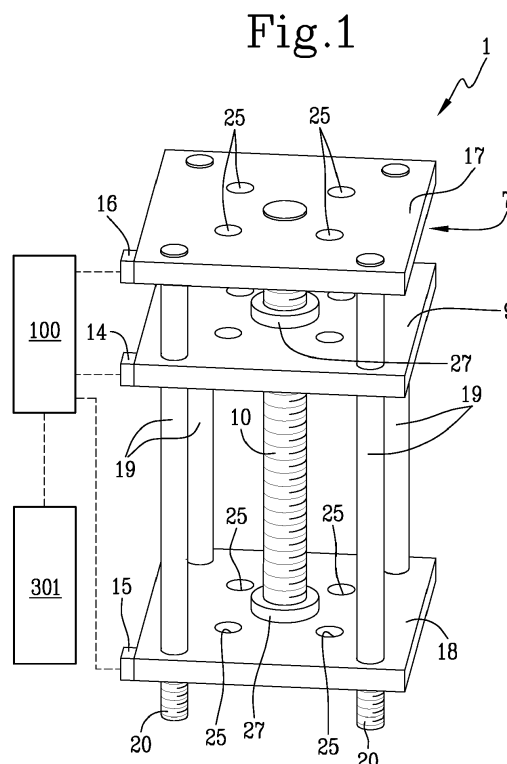




Description

Field of the invention

[0001] The present invention relates to a device for varying the end stroke position of a cabin of a rope lifting system, in particular of a cabin movable within a compartment, e.g. lift cabins, hoists and the like.

[0002] Within the scope of this description and the subsequent claims, the terms "rope" or "pulling rope" are used extensively to refer also to structurally and/or functionally equivalent elements such as, for example, a chain, a belt and the like.

[0003] Additionally, within the scope of the present description and the subsequent claims, the term "rope" or "pulling rope" is used to refer to one or more ropes forming part of a same lifting device.

Background of the invention

[0004] Installation technicians of cabins of lifting systems are often required to install new lifting systems in pre-existing buildings or to carry out maintenance operations on old pre-existing systems. In these circumstances, the compartments housing the lifting cabins do not have adequate safety spaces, particularly between the ceiling of the compartment and the upper end stroke position of the cabin, or between the bottom of the compartment or pit and the lower end stroke position of the cabin. These spaces are necessary for maintenance workers to comfortably work safely and avoid accidents at work.

[0005] However, it often turns out that said spaces have not been provided with a sufficiently large size or are sometimes missing altogether. Furthermore, said spaces may not often be implemented in retrospect within the compartment due to the compartment or building structural reasons. Consequently, during the step of installing or maintaining the lifting systems, a maintenance technician is under a constant risk of injury in the event of a malfunction of the rope lifting system or of the auxiliary safety cabin locking systems currently in use and provided for by current industry regulations while the maintenance technician is working positioned on the cabin roof or under the cabin or in the bottom of the compartment or in the pit.

[0006] According to UNI EN 81-20:2014 and UNI EN 81-50:2014 standards concerning the safety rules for the construction and installation of lifting systems, it is a legal requirement that the greatest possible safety conditions at the workplace are ensured for maintenance operators, including the presence of a minimum safety operating space between the cabin and the compartment ceiling rather than between the cabin and the compartment bottom/pit. However, to date, there is no solution, either within the regulations or within the prior art, aiming at guaranteeing this minimum operating space.

Summary of the invention

[0007] In this context, the technical problem underlying the present invention is to make available a device for varying the end stroke position of a cabin of a rope lifting system that can meet the aforesaid requirement, i.e. to ensure a minimum safety operating space for maintenance operations.

[0008] This technical problem underlying the present invention is solved by a device for varying the end stroke position of a cabin of a rope lifting system in accordance with claim 1.

[0009] The remaining claims detail further characteristics related to possible specific embodiments.

[0010] In particular, the idea underlying the present invention is to be able to vary the position of an end stroke position of the cabin of a rope lifting system within its compartment if necessary by adjusting the length of the pulling ropes, i.e. the position of the ends of the pulling ropes.

[0011] The device according to the invention is intended to be connected to said pulling ropes of the rope lifting system at a fastening point of the rope lifting system. The ropes are attached to a movable element of the device which, once assumed certain operating configurations, makes it possible to vary the position of the rope ends and, consequently, to vary the height of one of the cabin end stroke positions within the compartment.

[0012] Said device is used in all the lifting systems that use pulling ropes as the cabin handling components, preferably but not exclusively in counterweight or pulley hydraulic piston lifting systems.

Brief description of the figures

[0013] Further features and advantages of the present invention will be apparent from the hereinafter reported description of some of its preferred embodiments, given by way of indication and not limitation, with reference to the accompanying figures, wherein:

- Figures 1 and 2 are axonometric views of a preferred but not exclusive embodiment of a device for varying the end stroke position of a cabin of a rope lifting system subject of the present invention in different operating configurations respectively;
- Figures 3, 4 and 5 are schematic views indicative of the possible positioning of the device subject of the present invention in the case of a rope lifting system of the counterweight type;
- Figures 6 and 7 are schematic views indicative of the possible positioning of the device subject of the present invention in the general case of a rope lifting system with a pulley hydraulic piston;
- Figures 8 and 9 are schematic views indicative of possible alternative embodiments of the device in Figures 1 and 2;
- Figure 10 indicates an axonometric view of an en-

larged detail of Figure 1;

- Figure 11 indicates a variant of Figures 3, 4 and 5 where the device subject of the present invention is fixed at an intermediate point of the pulling ropes;
- Figure 12 indicates a variant of Figures 6 and 7 where the device subject of the present invention is fixed at an intermediate point of the pulling ropes;
- Figures 13 and 14 indicate axonometric views of an alternative embodiment of a device for varying the end stroke position of a cabin of a rope lifting system, where the handling device is a rotational mechanism in different operating configurations.

Detailed description of the invention

[0014] With reference to the enclosed figures, a device for varying the end stroke position of a cabin of a rope lifting system has been globally referred to as 1 (hereinafter simply referred to as "device 1").

[0015] With reference to Figures 3 to 7, a rope lifting system comprising pulling ropes 2 and a cabin 3 movable within a vertical compartment 4 is shown. The pulling ropes 2 are operatively connected to the cabin 3 to move it along a vertical compartment 4.

[0016] As specified in the introduction, the term pulling rope is herein used extensively to also refer to structurally and/or functionally equivalent elements such as, for example, a chain, a belt and the like.

[0017] As described, the cabin 3 is movable along a vertical working path within the vertical compartment 4. The working path comprises two end stroke positions, in particular an upper end stroke position 5 and a lower end stroke position 6.

[0018] In particular, Figures 3 to 5 refer to a rope lifting system of the counterweight type and thus comprising a counterweight "C", while Figures 6 to 7 refer to a rope lifting system with a pulley hydraulic piston and thus comprising a hydraulic piston "PI" and a pulley "PU".

[0019] With reference to Figures 1 and 2 or Figures 8 and 9, the device 1 comprises a fixed structure 7 that can be connected to a fastening zone 8 (see Figures 3 to 7) of the rope lifting system.

[0020] The device 1 comprises an adjustment element 9 which is mounted as movable relative to the fixed structure 7.

[0021] The device 1 further comprises a handling mechanism 10 operatively interposed between the adjustment element 9 and the fixed structure 7 and configured to make the adjustment element 9 assume a plurality of operating configurations. These operating configurations assumed by the adjustment element 9 correspond to possible positions of the ends of the pulling ropes 2 and consequently of the cabin end stroke positions 3 within the vertical compartment 4.

[0022] With reference to Figures 1 and 2 and to a first embodiment, the adjustment element 9 is capable of assuming two operating configurations, specifically a maintenance operating configuration (see Figure 1) and a

working operating configuration (see Figure 2). The working operating configuration of the adjustment element 9 (see Figure 2) defines a working position of the ends of the pulling ropes 2 which defines within the vertical compartment 4 the upper 4 and lower 5 end stroke positions of the cabin 3 according to the operation of the rope lifting system provided in regular operating conditions. The maintenance operating configuration of the adjustment element 9 (see Figure 1) defines a maintenance position of the ends of the pulling ropes 2, in particular so as to vary one of the end stroke positions of the cabin 3 within the vertical compartment 4 so as to define a safety space of a predefined height within the vertical compartment 4 itself. This maintenance operating configuration comprises, in particular, either that the upper end stroke position 5 is lowered, thus defining an upper maintenance end stroke position 5a that is lowered relative to the aforesaid upper end stroke position 5, or that the lower end stroke position 6 is raised to define a lower maintenance end stroke position 6a. For distinction purposes, reference will be made to:

- *"upper maintenance operating configuration"* the configuration of the device 1 when a safety space of a predefined height is ensured within the vertical compartment 4 between the roof of the cabin 3 and the ceiling of the vertical compartment 4 due to the height difference between the upper end stroke position 5 and the upper maintenance end stroke position 5a and
- *"lower maintenance operating configuration"* the configuration of the device 1 when a safety space of a predefined height is ensured within the vertical compartment 4 between the bottom of the cabin 3 and the bottom of the vertical compartment 4 (or pit) due to the height difference between the lower end stroke position 6 and the lower maintenance end stroke position 6a.

[0023] The maintenance operating configuration shown in Figure 1 may correspond to the upper or lower maintenance operating configuration depending on where the fastening zone 8 is located and how the device 1 interacts with the pulling ropes 2.

[0024] In particular, the adjustment element 9 shown in Figures 1 or 2, while in use, can alternatively and exclusively assume one configuration between the working operating configuration and the maintenance configuration.

[0025] In a second embodiment alternative to the one described above, Figures 1 and 2 correspond to the upper maintenance operating configuration and lower maintenance operating configuration respectively (or vice versa depending on where the fastening zone 8 is located and how the device 1 interacts with the pulling ropes 2). In this case, the working operating configuration (not shown in Figures 1 and 2) would correspond to having the adjustment element 9 in an intermediate position

between those shown in Figures 1 and 2.

[0026] It is noted that in this case, by means of a single device 1, the maintenance technician would take advantage of an "upper maintenance operating configuration" of the device 1 when he is required to work on the roof of the cabin. Alternatively, the maintenance technician would take advantage of a "lower maintenance operating configuration" of the same device 1 when he is required to work in the bottom of the compartment (or pit) or, generally, underneath the cabin 3. In both cases, these configurations ensure a safety space of a predefined height within the vertical compartment 4, respectively between the roof of the cabin 3 and the ceiling of the vertical compartment 4 due to the height difference between the upper end stroke position 5 and the upper maintenance end stroke position 5a, or between the bottom of the cabin 3 and the bottom of the vertical compartment 4 (or pit) due to the height difference between the lower end stroke position 6 and the lower maintenance end stroke position 6a. As a result, in the event of an accident, the cabin is physically prevented from moving beyond the limit imposed by the maintenance end stroke position set according to the position of the rope ends 2 in the direction chosen by the operator, which would conveniently coincide with the side of the cabin where the operator would perform the work.

[0027] It should be noted that in the transition from the working operating configuration to the maintenance operating configuration, and vice versa, the length of pulling ropes 2 does not change in an absolute sense, but only their working arrangement changes, and in particular the position assumed by the ends of said pulling ropes 2.

[0028] With reference to Figures 1 and 2, the device 1 comprises detection means configured to detect which operating configuration the device 1 is in, specifically one between the working operating configuration and the maintenance configuration. Said sensing means preferably comprise a plurality of sensor members, for example, a movable sensor member 14 integral with the adjustment element 9, a first fixed sensor member 15 preferably integral with the fixed structure 7 and a second fixed sensor member 16 preferably integral with the fixed structure 7. In the second embodiment described, the sensing means also comprise a third fixed sensor member (not shown).

[0029] The relief of the configuration results from the interaction between the movable sensor member 14 with the first fixed sensor member 15 or the second sensor member 16 or the third fixed sensor member (not shown).

[0030] In the first embodiment described with reference to Figures 1 and 2, if the movable sensor member 14 and the first fixed sensor member 15 are configured to detect when the adjustment element 9 is in the working operating configuration, then, the movable sensor member 14 and the second fixed sensor member 16 are configured to detect when the adjustment element 9 is in the maintenance operating configuration or vice versa, depending on where the fastening zone 8 is located and

how the device 1 interacts with the pulling ropes 2.

[0031] In the second embodiment, the movable sensor member 14 and the first fixed sensor member 15 are configured to detect when the adjustment element 9 is in the upper maintenance operating configuration (or lower depending on where the fastening area 8 is located and how the device 1 interacts with the pulling ropes 2). In addition, the movable sensor member 14 and the second fixed sensor member 16 are configured to detect when the adjustment element 9 is in the lower maintenance operating configuration (or upper depending on where the fastening area 8 is located and how the device 1 interacts with the pulling ropes 2). Finally, the movable sensor member 14 and the third fixed sensor member (not shown) are configured to detect when the adjustment element 9 is in the working operating configuration.

[0032] Preferably, the device 1 comprises an operating control system 100 configured to communicate with a control module 200 of the lifting system suitable for activating/deactivating a first command interface 300 arranged inside the cabin 3 and for activating/deactivating a second command interface 301 arranged remote from the cabin 3. The control system 100 is operatively linked with the sensing means and when the maintenance configuration is detected it is configured to command the control module 200 to deactivate a first command interface 300 arranged inside the cabin 3, for example a hand control inside the cabin 3, thus preventing the cabin 3 from moving in the compartment 4 as in regular operating conditions. When the maintenance configuration is detected, the control system 100 is also configured to activate a second command interface 301 located remote from the cabin 3, for example a remote controller that can be controlled remotely by the operator technician while carrying out installation or maintenance work on the rope lifting system. Thanks to the presence of the sensor means, it is also possible to detect the case wherein the adjustment element 9 is neither in the working nor in the maintenance operating configuration. In particular, this scenario occurs when there is no interaction between the movable sensor member 14 and one of the fixed sensor members. In this case, the control system 100 is configured to deactivate both the first command interface 300 and the second command interface 301 so that the rope lifting system is centrally blocked from carrying out any movement of the cabin 3 other than the movement implemented by the device 1.

[0033] Preferably, the rope lifting system comprises a control panel 400, which comprises the control module 200 and the operating control system 100.

[0034] Preferably, the device 1 comprises a safety mechanism adapted to stop the pulling ropes 2 and/or the adjustment element 9 in the event of structural failure of the adjustment element 9.

[0035] Next, we proceed to describe in more detail the preferred, but not exclusive, embodiment of said device 1, as shown in Figures 1 and 2.

[0036] In the preferred embodiment, the adjustment el-

ement 9 is movable by translation along the fixed structure 7 between a working position corresponding to the working configuration and at least one maintenance position corresponding to the maintenance configuration. In this case, the handling mechanism 10 is a linear movement mechanism.

[0037] Preferably, the fixed structure 7 comprises two stop plates 17 and 18 arranged spaced apart and parallel, supported by a plurality of rods 19 arranged parallel to each other and perpendicular to said stop plates 17 and 18.

[0038] Said rods 19 can be compatible with suitable fastening means so that they can be fastened to the stop plates 17 and 18. For example, such rods may have threaded surfaces engaged with fastening members, such as bolts or the like.

[0039] In the preferred embodiment, said rods 19 extend further beyond at least one stop plate forming extension portions 20 which themselves possess a profile compatible with suitable fastening means. The extension portions 20 may also have threaded surfaces. Said extension portions 20 are configured to anchor the device 1 both to fixed points inside the compartment 4 and to the movable members of the rope lifting system. Looking at Figures 3, 4, 5, 6 and 7, the device 1 can be anchored in a plurality of fastening zones 8. The fastening zones 8 shown represent some, though non-exclusive, examples of fastening zones of said device 1. It should be noted that the fastening zone 8 can be at the vertical compartment 4 by providing that the adjustment element 9 is fastened at a first end 21 of the pulling ropes 2 opposite the cabin 3. Alternatively, the fastening zone 8 may be on the cabin 3 by providing that the adjustment element 9 is fastened to a second end 22 of said pulling ropes 2 associated with the cabin 3. Still alternatively, the fastening zone 8 may be at the vertical compartment 4 by providing that the adjustment element 9 is fastened to at least one return pulley 23 of said pulling ropes 2.

[0040] Some special embodiments may even provide for the rope lifting system to be fastened to an intermediate point of the pulling ropes. More precisely, as can be seen in Figures 11 and 12, the device can also generally be interposed between two stretches of the pulling ropes, acting as a connection between the stretches themselves. In this embodiment, the device is movable together with the rope under normal operating conditions. Such an arrangement requires particular care when choosing the arrangement of the device in order to prevent it from hindering the operation of the devices transmitting motion to the rope.

[0041] The shape of the stop plates 17 and 18 and of the rods 19 may vary from what shown. In the embodiment shown in Figures 1 and 2, these stop plates have a planar geometry with a rectangular axial view. The choice of different geometries depends on the pre-existing or planned anchorage system of the pulling ropes 2, the number of pre-existing or planned pulling ropes 2 and the positioning of the fastening of said device 1. The rods

19 are dimensioned so as to ensure structural strength to withstand the tensile load to which they are subjected.

[0042] In the embodiment shown in Figures 1 and 2, the adjustment element 9, which is also preferably in the form of a plate, is mounted between the stop plates 17 and 18 and slidable along said rods 19, and it is movable by means of a linear translating motion, i.e. maintaining a constant inclination parallel thereto and moving axially along the fixed structure 7. It is preferable that the plate constituting said adjustment element 9 has a geometry arranged in a mirror-like manner relative to the stop plates 17 and 18. In the embodiment shown in Figures 1 and 2, said adjustment element 9 is movable by means of a linear handling mechanism 10, e.g. by means of a worm screw, nut screw, hydraulic piston or the like, preferably arranged axially along the device 1 and parallel to the rods 19.

[0043] Said handling mechanism 10 is preferably positioned parallel and concentric to the rods 19 and perpendicularly intersecting both the stop plates 17 and 18 and the adjustment element 9.

[0044] Both the stop plates 17 and 18 and the adjustment element 9 each have a plurality of through holes, arranged in a mirror-like manner to coincident axes. For illustrative purposes, Figure 10 shows the arrangement of said holes on the stop plate 17. A first set of holes 24, preferably positioned at the ends of each stop plate 17 and 18 and the adjustment element 9, are intended to house the rods 19. A second set of holes 25, preferably arranged more internally than the first set of holes 24, is intended to house the ends of the pulling ropes 2. In particular, one of the two stop plates, in particular the stop plate 17, opposite the stop plate 18 housing the extension portions 20 acting as anchoring elements, is intended to house the pulling ropes 2 in a sliding manner within each hole 25. Said pulling ropes 2 have the ends anchored to the plate forming the adjustment element 9. In particular, the ends of the pulling ropes 2 are moved together with the adjustment element 9, sliding inside the corresponding holes 25 on the stop plate 17.

[0045] The stop plates 17 and 18 and the adjustment element 9 also comprise an additional hole 26 each. The three resulting holes 26 are arranged in a mirror-like manner and with coincident axes. Said holes 26 are intended to house, fasten and, where necessary, assist the handling mechanism 10 in moving the adjustment element 9 by means of appropriate connecting members 27 between said handling mechanism 10, said stop plates 17 and 18 and said adjustment element 9.

[0046] In the embodiment shown in Figures 1 and 2, the stroke of said adjustment element 9 is between the stop plates 17 and 18.

[0047] In the first embodiment of the device 1 shown in Figures 1 and 2, the adjustment element 9 is in the working operating configuration when the adjustment element 9 itself is close to or adherent to the stop plate 17 and in the maintenance operating configuration when the adjustment element 9 itself is close to or adherent to the

stop plate 18. The switching of the adjustment element 9 from one stop plate to another stop plate results in the change of one of the two end stroke positions of the cabin, respectively upper 5 or lower 6, to a respective upper or lower maintenance end stroke position depending on the corresponding choice of the extremes assigned as working or maintenance operating configurations of the device 1.

[0048] With reference to the sensing means, the movable sensor element 14 is integral with the adjustment element 9 as described above. The first and second fixed sensor members 15 and 16 are integral with each stop plate 17 or 18 correspondingly.

[0049] Preferably, the stop plates 17 and 18, being mounted on the rods 19 at the respective end portions of the rods 19, provide a safety mechanism for the pulling ropes 2 in the event that the adjustment element 9 structurally fails.

[0050] In the second embodiment of the device 1 shown in Figures 1 and 2, the adjustment element 9 is in the working operating configuration when the adjustment element 9 is in an intermediate position between the two stop plates 17, 18. Furthermore, the adjustment element 9 is in the upper maintenance operating configuration when the adjustment element 9 is close to or adherent to the stop plate 17 and in the lower maintenance operating configuration when the adjustment element 9 is close to or adherent to the stop plate 18, or vice versa, depending on where the fastening zone 8 is located and how the device 1 interacts with the pulling ropes 2. The switching of the adjustment element 9 from the intermediate position to one stop plate or the other stop implies, within the compartment 4, the respective variation of the end stroke position, either upper 5 or lower 6, into a respective upper 5a or lower 6a maintenance end stroke position.

[0051] In the second embodiment, with reference to the sensing means, the movable sensor member 14 is integral with the adjustment element 9, the first and second fixed sensor members 15 and 16 are integral respectively with each stop plate 17 or 18, and the third fixed sensor member is fixedly arranged at an intermediate zone between the two stop plates 17, 18 corresponding to the working operating condition of the adjustment element 9.

[0052] Said device 1, in addition to the preferred embodiment shown in Figures 1 and 2, may be made in different embodiments. In particular, with reference to Figures 8 and 9, the device 1 may comprise the adjustment element 9, preferably formed as a plate, movable by means of a linear translating motion by means of a plurality of rods and/or support surfaces connected by means of hinges 28. In particular, two groups of rods or support surfaces are present. A first group comprises a first plurality of rods or support surfaces 29 connected at one end to the adjustment element 9. A second group comprises a second plurality of rods or resulting support surfaces 30 fastened to the fixed structure 7 of the device

1. In Figure 8, the rods or support surfaces belonging to the first group 29 are connected with the rods or support surfaces belonging to the second group 30 by means of the hinges 28 joining their respective non-engaged ends, possibly by means of connecting elements. Furthermore, in Figure 8 the linear movement mechanism 10 is arranged perpendicular to the adjustment element 9. In Figure 9, the rods or support surfaces belonging to the first group 29 are connected to the rods or support surfaces belonging to the second group 30 by means of the connecting members 27 of the handling means 10 arranged parallel to the adjustment element 9.

[0053] The design of the embodiments of the device 1 shown in Figures 8 or 9 have an overall hexagonal or octagonal vertical section.

[0054] In addition to the embodiments shown, for illustrative purposes only, the device 1 according to the invention may assume further different configurations. In one possible embodiment shown in Figures 13 and 14, the adjustment element 9 may comprise a rotating element, e.g. cylindrical in shape, rotationally supported by the fixed structure 7 of the device so as to be able to rotate and be actuated to rotate about the aforesaid longitudinal axis between a first angular position (see Figure 14), corresponding to the working operating configuration of the device, and at least a second angular position (see Figure 15), corresponding to the maintenance operating configuration of said device 1. In this case, the device according to the invention 1 therefore has a rotational movement mechanism, which may be rotated between the aforesaid first angular position and the aforesaid second angular position in order to obtain the passage of the device between the working operating configuration and the maintenance operating configuration, with a consequent variation within the compartment 4 of the end stroke position of the cabin connected to the rope 2. The fixed structure 7 is anchored to a fastening zone 8 of the rope lifting system and is adapted to vary the position of the ends of the pulling ropes 2 by taking advantage of the presence of sensing means, more precisely sensor members, configured to detect in which operating configuration the device 1 is, in particular between a working operating configuration (see Figure 13) and a maintenance configuration (see Figure 14). In such an embodiment, for example, a fixed relief sensor member 31 can be fixedly arranged on the outside of the device. A first movable sensor member 32 and a second movable sensor member 33, integral with the movable element 9, communicate to the relief sensor member 31 if the device 1 is in the working operating configuration or in the maintenance operating configuration. This arrangement of the detection means is purely indicative and not limitative.

[0055] The movement mechanism 10 is therefore designed to perform a rotational-type movement.

[0056] According to the invention, the process for varying the end stroke position of a cabin in a rope lifting system is characterised by comprising the steps of:

- providing a device for varying the end stroke position of a rope lifting system as described above,
- acting on the handling mechanism 10 operatively interposed between the adjustment element 9 and the fixed structure 7 in order to move reversibly the adjustment element 9 connected to said pulling ropes 2 and movably mounted on said fixed structure 7:
 - from a working operating configuration to define a working position of the ends of the pulling ropes 2 defining said end stroke positions 5, 6,
 - to at least one maintenance operating configuration adapted to define a maintenance position of the ends of the pulling ropes 2 so as to vary one of said maintenance said end stroke positions 5, 6 into a maintenance end stroke position 5a, 6a creating in said vertical compartment 4 a safety space for maintenance operators:
 - between a ceiling of the vertical compartment 4 and the upper end of said cabin 3 at said upper end stroke position 5 and/or
 - between the bottom of the vertical compartment 4 and the lower end of said cabin 3 at said lower end stroke position 6.

[0057] Preferably, according to the aforesaid process, the device comprises:

- sensing means configured to detect the configuration of the device 1 and the adjustment element 9 at least in the aforesaid working operating configuration and in the aforesaid at least one maintenance operating configuration, preferably the aforesaid sensing means preferably comprise a movable sensor member 14 integral with the adjustment element 9, a first fixed sensor member 15 and a second fixed sensor member 16, and
- an operating control system 100:
 - configured to communicate with a control module 200 designed to activate/deactivate a first command interface 300 arranged inside said cabin 3 and to activate/deactivate a second command interface 301 arranged in a remote position from the cabin 3 and
 - operatively connected with said sensing means to receive information related to the position and configuration assumed by the adjustment element 9;

wherein when said sensing means detect said maintenance configuration of the adjustment element 9 of the device 1 and the detected information is received by said operating control system 100 which then commands said control module 200 to:

- deactivate said first command interface 300 arranged inside the cabin 3 and

- activate said second command interface 301 arranged remote from the cabin 3.

[0058] Preferably, according to the aforesaid process, the control system 100 commands the aforesaid control module 200 to deactivate both the first command interface 300 and the second command interface 301 in case neither the aforesaid working configuration nor the aforesaid maintenance configuration is detected.

[0059] As can be seen from the above, the device according to the invention advantageously allows it to be operated reversibly from the aforesaid at least one working operating configuration to the aforesaid at least one maintenance operating configuration by varying the position of a end stroke position of the cabin of the rope lifting system within its compartment, by adjusting the length of the pulling ropes, i.e. of the position of the ends of the pulling ropes. Thereby, during the lift system maintenance operations, in order to safeguard the safety of the maintenance operators inside the compartment 4, a safety space of a predefined height is created between the ceiling of the lift compartment and the upper end of the cabin in the upper end stroke position and/or between the bottom of compartment 4 and the lower end of the cabin 3 in the aforesaid lower end stroke position depending on the configuration of the system, within which the cabin of the lift system cannot reach.

[0060] The danger of the cabin 3 crushing, or even hindering maintenance workers in the safety space is thereby avoided, so that maintenance operations by workers may be carried out more easily and safely, reducing the danger of work-related accidents.

[0061] Obviously, a person skilled in the art, for the purpose of satisfying contingent and specific requirements, shall make several modifications and variants to the device described above, all therefore contained within the scope of protection of the invention as defined in the following claims.

Claims

1. Device (1) for varying the end stroke position of a cabin of a rope lifting system, wherein said rope lifting system comprises a cabin (3) movable within a vertical compartment (4) along a working path between two end stroke positions (5, 6), an upper end stroke position (5) and a lower end stroke position (6) respectively, and pulling ropes (2) connected to said cabin (3), wherein said device for varying the end stroke position of said cabin (3) comprises:

- a fixed structure (7) which may be anchored to a fastening zone (8) of said rope lifting system;
- an adjustment element (9) adapted to be connected to said pulling ropes (2), wherein said adjustment element (9) is movably mounted on said fixed structure (7) so as to assume a work-

ing operating configuration adapted to define a working position of the ends of the pulling ropes (2) defining said end stroke positions (5, 6) of said cabin (3) in said compartment (4), and at least one maintenance operating configuration adapted to define a maintenance position of the ends of the pulling ropes (2) such as to vary one of said end stroke positions (5, 6) of said cabin (3) into a maintenance end stroke position (5a, 6a) such as to ensure a safety space inside said vertical compartment (4) of a predefined height and

- a handling mechanism (10) operatively interposed between said adjustment element (9) and said fixed structure (7) and configured to let said adjustment element (9) assume said plurality of operating configurations between said working operating configuration and said maintenance operating configuration.

2. A device (1) according to claim 1, comprising:

sensing means configured to detect the configuration of said adjustment element (9) in at least said working operating configuration and in at least said maintenance operating configuration, preferably said sensing means comprise a movable sensor member (14) integral with said adjustment element (9), a first fixed sensor member (15) and a second fixed sensor member (16), and

- an operating control system (100):

- configured to communicate with a control module (200) designed to activate/deactivate a first command interface (300) arranged inside said cabin (3) and to activate/deactivate a second command interface (301) arranged in a remote position from said cabin (3) and
- operatively connected with said sensing means configured to detect the configuration of said adjustment element (9),

wherein:

- said control system (100) is operatively connected with said sensing means and is configured to reversibly command said control module (200) to deactivate a first command interface (300) located inside said cabin (3) and to activate a second command interface (301) arranged in a remote position from said cabin (3) when said maintenance configuration is detected; and
- said control system (100) is also configured to deactivate both said first command interface (300) and said second command interface (301)

when neither said working configuration nor said maintenance configuration is detected.

3. The device according to claim 1 or 2, wherein said adjustment element (9) is movably mounted on said fixed structure (7) so as to assume an upper maintenance operating configuration adapted to define a maintenance position of the ends of said pulling ropes (2) such as to vary that said upper end stroke position (5) into an upper maintenance end stroke position (5a) so as to provide an upper safety space of a predefined height within said vertical compartment (4) between a ceiling of said vertical compartment (4) and a roof of the cabin (3).
4. The device according to any one of claims 1 to 3, wherein said adjustment element (9) is movably mounted on said fixed structure (7) so as to assume a lower maintenance operating configuration adapted to define a maintenance position of the ends of the pulling ropes (2) such that said lower end stroke position (6) varies into a lower maintenance end stroke position (6a) so as to ensure a safety space of a predefined height within said vertical compartment (4) between a bottom of said vertical compartment (4) and a base of the cabin (3).
5. The device according to claims 3 and 4, comprising sensing means configured to detect the operating configuration of the device (1), at least between the working operating configuration, the upper maintenance operating configuration and the lower maintenance operating configuration, wherein said sensing means preferably comprise a movable sensor member (14) integral with said adjustment element (9), a first fixed sensor member (15), a second fixed sensor member (16) and a third fixed sensor member.
6. The device according to any one of claims 1 to 5, comprising a safety mechanism adapted to stop said pulling ropes (2) and/or said adjustment element (9) in the event of structural failure of said adjustment element (9).
7. The device according to any one of claims 1 to 6, wherein said adjustment element (9) is movable by translation along said fixed structure (7) between a working position corresponding to said working configuration and at least one maintenance position corresponding to said maintenance configuration, and wherein said handling mechanism (10) is a linear handling mechanism.
8. The device according to claims 6 and 7, wherein said fixed structure (7) comprises a plurality of rods (19) on which said adjustment element (9), preferably in the form of a plate, is translationally mounted, and

wherein said safety mechanism comprises stop plates (17, 18) mounted on said rods (19) at respective end portions of said rods, preferably said rods (19) having extension portions (20) extending beyond a respective stop plate (18), said extension portions (20) being configured to anchor the device (1) to the cabin (3) or to a surface of the compartment (4) of said rope lifting system.

9. The device according to any one of claims 1 to 8 wherein:

- said adjustment element (9) is movable in rotation with respect to said fixed structure (7) between an angular working position corresponding to said working configuration and at least one angular maintenance position corresponding to said maintenance configuration and
- said handling mechanism (10) is a rotational handling mechanism.

10. The device according to any one of claims 1 to 9, wherein said adjustment element (9) is configured to be fixed to one end of said pulling ropes (2) and/or to at least one return pulley (23) of said pulling ropes (2) and/or along the pulling ropes (2).

11. A rope lifting system comprising a cabin (3) movable within a vertical compartment (4) along a working path between two end stroke positions (5, 6), an upper end stroke position (5) and a lower end stroke position (6) respectively, pulling ropes (2) connected to the cabin (3) to move it between said upper end stroke position (5) and said lower end stroke position (6) and a device (1) for varying the end stroke position according to any one of claims 1 to 10, wherein said adjustment element (9) is fixed to a first end (21) of said pulling ropes (2) opposite said cabin (3) or to a second end (22) of said pulling ropes (2) associated with the cabin (3) or to at least one return pulley (23) of said pulling ropes (2) or along said pulling ropes (2).

12. The rope lifting system according to claim 11, comprising a device (1) for varying the end stroke position according to claim 2 and a control unit (400) of said lifting system, wherein said control unit (400) comprises said control module (200):

- designed to activate/deactivate a first command interface (300) located inside said cabin (3) and to activate/deactivate a second command interface (301) arranged in a remote position from the cabin (3) and
- operatively connected with said sensing means to receive information related to the position and configuration assumed by said adjustment element (9).

13. A process for changing the end stroke position of a cabin in a rope lifting system characterised in that it comprises the steps of:

- providing a device for varying the end stroke position of a rope lifting system according to any one of claims 1 to 10,
- acting on said handling mechanism (10) operatively interposed between said adjustment element (9) and said fixed structure (7) to reversibly move said adjustment element (9) connected to said pulling ropes (2) and movably mounted on said fixed structure (7):

- from a working operating configuration to define a working position of the ends of the pulling ropes (2) defining said end stroke positions (5, 6),
- to at least one maintenance operating configuration to define a maintenance position of the ends of the pulling ropes (2) such as to vary one of said end stroke positions (5, 6) into a maintenance end stroke position (5a, 6a), creating in said vertical compartment (4) a safety space for maintenance operators:

- between a ceiling of said vertical compartment (4) and the upper end of said cabin (3) in said upper end stroke position (5) and/or
- between the bottom of said vertical compartment (4) and the lower end of said cabin (3) in said lower end stroke position (6).

14. The process according to claim 13, wherein said device comprises:

- sensing means configured to detect the configuration of said device (1) and said adjustment element (9) at least in said working operating configuration and in said at least one maintenance operating configuration, wherein said sensing means preferably comprise a movable sensor member (14) integral with said adjustment element (9), a first fixed sensor member (15) and a second fixed sensor member (16), and
- an operating control system (100):

- configured to communicate with a control module (200) designed to activate/deactivate a first command interface (300) arranged inside said cabin (3) and to activate/deactivate a second command interface (301) arranged in a remote position from said cabin (3) and

- operatively connected with said sensing means to receive information related to the position and configuration assumed by said adjustment element (9);

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wherein when said sensing means detect said maintenance configuration of said adjustment element (9) of said device (1) and said information is received by said operating control system (100), said operating control system (100) commands said control module (200) to:

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- deactivate said first command interface (300) arranged inside said cabin (3) and
- activate said second command interface (301) arranged in a remote position from said cabin (3).

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15. The process according to claim 14, wherein said control system (100) commands said control module (200) to deactivate both said first command interface (300) and said second command interface (301) when neither said working configuration nor said maintenance configuration is detected.

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Fig.1

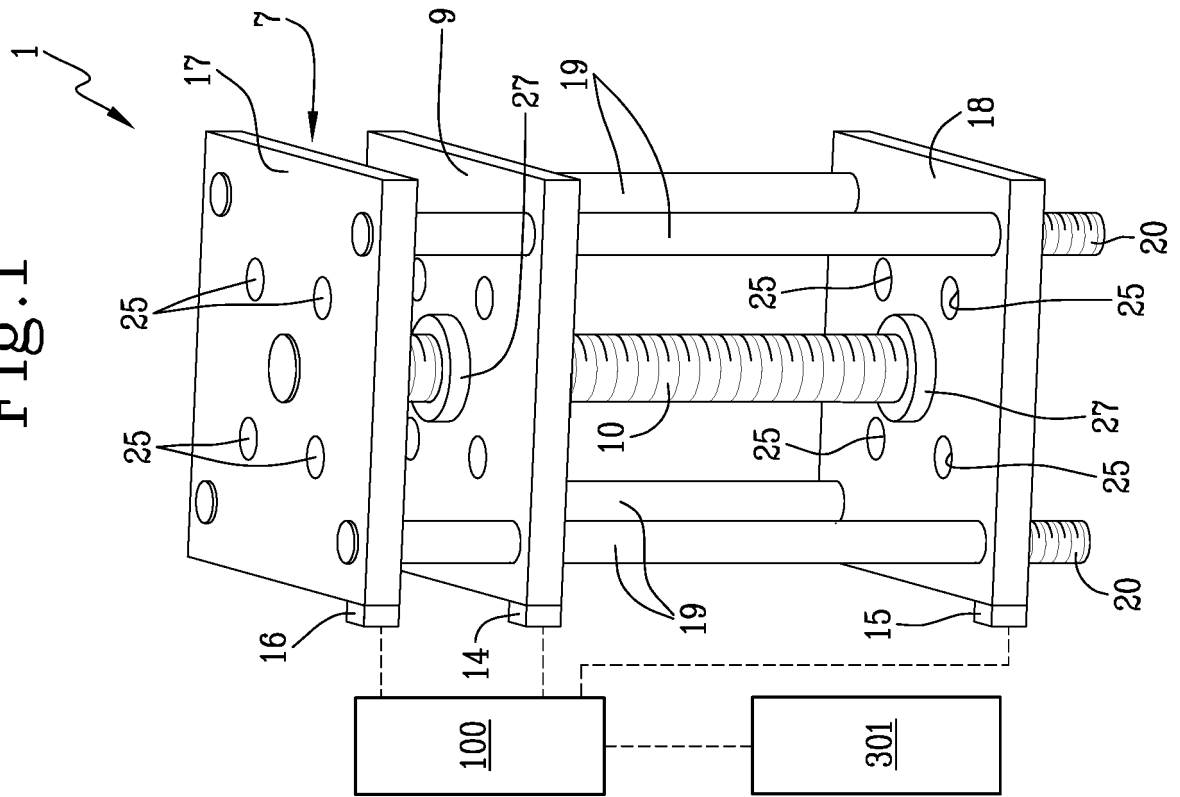


Fig.2

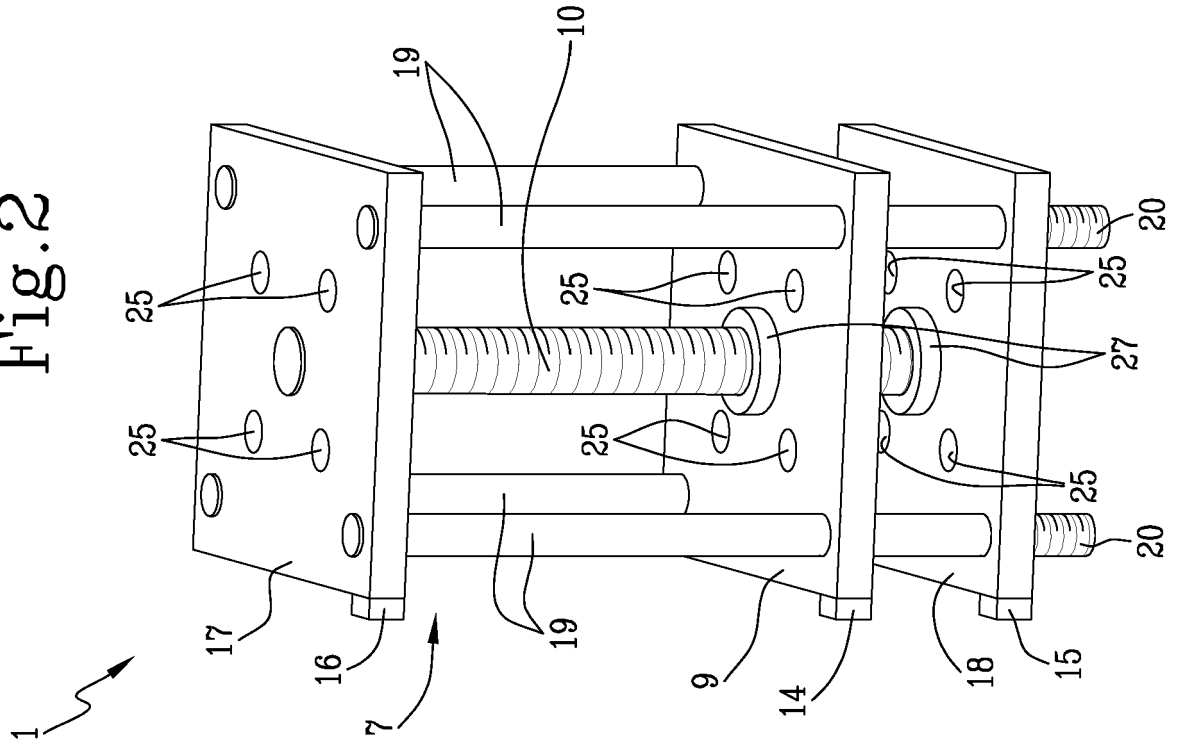


Fig.3

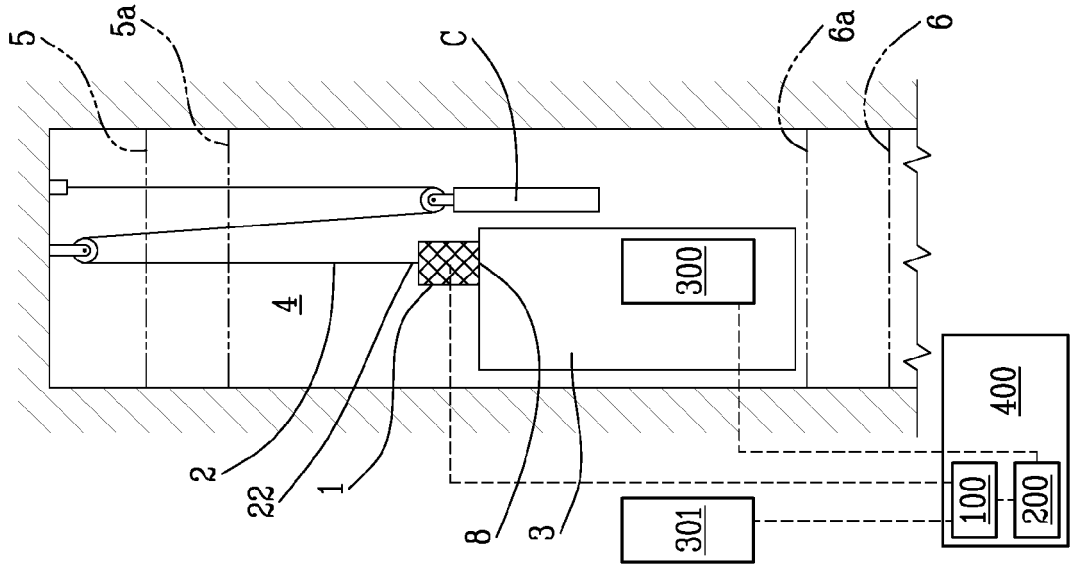


Fig.4

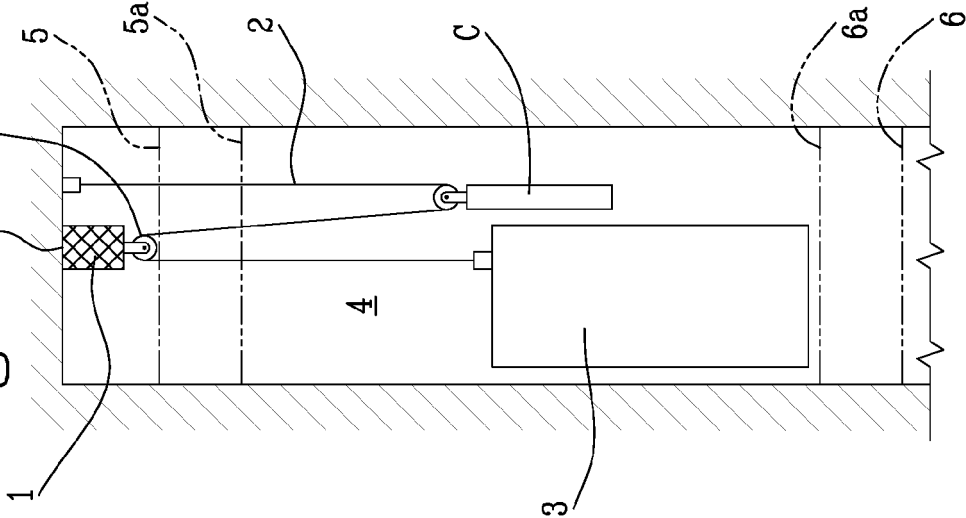


Fig.5

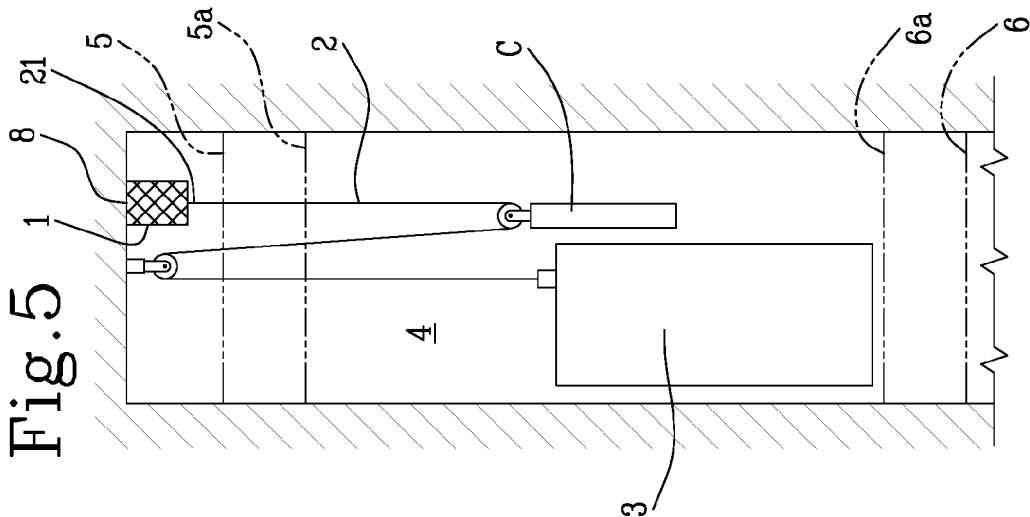


Fig.6

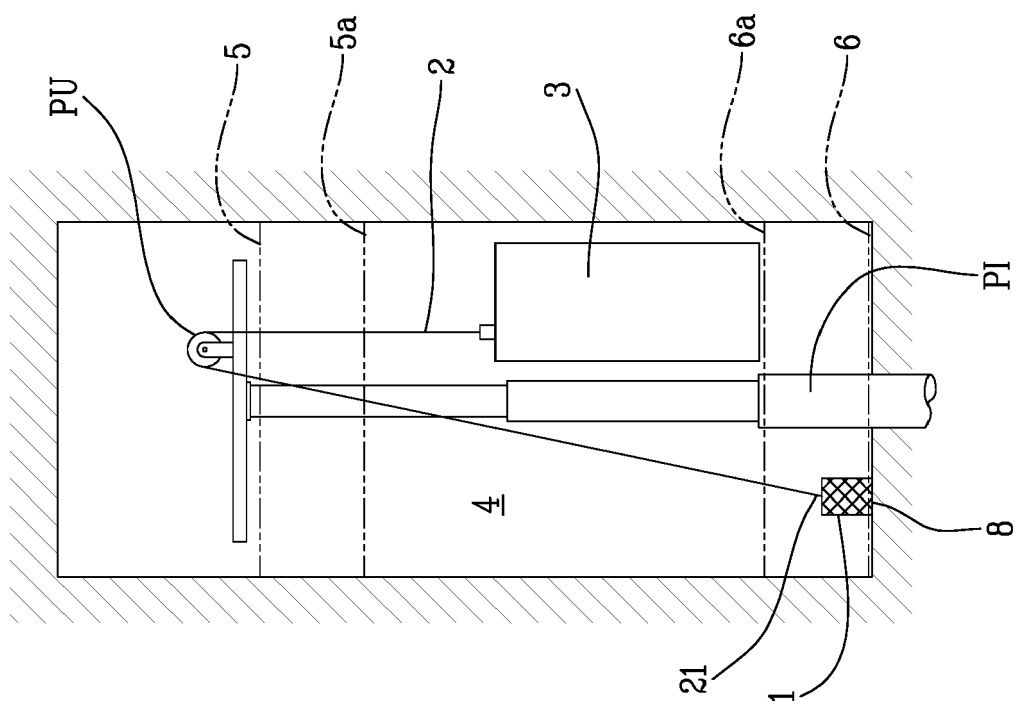


Fig.7

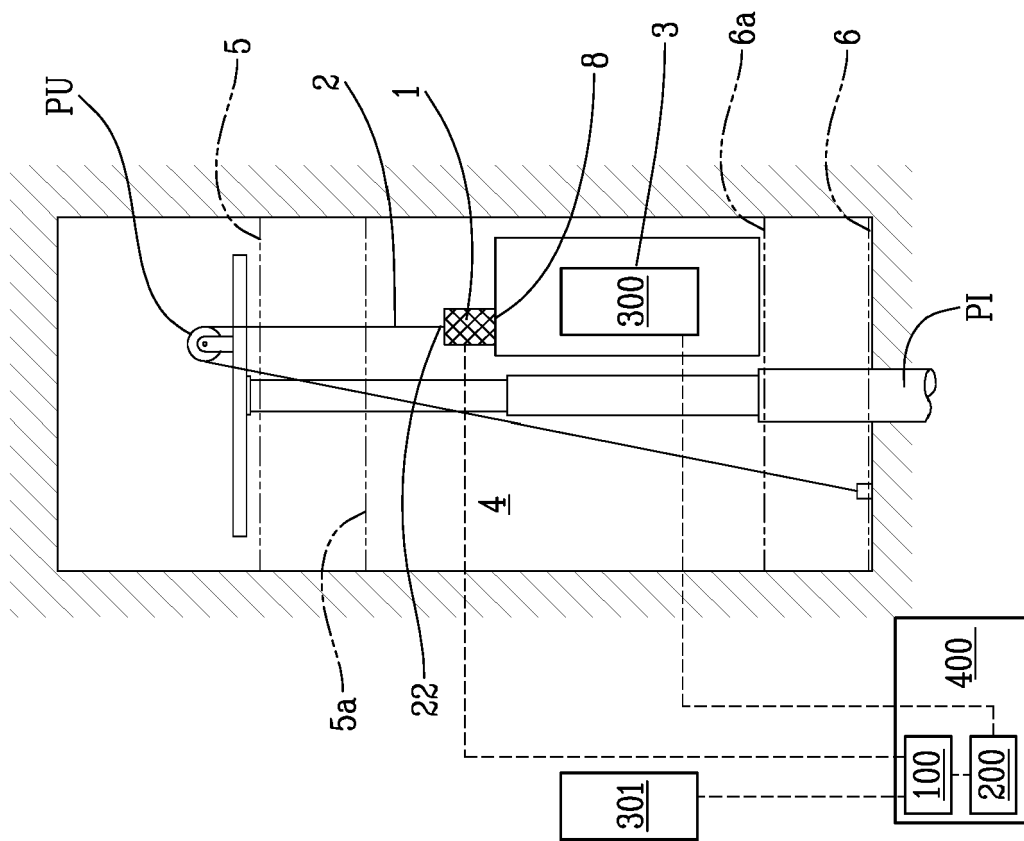


Fig. 9

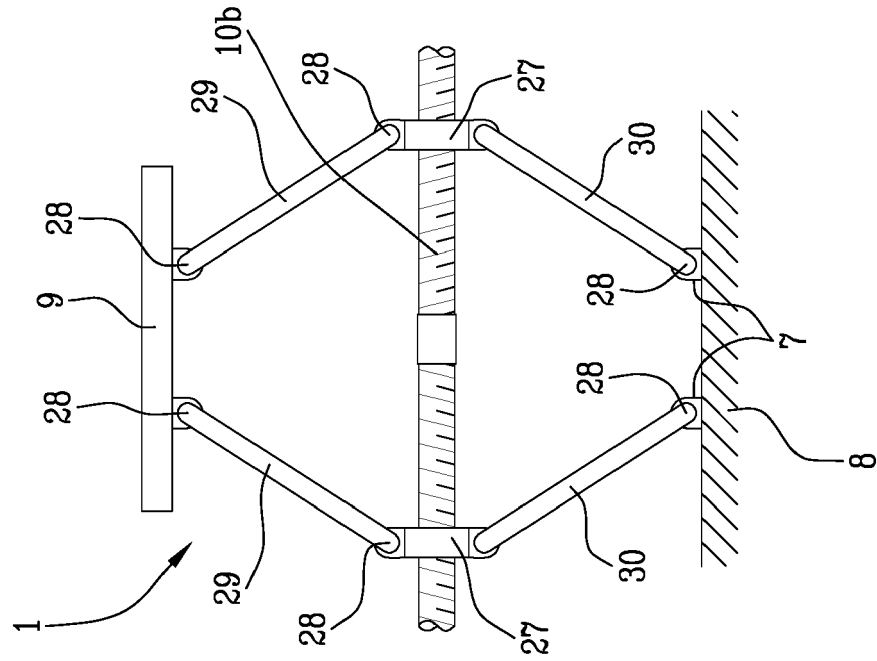


Fig. 8

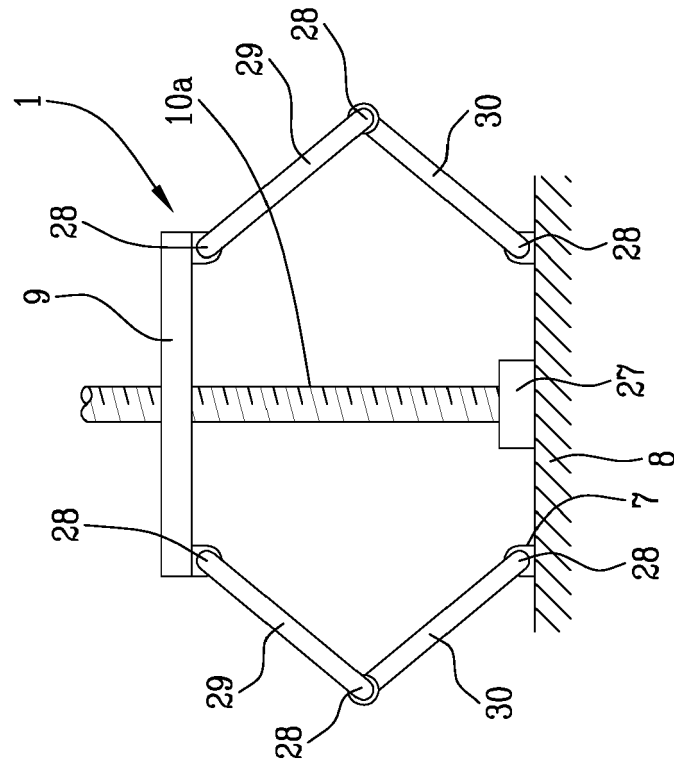


Fig.10

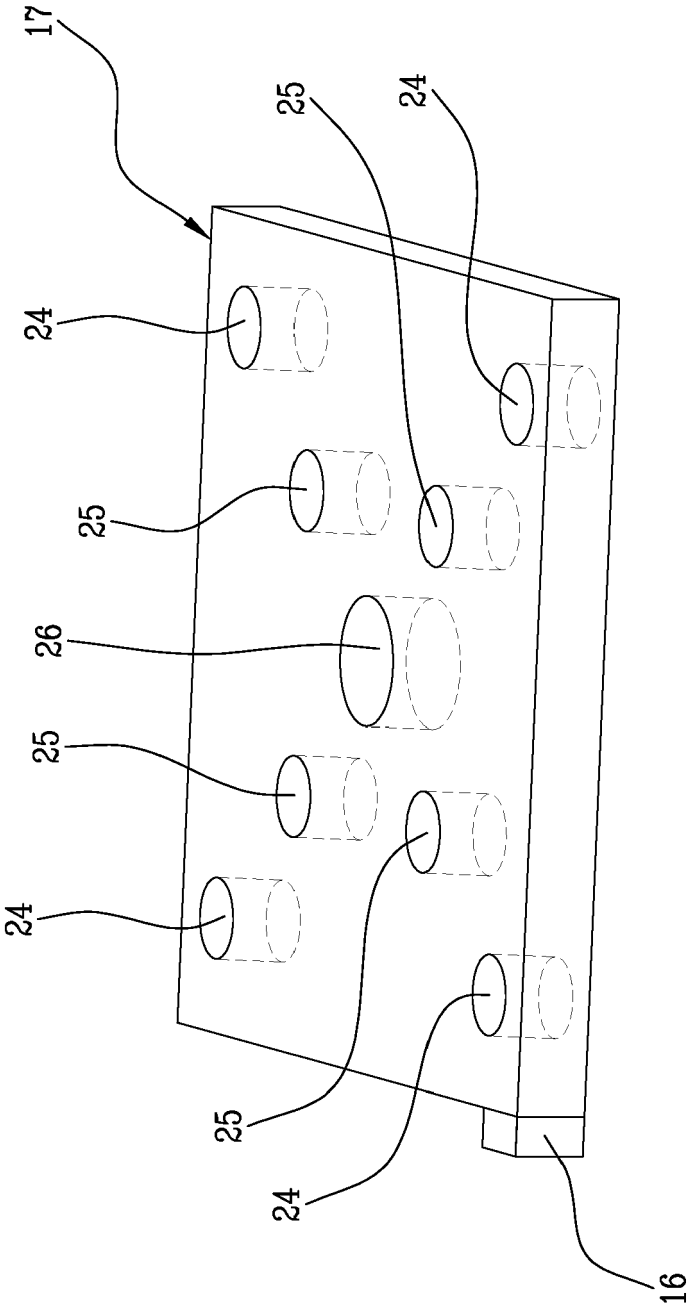


Fig.14

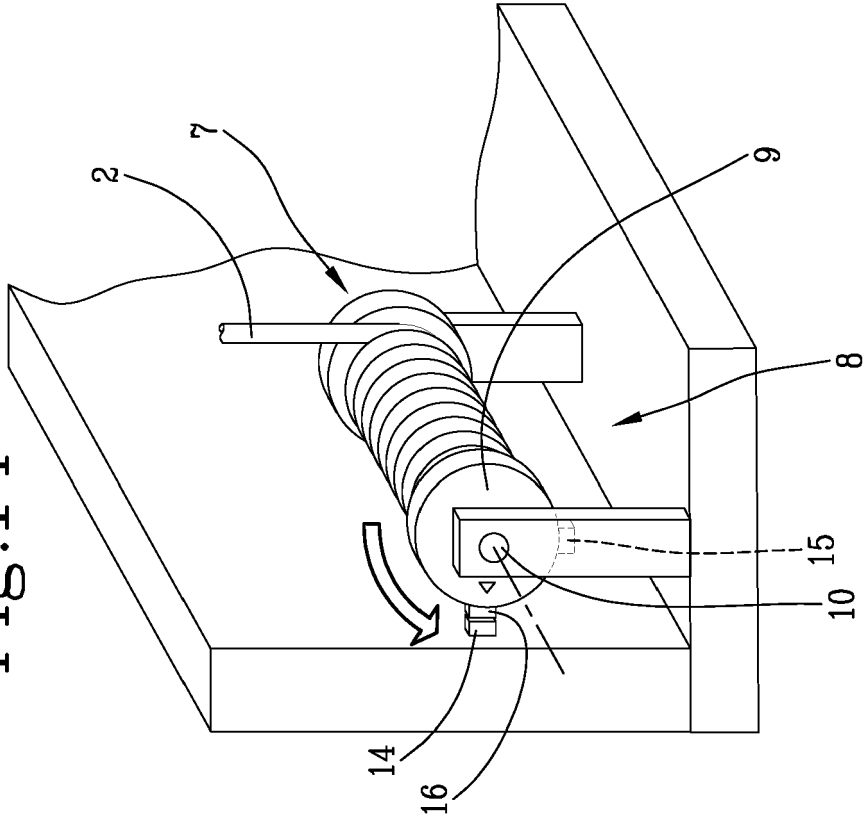
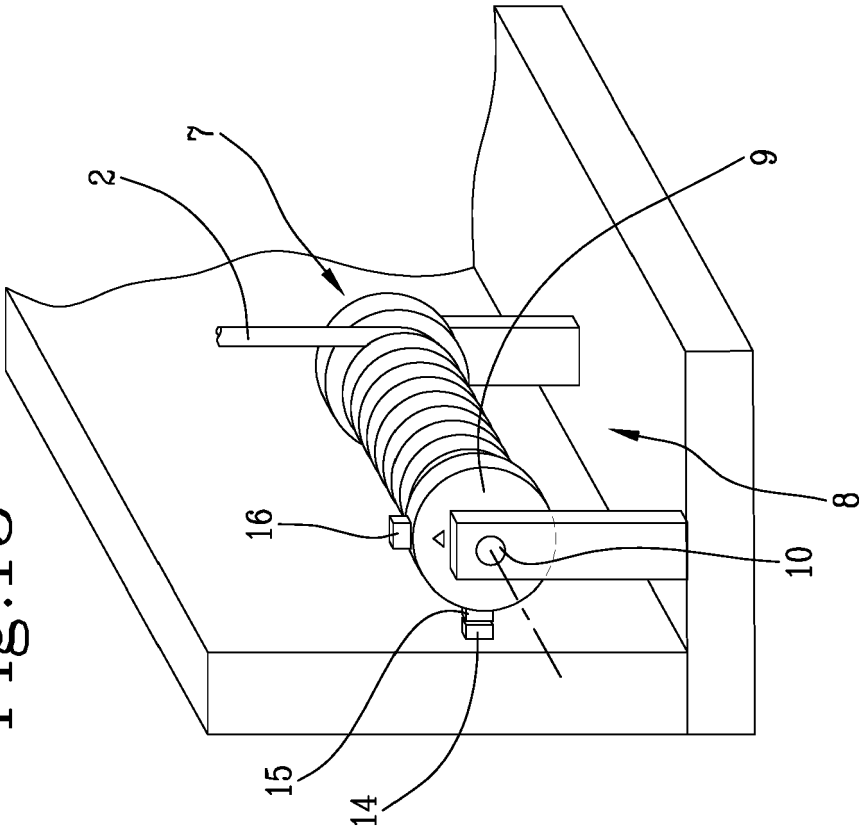


Fig.13





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Application Number

EP 23 20 4738

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A	* abstract * * paragraphs [0026] - [0040] * * figures 1, 2 *	2, 9, 12, 14, 15	

X	CN 106 219 335 A (XJ SCHINDLER XUCHANG ELEVATOR) 14 December 2016 (2016-12-14)	1, 3-8, 10, 11, 13	
A	* abstract * * paragraph [0015] * * figure 1 *	2, 9, 12, 14, 15	

X	EP 1 808 400 A1 (INVENTIO AG [CH]) 18 July 2007 (2007-07-18)	1, 3-5, 9, 10	
A	* abstract * * paragraphs [0020], [0021] * * figure 1 *	2, 6-8, 11-15	

			TECHNICAL FIELDS SEARCHED (IPC)
			B66B
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		11 January 2024	Oosterom, Marcel
CATEGORY OF CITED DOCUMENTS			
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ON EUROPEAN PATENT APPLICATION NO.

EP 23 20 4738

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The members are as contained in the European Patent Office EDP file on
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11-01-2024

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