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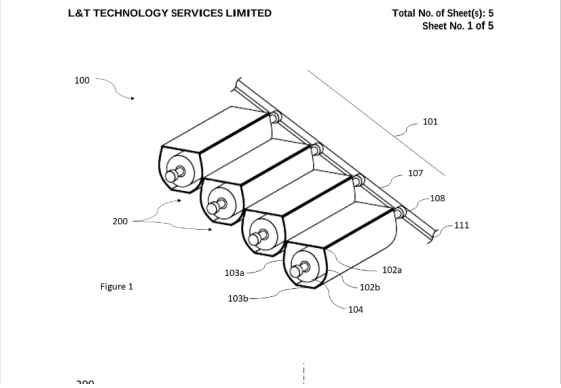
(54) Title: AN ESCALATOR SYSTEM AND A STEP THEREOF

(57) Abstract: Present disclosure discloses an escalator system (100), including a frame (101) which is defined with guideways (107). The guideways (107) define a travel path of the escalator system (100). Further, the escalator system (100) includes a plurality of steps (200) being movably accommodated between the guideways (107) to form the travel path. One or more steps (200) of the plurality steps (200) includes a support element (104). Also, one or more steps (200) of the plurality of steps (200) include an actuation unit (106) is connected to the support element (104) to rotate at least one of the one or more steps (200) between a first operating condition and a second operating condition, along the travel path. On toggling of one or more steps (200), vulnerability of commuters and goods to travel on the escalator system (100) may be minimized, as the second operating condition provides cushioning.



FORM 2

THE PATENTS ACT 1970
(39 OF 1970)
&
The Patent Rules, 2003

Complete Specification

(See Section 10 and Rule 13)

1. TITLE OF THE INVENTION

AN ESCALATOR SYSTEM AND A STEP THEREOF

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3. PREAMBLE TO THE DESCRIPTION

COMPLETE

The following specification describes the invention and the manner in which it is to be performed

DESCRIPTION

TECHNICAL FIELD

[001] The present disclosure, in general, relates to the field of escalator systems. Particularly, but not exclusively, the present disclosure relates to steps of the escalator system, capable of toggling between a first operating condition and a second operating condition, along a travel path of the escalator system.

BACKGROUND OF THE DISCLOSURE

[002] Escalator systems have been used for transportation of commuters and goods in and across at public spaces and/or industrial structures, institutions, healthcare facilities, entertainment sectors, and the like, to cater demand of fast and effortless movement between destinations. The escalator systems have been developed and are installed with different configurations and categories per requirement of the industry and based on technological objectives, to maintain steady transportation time at affordable and workable costs. For instance, the escalator systems installed in shopping malls have steps displacement speed slower when compared to those escalator systems installed at the metro station or in the airport.

[003] The safety of the escalator has always been a matter of concern for commuters, specifically, for the aged and toddlers due to stability and material being used in the escalators. In this regard, unforeseen mishaps may occur while commuting in the steps of the escalator which may cause severe bruises or sometimes be fatal. Therefore, there exists a need to provide a safe travel for the commuters using the escalators.

[004] The present disclosure is directed to overcome one or more limitations stated above or any other limitation associated with the prior arts.

SUMMARY OF THE DISCLOSURE

[005] One or more shortcomings of the prior art are overcome by a method as disclosed and additional advantages are provided through the method as described in the present disclosure.

[006] Additional features and advantages are realized through the techniques of the present disclosure. Other embodiments and aspects of the disclosure are described in detail herein and are considered a part of the claimed disclosure.

[007] In one non-limiting embodiment of the disclosure, a step for an escalator system is disclosed. The step includes a first landing portion, a first riser portion, a second landing portion and a second riser portion. The first landing portion, the first riser portion, the second landing portion and the second riser portion are connectable to each other. The step also includes a support element which is disposed between the first landing portion, the first riser portion, the second landing portion, and the second riser portion. The support element being configured to support at least the first landing portion and the second landing portion. Also, the support element is rotatable to toggle a position of the first landing portion and the second landing portion, between a first operating condition and a second operating condition.

[008] In an embodiment, the step comprises an actuation unit coupled to the support element. The actuation unit is configured to selectively rotate the support element to toggle position of each of the first landing portion, the first riser portion, the second landing portion, and the second riser portion between the first operating condition and the second operating condition.

[009] In an embodiment, the step comprises a plurality of coupler secured to the support element. At least one coupler of the plurality of couplers is configured to selectively engage with at least one the first landing portion, the first riser portion, the second landing portion and the second riser portion. Each of the plurality of couplers simultaneously grip and toggle position of each of the first landing portion, the first riser portion, the second landing portion, and the second riser portion, when the support element is rotated by a predetermined angular displacement.

[0010] In an embodiment, the first landing portion and the first riser portion are made of a first sustainable material and wherein the second landing portion and the second riser portion are made of a second sustainable material.

[0011] In another non-limiting embodiment of the present disclosure, an escalator system is disclosed. The escalator system includes a frame, defined with guideways which define a travel path. The escalator system further includes a plurality of steps, which are being movably accommodated between the guideways to form the travel path. One or more steps of the plurality steps includes a support element and an actuation unit, is connected to the support element to rotate at least one of the one or more steps between a first operating condition and a second operating condition, along the travel path.

[0012] In an embodiment, the escalator system comprises a locking mechanism configured to selectively lock each step of the plurality of steps to rotate and toggle between the first operating condition and the second operating condition.

[0013] In an embodiment, the escalator system comprises a sensor module, configured to sense a change in a parameter relative to at least one of the first landing portion and the first riser portion, based on condition of a commuter on at least one step of the plurality of steps.

[0014] In an embodiment, the escalator system comprises a control unit, communicatively coupled with at least one of the actuation unit of the support element, the sensor module and the displacement mechanism. The control unit is configured to determine, travel condition of the commuter based on signals corresponding to change in condition of the commuter relative to at least one the first landing portion and the first riser portion from the sensor module. The control unit is configured to actuate, the actuation unit to toggle position of the first landing portion, the first riser portion, the second landing portion, and the second riser portion of one or more steps in the travel path.

[0015] The foregoing summary is illustrative only and is not intended to be in any way limiting. In addition to the illustrative aspects, embodiments, and features described above, further aspects, embodiments, and features will become apparent by reference to the drawings and the following detailed description.

BRIEF DESCRIPTION OF THE ACCOMPANYING FIGURES

[0016] The novel features and characteristics of the disclosure are set forth in the appended description. The disclosure itself, however, as well as a preferred mode of use, further objectives and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying figures. One or more embodiments are now described, by way of example only, with reference to the accompanying figures wherein like reference numerals represent like elements and in which:

[0017] Figure 1 illustrates a schematic representation of a portion of an escalator system, in accordance with an embodiment of the present disclosure.

[0018] Figure 2a illustrates a side view of a step of the escalator of Figure 1, in accordance with an embodiment of the present disclosure.

[0019] Figure 2b illustrates an exploded view of the step of Figure 2a, in accordance with an embodiment of the present disclosure.

[0020] Figures 3a-3h illustrate embodiments of a locking mechanism for securing each step of Figures 2a and 2b, in accordance with an embodiment of the present disclosure.

[0021] Figure 4 is a block diagram of the escalator system, in accordance with an embodiment of the present disclosure.

[0022] The figures depict embodiments of the disclosure for purposes of illustration only. One skilled in the art will readily recognize from the following description that alternative embodiments of the methods illustrated herein may be employed without departing from the principles of the disclosure described herein.

DETAILED DESCRIPTION OF THE DISCLOSURE

[0023] The foregoing has broadly outlined the features and technical advantages of the present disclosure in order that the detailed description of the disclosure that follows may be better understood. Additional features and advantages of the disclosure will be described hereinafter which form the subject of the description of the disclosure. It should also be realized by those skilled in the art that such equivalent mechanism does not depart from the scope of the disclosure. The novel features which are believed to be characteristic of the disclosure, as to mechanism/method of operation, together with further objects and advantages will be better understood from the following description when considered in connection with the accompanying figures. It is to be expressly understood, however, that each of the figures is provided for the purpose of illustration and description only and is not intended as a definition of the limits of the present disclosure.

[0024] In the present document, the word "exemplary" is used herein to mean "serving as an example, instance, or illustration." Any embodiment or implementation of the present subject matter described herein as "exemplary" is not necessarily to be construed as preferred or advantageous over other embodiments.

[0025] While the disclosure is susceptible to various modifications and alternative forms, specific embodiment thereof has been shown by way of example in the drawings and will be described in detail below. It should be understood, however that it is not intended to limit the disclosure to the particular forms disclosed, but on the contrary, the disclosure is to cover all modifications, equivalents, and alternatives falling within the spirit and the scope of the disclosure.

[0026] The terms “comprises”, “comprising”, or any other variations thereof, are intended to cover a non-exclusive inclusion, such that a system that comprises a list of components does not include only those components but may include other components not expressly listed or inherent to such system. In other words, one or more components in a system proceeded by “comprises… a” does not, without more constraints, preclude the existence of other acts or additional acts in the method.

[0027] Figure 1 is an exemplary embodiment of the present disclosure which illustrates a schematic representation of an escalator system (100). The escalator system (100) [hereinafter also interchangeably referred to as “escalator”] is employed for effortless automatic commuting and transportation between two or more defined destinations about a travel path structured thereto. The escalator system (100) is adapted to carry load and transport articles and/or subjects in a horizontal path, an inclined path and a combination thereof, for suitably and adequately reducing time and effort required for such transportation. The escalator system (100) includes a plurality of steps (200), that displace along the travel path for boarding and deboarding, to act as means for transporting and commuting on the escalator system (100). Each of the plurality of steps (200) are structured and are arranged in the escalator system (100) in such a way that, at least some of the steps of the plurality of steps (200) forms a region for transportation (i.e., transportation region having step (200) configuration), while remaining or some of other steps (200) forms a convertible and/or foldable region (i.e., flat region where boarding onto the steps (200) and deboarding off the steps (200) is formed) which then circulate within the escalator system (100). Also, each step (200) of the plurality of steps (200) sequentially switches from being part of the transportation region to a convertible region, and vice versa, along the travel path. Additionally, the travel path consists of the plurality of steps (200) forming at least one transportation region between at least two convertible regions, and vice versa, where during continuous displacement of the plurality of steps (200), the at least one transportation region of the escalator system (100) is switched to the convertible region

and vice versa. In an embodiment, the escalator system (100) may only include the convertible region which acts as the transportation region as well, however, the present disclosure is not limited such configuration as for understanding, the escalator system (100) is defined and described to include both the transportation region and the convertible region.

[0028] In an embodiment, for facilitating such displacement of the plurality of steps (200), the escalator system (100) includes a frame (101) which is defined with guideways (107). The guideways (107) define the travel path of the escalator system (100), where the guideways (107) are either formed on or as a part of the frame (101). The guideways (107) of the escalator system (100) may be configured to movably accommodate the plurality of steps (200), where one or more steps of the plurality steps (200) may be continuously displaced forming an endless stretch along the travel path that may extend in the horizontal path, the inclined path and combination thereof as required for the escalator system (100). To facilitate displacement of the plurality of steps (200) along the guideways (107), the escalator system (100) includes a driver (111) disposed in the guideways (107) and coupled to each step of the plurality of steps (200). In an embodiment, the driver (111) may be in the form of a belt drive, a chain drive, and a combination thereof, which may be capable of being driven by a motor and impart force on each step (200) for displacement to the plurality of steps (200) along the guideways (107). In an embodiment, the driver (111) includes a plurality of rollers that are disposed between each step (200) of the plurality of steps (200) and the driver (111), along the travel path. The plurality of rollers may be configured to enable constant engagement between the plurality of steps (200) and the driver (111), while providing minimal frictional contact between the plurality of steps (200) and the driver (111). In the illustrative embodiment, each of the plurality of steps (200) include a displacement mechanism (108) which may be coupled with the plurality of rollers of the guideways (107) to minimize frictional engagement between the plurality of steps (200), the driver (111) and the guideways (107) for displacement. The displacement mechanism (108) of the plurality of steps (200) may be similar to complementing the plurality of rollers in the guideways (107). Alternatively, gear arrangements may be employed for engagement between plurality of steps (200) and the driver (111). In an embodiment, combination of the gear arrangement and the plurality of rollers may also be employed for maintaining engagement between the plurality of steps (200) and the driver (111).

[0029] In an embodiment, the escalator system (100) may include rails (not shown in figures) that may be adapted to displace along with the plurality of steps (200), where the rails may be

coupled to at least one of the driver (111) and the motor which displaces the plurality of steps (200). Coupling between the rails, the driver (111), and the motor may be performed by gear arrangement, belt drives, chain drives, and the like.

[0030] Figures 2a and 2b depict the step (200) of the escalator system (100), where characteristics of the step (200) described herein may be applicable to one or more steps (200) of the escalator system (100) of Figure 1. In an embodiment, each step (200) of the plurality of steps (200) of the escalator system (100) of Figure 1 may include characteristics of the steps (200) described herein. The step (200) includes a plurality of landing portions that allows for transportation and commuting. For sake of explanation of the present disclosure, the step (200) is defined with two landing portions and the same shall not be considered to be a limitation of the present disclosure. The step (200) may include more than two of such landing portions as defined hereafter. The step (200) includes a first landing portion (102a) and a second landing portion (103a), which are structured to be angularly oriented and/or off-set relative to a plane of positioning of one another. In the illustrative embodiment, the first landing portion (102a) and the second landing portion (103a) are opposite to one another and are separated by a predefined distance. i.e., angular positioning of the first landing portion (102a) and the second landing portion (103a) by at least 180° of rotation of the step (200), while such value would vary based on number of landing portion being included. For instance, on including three landing portions angular portioning may be 120° of rotation of the step (200). In an embodiment, when the first landing portion (102a) is visible and/or accessible for transportation on the escalator system (100), the second landing portion (103a) may be positioned and secured within the frame (101), where such second landing portion (103a) may not be accessible for transportation unless angularly displaced with the first landing portion (102a).

[0031] The first landing portion (102a) is supplemented by a first riser portion (102b) and the second landing portion (103a) is supplemented by a second riser portion (103b), where the first riser portion (102b) and the second riser portion (103b) define distance between the first landing portion (102a) and the second landing portion (103a). Further, the first riser portion (102b) may define no gap or a cavity when positioned relative to the first landing portion (102a), to prevent entry of foreign particles including, but not limited to, portions of the commuter/subject, the goods, dirt and dust, and the like, into the step (200) or the escalation system. Similarly, the second riser portion (103b) and the second landing portion (103a) may

be structured in-line with the first landing portion (102a) and the first riser portion (102b). Also, the first riser portion (102b) and the second riser portion (103b) may be integrally formed with the first landing portion (102a) and the second landing portion (103a), respectively. In an embodiment, the step (200) may include a third landing portion and a third riser portion, however, for explanation of the present disclosure the step (200) is described herein with two landing portions and two riser portions and the same cannot be construed to be a limitation of the present disclosure. Alternatively, one riser portion may be defined between the first landing portion (102a) and the second landing portion (103a) for operation of the present disclosure. Also, it would be possible to provide multiple riser portions between the first landing portion (102a) and the second landing portion (103a) and hence, depiction of the step (200) in Figure 2a cannot be construed to be a limitation.

[0032] In an embodiment, at least one of the first landing portion (102a) and the first riser portion (102b) are made of a first sustainable material. The second landing portion (103a) and the second riser portion (103b) are made of a second sustainable material. The first sustainable material and the second sustainable material are different and possess different properties such as but not limited to, hardness, cushioning capacity, compressibility, elasticity, and the like. For example, the first sustainable material may be including, but not limited to, metallic material, carbon fiber, and the like, which provide rigidity and aesthetic appeal to the step (200) of the escalator system (100). The sustainable materials may be including, but not limited to, cork, cork rubber, any other resilient material, capable of providing cushioning to the step (200) of the escalator system (100). It may be noted that the second sustainable material may also require to be structurally rigid, in order to cater factor of safety for structuring the step (200) of the escalator. In an embodiment, the second sustainable material may be laid on the first sustainable material, to define and form the second landing portion (103a), without compromising on structural and cushioning (i.e., combination of elastic and flexible properties) characteristics of the second landing portion (103a) and in-turn the step (200) of the escalator system (100).

[0033] In the illustrative embodiment, the step (200) includes a support element (104) which is disposed between the first landing portion (102a), the first riser portion (102b), the second landing portion (103a), and the second riser portion (103b). The support element (104) is configured to support at least the first landing portion (102a) and the second landing portion (103a), where for such supporting, the support element (104) may either directly or indirectly

be in contact with the first landing portion (102a) and the second landing portion (103a). Such support from the support element (104) to the first landing portion (102a) and the second landing portion (103a) may improve stability and load bearing capacity of the step (200) and prevents caving-in (i.e., collapsing inward) of the step (200) when subjected to point load and/or high loads at one particular location. Further, the support element (104) is rotatable to toggle position of the first landing portion (102a) and the second landing portion (103a), between the first operating condition and the second operating condition. Rotation of the support element (104) may be performed by an actuation unit (106) connected to the step (200), where the actuation unit (106) is connected to the support element (104). In the illustrative embodiment, the actuation unit (106) is concentrically disposed in the support element (104), for selectively rotating the support element (104) and operate the step (200) between the first operating condition and the second operating condition, along the travel path. Alternatively, the actuation unit (106) may be disposed outside of and externally connected to the support element (104) for rotation. In an embodiment, multiple actuation units (106) may be provisioned in the step (200) for selectively operating the support element (104), and in-turn the step (200) between the first operating condition and the second operating condition.

[0034] In an embodiment, the support element (104) may be hollow in order to accommodate the actuation unit (106), where operation of the actuation unit (106) in-turn rotates the support element (104). Alternatively, the support element (104) is motorized by the actuation unit (106), to selectively rotate in a predefined direction and to a predefined angle, which may be within preset values which govern operation of the actuation unit (106). In an embodiment, cross sectional profile of the support element (104) is depicted to be in a circular shape, while such cross-sectional profile of the support element (104) may not be considered to be a limitation of the present disclosure. Further, any cross-sectional profile of the support element (104) including, but not limited to, elliptical, square, rectangular, and the like which may be capable of being included in the step (200) and being operable by the actuation unit (106) may be employed. In an embodiment, the actuation unit (106) may be a motor including, but not limited to, a stepper motor, a servo motor, and the like, where degree of rotation of the motor may be regulated in order to selectively rotate the support element (104) to a defined angle, and in-turn toggle the step (200).

[0035] The step (200) of the present disclosure includes a plurality of couplers (105) secured to the support element (104), as best seen in Figure 2b. At least one coupler of the plurality of

couplers (105) is configured to selectively engage with at least one the first landing portion (102a), the first riser portion (102b), the second landing portion (103a) and the second riser portion (103b). The plurality of couplers (105) may enable engagement of the support element (104) with at least one the first landing portion (102a), the first riser portion (102b), the second landing portion (103a) and the second riser portion (103b), and in-turn provide structural support thereto. In an embodiment, the plurality of couplers (105) may also be secured within the support element (104), where such configuration of the support element (104) may enable direct engagement and support to each of the first landing portion (102a), the first riser portion (102b), the second landing portion (103a), and the second riser portion (103b). Further, the plurality of couplers (105) may be configured to selectively attach and detach from the at least one the first landing portion (102a), the first riser portion (102b), the second landing portion (103a) and the second riser portion (103b), to enable selective rotation therebetween, on rotation of the support element (104). Each of the plurality of couplers may be configured to individually or simultaneously grip and toggle position of each of the first landing portion, the first riser portion, the second landing portion, and the second riser portion, when the support element is rotated by a predetermined angular displacement.

[0036] In an embodiment, the plurality of couplers (105) may be magnetic couplers (105) that may be connectable to at least one of the first landing portion (102a), the first riser portion (102b), the second landing portion (103a) and the second riser portion (103b), where such magnetic couplers (105) may be actuated for connection when rotation of the support element (104) may be actuated. In an embodiment, the plurality of couplers (105) may be vacuum couplers (105) that may be connectable to at least one of the first landing portion (102a), the first riser portion (102b), the second landing portion (103a) and the second riser portion (103b), where such vacuum couplers (105) may be actuated for connection when rotation of the support element (104) may be actuated. In an embodiment, some of the plurality of couplers (105) may be magnetic couplers (105) and remaining of the plurality of couplers (105) may be vacuum couplers (105).

[0037] In an embodiment, couplers (105) connectable to the first landing portion (102a) and the first riser portion (102b) may be magnetic couplers (105), owing to the first sustainable material, while the couplers (105) connectable to the second landing portion (103a) and the second riser portion (103b) may be vacuum couplers (105), owing to the first sustainable material. Alternatively, couplers (105) connectable to the first landing portion (102a) and the

first riser portion (102b) may be vacuum couplers (105), while the couplers (105) connectable to the second landing portion (103a) and the second riser portion (103b) may be magnetic couplers (105). Additionally, the plurality of couplers (105) may be of other configuration including, but not limited to, electro-magnetic couplers (105), piezo electric couplers (105), mechanical couplers (105), and the like which may serve the purpose of coupling with at least one of the first landing portion (102a), the first riser portion (102b), the second landing portion (103a), and the second riser portion (103b) for rotation with the support element (104), to operate the step (200) between the a first operating condition and the a second operating condition.

[0038] In the illustrative embodiment, the first operating condition and the second operating condition of the step (200) may be referenced based on relative position of the first landing portion (102a) and the second landing portion (103a), in conjunction with operation of the support element (104) by the actuation unit (106). For instance, considering the first landing portion (102a) of the step (200) being accessible for transportation to be the first operating condition of the step (200), the second landing portion (103a) may be secured within the frame (101) of the escalator system (100) and not be accessible. In the second operating condition of the step (200), the second landing portion (103a) of the step (200) is accessible for transportation, while the first landing portion (102a) may be secured within the frame (101) of the escalator system (100) and not be accessible. The first landing portion (102a) and the second landing portion (103a) are angular displaced by the actuation unit (106), by at least 180° of rotation of the support element (104) to be operable and toggle between the first operating condition and the second operating condition of the step (200). The term “toggling” may refer to as interchanging position of the first landing portion (102a) and the second landing portion (103a), while position of the first riser portion (102b) and the second riser portion (103b) may also subsequently interchange on rotation. For sake of explanation, as best seen in Figure 2a, cyclic positioning in the step (200) may be referred in a sequence of the first landing portion (102a), the first riser portion (102b), the second landing portion (103a) and the second riser portion (103b), respectively. Due to such configuration of the step (200), the first landing portion (102a) and the second landing portion (103a) are opposite to one another, while the first riser portion (102b) and the second riser portion (103b) are opposite to one another. With that, on toggling of the step (200) between the first operating condition and the second operating condition, it is ensured that position of the first landing portion (102a) is interchanged

with that of the second landing portion (103a), and likewise position of the first riser portion (102b) is interchanged with the second riser portion (103b).

[0039] In an embodiment, toggling of the first landing portion (102a) and the second landing portion (103a) between the first operating condition and the second operating condition may be performed to improve safety of the escalator system (100) and mitigate any damage, injuries, impact and the like for goods or subject being transported therethrough. In the illustrative embodiment, as the second landing portion (103a) is made of the second sustainable material which possess properties of cushioning, elasticity and/or flexibility, any impact on or to the step (200) may be absorbed and generation of reaction to such impact may be prevented. Due to such configuration, damage to the goods or the subject being transported on the escalator system (100) may be substantially minimized. Here, the term "substantially" may be referred to as an extent of at least 80% of impact being absorbed by the second sustainable material, thereby reducing possibility of damage. Alternatively, when the escalator system (100) may be required to transport heavy loads, the plurality of steps (200) may be toggled to the first operating condition, however, such first operating condition may also be employed for transporting light loads without departing from its working principle.

[0040] The escalator system (100) includes a locking mechanism (114), as best seen in Figures 3a-3h, associated with each step (200) of the plurality of steps (200), where such locking mechanism (114) may be configured to selectively engage and disengage each of the plurality of steps (200) with the guideways (107). The locking mechanism (114) may be provisioned on the frame (101) and proximal to or in the guideways (107), for selectively engaging at least a portion of the support element (104) of each of the plurality of steps (200). The locking mechanism (114) may enable the support element (104) to selectively rotate on operation of the actuation unit (106), to toggle at least the first landing portion (102a) and the second landing portion (103a) between the first operating condition and the second operating condition. Additionally, the locking mechanism (114) may lock and restrict the support element (104) to one of the first operating condition and the second operating condition, when the actuation unit (106) may not be operated. Further, the locking mechanism (114) may be operable by a drive motor (not explicitly seen in Figures), to selectively extend from the frame (101) and suitably engage and lock the support element (104) of corresponding step of the plurality of steps (200). For unlocking, the drive motor may be operated to retract the locking mechanism (114) from engagement with the support element (106), due to which the support element (104) may be

rotatable by the actuation unit (106) between the first operating condition and the second operating condition. In the illustrative embodiment, the locking mechanism (114) may engage a lateral surface of the support element (104), locking such support element (104) from rotation about longitudinal axis of the step (200). Figures 3a and 3b depict the locking mechanism (114) to include a gear combination (112) for engaging and disengaging the plurality of steps (200). The gear combination (112) may include a first gear (112a) disposed on the frame (101) and a second gear (112b) extendable from the frame (101) and engagement with at least portion of the step (200), as best seen in Figure 3b. In an embodiment, the first gear (112a) is a rack gear while the second gear (112b) is a pinion gear which may operably extend from the pinion gear to engage with the step (200), on operation of the drive motor associated with the locking mechanism (114). For engagement, the rack gear may be provisioned with a locking head (112c) which contacts a locking slot (115) provided in the support element (104). According to an embodiment, the locking slots (115) are provided on the guideways (107). Further referring to Figures 3c and 3d, the locking mechanism (114) is depicted to be a screw arrangement (112d) in which a screw (112e) is configured to extend from the frame (101) for engagement with at least a portion of the steps (200), on operation of the drive motor associated with the locking mechanism (114). Similar to the rack gear, an end of the screw (112e) may be provisioned with the locking head (112c) which may be received in the locking slots (115) and coupled thereto by an interference fit. Such connection between the locking head (112c) and the locking slots (115) may cause the screw (112e) to lock with the locking slot (115) and restrict rotation of the support element (104). In an embodiment, the screw (112e) of the screw arrangement (112d) may be including, but not limited to, a leadscrew, a ball screw (112e), and the like. In the illustrative embodiment, it is depicted that the screw (112e) of the screw arrangement (112d) and the rack gear of the gear arrangement intrude into the locking slot (115) (though not explicitly seen in Figures 3a-3d, but similar configuration can be seen in Figures 3e-3h) of the step (200), however, it may also be structurally possible to engage with or intrude a slot or groove defined on a surface of the step (200) for locking.

[0041] In an embodiment, the locking mechanism (114) may be included in the support element (104), as seen in Figures 3e – 3h. Figures 3e and 3f depict the locking mechanism (114) in the screw arrangement (112d) similar to that of Figures 3c and 3d, while the screw arrangement (112d) of Figure 3e and 3f is configured to extend from inside of the support element (104) to lock with locking slots (115) defined in the frame (101) of the escalator system (100). The screw (112e) may be configured to extend outwardly from the support

element (104) to engage with the locking unit (115) and lock the support element (104) and in-turn the step (200) from rotational movement, as seen in Figure 3f. In an embodiment, the locking mechanism (114) may also include a combination (113) of the rack gear (113a), the pinion gear (113b) and the screw (113e) to selectively lock the support element (104) from rotation, as best seen in Figures 3g and 3h. The rack gear (113a), the pinion gear (113b) and the screw (113e) may be included within the support element (104), where the pinion gear (113b) may be coupled to the drive motor, and the rack gear (113a) and the screw (113e) may be integrated to one another such that the rack gear (113a) may be meshed with the pinion gear (113b) while the screw (113e) may be configured to extend outwardly from the support element (104) based on operation of the drive motor to operate the pinion gear (113b) as best seen in Figure 3h. Due to such configuration, the screw (113e) may engage and lock with the locking slot (115) of the frame (101) to restrict rotation of the support element (104). Such a locking mechanism to arrest a motion of the support element may provide a better stability to the commuters when stepping on the steps (200) of the escalator system (100).

[0042] According to an embodiment, to rotate and toggle at least the first landing portion (102a) and the second landing portion (103a) between the first operating condition and the second operating condition, the escalator system (100) may include a sensor module (109) and a control unit (110), as best seen in Figure 4. The sensor module (109) is configured to sense a change in a parameter relative to at least one of the first landing portion (102a) and the first riser portion (102b), based on condition of a commuter or goods on at least one step (200) of the plurality of steps (200). In an embodiment, parameter sensed by the sensor module (109) may be including, but not limited to, weight on the first landing portion (102a), presence of the commuter on the first landing portion (102a), occurrence of abrupt acceleration of the escalator system (100), relative inertial force between the plurality of steps (200) and rails of the escalator system (100), and the like. For determining such parameters, the sensor module (109) may include one or more sensors that may be positioned at various locations and/or positions of the escalator system (100). Alternatively, the sensor module (109) may be a centralized sensor module (109) capable of receiving signals from one or more sensors across the escalator system (100). For instance, the sensor module (109) may be capable of receiving signal corresponding to velocity of each step (200) and the rails based on sensors sensing accelerometers of the escalator, load on each step (200) based on load sensors, and the like. Also, the sensor module (109) may include an image capturing unit, as best seen in Figure 4, associated with the escalator system (100), where the image capturing unit may be configured to capture images

pertaining to condition of the commuter or the goods based on displacement of each step (200) of the plurality of steps (200) of the escalator system (100). Also, other sensors including, but not limited to, speed sensors, proximity sensors, and the like may be employed for sensing in the escalator system (100).

[0043] In the illustrative embodiment, the control unit (110) of the escalator system (200) may be communicatively coupled with at least one of the actuation unit (106) of the support element (104), the sensor module (109) and the displacement mechanism (108). The control unit (110) is configured to determine, travel condition of the commuter and/or goods based on signals corresponding to change in condition of the commuter and/or goods relative to at least one the first landing portion (102a) and the first riser portion (102b) from the sensor module (109). For instance, change in condition of the commuter and/or the goods may be sensed due to factors including, but not limited to, change in weight which may be sensed by the load sensor, change in orientation which may be sensed by the image capturing unit, and the like, relative to original or condition before preset time interval, relative to change in operating conditions of the escalator system (100). Such change in operating conditions may be including, but not limited to, displacement direction of the steps (200), velocity of steps (200), velocity of the rails, and the like. Further, the change in condition of the commuter may also include receiving input by the sensor module (109) regarding nature of commuter being transported. For instance, the escalator system (100) may include an input device (not explicitly shown in Figures) such as but not limited to, nature of commuter or the goods being transported, where such input device includes options such as, but not limited to, age group of the commuters, fragileness of the goods, medical condition of the commuter, and the like, in order to suitably vary operating condition by the control unit (110). When the control unit (110) is configured to determine change in condition of the commuter or the goods, or determine change in parameter input to the escalator system (100), the control unit (110) is configured to actuate the actuation unit (106) to toggle position of the first landing portion (102a), the first riser portion (102b), the second landing portion (103a), and the second riser portion (103b) of one or more steps (200) in the travel path from the first operating condition to the second operating condition.

[0044] In the illustrative embodiment, the control unit (110) is capable of operating the actuation unit (106) of each step (200) of the plurality of steps (200) independently to toggle the first landing portion (102a) and the second landing portion (103a) between the first operating condition and the second operating condition, as per input to the escalator and/or

change in parameter and/or change in condition of the commuter. In an embodiment, the control unit (110) may be configured to simultaneously operate the actuation unit (106) of each of the steps (200) to toggle the first landing portion (102a) and the second landing portion (103a) between the first operating condition and the second operating condition, as per input to the escalator and/or change in parameter and/or change in condition of the commuter. In an embodiment, the control unit (110) may be capable of performing both.

[0045] In the illustrative embodiment, the escalator system (100) and in-turn the actuation unit (106), the sensor module (109), and the locking mechanism (114) may be communicatively coupled with the control unit (110) either through wireless means or through wired means or combination thereof. Further, operation of the escalator system (100) and/or the control unit (11) may be regulated by a computing device (not explicitly depicted in Figures), which may be provide a wireless access network to an operator. In an embodiment, the computing device may be at least one of a mobile phone, a laptop, a desktop, a centralized control module of a building, or an any device using MQTT or HTTP communication protocols to communicate with at least one of the actuation unit (106), the sensor module (109), and the locking mechanism (114). The control unit (110) based on an operational signal from the computing device may be configured to selectively vary parameters associated with the escalator system (100), where some of such parameters may be including, but not limited to, speed of operation, direction of travel of the plurality of steps (200), direction of rotation of one or more steps between the first operational configuration and the second operational configuration, locking of the one or more steps (200) from rotation, and the like. In an embodiment, the computing device, the sensor module (109) and the escalator system (100) may be coupled through wired network including but not limited to, Local area network (LAN) for selective operation.

[0046] The escalator system (100) of the present disclosure may not be limited to transportation industry and may be considered to extend to other field of industries such as, but not limited to, transportation of commuters and goods in and across the public and/or industrial structures, institutions, healthcare facilities, entertainment sectors, and the like, where escalator system (100) may be employed for effortless and automatic conveyance.

EQUIVALENTS

[0047] With respect to the use of substantially any plural and/or singular terms herein, those having skill in the art can translate from the plural to the singular and/or from the singular to

the plural as is appropriate to the context and/or application. The various singular/plural permutations may be expressly set forth herein for sake of clarity.

[0048] It will be understood by those within the art that, in general, terms used herein, and especially in the appended claims (e.g., bodies of the appended claims) are generally intended as "open" terms (e.g., the term "including" should be interpreted as "including but not limited to," the term "having" should be interpreted as "having at least," the term "includes" should be interpreted as "includes but is not limited to," etc.). It will be further understood by those within the art that if a specific number of an introduced claim recitation is intended, such an intent will be explicitly recited in the claim, and in the absence of such recitation no such intent is present. For example, as an aid to understanding, the following appended claims may contain usage of the introductory phrases "at least one" and "one or more" to introduce claim recitations. However, the use of such phrases should not be construed to imply that the introduction of a claim recitation by the indefinite articles "a" or "an" limits any particular claim containing such introduced claim recitation to inventions containing only one such recitation, even when the same claim includes the introductory phrases "one or more" or "at least one" and indefinite articles such as "a" or "an" (e.g., "a" and/or "an" should typically be interpreted to mean "at least one" or "one or more"); the same holds true for the use of definite articles used to introduce claim recitations. In addition, even if a specific number of an introduced claim recitation *is* explicitly recited, those skilled in the art will recognize that such recitation should typically be interpreted to mean *at least* the recited number (e.g., the bare recitation of "two recitations," without other modifiers, typically means *at least* two recitations, or *two or more* recitations). Furthermore, in those instances where a convention analogous to "at least one of A, B, and C, etc." is used, in general such a construction is intended in the sense one having skill in the art would understand the convention (e.g., "a system having at least one of A, B, and C" would include but not be limited to systems that have A alone, B alone, C alone, A and B together, A and C together, B and C together, and/or A, B, and C together, etc.). In those instances where a convention analogous to "at least one of A, B, or C, etc." is used, in general such a construction is intended in the sense one having skill in the art would understand the convention (e.g., "a system having at least one of A, B, or C" would include but not be limited to systems that have A alone, B alone, C alone, A and B together, A and C together, B and C together, and/or A, B, and C together, etc.). It will be further understood by those within the art that virtually any disjunctive word and/or phrase presenting two or more alternative terms, whether in the description, claims, or drawings, should be understood to

contemplate the possibilities of including one of the terms, either of the terms, or both terms. For example, the phrase “A or B” will be understood to include the possibilities of “A” or “B” or “A and B.”

[0049] In addition, where features or aspects of the disclosure are described in terms of Markush groups, those skilled in the art will recognize that the disclosure is also thereby described in terms of any individual member or subgroup of members of the Markush group.

[0050] While various aspects and embodiments have been disclosed herein, other aspects and embodiments will be apparent to those skilled in the art. The various aspects and embodiments disclosed herein are for purposes of illustration and are not intended to be limiting, with the true scope and spirit being indicated by the following claims.

WE CLAIM:

1. A step (200) for an escalator system (100), the step (200) comprising:

   a first landing portion (102a) and a first riser portion (102b),

   a second landing portion (103a) and a second riser portion (103b), wherein the first landing portion (102a), the first riser portion (102b), the second landing portion (103a), and the second riser portion (103b), and

   a support element (104) disposed between the first landing portion (102a), the first riser portion (102b), the second landing portion (103a), and the second riser portion (103b),

   wherein the support element (104) being configured to support at least the first landing portion (102a) and the second landing portion (103a),

   wherein the support element (104) is rotatable to toggle a position of the first landing portion (102a) and the second landing portion (103a), between a first operating condition and a second operating condition.

2. The step (200) as claimed in claim 1, comprises an actuation unit (106) coupled to the support element (104), wherein the actuation unit (106) is configured to selectively rotate the support element (104) to toggle position of each of the first landing portion (102a), the first riser portion (102b), the second landing portion (103a), and the second riser portion (103b) between the first operating condition and the second operating condition.

3. The step (200) as claimed in claim 1, comprises a plurality of couplers (105) secured to the support element (104), wherein at least one coupler of the plurality of couplers (105) is configured to selectively engage with at least one the first landing portion (102a), the first riser portion (102b), the second landing portion (103a) and the second riser portion (103b).

4. The step (200) as claimed in claim 3, wherein each of the plurality of couplers (105) simultaneously grip and toggle position of each of the first landing portion (102a), the first riser portion (102b), the second landing portion (103a), and the second riser portion (103b), when the support element (104) is rotated by a predetermined angular displacement.

5. The step (200) as claimed in claim 1, wherein the first landing portion (102a) and the first riser portion (102b) are made of a first sustainable material and wherein the second landing portion (103a) and the second riser portion (103b) are made of a second sustainable material.

6. An escalator system (100), comprising:

a frame (101), defined with guideways (107), wherein the guideways (107) define a travel path;

a plurality of steps (200) being movably accommodated between the guideways (107) to form the travel path, wherein one or more steps (200) of the plurality steps (200) comprises a support element (104); and

an actuation unit (106) is connected to the support element (104) to rotate at least one of the one or more steps (200) between a first operating condition and a second operating condition, along the travel path.

7. The escalator system (100) as claimed in claim 6, wherein the support element (104) is connectable to a first landing portion (102a), a first riser portion (102b), a second landing portion (103a), and a second riser portion (103b) of the one or more steps (200) of the plurality of steps (200), wherein the actuation unit (106) is configured to rotate the support element (104) to toggle a position of each of the first landing portion (102a), the first riser portion (102b), the second landing portion (103a), and the second riser portion (103b) between the first operating condition and the second operating condition.

8. The escalator system (100) as claimed in claim 6, comprises a locking mechanism (114) configured to selectively lock and unlock each step (200) of the plurality of steps (200) to rotate and toggle between the first operating condition and the second operating condition.

9. The escalator system (100) as claimed in claim 6, comprises a sensor module (109), configured to sense a change in a parameter relative to at least one of the first landing portion (102a) and the first riser portion (102b), based on condition of a commuter on at least one step (200) of the plurality of steps (200).

10. The escalator system (100) as claimed in claim 6, comprises a control unit (110), communicatively coupled with at least one of the actuation unit (106) of the support

element (104), the sensor module (109) and the displacement mechanism (108), wherein the control unit (110) is configured to:

determine, travel condition of the commuter based on signals corresponding to change in condition of the commuter relative to at least one the first landing portion (102a) and the first riser portion (102b) from the sensor module (109); and

actuate, the actuation unit (106) to toggle position of the first landing portion (102a), the first riser portion (102b), the second landing portion (103a), and the second riser portion (103b) of one or more steps (200) in the travel path.

Dated this 23rd day of September 2022

-- Digitally Signed--
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ABSTRACT

"**AN ESCALATOR SYSTEM AND A STEP THEREOF**"

Present disclosure discloses an escalator system (100), including a frame (101) which is defined with guideways (107). The guideways (107) define a travel path of the escalator system (100). Further, the escalator system (100) includes a plurality of steps (200) being movably accommodated between the guideways (107) to form the travel path. One or more steps (200) of the plurality steps (200) includes a support element (104). Also, one or more steps (200) of the plurality of steps (200) include an actuation unit (106) is connected to the support element (104) to rotate at least one of the one or more steps (200) between a first operating condition and a second operating condition, along the travel path. On toggling of one or more steps (200), vulnerability of commuters and goods to travel on the escalator system (100) may be minimized, as the second operating condition provides cushioning.

[Figs. 1 & 4.]

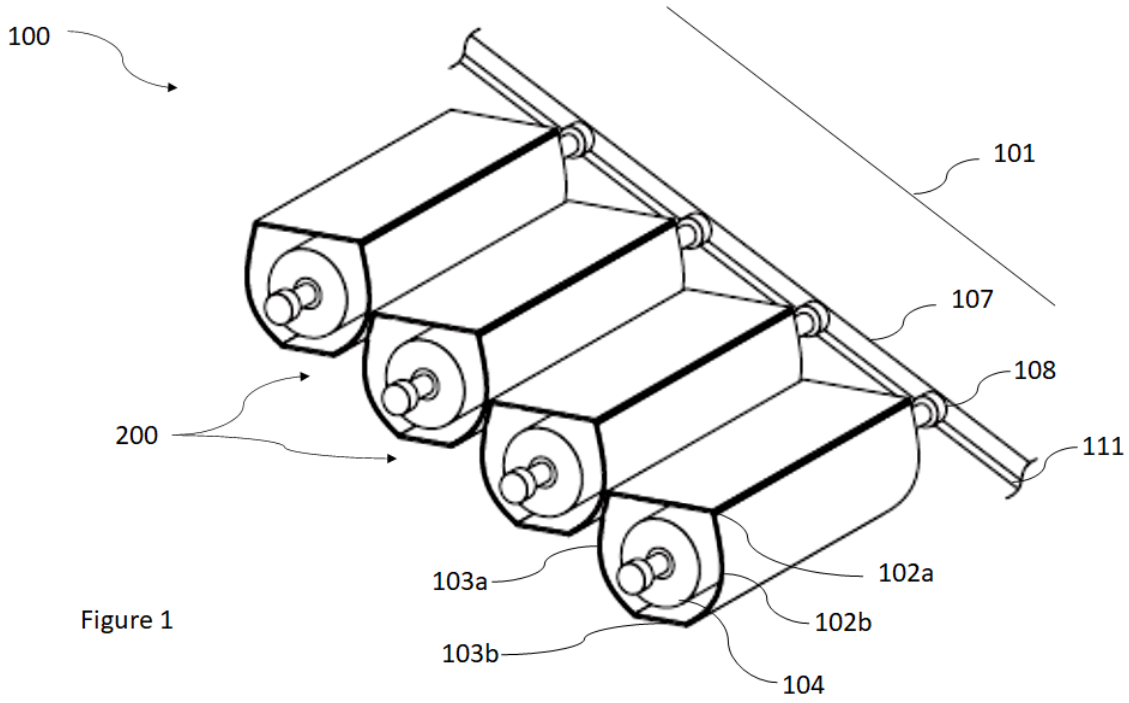

Figure 1

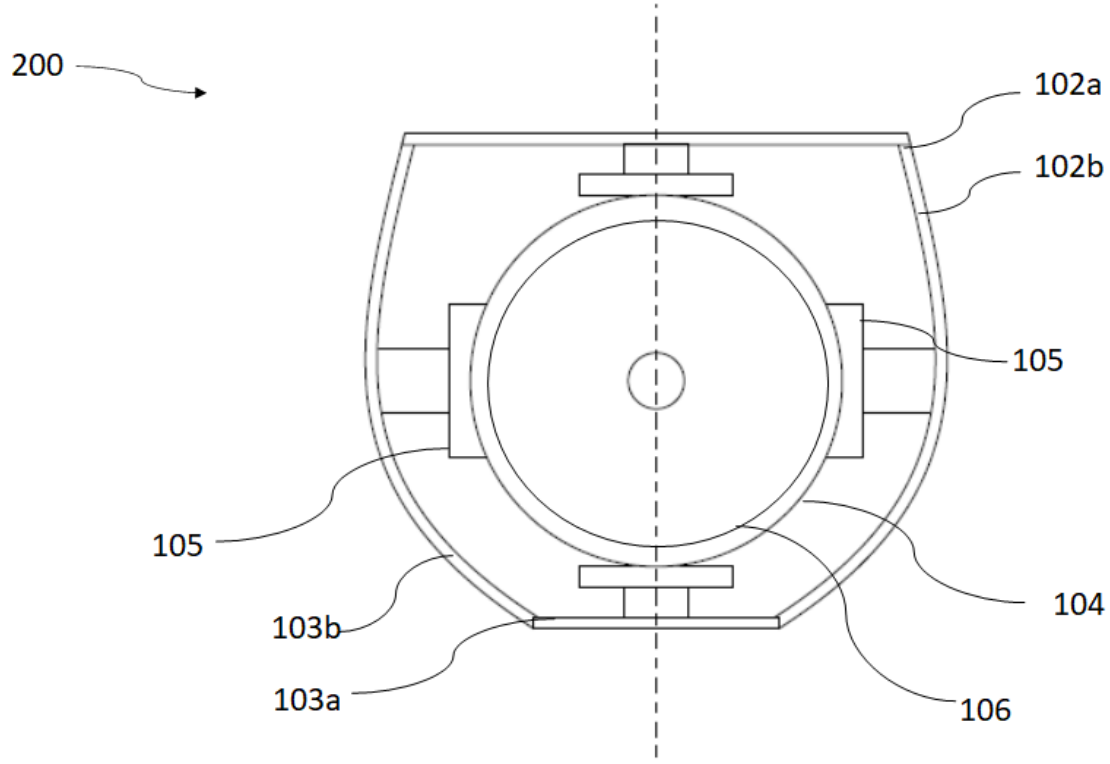

Figure 2a

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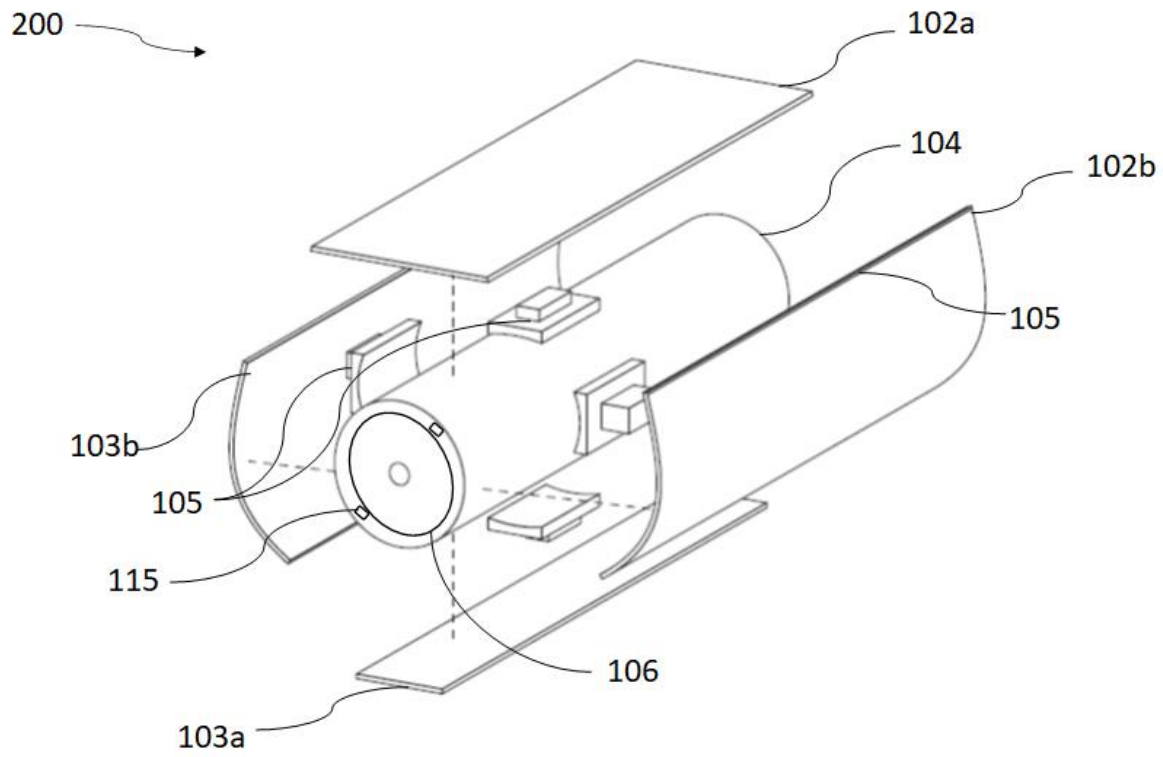

Figure 2b

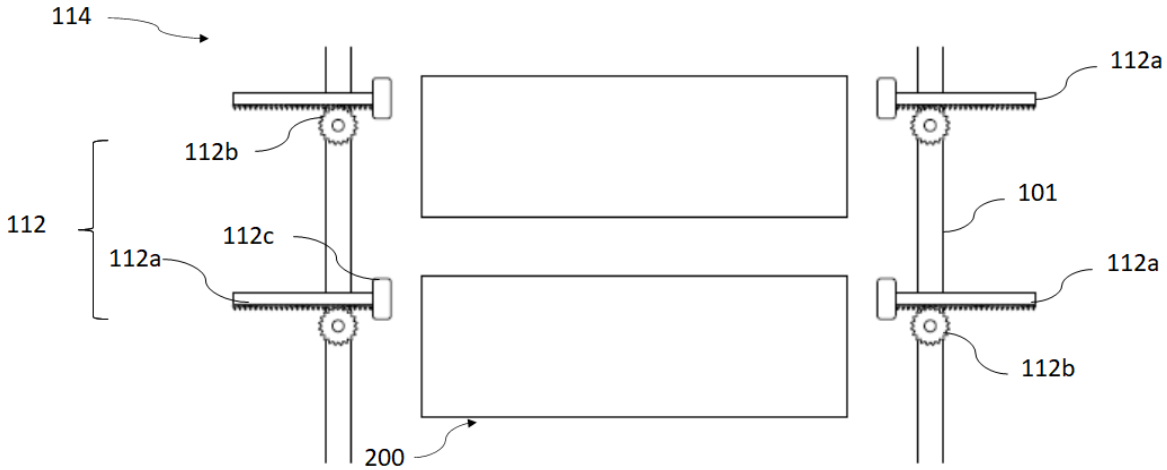

Figure 3a

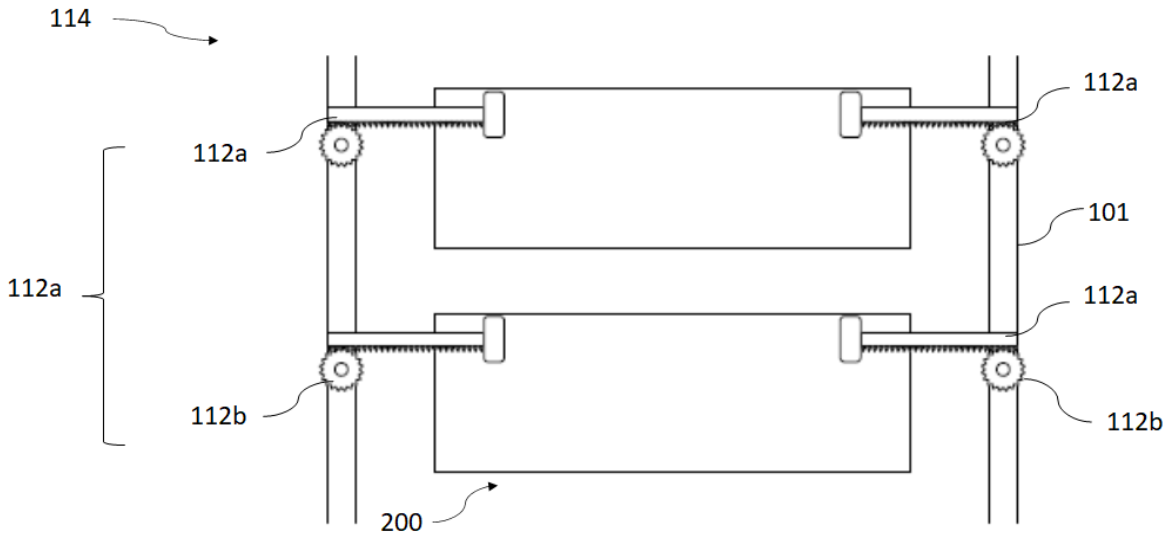

Figure 3b

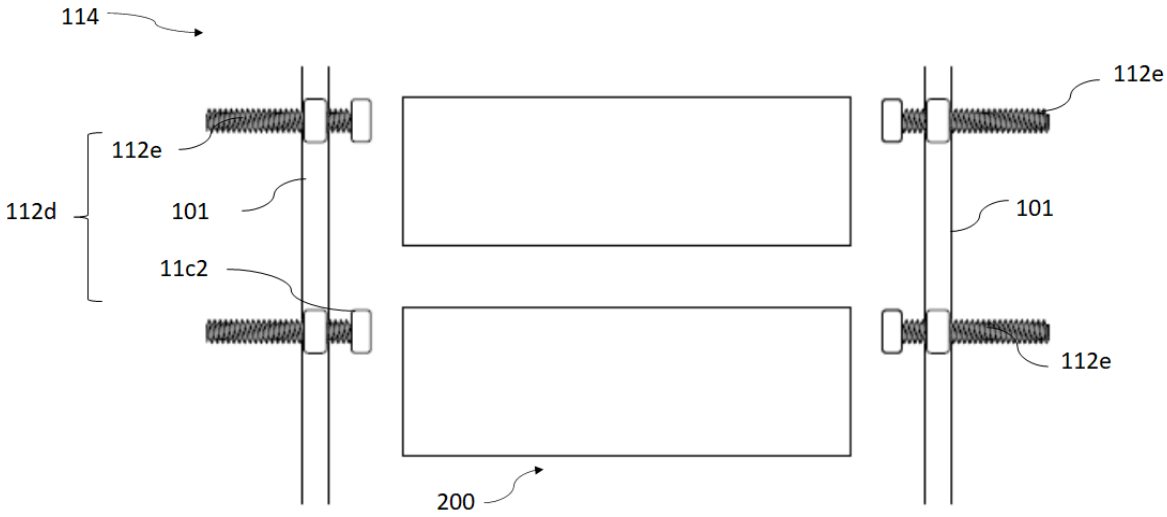

Figure 3c

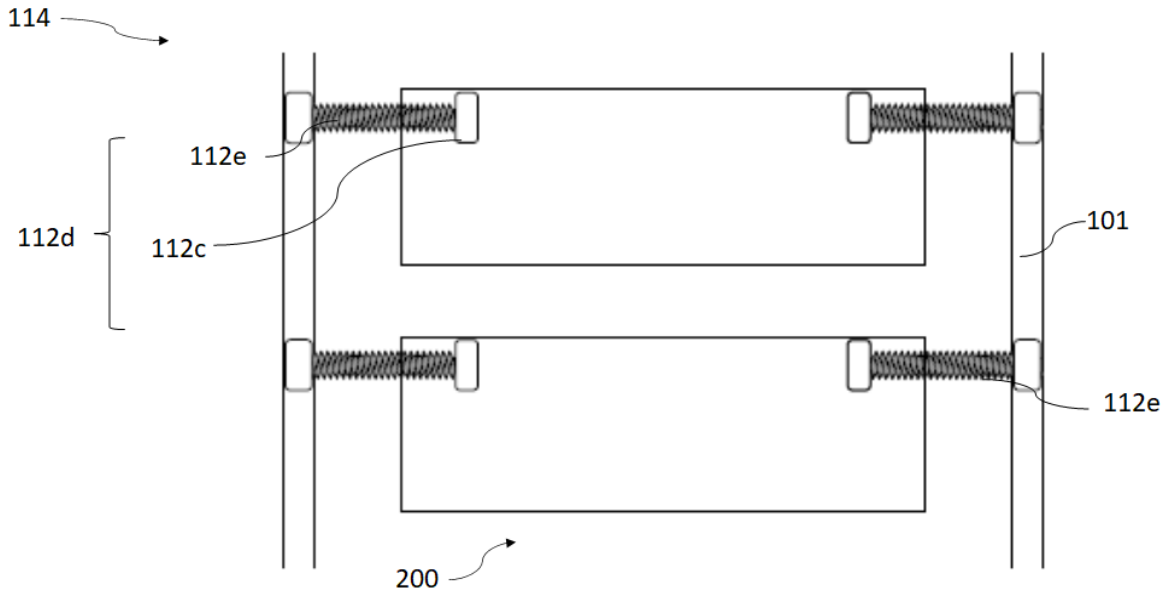

Figure 3d

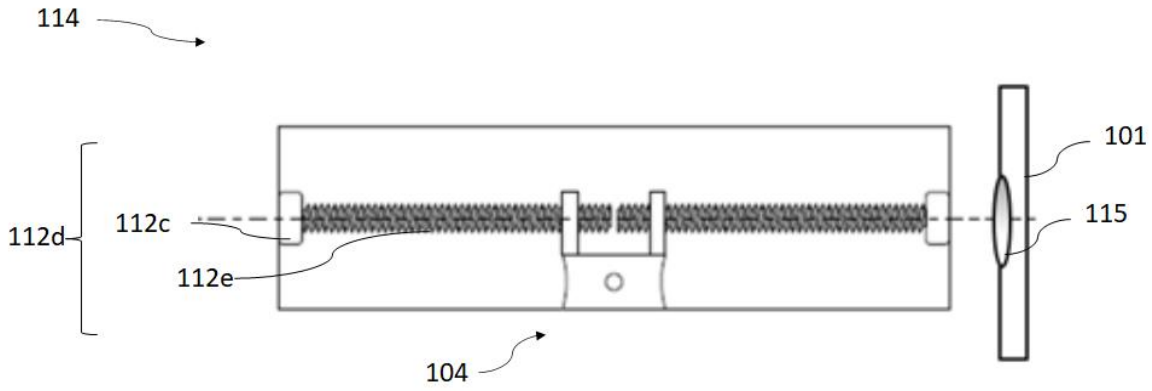

Figure 3e

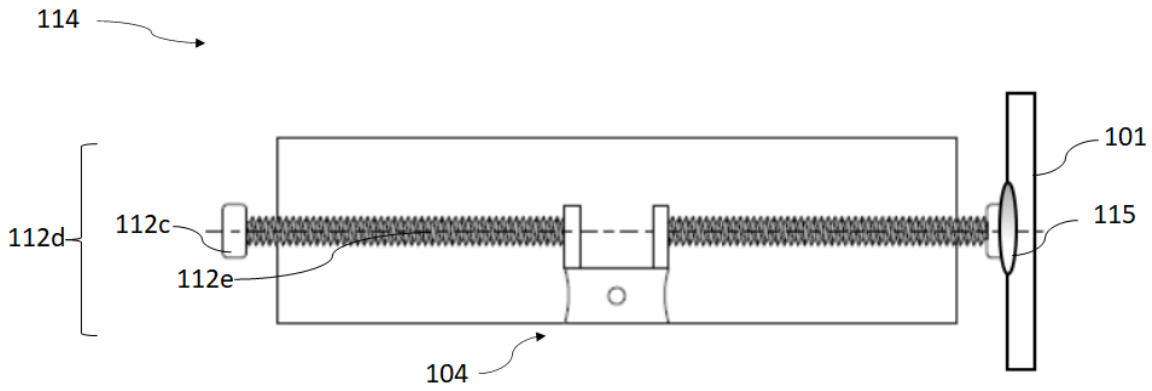

Figure 3f

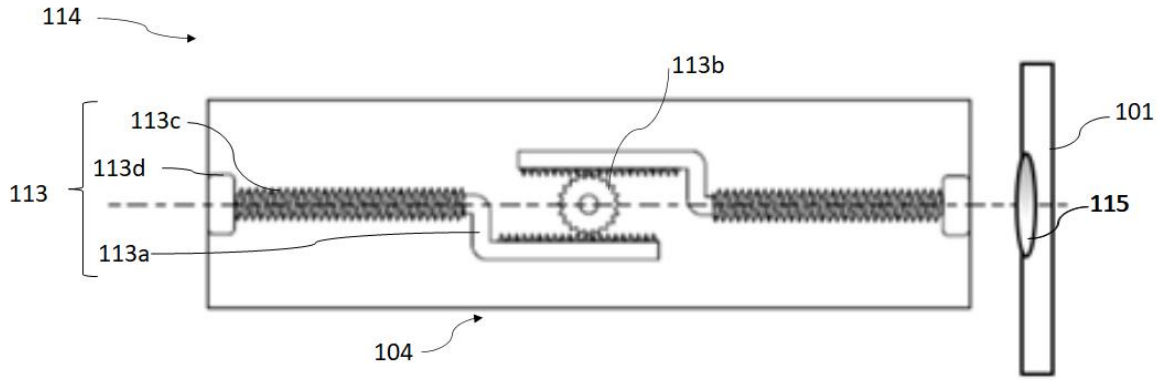

Figure 3g

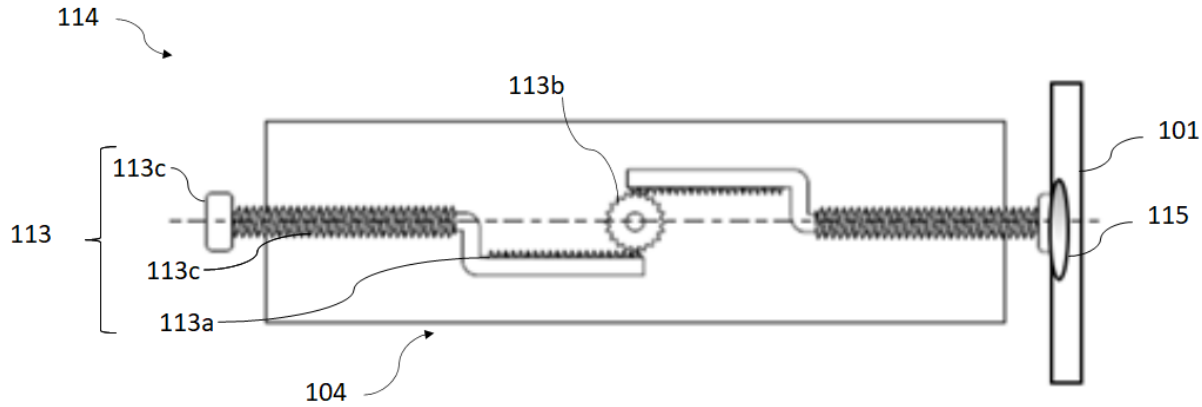

Figure 3h

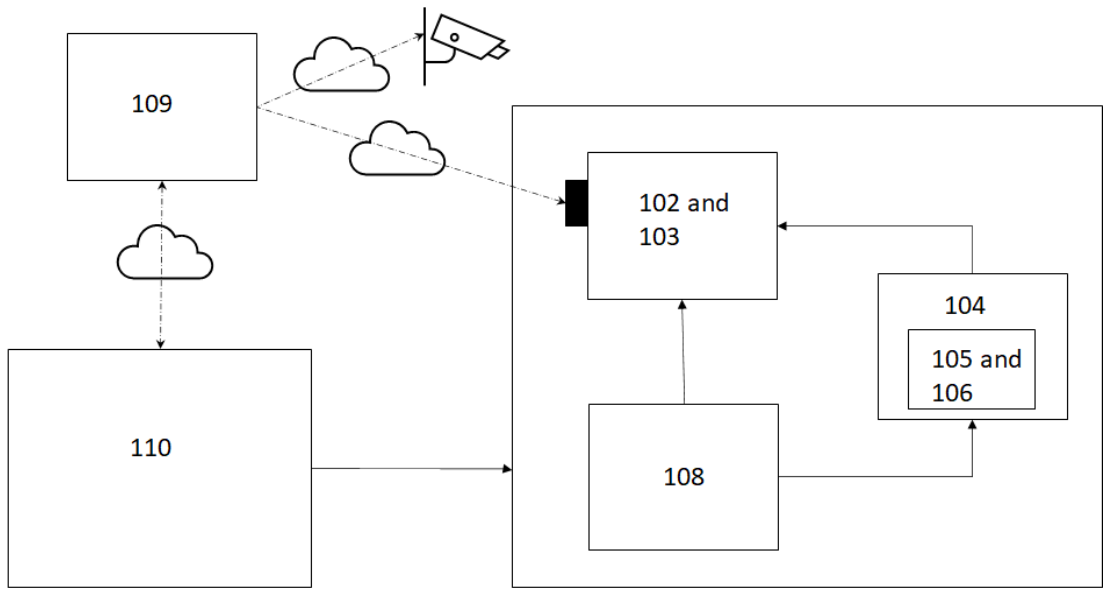

Figure 4

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