



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
30.12.2015 Bulletin 2015/53

(51) Int Cl.:
E05F 15/681 (2015.01)

(21) Application number: **15173950.5**

(22) Date of filing: **25.06.2015**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA

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(30) Priority: **26.06.2014 IT TV20140091**

(54) **DEVICE TO OPEN/CLOSE GARAGE DOORS**

(57) A device is described which is adapted to open/close and/or lock a overhead canopy door (10) used to occlude an aperture (12). The device comprises an element (40) adapted to move only slightly the door, with respect to the vertical, by imparting to it a force on its

upper edge (20) by angularly oscillating around an axis (X).

Such a device simplifies the displacement of the door and the associated costs.

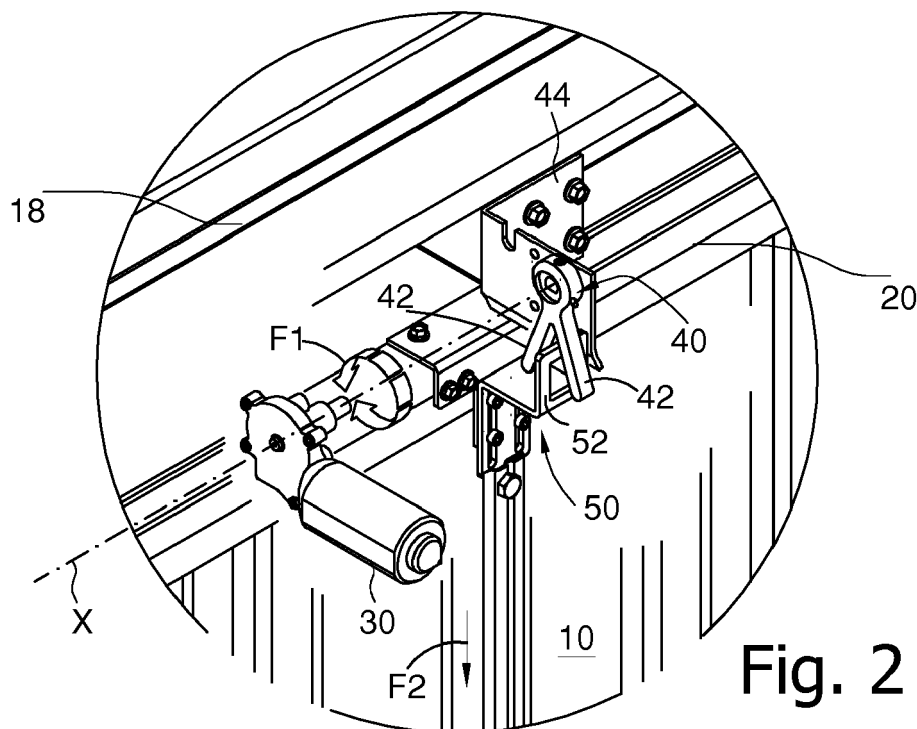


Fig. 2

Description

[0001] The invention relates to a device for gates or doors of the swinging type (overhead canopy door), e.g. for a garage. The device can serve for two functions: the opening/closing and/or locking of the gate or door.

[0002] Overhead gates or doors, that is, having an entire door that lifts leaning and sliding on side pillars that surround the opening to be occluded, suffer from the problem of the dead point, as e.g. document GB1382707 explains. In other words, one cannot open the door when it is closed because the mechanism that lifts it can only exert a vertical force. For the same reason one cannot completely close it during the closing phase.

[0003] GB 2334750 and FR2624186 propose as a solution an auxiliary motor that while turning drives a chain closed in a loop. The mesh of the chain upon translating pushes the upper end of the door to tilt it slightly relative to the vertical or to bring it vertical while it is closed. This is enough to have the door overcome the dead point, but the disadvantages are considerable.

[0004] First, the size of the chain ring makes the mechanism cumbersome horizontally, which is accordingly quite expensive and laborious to install. One must also ensure the constant engagement between the chain and a bracket mounted on upper part of the door, and the bracket must necessarily be extendable not to break away from the chain as the door tilts. Thus one cannot ensure a safe closure because the bracket may lower and break away from the chain if someone tries to force the door. And the size of the chain ring, difficult to protect, increases the risk of being crushed or dragged in the event of inadvertent contact with the user during the motion.

[0005] FR2750447 uses for the same purpose a driving sprocket engageable on a rack fixed to the door. However, the rack must be cleaned from dirt to avoid jamming, and the sprocket must have movable axis to compensate for the approaching of the rack. Moreover, the sprockets involve high risk of being crushed for the user.

[0006] Addressing to at least one of these problems is the main object of the invention.

[0007] Another object is to obtain an opening/closing and/or locking device which is simple, inexpensive and reliable.

[0008] One or more objects are achieved by what is defined in the appended claims, in which the dependent ones define advantageous variants.

[0009] It is proposed a device, adapted to open/close and/or lock an overhead canopy door, e.g. of a garage, used to occlude an aperture, comprising:

an element, adapted to move only slightly the door, with respect to the vertical, by imparting to it a force on its upper edge by angularly oscillating around an axis.

[0010] The oscillation, e.g. with an amplitude between

70 and 90 degrees, preferably takes place with reciprocating motion (as in a pendulum motion) to be able both to push and to pull the door. Even one single function is possible.

[0011] Such an element ensures compactness (not much horizontal bulk), low costs (reduced number of pieces) and a lot of reliability (the oscillating element is always able to engage the edge of the door). Also, it does not entail risk of entrainment and, having a reduced contact surface with the bracket, the risk of crushing is virtually zero.

[0012] Such a device can be used

a) to push the door at the beginning of the opening phase, from vertical to slightly inclined, or, in the closing phase, from slightly inclined to vertical; and/or

b) to lock (and unlock) the door in an upright position (closed).

[0013] In other words, the element defined above is very useful to initially move the door when opening or to lead it to the end-of-travel position when closing. However, the element can only have the function of blocking the door in the closed position, to prevent break-ins, without being involved in the handling of the door. In fact, the bracket is retained by the element and prevents opening of the door.

[0014] Preferably said element is coaxially fixed to the shaft of an electric motor, preferably irreversible and/or having a rpm-reducer unit, and e.g. arranged at the center of a (top) cross-piece which delimits the opening or at about 1/3 of the width of the cross-piece itself. In alternative or combination, the element may be fixed to a wall, which delimits said opening, in a similar position.

[0015] An irreversible motor allows the element when still to act as a safety, anti-opening stop member for the door.

[0016] The element can transfer a radial force to the door for example on a bracket, fixed to the top openable part of the door. The bracket may have, in the part facing the door, a part, e.g. flat, on which the oscillating element is destined to abut.

[0017] Preferably the element has an engagement portion comprising a concavity (e.g. a portion shaped as a fork or dinner fork, or e.g. V-shaped), and it is adapted to capture the bracket inside the concavity (e.g. of two segments which form the fork or the V). In this way, it is assured that the bracket is always pushed or pulled without slippage or loss of contact.

[0018] Note that the element by its oscillation ensures the displacement of the door also in the presence of friction caused by ice or friction with the floor or with the lateral uprights. In known systems, like GB2334750 and FR2624186, this does not happen because in them the bracket must necessarily be extensible not to break away from the chain as the door tilts, and therefore it is movable and maintained in contact with the chain by means of

springs. If a significant force on the bracket is necessary to win the frictions, the reaction of springs can be easily overcome: the bracket detaches and the door does not move.

[0019] The element also has the advantage that it is simple to manage electrically or electronically. It also lends itself to a simple and fast application on the door even after its laying.

[0020] Since the element only oscillates, e.g. at most by 90 degrees, in one sense in the first opening phase and in the opposite direction in the last closing phase, but does not rotate, has very low electric power consumption and has a good ecological impact.

[0021] Willing to motorize completely the lifting and lowering of the door, an extra drive is needed. Then the sides of the door are connected in known manner to suspension ropes or chains, adapted to lift it up and returned on a rotatable member for the fixing to counterweights.

[0022] Preferably to move the rope or chain one uses an electromechanical device comprising a second motor or gear-motor, preferably of epicyclic type because, being reversible, does not require a release mechanical member to open the door or leaf in case of lack of electrical energy. The second motor, which has an output shaft for rotating the rotatable member, is fixed close to the rotatable member and preferably so that the axis of the shaft is substantially horizontal and parallel to the rotation axis of the rotatable member, so as to limit the sizing. The shaft can be coupled with the rotatable member either by direct contact or e.g. with chains, belts or gears. The particular application of the force for opening and closing allows the use of only one motor for lifting and lowering the door, even if with pedestrian door inserted. Even this device lends itself to a simple and fast application on the manufactured article after installation. Preferably then a single motor or geared motor is used, placed on one of the two sides of the frame. With this arrangement one can transfer the motion to the rotatable member without using long transmission shafts inserted in the upper cross-member (as in GB 2334750) or mechanical lever systems. And there is no need for unlocking mechanisms for the manual use of the door in case of lack of electricity, as indicated above.

[0023] The rotatable member may be either a ring gear, when using a chain, or a pulley, when using a rope as a suspension member. When using as suspension organ a rope, it is advantageous to provide a device for controlling the slip of the rope, to solve the problem of accidental slips between rope and driving pulley, not only dangerous for the user but harmful to the integrity of the mechanical structure. To this aim, the angular position of a pulley, e.g. the driving one, is compared with the position of the rope that runs on it, e.g. measured indirectly. To a control unit there are sent a signal relating to the angular speed of the driving pulley and a signal relating to the angular speed of an idle pulley on which the rope is slidable. The two signals are compared by a microprocessor and an excessive difference indicates slip.

[0024] The speed signal of the rope can be obtained in many ways, e.g. by means of sensors capable of generate digital pulses in proportion to the speed of the pulley and the rope. E.g. an optical fork can be arranged around a phonic wheel fixed coaxially to an idle pulley on which the rope runs, thus forming an encoder. The number of pulses sent by the encoder is compared with those coming from the encoder of the motor for raising and lowering of the door. Or a pulley or wheel is installed coaxially fixed on the shaft of an encoder and is kept in contact with the rope by a spring.

[0025] It is also proposed a method for opening/closing an overhead door, e.g. of a garage, comprising the step of slightly moving (e.g. by 5-10 degrees) the door relative to the vertical by imprinting to it a force on the upper edge thereof, wherein the force is impressed by means of an element oscillating about an axis, preferably with reciprocating motion.

[0026] The method comprises all variants and advantages described above of the oscillating element which it incorporates, e.g. the element is mounted and driven in a rotatable manner on an upper cross-piece which delimits the aperture or on the wall, and/or a rotatable organ, destined to move a suspension cable or chain connected to the door, is actuated rotatably, independently from the element, preferably actuating the rotatable organ at a point located on one of the two sides of a frame that delimits the aperture; and/or the angular position of the pulley is compared with the position of the rope sliding on it.

[0027] It is also proposed a garage door comprising a device as defined herein, with all the variants.

[0028] The advantages of the invention will be more apparent from the following description of a preferred embodiment of an opening/closing device, making reference to the attached drawing in which

Fig. 1 shows a device for opening/closing a garage door;

Fig. 2 shows an enlargement of the circle C1 of Fig. 1;

Fig. 3 shows an enlargement of the circle C2 of Fig. 1;

Fig. 4 shows an exploded view of Fig. 3;

Fig. 5 shows an enlargement of the circle C3 of Fig. 1;

Fig. 6 shows an exploded view of Fig. 5;

Fig. 7 shows a variant of revolution detector;

Fig. 8 shows an exploded view of Fig. 7.

[0029] In the figures, identical numbers indicate identical or conceptually similar parts, and terms such as vertical, horizontal, top, etc. refer to the normal conditions of use.

[0030] An overhead garage door 10 (fig. 1) is movable to open or close an opening 12 and slides through wheels 14 inside guides located on a frame formed by two vertical uprights 16 joined together by an upper, horizontal cross-beam 18. The frame is installed on the edges of the aperture 12. To move the door 10 there are two separate drives, indicated respectively A1 and A2, each independent from the other.

[0031] The first, A1, is used to move slightly (e.g. by $5 \div 10$ degrees) the door 10 with respect to the vertical by imparting to the door a force on its upper edge 20. To the horizontal output shaft, with axis X, of an electric gear-motor 30 placed at the center of the cross-beam 18, there is coupled an oscillating element 40 with the shape of a fork defined by two segments 42 that form a V. The gear-motor 30 is fixed to an angular-bracket 44 integral with the cross-beam 18. The motor 30 is controlled, see electrical lines with arrows, by an electric control unit C so as to oscillate with reciprocating motion (see arrow F1) the element 40 about the axis X, axis which is substantially parallel to the cross-beam 18.

[0032] In the following, it is understood that it is the control unit C that controls suitably the driving components.

[0033] On the upper part of the door 10 there is a bracket 50, which in the figures has a flat terminal part 52 or - more preferably - can have in such part, on the side facing the door 10, an inclined plane (not shown). The bracket 50, however, can also be a hook, a pin, an edge or protruding lip, like the part 52, or in general a piece, integral with or connected to the door, with a portion maneuverable by the element 40. For example, the element 40 could have only one segment 42 engageable in a horizontal slot present in the bracket 50: the element 40 has the same effect by pushing or pulling an edge of the slot.

[0034] Coming back to FIG. 1 and 2, with the door 10 closed the part 52 stops between the segments 42, as shown in Fig. 2. In this configuration the element 40 blocks the part 52 and prevents the opening of the door 10.

[0035] In the opening phase, the element 40 rotates only by $70 \div 90$ degrees (counterclockwise in FIG. 2) and the inner segment 42 pushes the part 52, so that the door 10 opens and tilts slightly.

[0036] If the part 52 has the aforementioned inclined plane, the thrust of the segment 42 also determines an axial movement of the bracket 50, downwards (see arrow F2), which allows to unlock the door. It is convenient indeed that the bracket 50 can translate downwards, if e.g. it is manually operated, and that it is pushed by a spring towards the element 40. It is desirable that the bracket 50 can translate downwards only if it actuated by a lock and by means of a connecting bolt to unlock the door in case of lack of electrical energy.

[0037] During the closing phase, the part 52 arrives in proximity of the element 40, which rotates in the opposite direction to the previous one, and the external segment 42 captures and pushes the part 52 towards the cross-

beam 18, completing the closure. Then, with the motor 30 inactive, the element 40 keeps the bracket 50 blocked.

[0038] Willing to motorize completely the lifting and lowering of the door 10, the additional drive A2 is needed.

5 Then, the sides of the door 10 are connected in known manner to cables or chains 22, suitable to lift it up, and returned on a rotatable member (FIGURES 5-8) for fixing to counterweights 24.

10 **[0039]** Preferably an electromechanical device is used comprising a gear-motor 60 (Figures 3 and 4), preferably of the planetary gear type, whose output shaft rotates the rotatable member, e.g. a toothed gear 62 which meshes with a lifting chain 22.

15 **[0040]** The gear-motor 60 is fixed close to the wheel 62 so that the Y axis of its shaft is substantially horizontal and parallel to the rotation axis Z of the wheel 62 and parallel to the cross-beam 18 (and the X axis). On said shaft is mounted a pinion 66 coupled to a chain or belt 68 which moves the wheel 62. The gear-motor 60, the 20 wheel 62 and the transmission organs are supported by a bracket 64 fixed to an upright 16. Preferably a single gear motor 60 is used, placed on one of the two sides of the frame.

25 **[0041]** In fig. 3 or 4 the rotatable member can be a pulley if a rope is used as suspension organ.

[0042] In this case one can envisage a control device for the slip between the rope and the driving pulley.

30 **[0043]** To this aim the angular position of the drive pulley and the position of the rope are detected, measured e.g. indirectly. The position signals (digital pulses) are sent to the control unit C where an internal microprocessor M compares them to detect a difference indicating slip, in which case the control unit stops the door 10 and signals the malfunction.

35 **[0044]** Figs. 5 and 6 show a first variant for a device for detecting the speed of the rope, device that e.g. is placed on a pulley located on the opposite side, with respect to the cross-beam 18, to the motor 60. On a bracket 70 is rotatably pivoted a pulley 72 equipped with a phonic wheel 74 fixed coaxially to it. An optic fork 76 is placed 40 around the phonic wheel 74 thereby forming an encoder adapted to send to the control unit C pulses with a frequency proportional to the angular speed of the pulley 72. The pulley 72 can be e.g. the element indicated with 62 in fig. 3, or an idle guiding pulley for the rope.

45 **[0045]** Figs. 7 and 8 show a second variant for a device of the above type. On a bracket 80, fixed e.g. on an upright 16 and/or on the side of the motor 60, there is rotatably pivoted an idle pulley 82 used to return or guide the rope. 50 On the bracket 80 is hinged or attached an arm 84, to the end of which a wheel 86 is rotatable equipped with rotary encoder. The wheel 86 is preferably maintained in contact with the rope by a spring (not shown) that pushes the wheel 86 itself or the arm 84.

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Claims

edge, wherein the force is imparted by means of an element oscillating about an axis.

1. Device adapted to open/close and/or lock a overhead canopy door (10) used to occlude an aperture (12), **characterized by** comprising: 5

an element (40) adapted to move only slightly the door, with respect to the vertical, by imparting to it a force on its upper edge (20) by angularly oscillating around an axis (X). 10
2. Device according to claim 1, wherein the element is fixed coaxially to the shaft of an electric motor (30) mounted on an upper crosspiece (18) or a wall that delimits the opening. 15
3. Device according to claim 1 or 2, comprising a bracket (50), fixed to the openable, top part of the door, on which the oscillating element is destined to abut. 20
4. Device according to claim 3, wherein the element has an engagement portion (42) comprising a concavity and is adapted to capture the bracket inside the concavity. 25
5. Device according to one of the preceding claims, comprising: a second electric motor (60) having an output shaft adapted to rotate a rotatable member (62) destined to move a suspension rope or chain (22) connected to the door, wherein the second motor is fixed close to the rotatable member so that the axis (Y) of said shaft is substantially horizontal and parallel to the axis of rotation (Z) of the rotatable member. 30
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6. Device according to claim 5, wherein the second motor is only one and placed on one of two sides of a frame that delimits the opening.
7. Device according to claim 5 or 6, wherein the rotatable member is a pulley cooperating with a suspension rope, and the device comprises a device for controlling the slip of the rope. 40
8. Device according to claim 7, wherein the device for controlling is adapted to compare the angular position of the pulley with the position of the rope that runs on it. 45
9. Device according to claim 8, wherein the device for controlling comprises sensors for generating digital pulses in proportion to the speed of the pulley and the rope. 50
10. Method for opening/closing an overhead canopy door, for example a garage door, comprising the step of moving the door slightly relative to the vertical by imparting a force on its upper 55

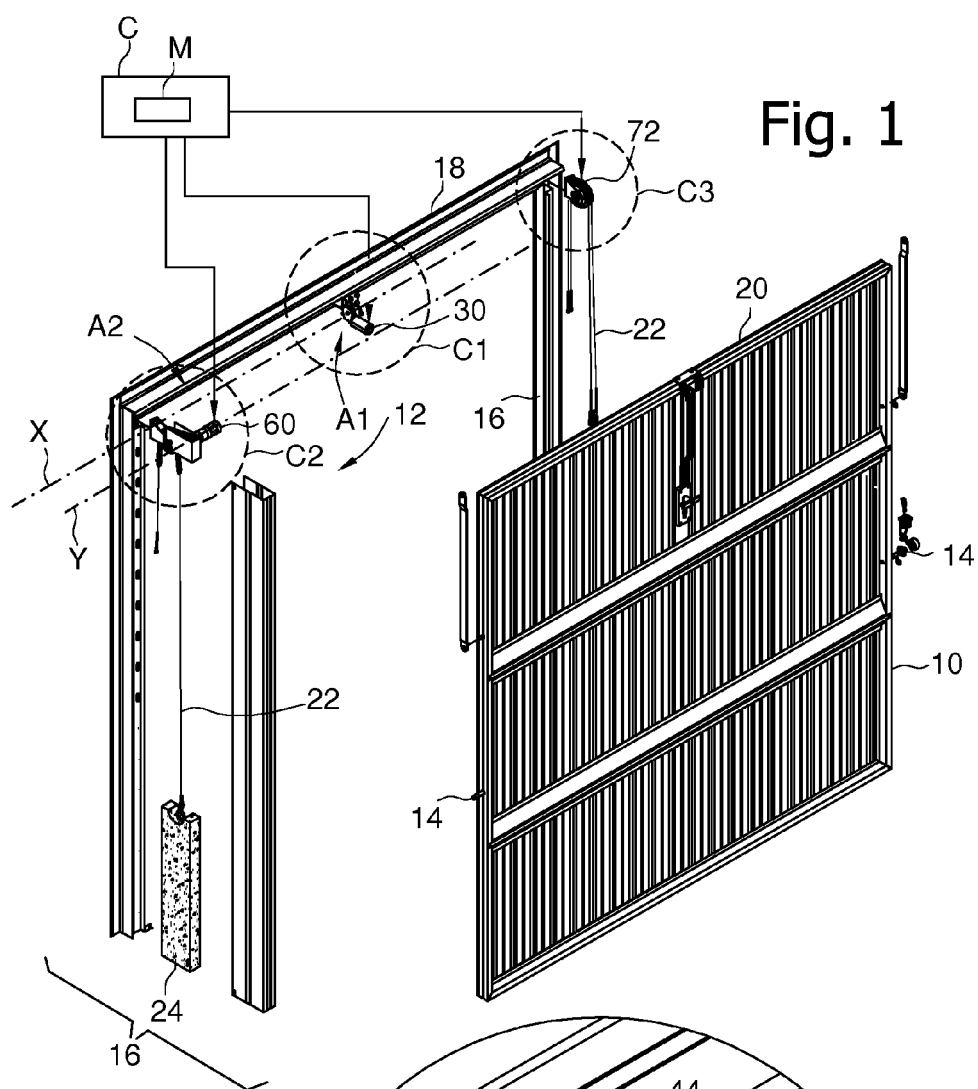


Fig. 1

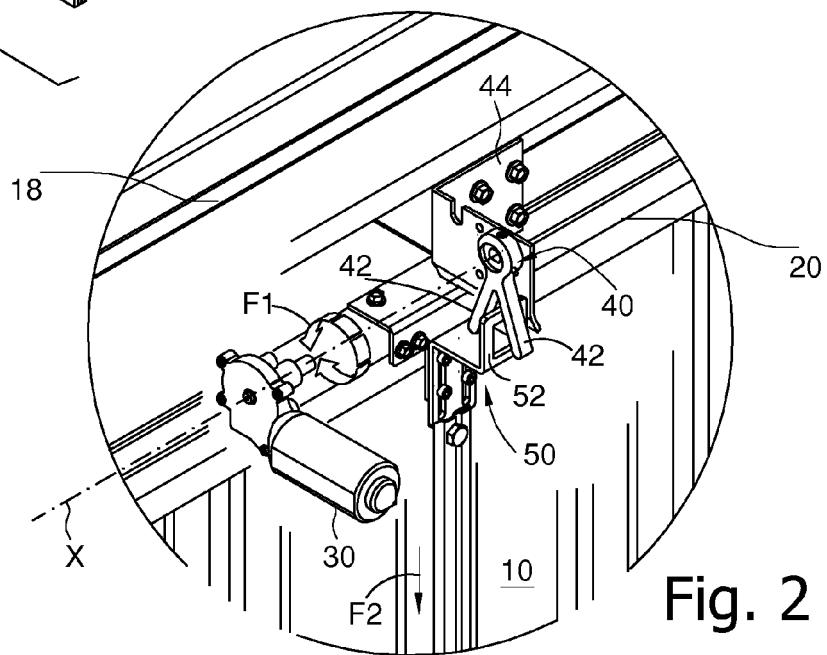


Fig. 2

Fig. 4

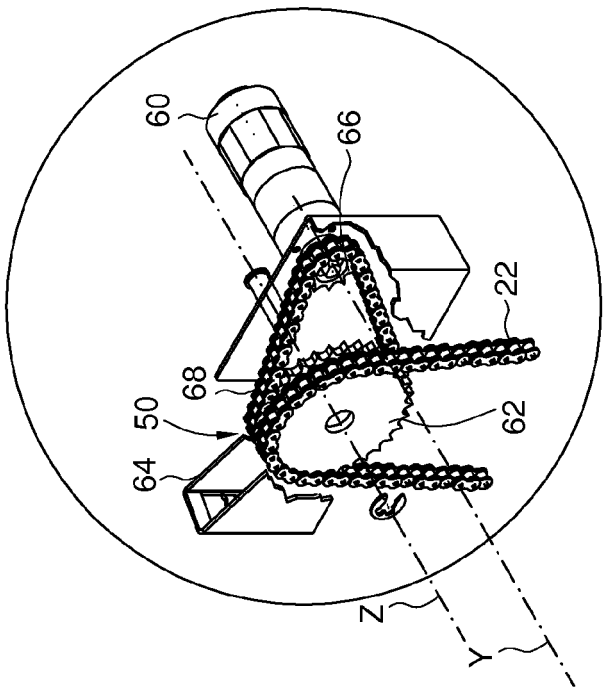
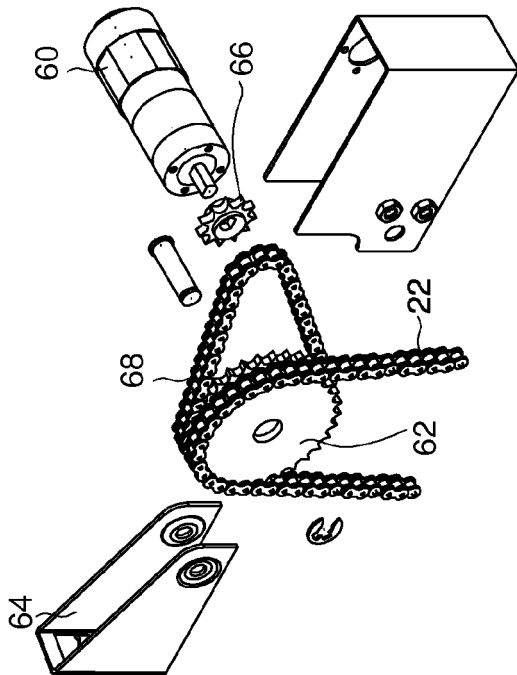


Fig. 3

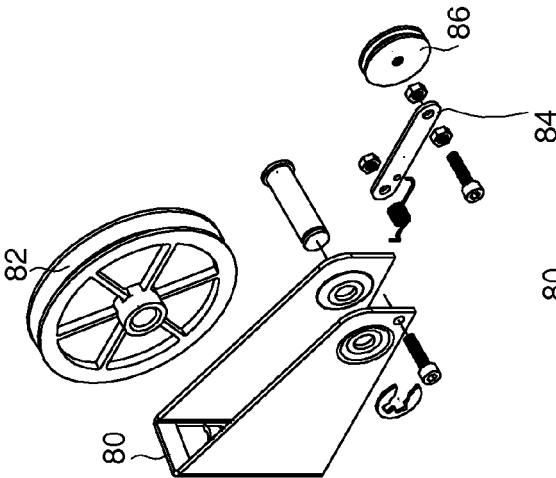


Fig. 8

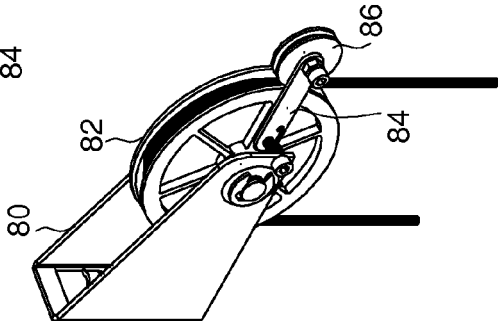


Fig. 7

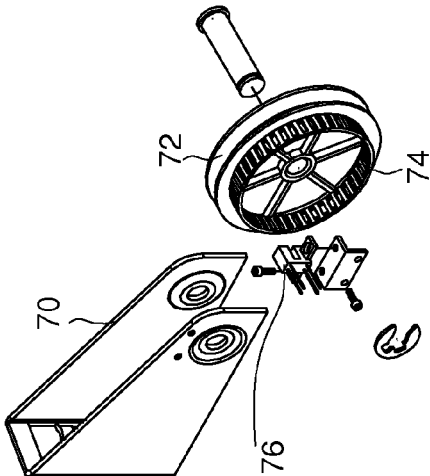


Fig. 6

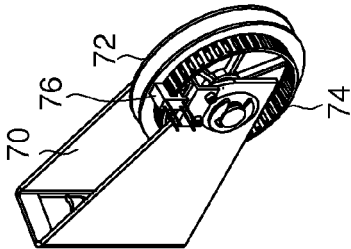


Fig. 5



EUROPEAN SEARCH REPORT

Application Number
EP 15 17 3950

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 3 708 917 A (STREETER P) 9 January 1973 (1973-01-09)	1,3,4, 7-10	INV. E05F15/681
Y	* column 1, line 50 - column 3, line 16 * * figures 5,6,7 *	2,5,6	
X	FR 2 711 175 A1 (DOITRAND FRERES SA ETS [FR]) 21 April 1995 (1995-04-21) * page 13, line 1 - page 14, line 20 * * figures 1,13-15 *	1,4	
Y	US 5 572 829 A (STOLTENBERG DONALD A [US]) 12 November 1996 (1996-11-12) * column 6, line 14 - column 7, line 50 * * figures 3-5 *	2,5,6	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			E05F
Place of search		Date of completion of the search	Examiner
The Hague		22 October 2015	Klemke, Beate
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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22-10-2015

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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