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(54) Speed controller for aperture closing elements and method for controlling speed of said elements

(57) The present invention refers to a speed controller for an aperture closing element, and to a method for controlling speed of said element.

According to the invention, a speed controller for an aperture closing element (31) that is movable between a first position wherein said aperture is closed by said closing element (31) and a second position wherein said aperture is at least partly opened comprises a movable member (5) adapted to be associated to a portion of said closing element (31), and a movement transmission assembly (11, 18, 19, 20). Said speed controller is characterised in that said transmission assembly (11, 18, 19, 20) comprises, in combination, a motor-dynamo (20) and a one-way clutch (18) arranged such that a first movement can be transferred from the movable member (5) to said motor-dynamo and a second movement, opposed to said first movement, can be transferred from said motor-dynamo (20) to the movable member (5).

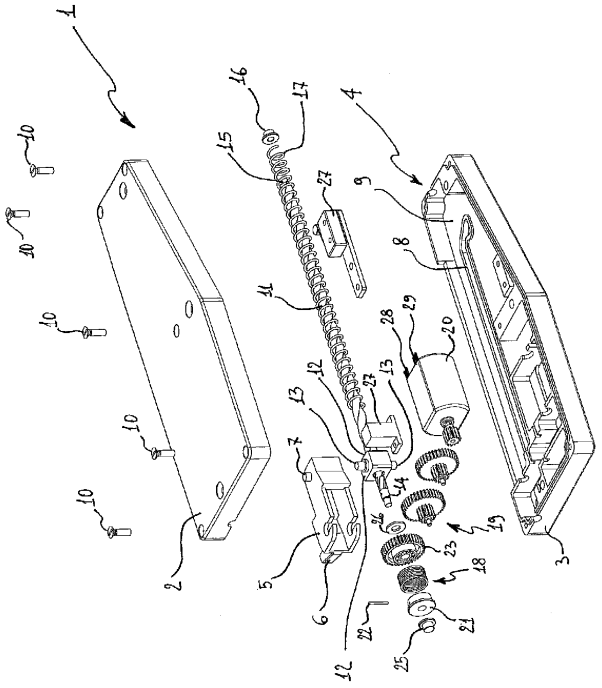

Fig. 1

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Description

[0001] The present invention refers to a speed controller for an aperture closing element, and to a method for controlling speed of said element.

[0002] Nowadays a large variety of aperture closing members like doors, shutters, panels and the like are automated or controlled in at least one of their opening/closing movements. A common example of such kind of automated closing members is represented by sliding doors, used at the entrance of a room or as furniture doors.

[0003] A known technical problem of sliding doors is linked to the first and second fundamental principles of dynamics, i.e. their mass influences greatly the force that a user or an automatic actuator has to apply to such doors to open or close them starting from a door static position. In addition, it is also a problem to efficiently control the speed of a sliding door closing movement, at least in the last part thereof, i.e. when the door is approaching its fully closed position, in order to avoid that such door slams against the frame structure on which it is slidably mounted.

[0004] Automatic sliding doors are driven by complex mechanisms generally comprising an electric motor and a chain for transferring an opening/closing movement to the door. Such arrangements are rather cumbersome and cannot be applied on a frame structure where space is limited, like those characterising a furniture article. Maintenance and a constant electrical power must be ensured to said arrangements for their efficient working. Evidently this can constitute a problem and even an important expense if this type of automatic doors are provided for a domestic use.

[0005] Some technical solutions have been provided in the art for solving problems noted above, and in particular that of controlling speed when a sliding door is to be closed. A mechanical door check is disclosed in the European Patent EP 0 363 642 B1 as comprising an input gear moved by a sliding door and provided for transferring such movement to a brake by means of a gear train. Brake means are in the form of a shoe brake wherein two friction plates are centrifugally movable within a brake cup for exerting rubbing forces thereby braking the gear train and consequently the door closing movement.

[0006] A drawback of the above type of door check consists in that brake cup is progressively worn out by friction plates thereby reducing the efficiency of the door check device, as typically happen with shoe brakes. For restoring full efficiency of such device frequent substitutions of the brake cup and/or friction plates are required which are not only costly but also undesirable because they causes the doors, and the relative environment closed by said doors, to be temporary out of service.

[0007] A further drawback of a check device as disclosed in EP 0 363 642 B1 concerns its large dimensions and noise produced during the brake action exerted by friction plates on brake cup. For applications in which only reduced space is available for mounting a check device, like in a wardrobe for example, a cumbersome arrangement like that disclosed in the above mentioned patent cannot easily be applied. In addition, noise produced by mechanical friction between mechanical components and the shoe brake in particular, cannot be tolerated in a wardrobe that is usually placed in bedrooms.

[0008] As a partial solution to the above drawbacks it has been proposed to the market braking devices for sliding doors wherein braking action is carried out by an eddy current brake. An embodiment of such devices is disclosed in the International Patent Application WO 2006/114352. A damping device according to said Patent Application comprises a sliding member moved by a sliding door and a gear train transforming a linear movement of the sliding member into a rotational movement of a disk with an angular speed determined by an appropriate gear transmission ratio. Said disk is made in an electrically conductive material and rotates facing a plurality of multipolarized permanent magnets. When disk rotates magnets creates in the disk eddy currents that opposes disk movement thereby determining a braking force without having any part in contact and therefore avoiding wear and tear of brake components.

[0009] A drawback of an eddy current damping device consists in that the braking force depends essentially on the disk speed and on the magnetic field intensity. Practically, the higher is the speed and/or the magnetic field intensity, the stronger is the braking action. Therefore such devices need to have well defined transmission gear ratio in order to transform even a slow linear movement of a sliding member into a quick rotation of the electrically conductive disk. Said transmission gear must be accurately designed and correctly assembled. Furthermore, intense magnetic fields can be obtained with several magnets that are costly and make the device heavy and mechanically complex to be assembled.

[0010] Damping device disclosed in WO 2006/114352 is designed for exerting a braking force when a sliding door is to be closed, for this reason the gear train is provided with a movable wheel that can be moved away from the other wheels of the train thereby transferring movement from the sliding member to the eddy current brake only when such member is moving in one of the two possible directions, i.e. the direction corresponding to the door closing movement. A spring element is associated to the movable wheel for keeping the latter meshed with neighbouring wheel and contrasting the moving away movement.

[0011] Since said movable wheel is moved away by a rack connected to the sliding member, the eddy current brake is activated in the first part or the rack movement when a user opens the sliding door starting from a position in which the door is completely closed. This because a couple of rack teeth has to mesh the moving wheel before it disengages the neighbouring wheel. Therefore when a user wants to open a sliding door provided with a device according to WO 2006/114352, he/she will dis-

advantageously have not only to overcome the closed door inertia but also the braking force exerted by the brake in the first part of the sliding movement.

[0012] In addition said moving wheel can work improperly if the spring member loses its efficiency or breaks as it can happen after a number of working cycles.

[0013] A drawback common to both devices disclosed respectively in EP 0 363 642 B1 and in WO 2006/114352 consists in that none of them is suitable for helping the user when he/she wants to open the sliding door manually. In fact when a sliding door is in a position fully closing an aperture, a user has to apply a force sufficiently intense to overcome door weight and friction forces in order to move such door from its closed position. Considering that door weight can be relevant specially whether metallic or glass material is used for door structure, it would be advantageous to have at least such first part of the door opening movement assisted, so as to reduce forces that user is requested to apply.

[0014] The aim of the present invention is therefore to solve the noted problems and thus providing a speed controller suitable for damping at least the last part of a closing movement of an aperture closing element and also suitable for reducing effort requested to a user or to an automatic actuator for imparting an opening movement to said aperture closing element.

[0015] A further object of the invention is to provide a versatile speed controller, i.e. a controller whose working performances can be finely adapted to the features characterising the aperture closing element, like its weight, its particular use and the gradient of speed to be imposed to such element.

[0016] Still another object of the invention is to provide a speed controller for an aperture closing element, like a furniture door, that greatly reduces wear and tear of moving parts thereby keeping speed controller performance constantly high even after a consistent number of working cycles.

[0017] A further object of the invention is providing a speed controller having a reduced number of parts and overall dimensions compared to known type controllers, the same controller reducing emitted noise and being extremely reliable.

[0018] Another object of the present invention consists in providing a speed controller for an aperture closing element having a simple and reliable mechanical transmission adapted to efficiently allow the same controller to work as an aperture closing element brake or as an aperture closing element actuator.

[0019] Still another object of the present invention is to provide an improved frame structure, like a furniture article, having at least a door, in particular a sliding door, whose closing and/or opening movement is assisted by a speed controller according to the present invention.

[0020] Another object of the invention is to provide a method for controlling speed of an aperture closing element, like a door, and when said element is moved in an opening direction, both when it is moved in a closing direction.

[0021] Advantages, objects, and features of the invention will be set forth in part in the description and drawings which follow and in part will become apparent to those having ordinary skill in the art upon examination of the following or may be learned from practice of the invention. The objects and advantages of the invention may be realised and attained as particularly pointed out in the appended claims.

[0022] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate a possible embodiment of the invention and together with the description serve to explain the principles of the invention.

[0023] In the drawings:

[0024] Figure 1 shows an exploded view of a speed controller for an aperture closing element according to the present invention;

[0025] Figure 2 shows in a perspective view speed controller of figure 1 with a movable member in a first position corresponding to a closed position of an aperture closing element;

[0026] Figure 3 shows in a perspective view speed controller of figure 1 with a movable member in a second position corresponding to an open position of an aperture closing element;

[0027] Figure 4 shows in a sectional view a one-way clutch;

[0028] Figure 5 shows in a perspective view a frame structure provided with a speed controller according to the present invention;

[0029] Referring to figure 1, a speed controller for an aperture closing element comprises a casing 1 made in two halves 2 and 3 coupled by screw means 10. Said halves 2, 3 defines a compartment 4 housing a movable member 5 which is associable, at least temporarily, to an opening closure element of a frame structure, like a door of a furniture article, by hook means 6 adapted to clasp a pin (not shown in the figures) provided on said opening closure element. Movable member 5 is slidably coupled to casing 1 through a cam follower 7 and a cam 8 provided on a inner base wall 9 of each casing half 2, 3. A worm 11 is rotatably coupled to the movable member 5 through a connector 12 threadly engaged to worm 11 such that a translational movement of the movable member 5 is transformed in a rotational movement of worm 11 and vice versa. Connector 12 has further cam followers 13 coupled to cam 8 so as to be pivotally associated to casing 1 about said cam followers 13. In this way a rotation of the movable member 5 relatively to worm 11 is allowed about cam followers 13. First and second end portions 14, 15 of worm 11 are associated to casing 1 through bushes 16, 25. Elastic means 17 are coaxially arranged around worm 11 for pushing movable member 5.

[0030] A one-way clutch 18 is provided on the first end portion 14 of worm 11 so as to mechanically connect worm 11 with a gear train 19. Gear train 19 is provided

for transferring a movement from the worm 11 to a motor-dynamo 20 and vice versa. The term "motor-dynamo" is used in the present description for designating a reversible electric machine for converting electrical energy into mechanical energy and vice versa. Moreover, the term covers both AC and DC machines. Motor-dynamo 20 is provided with electrical terminals 28, 29 serving as means for emitting a current when the motor-dynamo 20 is working as a dynamo, and for receiving a powering current from a power source when the motor-dynamo 20 is working as a motor.

[0031] One-way clutch 18, whose working operation will be described here below, is provided for allowing transfer of a first movement from movable member 5 to motor-dynamo 20 only when said member 5 moves along worm 11 from a position wherein the aperture closing element is at least partly opened (see figure 3) leaving the aperture partly accessible to a position wherein said aperture is closed (see figure 2). One way clutch 18 can also transfer a second movement, opposed to the first movement, from the motor-dynamo 20 to the movable member 5 for moving the latter from a first position shown in figure 2 corresponding to a situation in which said aperture closing element closes said aperture to a second position, shown in figure 3, wherein the aperture is at least partly accessible.

[0032] With reference to figure 4, such working operation is obtained by connecting the end portion 14 of worm 11 to a cap 21 through a pin 22 and a first wheel 23 of gear train 19 to a spring element 24 which is also engaged on the cap 21. Wheel 23 is mounted idly with respect to worm 11, i.e. a clearance is present between wheel 23 and worm 11. A washer 26 is provided on a side of wheel 23 to avoid direct contact with worm 11. Windings of spring element 24 can tight when worm 11 and cap 21 are solidly rotated in a first direction indicated with arrow A in figure 4, in this way a connection is established between cap 21 and wheel 23 via said spring 24 and wheel 23 is driven by worm 11. A rotation of worm 11 and cap 21 in a direction opposite to that indicated with arrow A in figure 4 will leave wheel 23 idle because spring windings widen. Evidently when wheel 23 works as driving wheel a movement is transferred to worm 11 only when wheel 23 rotates in the direction opposite to that indicated by arrow A in figure 4. When worm 11 is the driving means, direction A operatively corresponds to a closing movement of the aperture closing element, i.e. indicates the rotation of worm 11 when an aperture closing element is moved for closing such aperture. On the contrary, when wheel 23 is the driving wheel, a rotation of said wheel 23 in the same direction A leaves the worm 11 idle. This means that only a rotation of wheel 23 in a direction opposite to that indicated by arrow A can be transferred to worm 11. This happens when an opening movement is imparted by motor-dynamo 20 to the aperture closing element, as it will be disclosed here below.

[0033] It will be now described the operation of a speed controller according to the invention with reference to figures 2 and 3 where the upper half 2 of casing 1 has been removed.

[0034] In figure 2 speed controller is shown in its rest position corresponding to a situation wherein the opening closure element (not shown in figure 2) is closed and the aperture is not accessible. In this rest position a pin provided on said closing element is engaged by hook 6 of movable member 5 and the latter is placed substantially parallel to worm 11. Elastic means 17 have a minimal potential energy stored therein. When a user or an automatic actuator moves the closing element in the opening direction for making the aperture accessible, movable member 5, dragged by the aperture closing element, translates along worm 11 guided by cam followers 13 and 7 sliding on cam 8. Connector 12 translates solidly with member 5 and rotates worm 11 in direction indicated by arrow B in figure 2 which is opposite to arrow A shown in figure 4. Since the worm 11 is now the driving means, the one-way clutch 18 leaves wheel 23 idle, i.e. wheel 23 is not driven by worm 11 and therefore, gear train 19 and motor-dynamo 20 do not receive any movement, and the speed controller is inactive.

[0035] If it is desired to reduce forces that a user or an automatic actuator is requested to apply when an opening movement is imparted to an aperture closing element, motor-dynamo 20 can be powered by any kind of electrical powering means, such as a battery or a main power supply. Depending on the type of powering means used, such means can equivalently be incorporated in the speed controller compartment 4 or placed outside the casing 1. In this way a movement is transferred from the motor-dynamo 20, working as an electrical motor, to worm 11 through gear train 19. Wheel 23 is therefore a driving wheel rotating in the direction B and imparting the worm 11 a rotation via one-way clutch 18. As described above, such rotation of worm 11, which is opposite to that shown in figure 4 by arrow A, will be transformed by connector 12 in a translational movement of movable member 5.

[0036] Sensing means 27 can be provided substantially at the end portions of cam 8 for sensing position and/or speed of movable member 5 so as to start or stop powering motor-dynamo 20, respectively, as soon as an opening movement is imparted to the aperture closing element and therefore to movable member 5 or as soon as the aperture closing element disengages from movable member 5, i.e. when the latter is approaching the end portion 30 of cam 8, compressing almost completely the elastic means 17 (figure 3). Sensing means 27 can be of many known types, like a Hall effect sensor, a micro switch and the like. In order to power motor-dynamo 20 on and off in response to signals output by sensing means 27, control means (not shown in the figures) can be provided in signal communication with said sensing means 27. Said control means are suitable to operate powering means to supply a current to electrical terminals 28, 29 of motor-dynamo 20 and also to dissipate current pro-

duced on terminals 28, 29, by connecting therebetween a resistance R>0, or by short-circuiting them, as it will be diffusely described here after.

[0037] In figure 3 it is shown the speed controller of figure 2 after that movable member 5 has travelled substantially along the whole longitudinal run of worm 11 and has compressed almost completely the elastic means 17 causing it to store potential energy. Cam followers 13 slides on cam 8 which comprises a straight portion parallel to longitudinal extension of worm 11 and an end portion 30 forming an angle with the straight portion. Such end portion 30 is designed so as to cause movable member 5 to rotate about cam follower 7 thereby rotating hook 6 for disengaging the latter from pin provided on the aperture closing element.

[0038] In case an opening translational movement of movable member 5 is imparted by motor-dynamo 20 working as an electrical motor through gear train 19, as mentioned above, sensing means 27, placed substantially at the end portion 30 of cam 8, senses presence of movable member 5 and outputs a signal that is used by control means for powering motor-dynamo 20 off.

[0039] When the cam follower 13 has reached the end portion 30 of cam 8, movable member 5 stays in the rotated position reached at the end of cam 8 as shown in figure 3 until the aperture closing element is engaged again by hook 6 in the closing movement imparted to said element by a user or an automatic actuator. Evidently, when the aperture closing element is moved for closing such aperture, movable member 5 will travel along worm 11 in the opposite direction compare to that described above, i.e. it will move from the end portion 30 of cam 8 (figure 3) to its rest position shown in figure 2. During its return movement, i.e. during the closing movement of the aperture closing element, movable member 5 is not only dragged by the aperture closing element but it is also pushed by elastic means 17 that releases its potential energy. Similarly to what has been already described above, movable member 5 causes worm 11 to rotate about its longitudinal axis by means of connector 12. This rotation takes place in direction of arrow A shown in figure 4. Since worm 11 is now the driving means, one-way clutch 18 transfer worm 11 rotational movement to wheel 23 and therefore motor-dynamo 20 is activated by gear train 19. Said motor-dynamo 20 now works as a dynamo, producing a voltage on its electrical terminals 28, 29. For braking translational movement of movable member 5, motor-dynamo 20 works as an electromagnetic brake, i.e. as a dynamo brake. In other words, voltage produced on electrical terminals 28, 29 can be used for generating a current through an electrical resistance R>0 interposed between terminals 28, 29 and not shown in the drawings. Such resistance R>0 can also be varied, i.e. adjusted, by control means during movement of the movable member 5 towards its rest position shown in figure 2. In this way the braking action can be arranged as desired, considering the weight of the aperture closing element, the tolerable noise produced by the contact of closing element with the frame structure on which the element is mounted or the speed reached by said closing element during its closing movement. For example, a constant resistance R can be set between electrical terminals 28, 29 so as to maintain a constant braking action during the whole movement of movable member 5 along worm 11, or, if preferred, terminals 28, 29 can be maintained reciprocally isolated for a first portion of movable member 5 movement and a resistance R can be set between electrical terminals 28, 29 just on the last part of movable member 5 movement so as to brake suddenly the aperture closing member only when it is approaching the complete closed position.

[0040] It is also possible to short-circuiting terminals 28, 29 to obtain an intense braking action. Intervention of control means on the resistance R is made evaluating position and/or speed of movable member 5 through signals output by sensing means 27. As a further embodiment of the present speed controller, a resistance R of a specific and predetermined value can be permanently set between electrodes 28, 29 when the controller is mounted on an aperture closing element.

[0041] When the aperture closing element has fully closed the aperture, i.e. the movable member 5 has reached its rest position shown in figure 2, sensing means 27 outputs a signal to control means so as to interrupt the action of the latter on electrical terminals 28, 29 of the motor-dynamo 20. In this way the speed controller will be ready to assist a user or an automatic actuator when start performing the next opening movement of the aperture closing element.

[0042] It is now clear as the present speed controller is very versatile because it can be adapted to aperture closing elements different in shape and in weight, and also to closing elements that are mounted in a variety of frame structures, like walls, furniture articles, vehicles and so on. A speed controller according to the invention can also be applied to already existing aperture opening elements.

[0043] In figure 5 it is shown a mere example of a possible application of a speed controller as described before. A couple of aperture closing elements in the form of sliding doors 31 are mounted on a frame structure in the form of a furniture article 32. Each door 31 is provided with a speed controller connected to a main electrical energy power supply by means of wires 33. Control means for controlling working operations of the speed controller can be stored in a box 34 placed outside the speed controller. However, said control means can be also placed within compartment 4 of the speed controller casing 1.

[0044] In view of the above disclosure, it is evident as a speed controller according to the present invention can be arranged and/or operated so as to work either only as a braking device for reducing speed of an aperture opening element while closing or both as a breaking device and as opening assistant for reducing forces that a user or an automatic actuator has to apply to an aperture

closing element for starting an opening movement of the latter. The invention is therefore advantageously suitable for modifying speed of an aperture closing element as desired during its opening and/or only during its closing movement, in particular a deceleration is produced during the closing movement and an acceleration of the aperture closing element is produced by the speed controller when an opening movement is initiated.

[0045] It should be also considered as comprised in the present invention a speed controller having the features recited in the appended claims and provided for an opening closure element pivotally mounted on a frame structure. If preferred, said speed controller can also be mounted on an aperture closing element for providing the same effects described above when the closing element is to be closed and/or opened.

Claims

1. Speed controller for an aperture closing element (31) that is movable between a first position wherein said aperture is closed by said closing element (31) and a second position wherein said aperture is at least partly opened, said controller comprising a movable member (5) adapted to be associated to a portion of said closing element (31), and a movement transmission assembly (11, 18, 19, 20), **characterised in that** said transmission assembly (11, 18, 19, 20) comprises, in combination, a motor-dynamo (20) and a one-way clutch (18) arranged such that a first movement can be transferred from the movable member (5) to said motor-dynamo (20) and a second movement, opposed to said first movement, can be transferred from said motor-dynamo (20) to the movable member (5).

2. Speed controller according to claim 1 wherein said first movement corresponds to a movement of said aperture closing element (31) from its second position to its first position.

3. Speed controller according to claim 1 or 2 wherein said movement transmission assembly (11, 18, 19, 20) comprises: a worm (11) rotatably coupled to the movable member (5) for transforming a translational movement thereof in a rotational movement, said worm (11) being associated to a first portion of said one-way clutch (18); a gear train (19) associated to a second portion of said one-way clutch (18) and to said motor-dynamo (20).

4. Speed controller according to claim 3 comprising elastic means (17) coaxially arranged around said worm (11), the elastic means (17) being provided for pushing said movable member (5).

5. Speed controller according to any claim 1 to 4 wherein said motor-dynamo (20) comprises short-circuited electrical terminals (28, 29).

6. Speed controller according to any claim 1 to 4 wherein said motor-dynamo (20) comprises electrical terminals (28, 29) and at least one electrical resistance R>0 placed therebetween.

7. Speed controller according to any preceding claim wherein said motor-dynamo (20) comprises electrical terminals (28, 29) electrically connected to control means adapted to adjust electrical resistance R between said electrical terminals (28, 29).

8. Speed controller according to any preceding claims comprising sensing means (27) adapted to sense position and/or speed of said movable member (5).

9. Speed controller according to claims 7 and 8 wherein said sensing means (27) are in signal communication with said control means so as to drive the motor-dynamo (20) in response to position and/or speed of the movable member (5).

10. Speed controller according to any preceding claim further comprising powering means electrically connected to said motor-dynamo (20) for driving said movable member (5) so as to move said aperture closing element (31) from the first to the second position.

11. Method for controlling speed of an aperture closing element **characterised by** comprising the following step: (a) detecting whether a movable member (5) associated to an aperture closing element (31) is moving from a first position wherein said aperture is closed to a second position wherein said aperture is at least partly opened or in the opposed direction; (b) powering a motor-dynamo (20) so as to accelerate the closing element (31) towards said second position if in step (a) a movement of the movable member (5) toward said second position has been detected, or dissipating electric power generated by a motor-dynamo (20) providing a resistance $R \geq 0$ between electrical terminals (28, 29) of said motor-dynamo (20) if in step (a) a movement of the movable member (5) toward said first position has been detected.

12. Method according to claim 11 wherein step (a) is carried out by sensing means (27) and step (b) is carried out by control means in signal communication with said sensing means (27).

13. Method according to claim 12 wherein the resistance R is adjusted by said control means until the movable member (5) is stopped.

14. Frame structure comprising at least one aperture closing element (31) and a speed controller according to any claim 1 to 10.

15. Frame structure according to claim 14 **characterised by** being a furniture article (32) wherein said at least one aperture closing element (31) is a door slidably coupled to said frame structure.

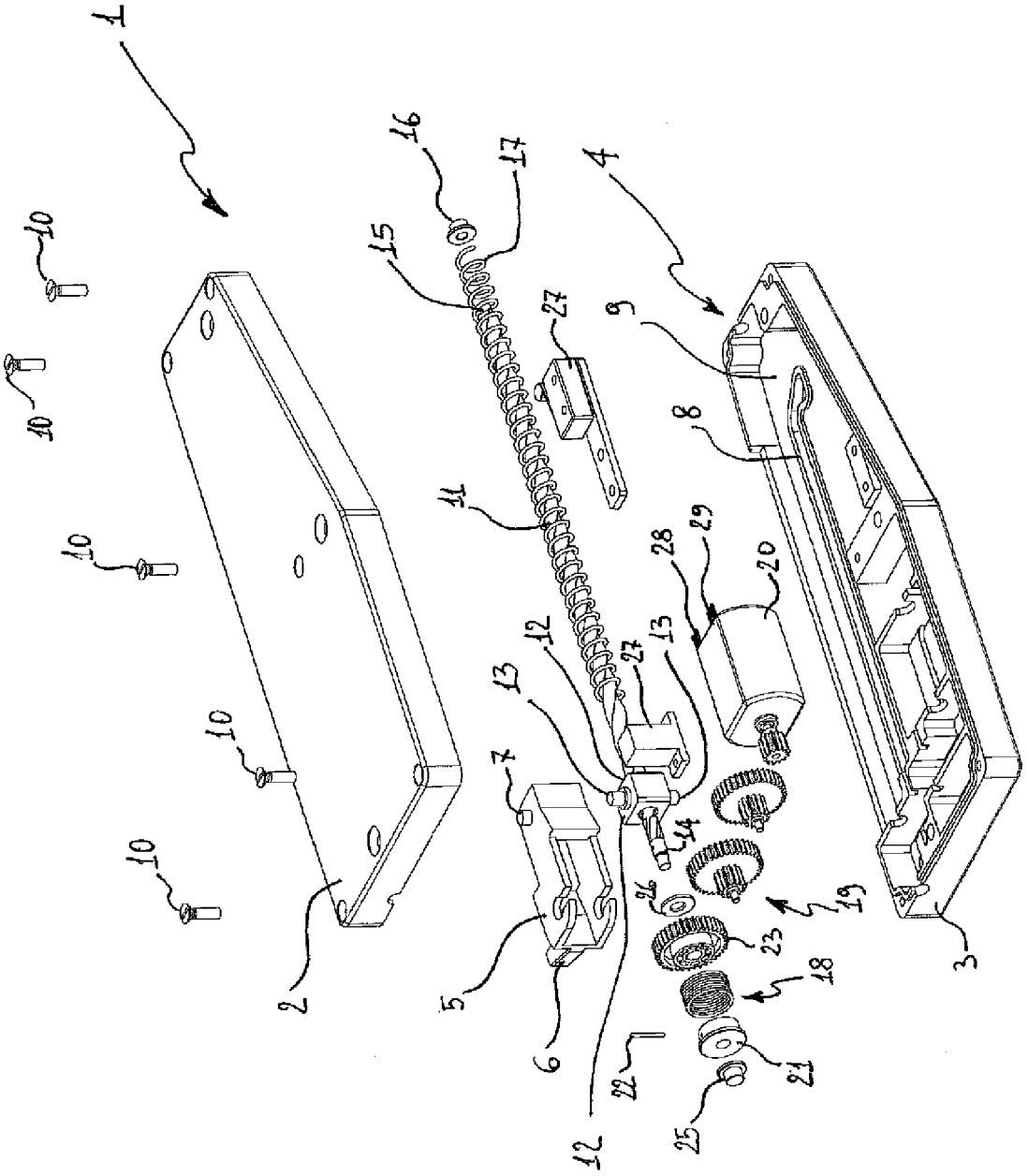
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Fig. 1

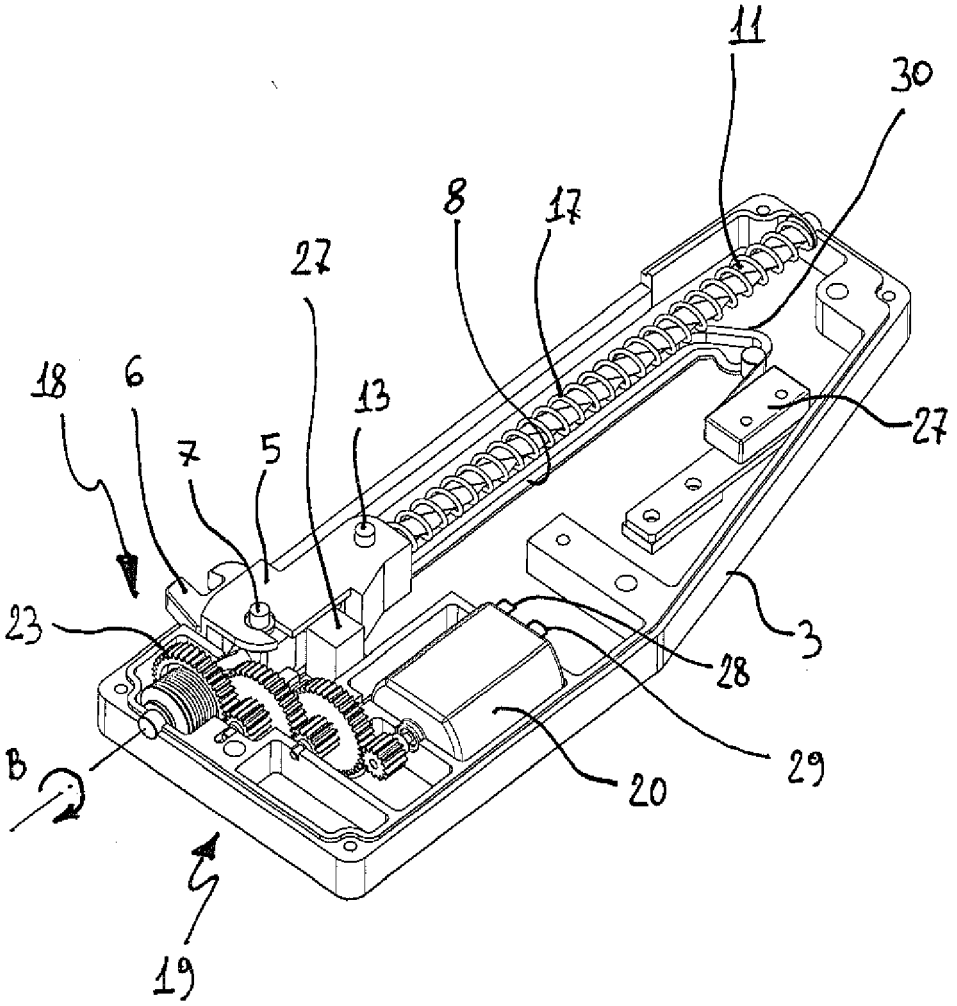

Fig. 2

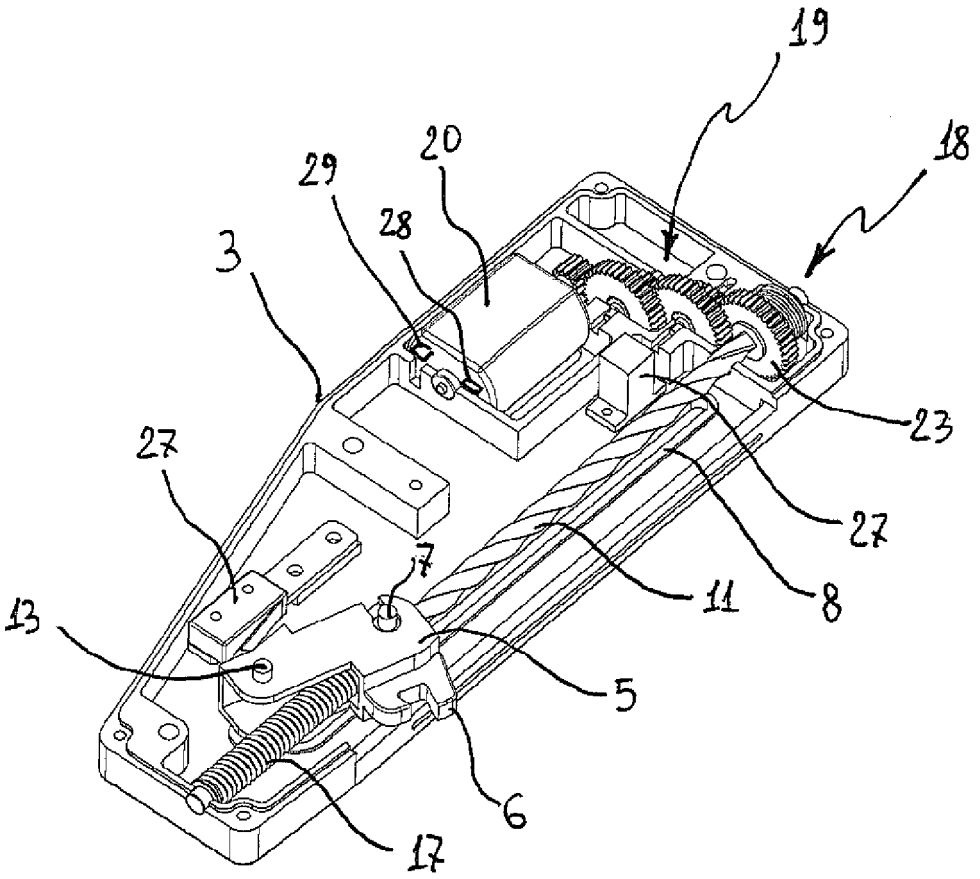

Fig. 3

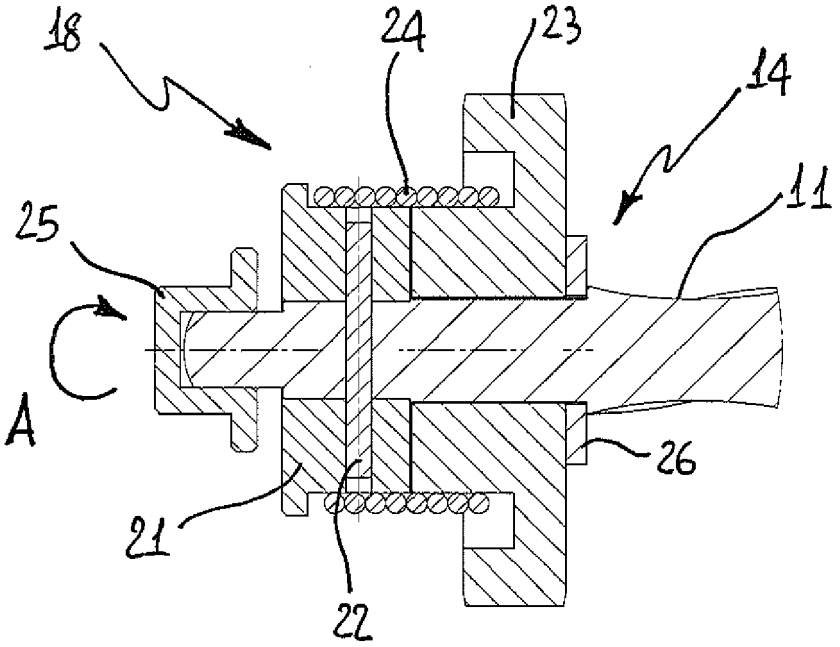

Fig. 4

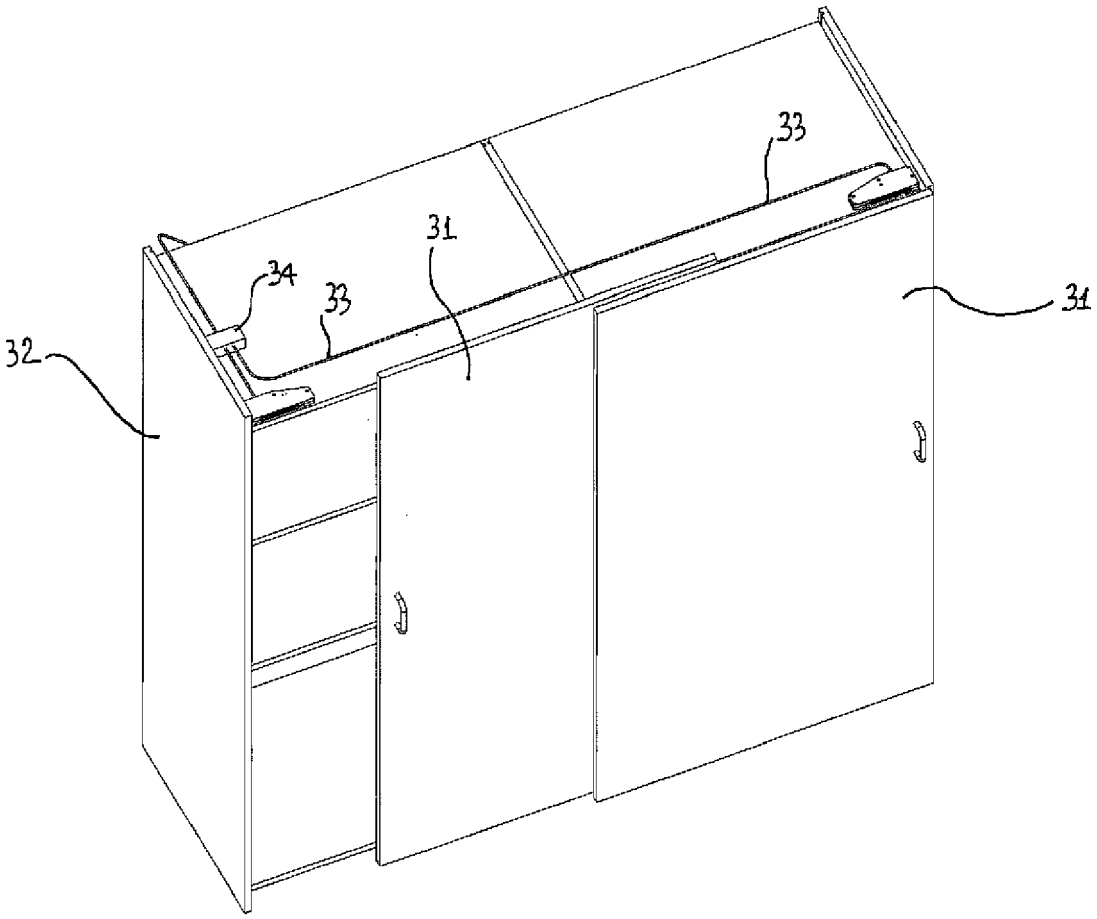

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 08 15 9128

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y A	EP 0 559 947 A (THOMAS INDUSTRIES INC [US]) 15 September 1993 (1993-09-15) * column 3, line 40 - column 6, line 6 * * figures * -----	1,2,5-8, 10,14 3,4,9,15 4,11-13	INV. E05F3/22 E05F5/00 E05F5/02 E05F15/14
X Y	US 5 687 507 A (BERAN MARK A [US]) 18 November 1997 (1997-11-18) * column 5, line 21 - line 22 * * column 5, line 55 - column 6, line 23 * * column 7, last paragraph * * column 8, line 23 - line 37 * * figures * -----	11-13 3,4,9	A47B88/04
Y A	US 2007/101539 A1 (SUTTERLUTTI HARALD [AT] ET AL) 10 May 2007 (2007-05-10) * paragraph [0001] - paragraph [0005] * * paragraph [0014] - paragraph [0016] * * paragraph [0037] - paragraph [0039] * * paragraph [0064] * * paragraph [0070] * * figures * -----	15 4	
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A	DE 20 2006 006181 U1 (HETTICH PAUL GMBH & CO KG [DE]) 30 August 2007 (2007-08-30) * abstract * * paragraph [0023] * * paragraph [0036] * * figure 2 * -----	1,15	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	31 October 2008	Van Kessel, Jeroen

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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