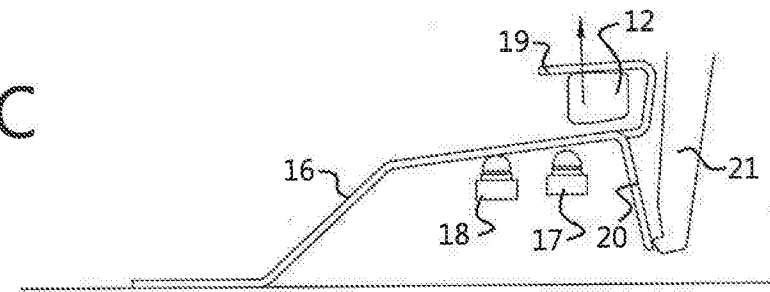


Fig. 5D

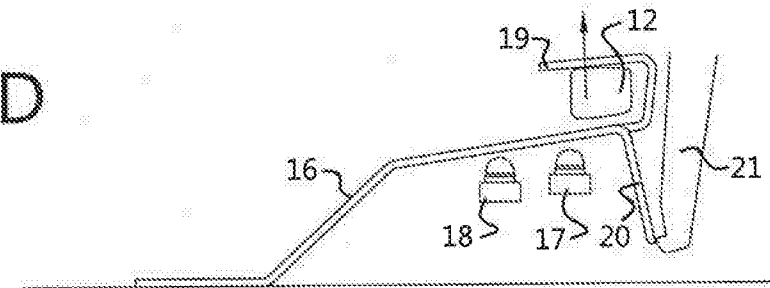


Fig. 5E

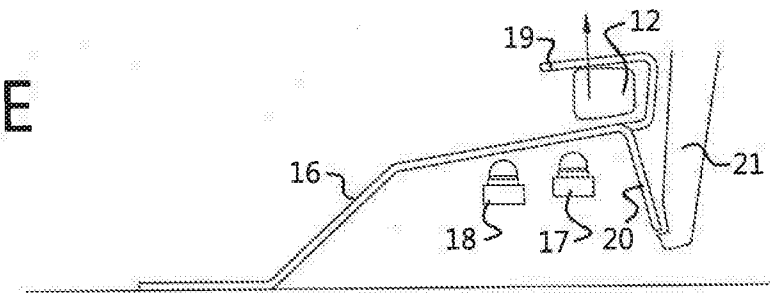
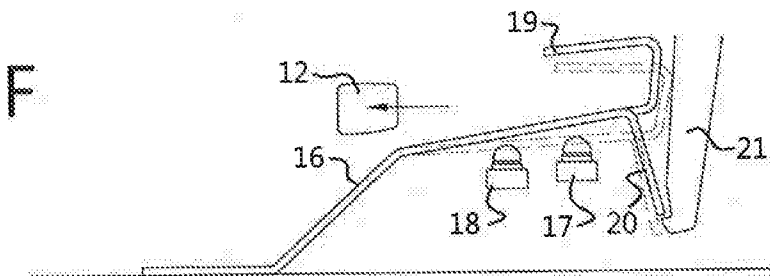


Fig. 5F



Abstract

The invention provides a device for limiting a movement of a member driven by a motor, comprising at least one switch functionally couplable to the motor, at least one movable actuating element, driven by the member driven by the motor and co-
5 acting with the at least one switch, and a mechanical lock for engaging said actuating element for mechanically locking said actuating element when it is at or past at least one set limit position.

SAMENWERKINGSVERDRAG (PCT)

RAPPORT BETREFFENDE NIEUWHEIDSONDERZOEK VAN INTERNATIONAAL TYPE

IDENTIFICATIE VAN DE NATIONALE AANVRAGE	KENMERK VAN DE AANVRAGER OF VAN DE GEMACHTIGDE P100270NL00
Nederlands aanvraag nr. 2018214	Indieningsdatum 23-01-2017
	Ingeroepen voorrangsdatum
Aanvrager (Naam) Ridder Beheer B.V.	
Datum van het verzoek voor een onderzoek van internationaal type 08-04-2017	Door de Instantie voor Internationaal Onderzoek aan het verzoek voor een onderzoek van internationaal type toegekend nr. SN68696
I. CLASSIFICATIE VAN HET ONDERWERP (bij toepassing van verschillende classificaties, alle classificatiesymbolen opgeven)	
Volgens de internationale classificatie (IPC) H01H3/26;H01H3/40;H01H19/18;F16H25/20;H01H13/52;H01H3/16	
II. ONDERZOCHE TE GEBIEDEN VAN DE TECHNIEK	
Onderzochte minimumdocumentatie	
Classificatiesysteem	Classificatiesymbolen
IPC	H01H;F16H
Onderzochte andere documentatie dan de minimum documentatie, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen	
III.	GEEN ONDERZOEK MOGELIJK VOOR BEPAALDE CONCLUSIES (opmerkingen op aanvullingsblad)
IV.	GEBREK AAN EENHEID VAN UITVINDING (opmerkingen op aanvullingsblad)

**ONDERZOEKSRAPPORT BETREFFENDE HET
RESULTAAT VAN HET ONDERZOEK NAAR DE STAND
VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE**

Nummer van het verzoek om een onderzoek naar
de stand van de techniek

NL 2018214

A. CLASSIFICATIE VAN HET ONDERWERP

INV. H01H3/26 H01H3/40 H01H19/18
ADD. F16H25/20 H01H13/52 H01H3/16

Volgens de Internationale Classificatie van octrooien (IPC) of zowel volgens de nationale classificatie als volgens de IPC.

B. ONDERZOCHETE GEBIEDEN VAN DE TECHNIEK

Onderzochte minimum documentatie (classificatie gevolgd door classificatiesymbolen)
H01H F16H

Onderzochte andere documentatie dan de minimum documentatie, voor dergelijke documenten, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

Tijdens het onderzoek geraadpleegde elektronische gegevensbestanden (naam van de gegevensbestanden en, waar uitvoerbaar, gebruikte trefwoorden)

EPO-Internal, WPI Data

C. VAN BELANG GEACHTE DOCUMENTEN

Categorie	Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages	Van belang voor conclusie nr.
A	WO 02/01588 A1 (RIDDER AANDRIJFSYSTEMEN B V [NL]; NUGTEREN LEO [NL]) 3 januari 2002 (2002-01-03) * bladzijden 4-6; figuren 1-5 *	1-15
A	EP 3 106 598 A1 (SOCIÉTÉ INNOVATION DU BÂTIMENT [FR]) 21 december 2016 (2016-12-21) * samenvatting; figuren 1-4 *	1-15
A	US 3 474 317 A (DELANEY CHARLES E) 21 oktober 1969 (1969-10-21) * samenvatting; figuren 1-7 *	1-15
A	US 5 299 678 A (CHANG JAMES S [US] ET AL) 5 april 1994 (1994-04-05) * samenvatting; figuren 1-6 *	1-15

Verdere documenten worden vermeld in het vervolg van vak C. Leden van dezelfde octroofamilie zijn vermeld in een bijlage

*** Speciale categorieën van aangehaalde documenten**

A niet tot de categorie X of Y behorende literatuur die de stand van de techniek beschrijft

D in de octrooiaanvraag vermeld

E eerdere octrooi(aanvraag), gepubliceerd op of na de indieningsdatum, waarin dezelfde uitvinding wordt beschreven

L om andere redenen vermelde literatuur

O niet-schriftelijke stand van de techniek

P tussen de voorrangsdatum en de indieningsdatum gepubliceerde literatuur

T na de indieningsdatum of de voorrangsdatum gepubliceerde literatuur die niet bezwarend is voor de octrooiaanvraag, maar wordt vermeld ter verheldering van de theorie of het principe dat ten grondslag ligt aan de uitvinding

X de conclusie wordt als niet nieuw of niet inventief beschouwd ten opzichte van deze literatuur

Y de conclusie wordt als niet inventief beschouwd ten opzichte van de combinatie van deze literatuur met andere geciteerde literatuur van dezelfde categorie, waarbij de combinatie voor de vakman voor de hand liggend wordt geacht

& lid van dezelfde octroofamilie of overeenkomstige octrooipublicatie

Datum waarop het onderzoek naar de stand van de techniek van internationaal type werd voltooid

26 september 2017

Verzenddatum van het rapport van het onderzoek naar de stand van de techniek van internationaal type

Naam en adres van de instantie

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

De bevoegde ambtenaar

Rucha, Johannes

**ONDERZOEKSRAPPORT BETREFFENDE HET
 RESULTAAT VAN HET ONDERZOEK NAAR DE STAND
 VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE**

Informatie over leden van dezelfde octroofamilie

Nummer van het verzoek om een onderzoek naar
 de stand van de techniek

NL 2018214

In het rapport genoemd octrooi-geschrift	Datum van publicatie	Overeenkomend(e) geschrift(en)	Datum van publicatie
WO 0201588	A1	AU 6961701 A WO 0201588 A1	08-01-2002 03-01-2002
EP 3106598	A1	EP 3106598 A1 FR 3037607 A1	21-12-2016 23-12-2016
US 3474317	A	GB 1166021 A IE 31946 B1 US 3474317 A	01-10-1969 21-02-1973 21-10-1969
US 5299678	A	GEEN	

WRITTEN OPINION

File No. SN68696	Filing date (day/month/year) 23.01.2017	Priority date (day/month/year)	Application No. NL2018214
International Patent Classification (IPC) INV. H01H3/26 H01H3/40 H01H19/18 ADD. F16H25/20 H01H13/52 H01H3/16			
Applicant Ridder Beheer B.V.			

This opinion contains indications relating to the following items:

- Box No. I Basis of the opinion
- Box No. II Priority
- Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- Box No. IV Lack of unity of invention
- Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- Box No. VI Certain documents cited
- Box No. VII Certain defects in the application
- Box No. VIII Certain observations on the application

Examiner Rucha, Johannes

WRITTEN OPINION

Box No. I Basis of this opinion

1. This opinion has been established on the basis of the latest set of claims filed before the start of the search.
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the application and necessary to the claimed invention, this opinion has been established on the basis of:
 - a. type of material:
 - a sequence listing
 - table(s) related to the sequence listing
 - b. format of material:
 - on paper
 - in electronic form
 - c. time of filing/furnishing:
 - contained in the application as filed.
 - filed together with the application in electronic form.
 - furnished subsequently for the purposes of search.
3. In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty	Yes: Claims	1-15
	No: Claims	
Inventive step	Yes: Claims	1-15
	No: Claims	
Industrial applicability	Yes: Claims	1-15
	No: Claims	

2. Citations and explanations

see separate sheet

WRITTEN OPINION

Application number
NL2018214

Box No. VII Certain defects in the application

see separate sheet

1 **Re Item V**

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1.1 Reference is made to the following documents:

D1 WO 02/01588 A1 (RIDDER AANDRIJFSYSTEMEN B V [NL];
NUGTEREN LEO [NL]) 3 januari 2002 (2002-01-03)

1.2 D1 is regarded as being the prior art closest to the subject-matter of claim 1, and shows in Fig. 1-5:

"Een inrichting voor het beperken van een beweging van een onderdeel dat aangedreven wordt door een motor, omvattende:

- ten minste een schakelaar die functioneel koppelbaar is met de motor;
- ten minste een beweegbaar bedieningselement, aangedreven door het onderdeel dat aangedreven wordt door de motor en dat samenwerkt met de ten minste ene schakelaar, en
- een mechanische grendel voor aangrijpen van het bedieningselement voor mechanisch vergrendelen van het bedieningselement wanneer het bij of voorbij ten minste een ingestelde limit positie is".

1.3 The subject-matter of claim 1 therefore differs from this known limiting device in that : "een mechanische grendel voor aangrijpen van het bedieningselement voor mechanisch vergrendelen van het bedieningselement wanneer het bij of voorbij ten minste een ingestelde limit positie is".

The subject-matter of claim 1 is therefore novel.

1.4 The problem to be solved by the present invention may therefore be regarded as to prohibit a possible reset from a distance.

1.5 The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step for the following reasons: the "mechanical lock" (21) catches the operating element (16) and thus denies the release of the switch (18) without direct manual interaction or inspection. The claimed feature solves the problem posed and is neither present nor rendered obvious in the available prior art. None of the available documents disclose a latching mechanism for limiting device that necessitates direct manual interaction of any kind.

1.6 Claims 2-15 are dependent on claim 1 and as such also meet the requirements of inventive step.

2 **Re Item VII**

Certain defects in the application

- 2.1 Independent claim 1 is not in the two-part form, which in the present case would be appropriate, with those features known in combination from the prior art being placed in the preamble and the remaining features being included in the characterising part.
- 2.2 The features of all claims are not provided with reference signs placed in parentheses.
- 2.3 The vague and imprecise statement in the description on page 14 lines 10-15 implies that the subject-matter for which protection is sought may be different to that defined by the claims, thereby resulting in lack of clarity when used to interpret them.