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(71) Applicant: **Liftup A/S**
9530 Støvring (DK)

(72) Inventors:
- **Mørup-Petersen, Lars-Mikkel**
  9530 Støvring (DK)
- **Møller, Anders Lykkegaard**
  9530 Støvring (DK)

(74) Representative: **Plougmann Vingtoft a/s**
Strandvejen 70
2900 Hellerup (DK)

(54) **A PLATFORM LIFTING SYSTEM**

(57) The invention relates to a platform lifting system for transporting a person or an object between at least a ground level and a second level, said platform lifting system 1 comprises a platform 15, a gate 16, and lifting means 84 to move the platform at least between the ground level and the second level, and a barrier arrangement 17. The barrier arrangement comprises a safety bar and a mechanical raising mechanism 20 to move the safety bar between a raised position, preventing persons from passing through the gate, and a lowered position, allowing persons to pass through the gate. The mechanical raising mechanism comprises an activation plate 14'. The activation plate engages a floor 22, or a carrier plate 23, when the platform approaches the ground level, and the safety bar is released and moves to the lowered position. The activation plate does not engage the floor, or the carrier plate, when the platform is away from the ground level, and the safety bar is placed in the raised position.

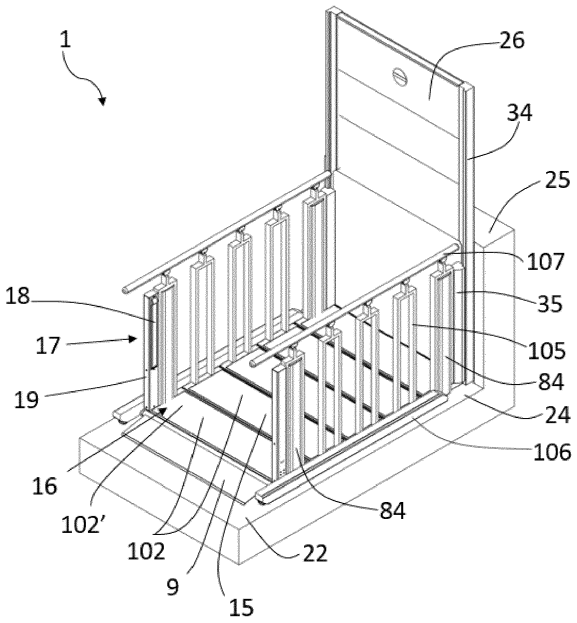


Fig. 1

EP 4 431 434 A1

Description

FIELD OF THE INVENTION

[0001] The present invention relates to a platform lifting system for transporting a person or an object between at least a ground level and a second level. Said platform lifting system comprises a platform, a gate and a barrier arrangement. The barrier arrangement comprises a safety bar moving between a raised position, preventing persons or objects from leaving the platform through the gate guarded by the barrier arrangement, and a lowered position, allowing persons or objects to enter or leave the platform through the gate guarded by the barrier arrangement.

BACKGROUND OF THE INVENTION

[0002] In a building there may be a platform lifting system moving persons or objects between at least a ground level and a second level. The platform lifting system comprises a gate for persons to enter or leave the platform at ground level. It is essential that the platform has a barrier arrangement preventing persons or objects from falling off or leaving the platform through the gate, when the platform is in a position away from the floor or ground level. At the second level there may be an exit, which may be placed opposite the gate, for persons to enter or leave the platform.

[0003] The barrier arrangements may require manual operation risking that the barrier arrangements may not be arranged to prevent persons from leaving or falling off the platform, when the platform is in a lifted position away from the floor. Further, a door used as a barrier arrangement also requires space to open the door, requiring more space for the platform lifting system.

[0004] Alternatively, such barrier arrangements may be controlled automatically using electronic sensors to detect the position of the platform and motors to control the barrier arrangement. Such a system would require use of power and may malfunction in case of a defect sensor or a defect motor.

[0005] Hence, an improved, simple and fail proof barrier arrangement would be advantageous, and in particular, a more efficient and/or reliable barrier arrangement ensuring the barrier arrangement is arranged to prevent persons from leaving or falling off the platform, when the platform is not at the ground level would be advantageous. Also a compact platform not requiring space for opening a door would be advantageous.

OBJECT OF THE INVENTION

[0006] It is an object of the present invention to provide a barrier arrangement for a platform lifting system, which is ensuring that persons cannot fall off or leave the platform when the platform is not at the ground level.

[0007] It is an object of the present invention to provide a barrier arrangement for a platform lifting system, which is mechanical and not relying on motors, sensors or manual operation.

[0008] It is a further object of the present invention to provide an alternative to the prior art.

[0009] In particular, it may be seen as an object of the present invention to provide a safety bar arrangement that solves the above mentioned problems of the prior art.

SUMMARY OF THE INVENTION

[0010] Thus, the above described object and several other objects are intended to be obtained in a first aspect of the invention by providing a platform lifting system for transporting a person or an object between at least a ground level and a second level, said platform lifting system comprises:

- a platform,
- a gate,
- lifting means to move the platform at least between the ground level and the second level, and
- a barrier arrangement,

wherein the barrier arrangement comprises a safety bar, a barrier housing, and a mechanical raising mechanism adapted to move the safety bar between a raised position, preventing persons from passing through the gate, and a lowered position, allowing persons to pass through the gate, wherein
the mechanical raising mechanism comprises a contact linkage and a sliding block;

- when the contact linkage engages a floor, or a carrier plate, and the sliding block is displaced a minimum release distance relative to the barrier housing, the mechanical raising mechanism is adapted to release the safety bar so that the safety bar is positioned in the lowered position, and
- when the contact linkage does not engage the floor, or the carrier plate, the mechanical lifting mechanism is adapted to engage the safety bar and position the safety bar in the raised position.

[0011] The invention is particularly, but not exclusively, advantageous for obtaining a platform lifting system comprising a barrier arrangement with a safety bar preventing persons from falling off the platform through the gate, when the platform is away from the ground level.

[0012] A further advantage of the invention is that the gate is closed with the safety bar, which does not require additional space for opening, like a door would.

[0013] The platform lifting system may be mounted on or in an associated building, where the platform moves between at least two different levels. However, it should be understood that the platform might move between more than two levels. The lowest level is the ground level

or the first level.

[0014] The platform comprises a gate through which persons may enter or leave the platform, when the platform is at the ground level. Further, the platform may comprise an exit through which persons can leave the platform at different levels. At each level, there may be an access opening in the associated building through which a person can leave the platform through the exit. The platform will stop at a selected level outside the access opening in the associated building and a person may leave or enter the platform through the exit of the lifting system and the access opening in the building.

[0015] When the platform is at the ground level, persons may leave or enter the platform through the gate. The ground level may also be named the first level, and ground level is to be understood as the lowest level the platform can be at.

[0016] The platform lifting system comprises a barrier arrangement. The barrier arrangement comprises a safety bar, a barrier housing and a mechanical raising mechanism. The safety bar is automatically raised when the platform is away from the ground level, and the safety bar is automatically lowered when the platform is in a defined minimal distance from the ground level.

[0017] The mechanical raising mechanism is raising or lowering the safety bar and is doing so automatically depending on the position of the platform. When the safety bar is in a raised position, it is preventing persons from passing through the gate. When the safety bar is in a lowered position, persons are allowed to pass through the gate entering or leaving the platform.

[0018] The mechanical raising mechanism comprises a contact linkage and a sliding block. The contact linkage may be a one piece contact rod or may alternatively be divided in two or more pieces. The contact linkage may comprise a connection rod and an activation plate. A contact linkage is a mechanical linkage that is designed to maintain contact between two or more parts, in this case between the floor or carrier plate and the sliding block. In normal operation, if the contact linkage is divided in more pieces, the pieces move together as one and function the same way as when the contact linkage is a one piece contact rod.

[0019] The sliding block may be fixed to the contact linkage so the contact linkage and sliding block are moving together. Alternatively, the contact linkage and the sliding block may be made in one piece. The sliding block may be the part of the mechanical raising mechanism, which is engaging the safety bar. The sliding block is attached to the upper end of the contact linkage or is an integrated part of the upper end of the contact linkage. The upper end of the contact linkage is the end closest to the top of the barrier housing.

[0020] The platform lifting system comprises lifting means; the lifting means may move the platform at least between the ground level and at least a second level. The lifting means may comprise actuators, motors or drives, which may be capable of moving the platform between different levels. There may be two or more levels. There are at least a ground level, which also may be the first level, and a second level, but there may be additional levels like a third level, a fourth level etc.

[0021] In the context of the invention, the "lifting means" may be understood as being one or more lifting means, such as actuators, motors or drives. The one or more lifting means may be the same type, or it may be different types of lifting means / actuators. Preferably, four actuators are provided in the lifting system.

[0022] The mechanical raising mechanism is mechanical, which is to be understood as that the mechanical raising mechanism is not using electricity or power. The mechanical raising mechanism comprises a contact linkage. The contact linkage is placed so that when the platform approaches the ground level, the contact linkage is activated to make the mechanical raising mechanism release the safety bar, so that the safety bar moves to the lowered position. When the platform is at its lowest position, the contact linkage will be displaced as much as possible relative to the barrier housing, and the safety bar will be in the lowered position.

[0023] When the platform is moving away from the ground level, the mechanical raising mechanism is adapted to lift the safety bar to a raised position and to lock the safety bar in the raised position, so that the safety bar cannot be moved easily, for instance by a person attempting to press it down with his hands.

[0024] "Approaching the ground level" is to be understood as that the platform has a minimal distance to the ground level that the contact linkage, being part of the mechanical raising mechanism, is in contact with the floor, or a carrier plate, at ground level. When the contact linkage engages the floor, or the carrier plate, the contact linkage is activated and the safety bar is lowered.

[0025] That the contact linkage is activated is to be understood that it is engaging, is in contact with, the floor, or the carrier plate, so that the contact linkage is displaced relative to the barrier housing. When the sliding block is displaced by a minimum release distance relative to the barrier housing from the sliding blocks lowest position, the contact linkage causes the safety bar to be released so that the safety bar is able to move to the lowered position. When the safety bar is in the lowered position, the gate is open and persons can enter or leave the platform through the gate.

[0026] When the contact linkage is engaging the floor, or the carrier plate, the sliding block is displaced by the contact linkage being pushed into the barrier housing by the floor, or the carrier plate. When the sliding block is displaced by the minimum release distance, the safety bar is released.

[0027] The minimum release distance is to be understood as the minimum distance the sliding block is to be displaced relative to the barrier housing from the lowest possible position of the sliding block relative to the barrier housing, before the mechanical raising mechanism is adapted to release the safety bar, so that the safety bar

can be positioned in the lowered position. The lowest possible position of the sliding block is also a locking position, where the sliding block locks the safety bar in the raised position. Therefore, the minimum release distance is the distance the sliding block must be moved from the locking position to the release position, where the sliding block is not engaging the safety bar, and the safety bar can move freely, and due to gravity, will move to the lowered position. In between the lowered position and the raised position, the safety bar is in intermediate positions, where the safety bar may still be engaged by the sliding block, while the sliding block is moving from the locking position to the release position or vice versa.

[0028] The minimum release distance may preferably be 50 mm, but may alternatively for instance be 0 mm, 10 mm, 20 mm, 30 mm, 40 mm, 60 mm, 70 mm, 80 mm, 90 mm, or 100 mm.

[0029] When the platform is away from the ground level, the contact linkage will be in its lowest position relative to the barrier housing, due to gravity or due to the tension spring, and the safety bar is positioned in the raised position and closes the gate so that persons cannot leave the platform through the gate.

[0030] The safety bar will automatically be in the raised position when the platform is away from the ground level. That the platform is away from the ground level is to be understood as the contact linkage is not engaging the floor, or the carrier plate. Therefore, when the platform is at ground level, and the safety bar is in the lowered position and the platform then moves up, away from the ground level, the safety bar is automatically raised and moved to the raised position. The safety bar remains in the raised position as long as the platform is away from the ground level.

[0031] The platform lifting system may comprise an exit opposite to the gate. The exit is usually turned towards a wall or a floor deck of an associated building, and when there are access openings or doorways in the wall or the floor deck on the second level or at a higher level, persons can enter or leave the platform through the exit and the access opening. At the second level or higher levels or any level away from the ground level, persons cannot leave the platform through the gate.

[0032] The platform lifting system may take at least two positions:

- a stairway position
- a platform lift position.

[0033] In an embodiment, the platform may be divided in steps. When the platform is in the platform lift position, the steps are forming a plane surface, but in the stairway position, the platform is turned into a stairway, where the steps are vertically offset in relation to each other. When in stairway position, the carrier plate is positioned to engage the contact linkage to ensure the safety bar is in the lowered position so that persons can use the stairway.

[0034] In some situations, it may not be practical to use the floor to engage the contact linkage, and in that case a carrier plate can be positioned to engage the contact linkage instead. For instance, when in stairway position, the contact linkage will be too far away from the floor, therefore when in stairway position, a carrier plate is used to engage the contact linkage. The carrier plate may be mounted under the actuators fixed to the legs of the actuators, so the carrier plate is not at floor level, but when in stairway position the carrier plate is placed with some distance to the floor.

[0035] The barrier housing comprises a guide bearing; the guide bearing may act as a stop for the contact linkage. The guide bearing limits how far the contact linkage may be displaced downwards relative to the barrier housing. The contact linkage may comprise an opening allowing the contact linkage to move slidably around the guide bearing. The guide bearing may act as a stop limiting how far the contact linkage may be displaced downwards relative to the barrier housing. The barrier housing may have an open structure (partly or fully), or a closed structure (partly or fully), and the skilled person will readily understand that the function of the barrier housing comprises to fixate selected part(s), and guide moveable part(s).

[0036] It is to be noted that when writing that the contact linkage is moved or displaced relative to the barrier housing, it is actually the barrier housing which is fixed to the platform that is moving, while the contact linkage, connection rod and activation plate are standing on the floor or carrier plate.

[0037] In an embodiment, the platform may be a uniform plate. In this case, the platform cannot be divided into steps and cannot take the stairway position.

[0038] In an embodiment of the invention, , when the contact linkage does not engage the floor, or the carrier plate, the sliding block is adapted to being positioned in a locking position, locking the safety bar in the raised position.

[0039] The locking position of the sliding block may also be the lowest possible position of the sliding block, locking the safety bar in the raised position.

[0040] In an embodiment of the invention, when the contact linkage does engage the floor, or the carrier plate, and the sliding block is displaced a minimum release distance relative to the barrier housing, the sliding block is adapted to being positioned in a release position, and the safety bar is released from the raised position.

[0041] The safety bar comprises a swivel head, which is the rotatable end of the safety bar. The swivel head may be an integrated part of the safety bar, or may be a separate piece fixed to the bar portion of the safety bar. The swivel head is mounted rotatably around a bearing, so the safety bar can move between a raised position and a lowered position by rotating around the bearing.

[0042] The sliding block is placed, so it may engage the swivel head at the rotatable end of the safety bar. The sliding block may be positioned in a locking position, a release position and an intermediate position. In the

locking position, the sliding block locks the safety bar in the raised position by engaging the swivel head, so the safety bar is locked in the raised position. In the release position, the sliding block is displaced the minimum release distance relative to the barrier housing from the sliding blocks lowest position, and then the sliding block is no longer in contact with the swivel head and the safety bar will, due to gravity, be in the lowered position. When the sliding block is in the intermediate position, the sliding block is moving between the release position and the locking position or vice versa. In the intermediate position, the sliding block is in contact with the swivel head, but is not locking the safety bar.

[0043] When the contact linkage does not engage the floor, or the carrier plate, the contact linkage will be placed in its lowest position by either gravity or a tension spring. The sliding block is fixed to the contact linkage and is therefore following the contact linkage down. The sliding block then engages the swivel head of the safety bar making the safety bar rotate around the bearing to the raised position. When the contact linkage is in its lowest position, the sliding block is positioned to lock the safety bar in the raised position.

[0044] When the contact linkage is engaging the floor, or the carrier plate, and the sliding block is displaced a minimum release distance relative to the barrier housing from the lowest position of the contact linkage, the contact linkage is arranged to cause the sliding block to be positioned in the release position, whereby the safety bar is being positioned in the lowered position.

[0045] In an embodiment of the invention, the contact linkage comprises a connection rod and an activation plate, the connection rod is mounted between the activation plate and the sliding block, so that when the activation plate engages the floor, or the carrier plate, the activation plate engages the connection rod, and the connection rod engages the sliding block, so that when the sliding block is displaced a minimum release distance relative to the barrier housing, the sliding block is positioned in the release position.

[0046] The contact linkage may comprise a connection rod and an activation plate. A connection rod may be placed between the activation plate and the sliding block. When one end of the activation plate engages the floor, or the carrier plate, the other end of the activation plate during normal operation engages the connection rod.

[0047] If the contact linkage comprises an activation plate and a connection rod, the contact linkage and the activation plate both comprise openings allowing the activation plate and the connection rod to move slidably around the guide bearing, and the guide bearing may act as a stop limiting how far the activation plate and the connection rod may be displaced both upwards and downwards relative to the barrier housing.

[0048] When the sliding block is displaced a minimum release distance relative to the barrier housing, the connection rod is at its highest possible position. When the connection rod is at its lowest possible position, the connection rod cannot move further, such as further down, because it is stopped by the guide bearing.

[0049] It is to be noted that when writing that the contact linkage, connection rod and activation plate are moved or displaced relative to the barrier housing, it is actually the barrier housing which is fixed to the platform that is moving, while the contact linkage, connection rod and activation plate are standing on the floor or carrier plate.

[0050] In an embodiment of the invention, when the activation plate does not engage the floor, or the carrier plate, the sliding block is adapted to be positioned in the locking position.

[0051] In an embodiment of the invention, when the sliding block is positioned in the release position, the safety bar is positioned in the lowered position.

[0052] When the contact linkage and the sliding block are pushed up by engaging the floor, or the carrier plate, and the sliding block is placed in the release position, the safety bar is arranged to move to the lowered position by gravity.

[0053] In an embodiment of the invention, the mechanical raising mechanism further comprises spring means, preferably a tension spring, and when the contact linkage does not engage the floor, or the carrier plate, the spring means entail that the safety bar is being positioned in the raised position.

[0054] When the platform is moving away from the ground level, the contact linkage and the sliding block will be pulled down by spring means, preferably a tension spring. Then the sliding block will be pulled down to engage the swivel head of the safety bar, and when the sliding block reaches its lowest position, it fixes the safety bar in the raised position and locks the safety bar in the raised position, so the safety bar cannot be pushed down. Therefore, when the sliding block is in the locking position, the sliding block locks the safety bar in the raised position.

[0055] Preferably, a tension spring is used to pull the sliding block and the contact linkage down to raise the safety bar to the raised position. Alternatively, a linear actuator, a gas tension spring, an air cylinder, a hydraulic cylinder or other means providing the necessary force may be used instead of a tension spring.

[0056] The spring means entail that the safety bar is being positioned in the raised position by pulling the contact linkage to its lowest possible position relative to the barrier housing. The sliding block is fixed to or part of the contact linkage, and the sliding bock is engaging the safety bar or the swivel head of the safety bar, to position the safety bar in the raised position.

[0057] In an embodiment of the invention, when the contact linkage does not engage the floor, or the carrier plate, the spring means, preferably a tension spring, is adapted to pull the contact linkage down, and the sliding block is adapted to engage the safety bar, so the safety bar is positioned in a raised position, which is preferably substantially horizontal.

[0058] Typically, the spring means is mounted as a pull

tension spring and is pulling the contact linkage and the sliding block down against the floor, the carrier plate or the stop in the guide bearing.

[0059] When the contact linkage is engaging the floor, or the carrier plate, the contact linkage is pushing the sliding block up against the tension spring force, placing the sliding block in the release position. However, when the contact linkage is not engaging the floor, the tension spring force is retracting, and the contact linkage and the sliding block will be in their lowest position, and the sliding block is positioned in the locking position.

[0060] When the safety bar is moving towards the raised position, the safety bar may meet resistance, for instance a person may be in its way, so the safety bar cannot move to the raised position. In that case, as the safety bar is moved by the force of the tension spring, the safety bar makes no harm and simply stops its movement towards a raised position, until the obstacle preventing it from moving is removed. Also, when the safety bar is moving towards the lowered position, the safety bar stops if the safety bar is meeting resistance.

[0061] In an embodiment of the invention, the spring means, preferably a tension spring, the sliding block and at least a part of the contact linkage are mounted inside the barrier housing.

[0062] Preferably, the spring means and the rod are mounted inside the barrier housing to protect the moving parts and to ensure no external means, including persons on the platform, may interfere with the rod, the sliding block and the spring means.

[0063] In an embodiment of the invention, the barrier housing and the mechanical raising mechanism is positioned in a fixed position on the platform.

[0064] That the barrier housing and the mechanical raising mechanism is positioned in a fixed position on the platform is to be understood as the barrier housing is placed so the barrier housing moves parallel with the platform. The barrier housing may be fixed on the platform.

[0065] In an embodiment of the invention, a sensor mechanism is adapted to stop the movement of the platform if the safety bar is not positioned in the raised position when the contact linkage disengages the floor, or the carrier plate.

[0066] For security reasons, the platform must not be able to move too far away from the ground level without the safety bar raised and locked. The safety bar may be prevented from moving to a raised position, for instance, it may be blocked by items or persons in the way for the movement of the safety bar. If the safety bar is not raised, a sensor mechanism, e.g. a switch is activated causing the movement of the platform to stop. The sensor mechanism preferably is an electromechanical switch, but may be any sensor mechanism capable of detecting that the safety bar is not raised when the platform is moving away from ground level.

[0067] In normal operation, the connection rod and activation plate move together as one and function the same way as when the contact linkage is made in one piece, such as a one piece contact rod.

[0068] When the safety bar is not in the raised position, and the connection rod and the activation plate are displaced relative to each other, then there may be a sensor mechanism, preferably a switch, detecting the displacement between the connection rod and activation plate, and when the sensor mechanism is activated, by detecting a displacement, the movement of the platform is stopped.

[0069] In some countries, it is required for safety reasons that the safety bar is raised and locked when the platform is not at ground level. Therefore, the contact linkage is in this case divided into an activation plate and a connection rod, and a sensor mechanism, preferably a switch, is placed to be activated in case the connection rod and the activation plate are displaced relatively to each other.

[0070] In an embodiment of the invention, a sensor mechanism is adapted to stop the movement of the platform if the activation plate and the connection rod are displaced relative to each other with more than a maximum displacement.

[0071] When the platform is moving away from ground level, the two parts of the contact linkage, the connection rod and the activation plate, are expected to follow each other and move together as one. However, if the safety bar meets an obstacle, preventing the safety bar from moving to the raised position, the stopped safety bar will stop the connection rod from moving downwards relative to the housing. The movement or displacement of the connection rod relative to the housing is stopped by the swivel head of the safety bar preventing the sliding block, which is fixed to the connection rod, to move to the locking position. Hereby, the connection rod stops being displaced relative to the barrier housing.

[0072] If the activation plate is not moving together with the connection rod as the activation plate continues being displaced downward relative to the barrier housing, while the connection rod is not being displaced relative to the housing, a sensor mechanism may be activated to stop the movement of the platform, when the distance between the connection rod and the activation plate becomes too big, and the activation plate and the connection rod are displaced relative to each other with more than a maximum displacement.

[0073] The maximum displacement may only be a few millimetres, the maximum displacement may preferably be 5 mm, or more preferably 3 mm, or even more preferably 2 mm. Alternatively, the maximum displacement may be 10 mm, 8 mm, 6 mm or 4 mm.

[0074] When the obstacle is removed, the connection rod will be displaced downwards relative to the housing, until the connection rod and the activation plate resume contact, and the switch is deactivated and the platform may resume moving.

[0075] The sensor mechanism may only be operational at the lower 50 (or 30, 40, 60, 100) mm of the platform

travel. Above 50 mm, the sensor mechanism is inactive, because the connection rod and activation plate are at their maximum travel around the guide bearing, and the safety bar is in the raised position. The activation plate is activated by the floor, or the carrier plate, only at the lower 50 mm of the platform travel (or by the carrier plate when the platform is in stairway position).

[0076] In an embodiment of the invention, the lifting means comprises at least one drive unit.

[0077] Preferably, lifting means are placed in each corner of the platform; the lifting means may be actuators with legs, which may be extendable and thereby lifting up the platform. Thereby the lifting means may comprise four motor or drive units, one in each actuator. The lifting means are moving the platform up and down.

[0078] Alternatively, a drive unit is mounted on the associated building at either the wall or the floor deck. The platform is attached to the two columns mounted on the associated building, and means like a cable or a belt in at least one of the two columns moves the platform up and down between the levels. The drive unit may be mounted between the two columns driving the cable or belt in the two columns.

[0079] The access openings in the building may be placed between two columns, and the exit from the platform may be placed between the two columns.

[0080] In an embodiment of the invention, the platform lifting system comprises an exit opposite to the gate.

[0081] There may be an exit opposite to the gate, allowing persons to leave or enter the platform, when the platform is not at ground level. The persons may leave the platform through the exit, when the exit is at an access opening placed opposite of the gate, when the platform is at the second level, third level, fourth level etc.

[0082] In an embodiment of the invention, the platform lifting system is configurable to at least two positions:

- a stairway position, wherein the platform is turned into a stairway comprising at least two steps, which are displaceable in relation to each other; in the stairway position the carrier plate is positioned to engage the contact linkage to ensure the safety bar is in the lowered position, and
- a platform lift position, wherein the platform is turned into a plane surface.

[0083] In the stairway position, the platform is reconfigured to form a stairway. In this case, the platform comprises two, or more, steps. The steps are vertically offset relative to each other forming a stairway, and the lowest step is the step closest to the floor, and the safety bar, the barrier housing and activation plate may be mounted to follow the lowest step. When in stairway position, the carrier plate is lifted off the ground, so the carrier plate engages the contact linkage , and the safety bar is lowered.

[0084] The invention further relates to a second aspect of the invention being a method of operating a platform lifting system for transporting a person or an object between at least a ground level and a second level, said platform lifting system is comprising:

- a platform,
- a gate,
- lifting means to move the platform at least between the ground level and the second level, and
- a barrier arrangement,

wherein the barrier arrangement is comprising a safety bar, a barrier housing, and a mechanical raising mechanism to move the safety bar between a raised position, preventing persons from passing through the gate, and a lowered position allowing persons to pass through the gate,
the mechanical raising mechanism is comprising a contact linkage and a sliding block;
the method comprises the steps:

- when the contact linkage is engaging a floor, or a carrier plate
- , and the sliding block is displaced a minimum release distance relative to the barrier housing, the mechanical raising mechanism is releasing the safety bar, so that the safety bar is in the lowered position, and
- when the contact linkage is not engaging the floor, or a carrier plate, the mechanical raising mechanism is positioning the safety bar in the raised position.

[0085] The first and second aspect of the present invention may each be combined with any of the other aspects. These and other aspects of the invention will be apparent from and elucidated with reference to the embodiments described hereinafter.

BRIEF DESCRIPTION OF THE FIGURES

[0086] The platform lifting system according to the invention will now be described in more detail with regard to the accompanying figures. The figures show one way of implementing the present invention and are not to be construed as being limiting to other possible embodiments falling within the scope of the attached claim set.

Fig. 1 illustrates the lifting system of the invention with the platform at ground level with the safety bars lowered.

Fig. 2 illustrates the lifting system of the invention with the platform at the second level with the safety bars raised.

Fig. 3 illustrates the lifting system in the stairway position.

Fig. 4 illustrates the barrier arrangement, which is arranged to lower and raise the safety bar.

Fig. 5a illustrates a cross section of the barrier ar-

rangement illustrating the parts inside the barrier arrangement, in the embodiment including a sensor arrangement.

Fig. 5b illustrates the inside of the lower part of the barrier housing in an embodiment including the sensor arrangement.

Fig. 6a illustrates a cross section of the barrier arrangement illustrating the parts inside the barrier arrangement, in the embodiment without a sensor arrangement.

Fig. 6b illustrates the inside of the lower part of the barrier housing, in the embodiment without the sensor arrangement.

Fig. 7a and 7b illustrate the upper part and the lower part of the barrier housing when the platform is at its lowest position.

Fig. 8a and 8b illustrate the upper part and the lower part of the barrier housing when the platform has started moving away from the ground and the safety bar is in an intermediate position.

Fig. 9a and 9b illustrate the upper part and the lower part of the barrier housing when the activation plate is no longer engaging the floor, or the carrier plate.

Fig. 10a and 10b illustrate the sensor mechanism.

Fig. 11 illustrates the method where the safety bar moves between the lowered position and the raised position.

DETAILED DESCRIPTION OF AN EMBODIMENT

[0087] Fig. 1 illustrates the platform lifting system 1 of the invention comprising the platform 15, a gate 16, a barrier arrangement 17, steps 102, a rotatable ramp 9, at least one baluster 105 - ten balusters are shown in fig. 1, side pieces 106, and banisters 107. The barrier arrangement 17 comprises safety bars 18 and barrier housings 19.

[0088] In fig. 1, the platform is at ground level 24 at the floor 22, with the safety bars 18 in the lowered position. The platform 15 can move between the ground level 24 and at least a second level 25. An access opening 26 or a doorway may be located at the second level allowing persons to move on and off the platform through the exit 27 and the access opening 26.

[0089] The platform 15 may be connected to the columns 34 by attachment bars 35, which is fixed to the platform, preferably to the step furthest away from the gate 16 and slideably attached to the columns 34.

[0090] The platform comprises two, or more, steps 102. In fig. 1, five steps are shown, but there may be more steps or fewer steps. In fig. 1, the steps are placed in the same level forming a plane surface of the platform.

[0091] In the front and the rear baluster 105 on each side of the platform 15 are mounted lifting means 84 in the form of actuators which can lift up the platform.

[0092] Fig. 2 illustrates the platform lifting system 1 showing the platform at the second level with the safety bars 18 raised to a substantial horizontal position, preventing persons from the platform 15 to leave the platform through the gate 16. However, persons may leave or enter the platform through the exit 27 on the second level 25 of the building. The barrier housings 19 may comprise a recess 28. The safety bars 18 may move into the recess 28 when in the lowered position.

[0093] The safety bars 18 are preventing persons on the platform 15 from leaving the platform. The safety bars in fig. 2 are in a raised position, where the safety bars are in a horizontal position preventing persons from passing through the gate 16. When at the ground level, the safety bars 18 are lowered to the lowered position as shown in fig. 1, where the safety bars are in a substantially vertical position, and moved into the recess 28.

[0094] In fig. 2, the rotating ramp 9 is moved to a position where it also contributes to hinder passage from the platform 15 through the gate 16. Lifting means 84 are provided to lift the platform. The lifting means 84 preferably may be actuators placed in the front and rear baluster 105 on each side of the platform 15, so lifting means 84 are placed in each corner of the platform. The lifting means 84 may have telescopic legs 85, which are extending when lifting the platform and retract when the platform is lowered. A carrier plate 23 is attached on each of the lifting means placed at the gate 16 next to the barrier housings 19.

[0095] Alternatively, lifting means may be placed in the columns 34; in this case, there may not be any legs.

[0096] Fig. 3 illustrates the platform in the stairway position. The steps 102 are now vertically offset relative to each other forming a stairway, and the lowest step 102' is the step closest to the floor, and the safety bar 18, the barrier housing 19 and activation plate (not shown) may be mounted to follow the lifting means 84 mounted in the front baluster 105'. The legs of the front lifting means comprise a carrier plate 23 (shown in fig 2); the carrier plate is needed if the platform 15 may go into the stairway position, where in the stairway position, the lowest step is raised above the floor 22, as in fig. 3, and therefore the safety bar would move to a raised position, if a carrier plate 23 was not mounted on the actuator legs 85 of the front lifting means 84, as shown in fig. 2.

[0097] When the platform lifting system is in the stairway position, the front actuator legs 85 are pulled up into the front lifting means 84, thereby the carrier plate 23 is placed close to the lowest step 102' in contact with the contact linkage 14 pushing the contact linkage into the barrier housing 19, releasing the safety bars 18, which then move to the lowered position allowing persons to enter the stairway. The front end of the platform is resting on the front end of the side piece 106, while the front actuator legs are pulled up for the carrier plate 23 to engage the activation plate 14' to lower the safety bar 18.

[0098] When in stairway position, the safety bars 18 are in the lowered position allowing passage to the stairway, the highest step 102" is at level with the second level, so persons may use the stairway to move between the ground level 24 and the second level 25.

[0099] Fig. 4 illustrates the barrier arrangement 17, which is arranged to lower and raise the safety bar 18 between a raised position, where the safety bar is positioned substantially horizontally, and a lowered position, where the safety bar is positioned substantially vertically, preferably in a recess 28. The safety bar moves around a turning point 29 (see fig. 5a).

[0100] The barrier arrangement 17 comprises a barrier housing 19, a safety bar 18, and a contact linkage 14. When the contact linkage 14 engages the floor 22, or a carrier plate 23, the contact linkage is pushed partly up into the barrier housing 19 and is thereby causing the safety bar 18 to be released from the raised position, when the sliding block is displaced to a minimum release distance relative to the barrier housing, and the safety bar will move to the lowered position.

[0101] Fig. 5a illustrates a cross section of the barrier arrangement 17 illustrating the parts inside the barrier arrangement, in the embodiment without a sensor arrangement. The contact linkage 14 in this embodiment comprises a connection rod 14" and an activation plate 14'. Inside the barrier arrangement 17 is the connection rod 14", a tension spring 50, a sliding block 30 and a sensor mechanism 48. When the activation plate 14' engages the floor 22, or a carrier plate 23, the activation plate 14' is pushed up into the barrier housing 19, where it engages the connection rod 14" and pushes the connection rod up, so the connection rod engages the sliding block 30, which is pushed up and thereby is pushed away from the locking position to a release position. Then the safety bar 18 moves down due to gravity and the safety bar moves to the lowered position giving access to the platform 15 through the gate 16. The sliding block 30 is fixed to the upper end 36 of the contact linkage 14 or is an integrated part of the upper end of the contact linkage. The upper end of the contact linkage is the end closest to the top 37 of the barrier housing.

[0102] When the platform is moving away from the ground level to a higher position, the safety bars are raised to a horisontially raised position. This is done by the tension spring 50 pulling the contact linkage 14 down, and thereby also pulling down the sliding block 30, which is fixed to the contact linkage 14. The sliding block engages the safety bar 18, and makes the safety bars 18 rotate on the turning point 29 to a horizontal raised position. The tension spring is fixed to the contact linkage 14 at a connection point 71 and to the barrier housing 19 at a connection point 72. The connection point 72 in the barrier housing is placed lower than the connection point 71 in the contact linkage 14, so the tension spring is pulling the actuation rod 14 downwards relative to the barrier housing.

[0103] Fig. 5b illustrates a cross section of the inside of the lower part of the barrier housing 19 in the embodiment without the sensor arrangement. Fig. 5b shows the contact linkage 14 comprising a connection rod 14" and the activation plate 14', a rod plate 41, which is fixed to the connection rod 14" and may be an integrated part of the connection rod, and always moves together with the connection rod, the activation plate 14' and the sensor mechanism 48. The sensor mechanism 48 comprises a switch 60 comprising a switch arm 51, which in fig. 5b is shown twice, both in the deactivated position 51' and in the activated position 51". The switch housing 52 is fixed to the connection rod by plate 41. A guide bearing 55 is fixed to the barrier housing 19. The connection rod 14" and the activation plate 14' are mounted slidably around the guide bearing 55, allowing the connection rod 14" and the activation plate 14' to move or be displaced relative to each other. An edge 57 in an opening 59 in the activation plate 14' may push down the switch arm 51" and activate the switch.

[0104] The displacement spring 64 is pushing down the activation plate 14', when the connection rod is stopped from moving by a blocked safety bar.

[0105] Fig. 6a illustrates a cross section of the barrier arrangement 17 illustrating the parts inside the barrier arrangement, in the embodiment without a sensor arrangement. The barrier arrangement is similar to the barrier arrangement illustrated in Fig. 5a except the barrier arrangement does not comprise a sensor mechanism 48. Instead in Fig. 6a, the activation plate 14' and the connection rod 14" are fixed together so they cannot move relative to each other. Thereby a contact linkage 14 is obtained comprising the activation plate 14' and the connection rod 14". Alternatively, the activation plate and the connection rod are formed in one piece. The sliding block 30 is attached to the upper end 36 of the contact linkage 14. The upper end of the contact linkage is the end closest to the top 37 of the barrier housing.

[0106] Fig. 6b illustrates the inside of the lower part of the barrier housing, in the embodiment without the sensor mechanism. The contact linkage 14 comprises the activation plate 14' and the connection rod 14", and the activation plate 14' and the connection rod 14" cannot move relative to each other. The contact linkage 14 is mounted slidably around the guide bearing 55, the guide bearing limits the movements of the contact linkage 14 and functions as a stop for how far out of the barrier housing 19 the lower end of the contact linkage 14 or the activation plate 14' may move.

[0107] Fig. 7a, 7b, 8a, 8b, 9a and 9b illustrate the interaction between the sliding block 30, the safety bar 18, the connection rod 14" and the activation plate 14' during normal operation. The safety bar 18 comprises a swivel head 18'. The swivel head may comprise rollers 32.

[0108] Fig. 7a and 7b are respectively showing the upper part and the lower part of the barrier housing 19, when the platform is at its lowest position. The activation plate 14' is pushed as far as possible into the barrier housing 19. The activation plate 14' has therefore pushed the connection rod 14" and the sliding block 30 as far up as possible, so that the sliding block 30 is pushed to its highest position towards the top of the barrier housing 19. Thereby, the sliding block is in the release position, to be understood as the sliding block is not in contact

with the swivel head 18' of the safety bar 18. Therefore, the safety bar is released and the safety bar 18 is in the lowered position substantially vertically along the barrier housing 19.

[0109] Fig. 8a and 8b respectively illustrate the upper part and the lower part of the barrier housing when the platform has just started to move away from the ground, but the sliding block 30, which is fixed to the contact linkage 14, is not displaced the minimum release distance relative to the barrier housing 19, and therefore the safety bar is not released, but is in an intermediate position. The activation plate 14' is not pushed as far into the barrier housing 19 as possible and is still in contact with the floor, or the carrier plate. The tension spring 50 is therefore pulling the connection rod 14" down, and with the rod, the sliding block 30 is being pulled down and is engaging the swivel head 18' of the safety bar 18 moving the safety bar up. The safety bar 18 is now in an intermediate position between the lowered position and the raised position.

[0110] Fig. 9a and 9b illustrate the safety bar 18 in the raised position, when the activation plate 14' is no longer engaging the floor, or the carrier plate. The activation plate 14' is not in contact with the floor, or the carrier plate, and is therefore now in its lowest position, pulled down by gravity, the displacement spring 64 or indirectly the tension spring 50. The tension spring 50 has pushed the connection rod 14" as far down as possible to the connection rod's 14" lowest position and the sliding block 30 is now locking the safety bar 18 in its raised position by the sliding block engaging the locking point 33 of the swivel head 18'. The sliding block 30 prevents the safety bar from lowering; the safety bar is locked in the raised position, and cannot be moved or pushed down, before the sliding block is pushed up and away from the locking position. The sliding block is pushed away by the activation plate engaging the floor, or the carrier plate.

[0111] Fig. 7a, 7b, 8a, 8b, 9a and 9b illustrate the preferred embodiment, where the contact linkage 14 comprises a connection rod 14" and an activation plate 14', however the functionality of the sliding block 30 engaging the swivel head 18' of the safety bar 18 is substantially the same in the embodiment where the contact linkage 14 is in one piece.

[0112] Fig. 10a and 10b illustrate the sensor mechanism 48. The sensor mechanism is a security function ensuring that the platform cannot move very far, only a few centimetres, from the floor, or the carrier plate, if the safety bar is not moved to the raised position and blocked by the sliding block. The switch 60 is mounted on the connection rod 14" or the rod plate 41. When working normally, the connection rod 14" and the activation plate 14' move together in unison, but if something is preventing the safety bar 18 to get into the raised position, when the platform is moving away from the ground level, then the activation plate 14' will move down or be displaced due to gravity or due to the displacement spring 64, but the connection rod 14" is not being displaced downwards, because the safety bar 18 is not moving up, preventing the sliding block 30 from moving to the locking position, and therefore a displacement occurs between the connection rod 14" and the activation plate 14', the activation plate is moving relative to the connecting rod around the guide bearing 55, and an edge 57 in the activation plate 14' will push down the switch arm 51 to the activated position 51". This activates the switch 60, and when the switch is activated, the lifting means 84 is stopped or turned off, so the movement of the platform stops. Therefore, the platform can only move a few centimetres away from ground level if the safety bar is not in the raised position.

[0113] The displacement spring 64 may not be needed, but in case activation plate 14' is not moving down by gravity, because it may be stuck, the displacement spring may add an extra push for the activation plate 14' to move or be displaced downwards.

[0114] Fig. 11 illustrates the method where the safety bar moves between the lowered position and the raised position. The step S1 is when the contact linkage 14 is engaging the floor 22, or a carrier plate 23, and the sliding block 30 is displaced a minimum release distance from the lowest position of the contact linkage relative to the barrier housing 19, then the mechanical raising mechanism 17 is releasing the safety bar 18, and is positioning the safety bar in the lowered position, and step S2 is when the contact linkage 14 is not engaging the floor 22, or a carrier plate 23, the mechanical raising mechanism 17 is positioning the safety bar 18 in the raised position.

[0115] When the platform lifting system moves up and down, to and away from ground level, the safety bar either moves to a lowered position in step S1 or a raised position in step S2.

[0116] Although the present invention has been described in connection with the specified embodiments, it should not be construed as being in any way limited to the presented examples. The scope of the present invention is set out by the accompanying claim set. In the context of the claims, the terms "comprising" or "comprises" do not exclude other possible elements or steps. Also, the mentioning of references such as "a" or "an" etc. should not be construed as excluding a plurality. The use of reference signs in the claims with respect to elements indicated in the figures shall also not be construed as limiting the scope of the invention. Furthermore, individual features mentioned in different claims may possibly be advantageously combined, and the mentioning of these features in different claims does not exclude that a combination of features is not possible and advantageous.

Claims

1. A platform lifting system for transporting a person or an object between at least a ground level (24) and a second level (25), said platform lifting system (1)

comprises:

- a platform (15),
- a gate (16),
- lifting means (84) to move the platform at least between the ground level and the second level, and
- a barrier arrangement (17),

wherein the barrier arrangement comprises a safety bar (18), a barrier housing (19), and a mechanical raising mechanism (20) adapted to move the safety bar between a raised position, preventing persons from passing through the gate, and a lowered position allowing persons to pass through the gate, wherein
the mechanical raising mechanism comprises a contact linkage (14) and a sliding block (30),

- when the contact linkage engages a floor (22), or a carrier plate (23), and the sliding block (30) is displaced a minimum release distance relative to the barrier housing (19), the mechanical raising mechanism (20) is adapted to release the safety bar so that the safety bar is positioned in the lowered position, and
- when the contact linkage does not engage the floor, or the carrier plate, the mechanical raising mechanism is adapted to engage the safety bar and position the safety bar in the raised position.

2. The platform lifting system according to claim 1, when the contact linkage (14) does not engage the floor (22), or the carrier plate (23), the sliding block is adapted to being positioned in a locking position, locking the safety bar in the raised position.

3. The platform lifting system according to claims 1 or 2, wherein when the contact linkage does engage the floor (22), or the carrier plate (23), and the sliding block (30) is displaced a minimum release distance relative to the barrier housing, the sliding block is adapted to being positioned in a release position, and the safety bar (18) is released from the raised position.

4. The platform lifting system according to any of the claims 1-3, wherein the contact linkage (14) comprises a connection rod (14") and an activation plate (14'), the connection rod is mounted between the activation plate (14') and the sliding block (30), so that when the activation plate engages the floor (22), or the carrier plate (23), the activation plate (14') engages the connection rod (14") and the connection rod engages the sliding block (30), so that when the sliding block is displaced a minimum release distance relative to the barrier housing, the sliding block is positioned in the release position.

5. The platform lifting system according to claim 4, wherein when the activation plate does not engage the floor (22), or the carrier plate (23), the sliding block (30) is adapted to be positioned in the locking position.

6. The platform lifting system according to any of the claims 1-5, wherein when the sliding block (30) is positioned in the release position, the safety bar (18) is positioned in the lowered position.

7. The platform lifting system according any of the claims 1-6, wherein the mechanical raising mechanism (20) further comprises spring means, preferably a tension spring (50), and when the contact linkage (14) does not engage the floor (22), or the carrier plate (23), the spring means entails that the safety bar (18) is being positioned in the raised position.

8. The platform lifting system according to claim 7, wherein, when the contact linkage (14) does not engage the floor (22), or the carrier plate (23), the spring means, preferably a tension spring (50), is adapted to pull the contact linkage down, and the sliding block (30) is adapted to engage the safety bar (18), so the safety bar is positioned in a raised position, which preferably is substantially horizontal.

9. The platform lifting system according to any of the claims 7-8, wherein the spring means, preferably a tension spring (50), the sliding block (30) and at least part of the contact linkage (14) are mounted inside the barrier housing (19).

10. The platform lifting system according to any of the claims 1-9, wherein the barrier housing (19) and the mechanical raising mechanism (20) is positioned in a fixed position on the platform (15).

11. The platform lifting system according to any of the claims 1-10, wherein a sensor mechanism (48) is adapted to stop the movement of the platform (15) if the safety bar (18) is not positioned in the raised position when the contact linkage (14) disengages the floor (22), or the carrier plate (23).

12. The platform lifting system according to any of the claims 1-10, wherein a sensor mechanism (48) is adapted to stop the movement of the platform (15), if the activation plate (14') and the connection rod (14") are displaced relatively to each other with more than a maximum displacement.

13. The platform lifting system according to any of the preceding claims, wherein the platform lifting system is configurable to at least two positions:

- a stairway position (91), wherein the platform (15) is turned into a stairway comprising at least two steps, which are displaceable in relation to each other; in the stairway position the carrier plate (23) is positioned to engage the contact linkage (14) to ensure the safety bar (18) is in the lowered position, and
- a platform lift position (92), wherein the platform (15) is turned into a plane surface.

14. A method of operating a platform lifting system for transporting a person or an object between at least a ground level (24) and a second level (25), said platform lifting system (1) is comprising:

- a platform (15),
- a gate (16),
- lifting means (84) to move the platform at least between the ground level and the second level, and
- a barrier arrangement (17),

wherein the barrier arrangement is comprising a safety bar (18), a barrier housing (19), and a mechanical raising mechanism (20) to move the safety bar between a raised position, preventing persons from passing through the gate, and a lowered position allowing persons to pass through the gate,
the mechanical raising mechanism is comprising a contact linkage (14) and a sliding block (30);
the method comprises the steps:

- when the contact linkage is engaging a floor (22), or a carrier plate (23), and the sliding block (30) is displaced a minimum release distance relative to the barrier housing (19), the mechanical raising mechanism is releasing the safety bar, so that the safety bar is positioned in the lowered position, and
- when the contact linkage is not engaging the floor, or a carrier plate, the mechanical raising mechanism is positioning the safety bar in the raised position.

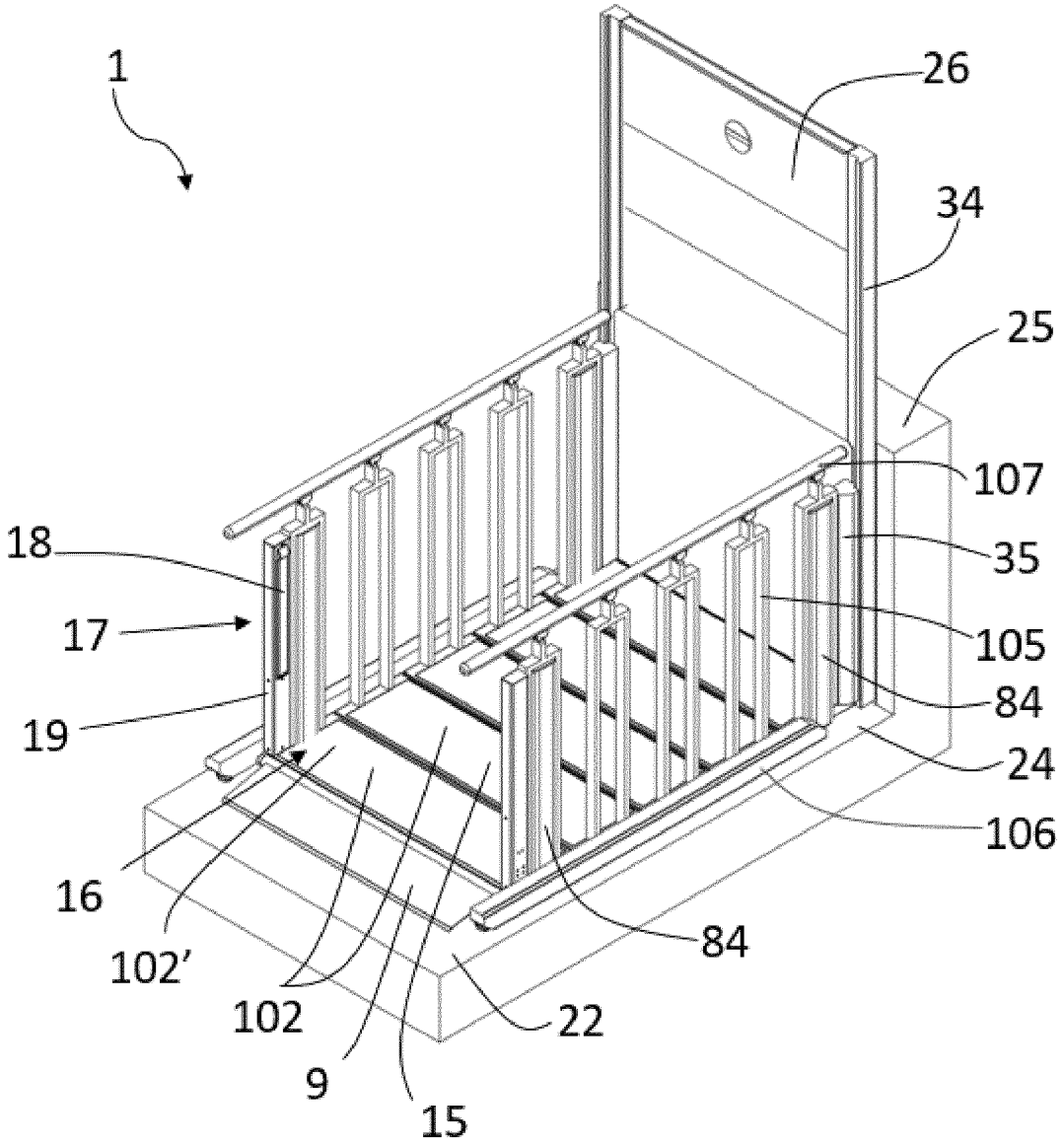


Fig. 1

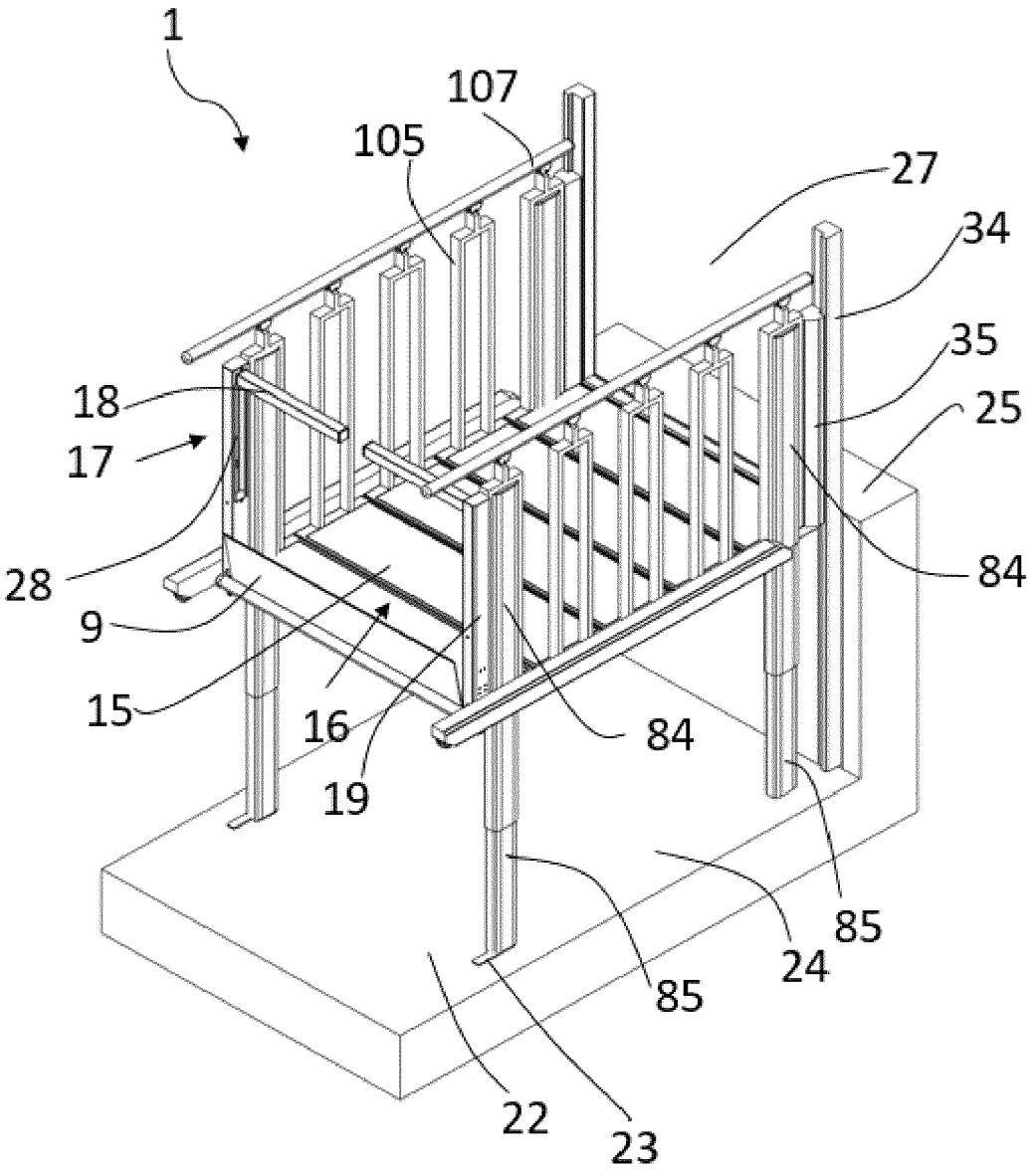


Fig. 2

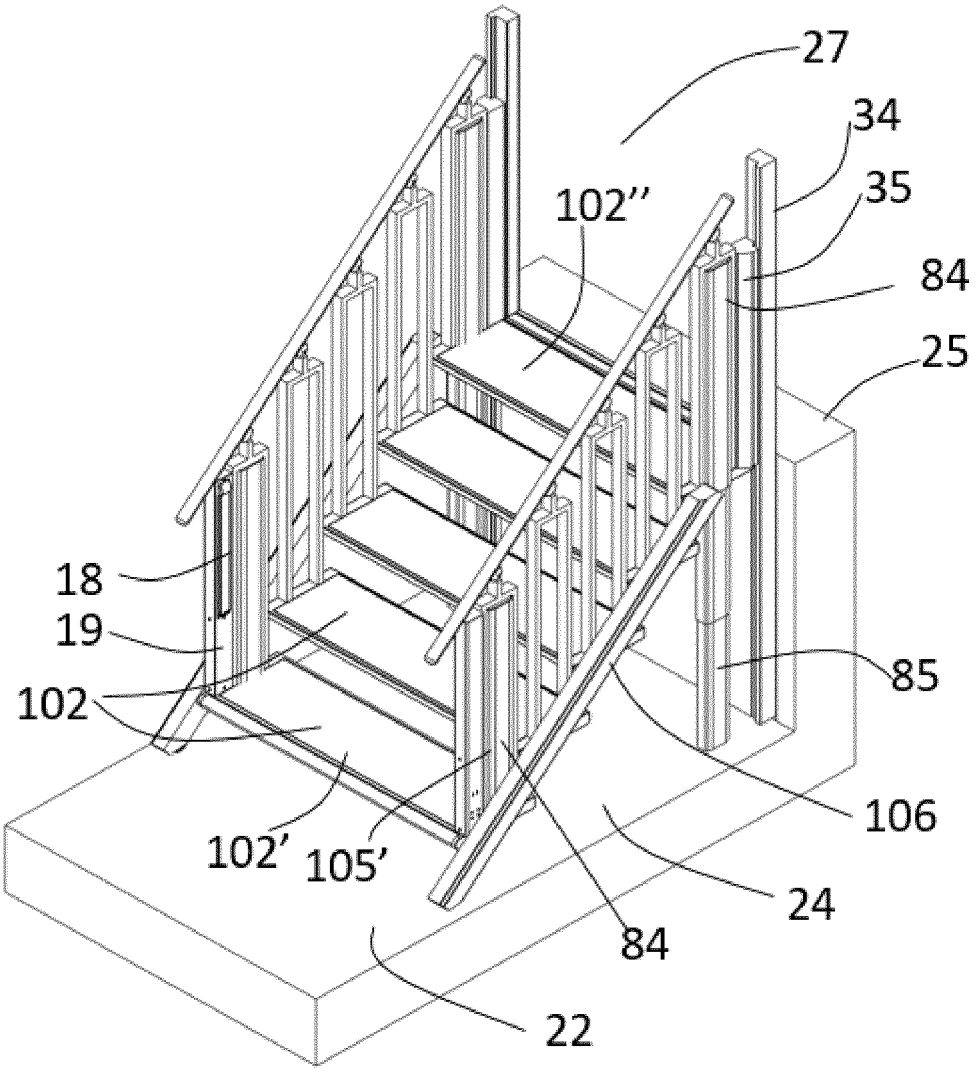


Fig. 3

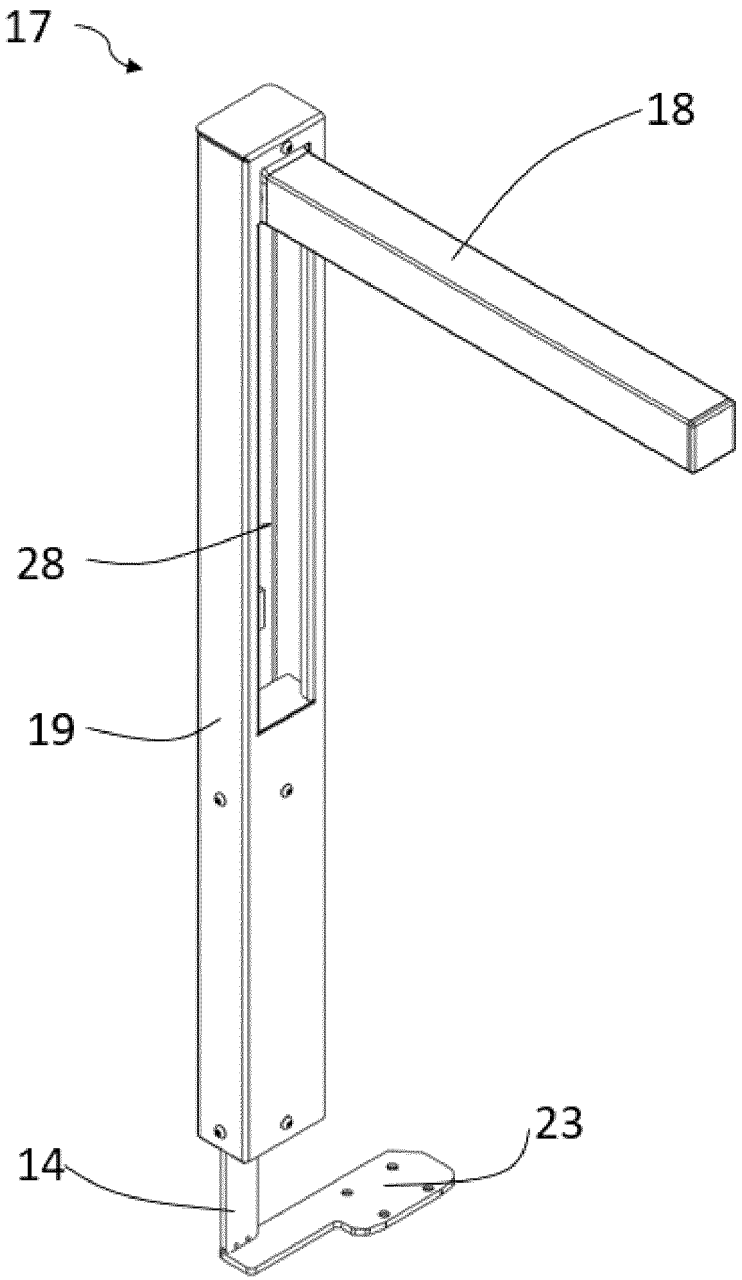
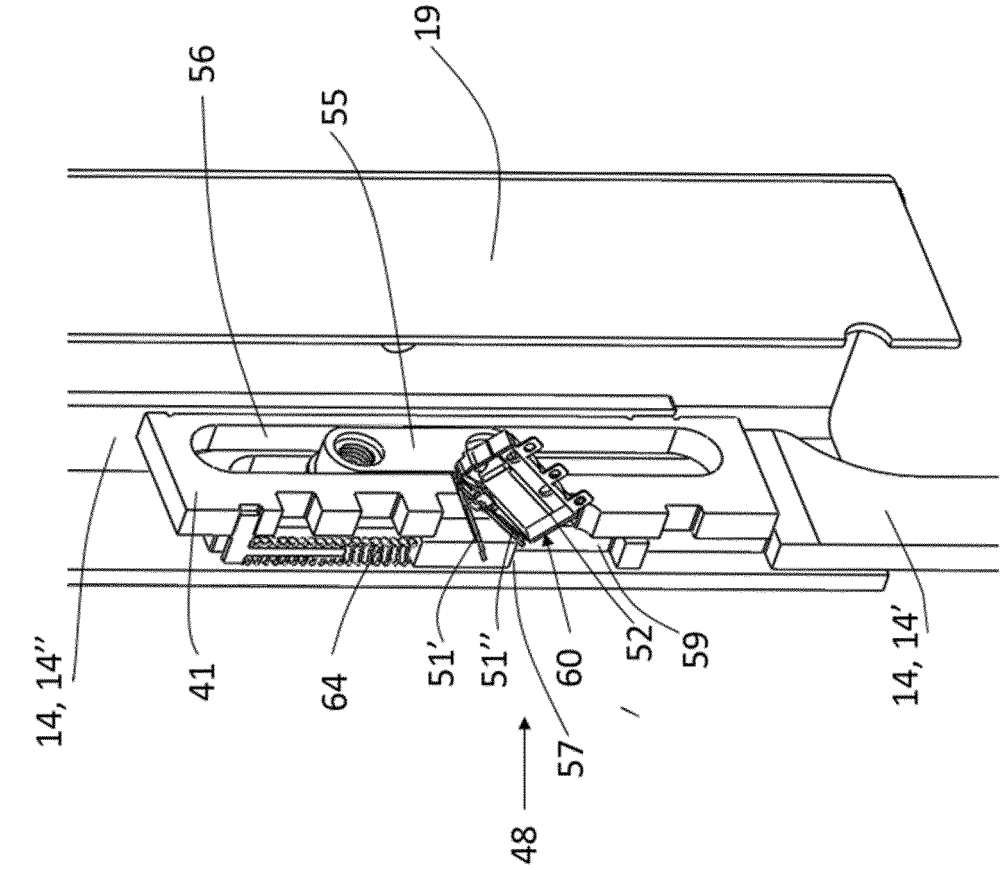


Fig. 4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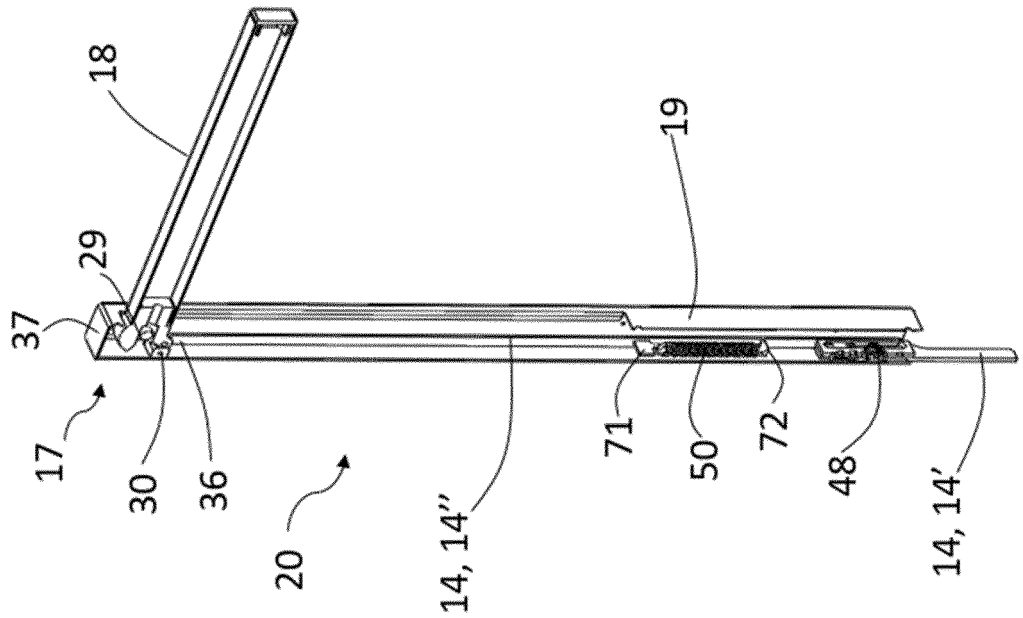
19
14, 14''
41
64
51'
51''
60
52
59
14, 14'
57
48

Fig. 5b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19
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36
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14, 14''
71
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14, 14'

Fig. 5a

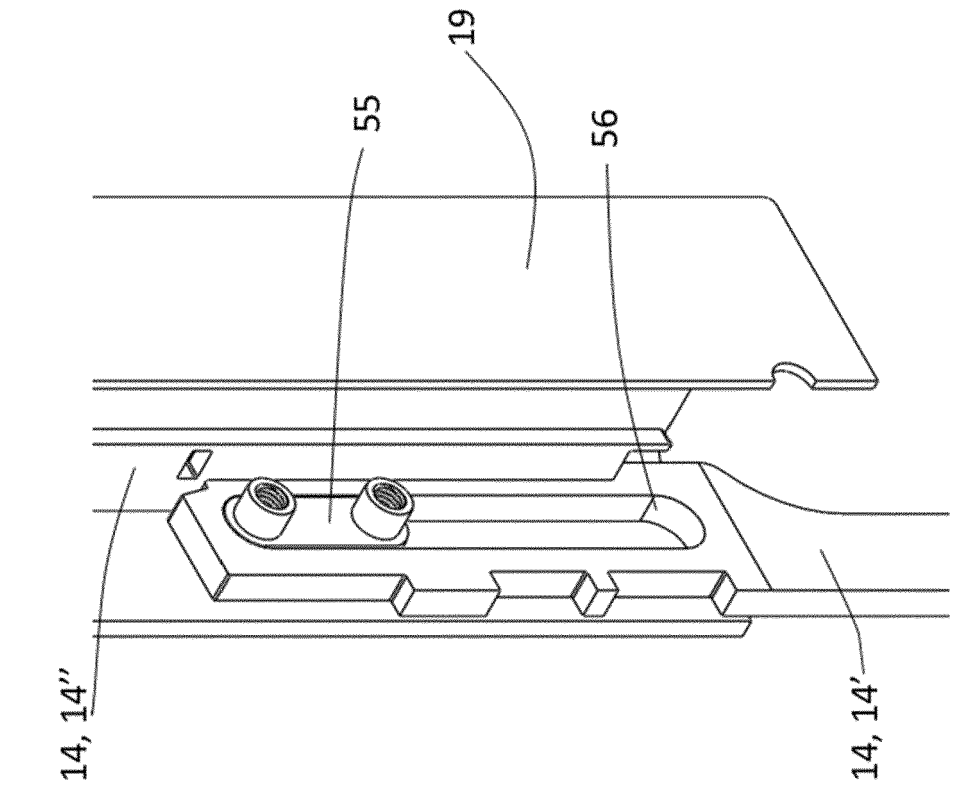

Fig. 6b

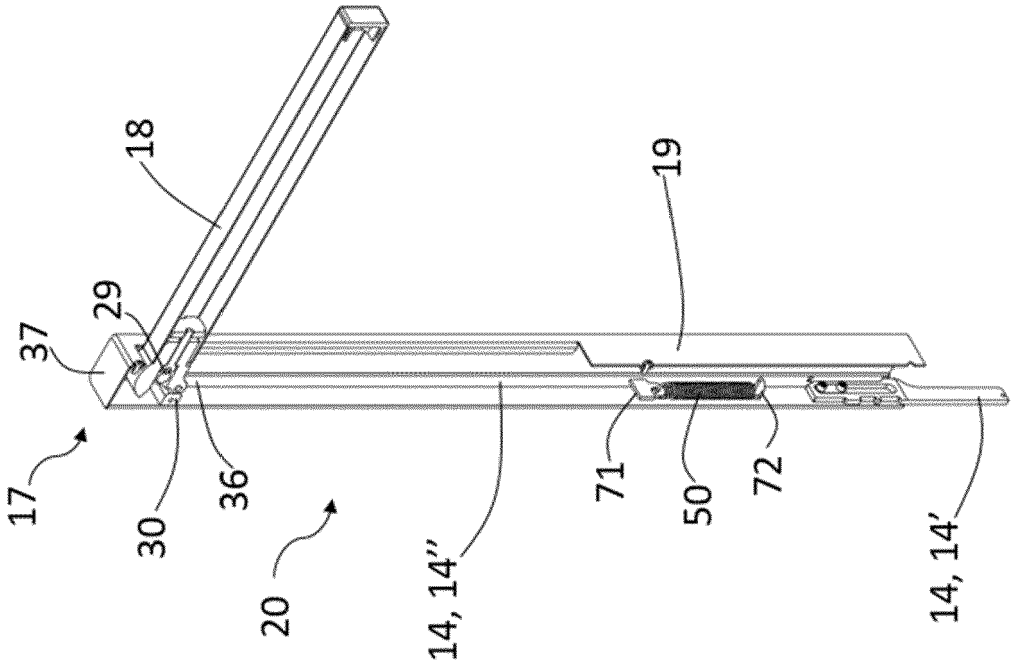

Fig. 6a

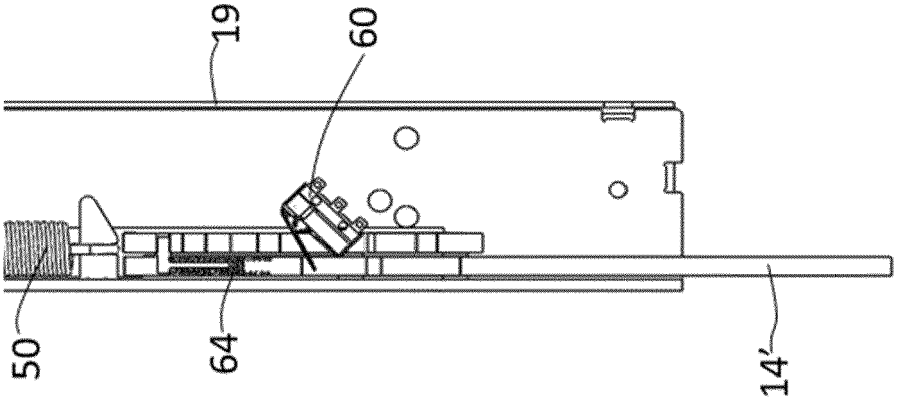

Fig. 7b

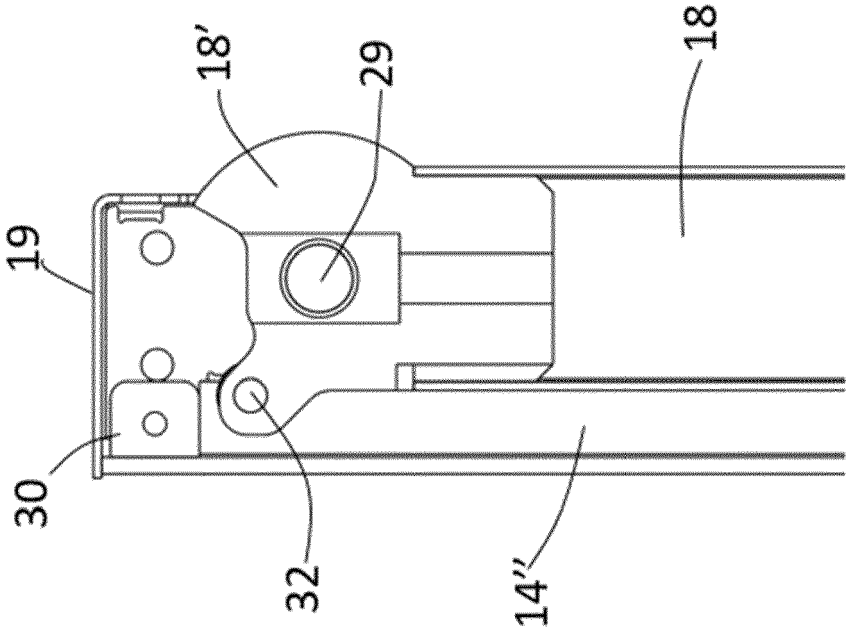

Fig. 7a

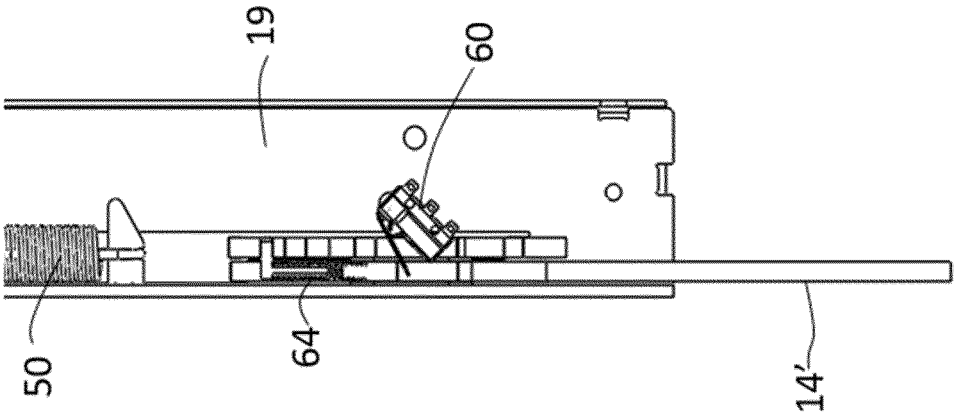

Fig. 8b

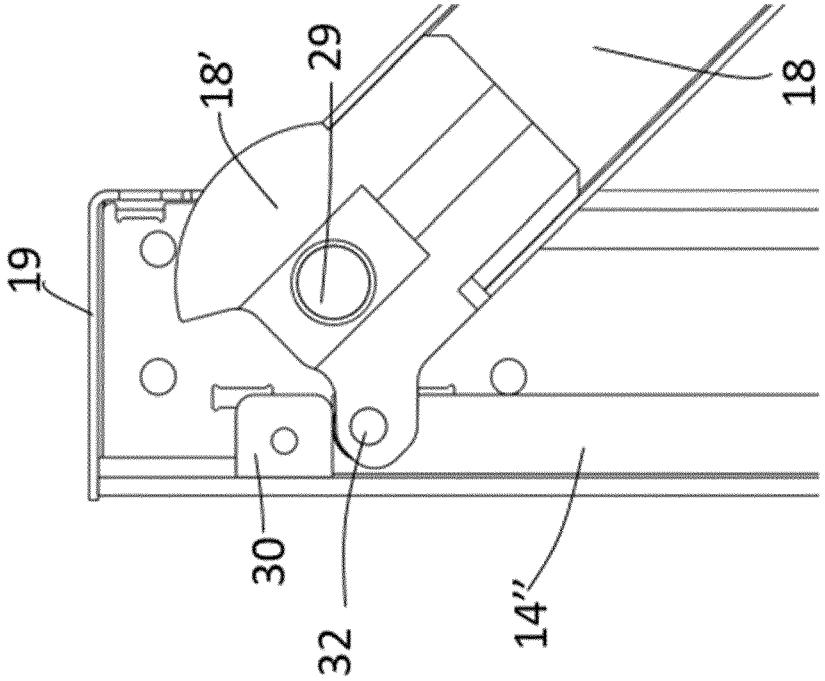

Fig. 8a

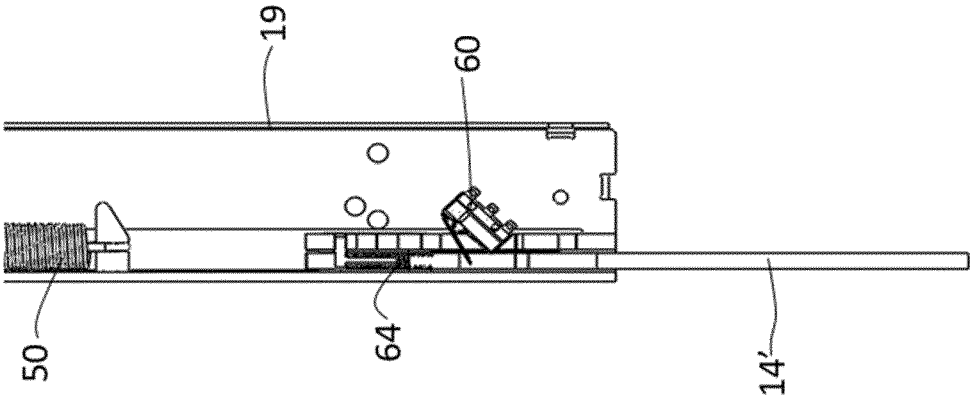

Fig. 9b

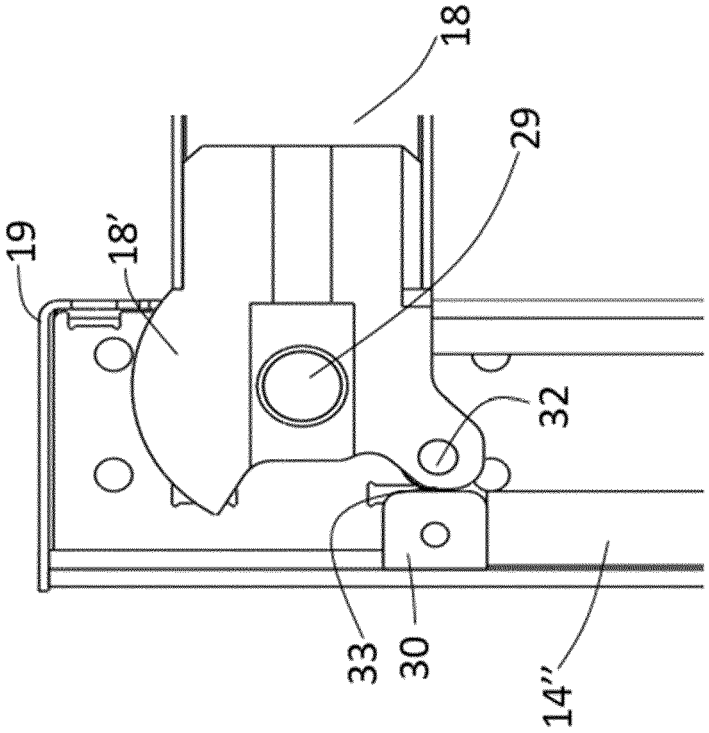

Fig. 9a

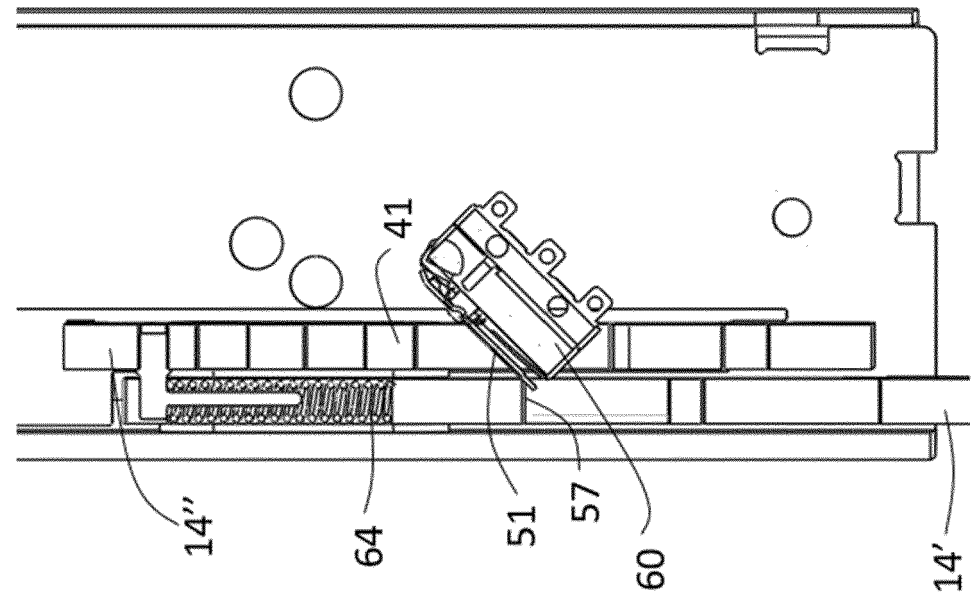

Fig. 10b

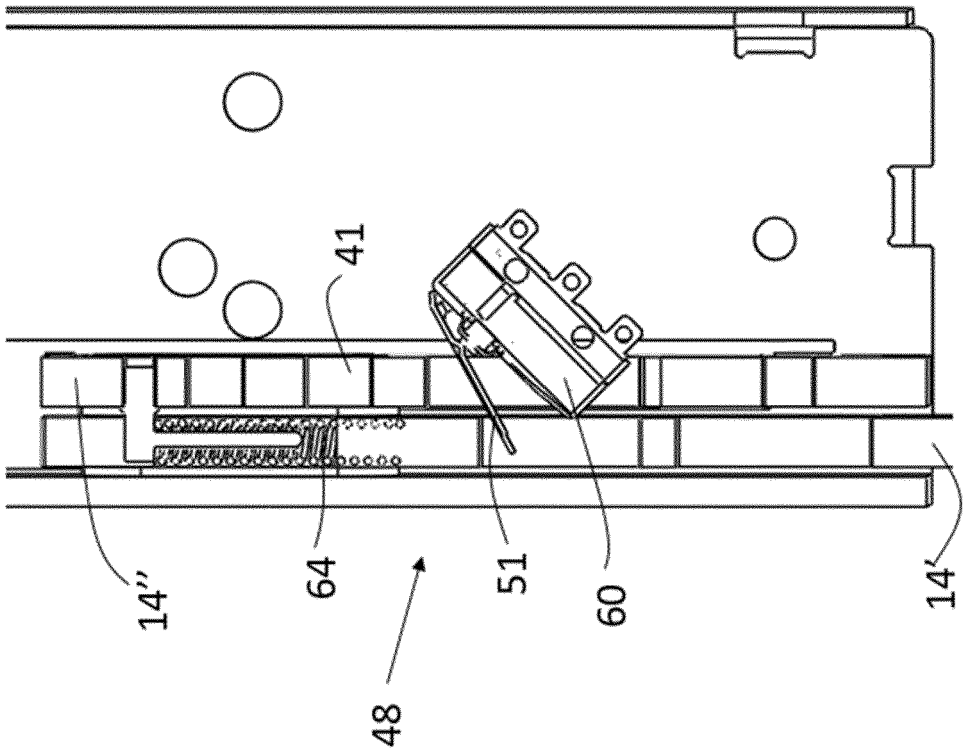

Fig. 10a

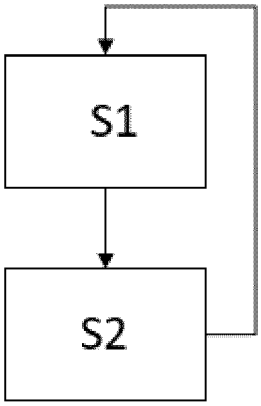

Fig. 11

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European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 23 16 2637

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	US 4 457 402 A (DEL VECCHIO JOSEPH A [US] ET AL) 3 July 1984 (1984-07-03) * column 6, line 4 - column 7, line 32; figures 1-12 *	1-14	INV. B66B9/08
X	US 5 234 078 A (SMITH VIRGIL A [CA]) 10 August 1993 (1993-08-10) * column 4, line 26 - line 44; figures 1-10 *	1-14	
			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	18 August 2023	Nelis, Yves

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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E : earlier patent document, but published on, or after the filing date
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L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 23 16 2637

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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18-08-2023

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US 4457402 A	03-07-1984	NONE	
US 5234078 A	10-08-1993	CA 2099311 A1	30-12-1993
		US 5234078 A	10-08-1993

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