

AUTOMATIC RAMP

[0001] The present patent application relates to an automatic ramp. The application also relates methods for making, assembling, disassembling, installing, configuring,
5 maintaining and using the automatic ramp.

[0002] Mobility vehicles, such as wheelchairs, powered wheelchairs (i.e. motorized wheelchairs) and electric scooters enable persons with disabilities to move around their homes and communities. However, there may be architectural barriers such as kerbs,
10 street gutters and steps that may prevent the mobility vehicles from moving around. Known ramps are available, which can assist the wheelchairs, powered wheelchairs and electric scooters to overcome raised grounds, stairs or edges. Wood and aluminium are sometimes used to build ramps. Most local wheelchair vendors stock portable ramps for one-step kerbs with heights of between one and four inches relating
15 to home use.

[0003] Ramps for public transports are specially challenging as powered vehicles and electric scooters have difficulty in getting onto buses and trains. Usually, a bus driver has to operate a ramp manually to provide access to the mobility vehicles. For example,
20 a train master or bus captain has to lay the ramp over a gap or height difference between a train or bus floor, and the ground. Frequent or repeated opening and closing of the ramp manually is both laborious and time consuming.

[0004] The present invention aims to provide a new and useful automatic ramp. The invention also aims to present new and useful methods of making, assembling,
25 installing, repairing, upgrading, modifying, configuring and using the automatic ramp. Essential features of the automatic ramp are provided by one or more independent claims, whilst advantageous features of the automatic ramp are presented by their dependent claims respectively.

[0005] The accompanying figures (Figs.) illustrate embodiments and serve to explain principles of the disclosed embodiments. It is to be understood, however, that these figures are presented for purposes of illustration only, and not for defining limits of relevant inventions.

[0006] Fig. 1 illustrates an embodiment of an automatic ramp in an extended state as viewed from a front top left point;

Fig. 2 illustrates a primary drive assembly of the automatic ramp along a left side of the first panel at the back side;

Fig. 3 illustrates a secondary timing belt of the automatic ramp along a right side of the first panel at the front side; and

Fig. 4 illustrates a secondary drive assembly of the automatic ramp along the left side of the first panel at the front side;

[0007] Exemplary, non-limiting embodiments of the present application will now be described with references to the above-mentioned figures.

[0008] Fig. 1 illustrates an embodiment of an automatic ramp 100 in an extended state as viewed from a front top left point. The automatic ramp comprises a first panel 102, a second 104 panel also known as a first ramp board and a third panel 106 also known as a second ramp board.

[0009] The dimensions of the ramp 100 are according to the wheelchair specifications as specified by ADA (Americans with Disabilities Act). The width of a wheelchair measured to the outside of the rear wheel is 26 inches (660 mm). The length of the wheelchair is 42 inches (1065 mm) measured from the back of the rear wheels to the front of the footrests. The automatic ramp 100 is constructed with the wheelchair in mind but not limited to the usage by wheelchairs. Other wheeled vehicles for example, baby pram and electric scooter for the immobile are included as well.

[0010] The first panel 102 forms a hollow box-shaped object with six flat sides and all the sides are orthogonally angled also known as the ramp main frame 102. The first panel 102 has a width of approximately 1060 millimetres (mm), a length of approximately 1500 mm and a height of approximately 100 mm. On a long front side, a rectangular aperture 110 of approximately 1265 mm in length and an approximate height of 90 mm is disposed towards the right side of the first panel as viewed from the side with the rectangular aperture 110. The rectangular aperture 110 is normally covered by a hinged flap or a dust cover 108 in a retracted state.

[0011] In front of the rectangular aperture 110 is the hinged flap 108 that is pivotal at a length. On the top side of the first panel 102, a frictional surface tape is being adhered (not shown). At the long front side along the periphery, there is a plurality of proximity sensors (not shown). The first panel 102 has a flat metal lid (not shown) which covers the top side of the first panel 102. The lid forms part of the first panel 102. Other types of sensors may be used for example, load sensors. The load sensors can be located out of sight within the panels.

[0012] Within the first panel 102 are two guiding rails or stationary rails 122 extend along the width of the first panel 102 from the rectangular aperture 110 to a long back side. The guide rails are made of square metal rods having a smooth surface.

[0013] Fig. 2 illustrates a primary drive assembly 112 of the automatic ramp 100 at a left side of the first panel 102 as viewed from a plan view at the back side.

[0014] The primary drive assembly 112 is located inside the first panel 102 along the left side panel. The drive assembly occupies about 200 mm along the length of the first panel 102 and 1060 mm along the left side panel of the first panel 102. The primary drive assembly 112 comprises a gear drive 114 and a gear belt or a primary timing belt 120.

[0015] The gear drive 114 comprises a rotatable drive gear 116 or a bevel gear 116 and a primary electric motor 118 which selectively rotates the rotatable drive gear 116 which cooperates with a first rotational gear 124 which is fixed to the stationary rail 122 having a mounting arrangement which is engaged within the first panel 102. The first rotational gear 124 cooperates with the primary gear belt 120.

[0016] Fig.3 illustrates a secondary timing belt 134 of the automatic ramp 100 along a front right side of the first panel 102.

[0017] A traveller body 132 straddles the two stationary rails 122. One stationary rail 122 on the left side adjacent to the primary drive assembly 112 and the second

stationary rail 122 on the right side adjacent to the secondary drive assembly 130 with a secondary timing belt 134 is seen.

5 [0018] The secondary timing belt 134 cooperates with another gear. The gear communicates with a secondary electric motor 138.

[0019] Fig. 4 illustrates a secondary drive assembly 130 of the automatic ramp 100 along the left side of the first panel 102 at the front side.

10 [0020] The secondary drive assembly 130 comprises a timing belt clamp 136 and a secondary electric motor 138. A guide unit 128 is interposed between the traveller body 132 and the stationary rail 122.

15 [0021] The second panel 104 has a width of approximately 860 millimetres (mm), a length of approximately 1300 mm and a height of approximately 90 mm. The second panel 104 having the third panel 106 is retractable and extendable from the rectangular aperture 110. The second panel 104 is formed with the first side wall, a second side wall, a flat rectangular metal sheet and a strut.

20 [0022] The strut runs along the length of the second panel joining the first internal side wall and the second internal side wall at the ends of the two side walls. The second side wall is directly opposite the first side wall. The flat rectangular metal sheet is laid horizontal having the two widths joined to the internal first side wall and the internal second side wall.

25 [0023] Along the external side walls (first side wall and second side wall) of the second panel are metallic tracks which are engaged with the corresponding guiding rails of the first panel 102.

30 [0024] Along the external first side wall, there is a rotational gear that engages with the rotational gear

[0025] Underneath the flat rectangular metal sheet is the third panel 106. Additionally, there are two guiding rods. A first and a second guiding rods are positioned adjacent to

each other at the middle of the second panel and a third guiding rod positioned at the right side of the second panel 104 with the ends of the guiding rods engaged with the strut. The opposite ends of the guiding rods are engaged with the third panel 106. On the internal sides of the two side walls are internal tracks that covers the length of the first and the second side walls to engage with a projection of the third panel 106.

[0026] At the front end of the second panel 104 are proximity sensors. The third panel 106 has a width of approximately 800 millimetres (mm), a length of approximately 1100 mm and a thickness of approximately 50 mm. The third panel 106 having the projections along the external side walls engaging with the internal tracks of the second panel 104. The projection is a protrusion that is located at the end of the side wall of the third panel 106 proximal to the second panel 104. The projection is a metal stud.

[0027] At the front end of the third panel 106 are proximity sensors. The first panel 102 is shaped as a box with the top lid and the hinged flap at the aperture 110 to protect the drive assembly 112,130 and the sensitive components from tampering and protection from water and dust. The aperture 110 provides an extension and retraction of the second panel 104 having the third panel 106. The aperture 110 is positioned slightly to the right as seen from the long front side to provide a channel on the left side within the first panel 102 for the installation of the drive assembly 112.

[0028] The proximity sensors are located at the long front side of the first panel 102 provides a detection of obstacles at the front side. The proximity sensors are also located at the long front side of the second panel 104 and the third panel 106.

[0029] The frictional surface tape adhered on the top side of the first panel 102 or the top lid provides a non-slip surface for the wheeled vehicles on the first panel 102.

[0030] The two guiding rails or the stationary rails 122 that extends along the width of the first panel 102 provides a support and a sliding of the second panel 104 having the third panel 106 within. The second panel 104 is able to slide along the guiding rails 122 effortlessly.

[0031] The traveller body 132 provides a stable and firm framework support resisting compression as well as providing the extension and retraction of the second panel 104 with the third panel 106. The guide unit 128 provides a secured attachment of the timing belt clamp 136 to the traveller body 132.

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[0032] The primary drive assembly 112 comprises the gear drive 114 and the primary timing belt 120 provide the motive force to move the second panel 104 having the third panel 106. The movement provides extending and retracting from the rectangular aperture 110.

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[0033] The gear drive 114 comprises a rotatable drive gear 116 and a primary electric motor 118. The primary electric motor 118 provides transmission of rotational motion. The rotational motion is transmitted to the rotatable drive gear 116. The rotatable drive gear 116 provides teeth around its periphery preventing slippage from the teeth.

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[0034] The rotational drive gear 116 is meshed or coupled to the primary timing belt 120. The gear belt is coupled to a first rotational gear 124 having corresponding teeth.

[0035] The first side wall and the second side wall provides the framework to support the flat rectangular metal sheet and the strut. The metallic tracks along the external side walls provide the travelling of the second panel 104 in and out from the rectangular aperture 110. The metallic tracks of the second panel 104 are slide into the guiding rails of the first panel 102 disposed in the rectangular aperture 110. The internal tracks located on the internal sides of the side walls provide a channel for the third panel 106 to travel.

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[0036] The flat rectangular metal sheet provides a support platform for the wheeled vehicle and provides protection of the mechanical parts beneath. The guiding rods beneath the second panel 104 provide guided uniform extension and retraction of the third panel 106.

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[0037] In use, the automatic ramp provides two modes of operation, an extended state and a retracted state. The method of extension and retraction describes herein is for illustration purpose which uses an on/off switch to extend and retract.

[0038] In the extended state, the second panel 102 together with the third panel 104 are extended at the same time. The primary electric motor 118 rotates the rotatable drive gear 116. The rotatable drive gear 116 cooperates with the corresponding first rotational gear 124 rotating in a different axis. The first rotational gear 124 then turns the primary timing belt 120 which extends the second panel 104 out of the rectangular aperture 110. At the same time, the secondary electric motor 138 is also activated and rotates a gear at the second timing belt 134. The second timing belt 134 then extends the third panel 106. The downward inclination of the second panel 104 and the third panel 106 is effected by the gravitational pull. The angle of inclination is determined by the height of the rectangular aperture 110 as well as the height of the first panel 102. The rectangular aperture 110 provides the pivotal point for the second panel 104 with the third panel 106. A thicker first panel 102 would imply there is more room for inclining the panels 104,106. The inclination can be also determined by mechanical installations within the first panel 102. The action of extending the second panel 104 and the third panel 106 from the first panel 102 is analogous to the extension of a telescope.

[0039] During the extension mode, if there were an immobile obstacle, the extension will halt temporarily. The immobile obstacle causes a disruption of the free rotation of the electric motors 118,138. The electric motors 118,138 may stop or the timing belts 120,134 to “skip” (the gear and the timing belt disengages) even though the electric motors 118,138 may still be rotating. After a while, the timing belts 120,134 reengages with the electric motors 118,138 and the extension resumes.

[0040] In the retracted state, the third panel 104 and the second panel 102 are retracted at the same time. The retraction of the automatic ramp 100 is the reverse action of the extension of the automatic ramp 100 as mentioned.

[0041] Alternatively, the automatic ramp 100 can use load sensors and/or proximity sensors to detect obstacles that are not fixed to the ground, for example the detection of a human standing in front of the ramp 100. Before hitting the human, the automatic ramp 100 will have the autonomy to decide to halt or to retract.

[0042] The sensors can be linked to a microcontroller that can be installed on board the automatic ramp 100. The microcontroller will contain algorithm for detection and actions to take to evade and avoid disastrous incidents like injuries to human beings and also to protect itself from damages. The automatic ramp can have also communication module like wireless communication allowing remote control of the automatic ramp and to allow the update of the algorithm from a remote computer by a remote user.

[0043] An algorithm can be controlling the extend of the extension of the panels 104,106. Instead of extending the third panel 106 from the second panel 104 simultaneously, the algorithm with the inputs from sensors can determine the distance and the inclination from the ramp 100 to an object like a kerb. There is control to extend one or two panel partially or fully depending on the circumstances. This helps to save the time in deployment of the automatic ramp 100.

[0044] The current application provides a solution for buses and trains to provide an automatic ramp for conveying wheeled vehicles, for example, wheelchair, pram and electric scooter on and off the buses and the trains.

[0045] In the application, unless specified otherwise, the terms "comprises", "comprise", and grammatical variants thereof, intended to represent "open" or "inclusive" language such that they include recited elements but also permit inclusion of additional, non-explicitly recited elements.

[0046] As used herein, the term "about", in the context of concentrations of components of the formulations, typically means +/- 5% of the stated value, more typically +/- 4% of the stated value, more typically +/- 3% of the stated value, more typically, +/- 2% of the stated value, even more typically +/- 1% of the stated value, and even more typically +/- 0.5% of the stated value.

[0047] Throughout this disclosure, certain embodiments may be disclosed in a range format. The description in range format is merely for convenience and brevity and should not be construed as an inflexible limitation on the scope of the disclosed ranges. Accordingly, the description of a range should be considered to have specifically disclosed all the possible sub-ranges as well as individual numerical values within that

range. For example, description of a range such as from 1 to 6 should be considered to have specifically disclosed sub-ranges such as from 1 to 3, from 1 to 4, from 1 to 5, from 2 to 4, from 2 to 6, from 3 to 6 etc., as well as individual numbers within that range, for example, 1, 2, 3, 4, 5, and 6. This applies regardless of the breadth of the range.

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[0048] It will be apparent that various other modifications and adaptations of the application will be apparent to the person skilled in the art after reading the foregoing disclosure without departing from the spirit and scope of the application and it is intended that all such modifications and adaptations come within the scope of the

10 appended claims.

Reference Numerals

	100	automatic ramp
	102	first panel, ramp main frame
5	104	second panel, first ramp board
	106	third panel, second ramp board
	108	hinged flap, dust cover
	110	rectangular aperture
	112	primary drive assembly
10	114	gear drive
	116	rotatable drive gear, bevel gear
	118	primary electric motor
	120	primary gear belt, primary timing belt
	122	stationary rail, guiding rail
15	124	first rotational gear
	128	guide unit
	130	secondary drive assembly
	132	traveller body
	134	secondary timing belt
20	136	timing belt clamp
	138	secondary electric motor

Claims

1. An automatic ramp for wheelchairs, the automatic ramp comprising:
 - a ramp main frame for anchoring onto a floor;
 - 5 ➤ a first ramp board movably connected to the ramp main frame;
 - a second ramp board movably connected to the first ramp board or the ramp main frame; and
 - a drive mechanism that is connected to ramp main frame, the first ramp board, the second ramp board or a combination of any of these parts for
10 expanding the automatic ramp;
wherein the ramp main frame, the first ramp board, the second ramp board or a combination of any of these parts are expandable or telescopically extendable with respect to each other for providing an elongated ramp with a continuous surface.
- 15 2. The automatic ramp according to claim 1, wherein the drive mechanism comprises an electric motor for expanding or extending automatic ramp.
- 20 3. The automatic ramp according to claim 1 or 2, wherein the ramp main frame comprises side components defining a receptacle for retracting the first ramp board, the second board or both into the ramp main frame.
- 25 4. The automatic ramp according to any of the preceding claims, wherein the first ramp board side components defining a chamber for retracting the second board into the chamber.
5. The automatic ramp according to any of the preceding claims, wherein
30 the drive mechanism comprises a detector for regulating movement of the automatic ramp.
6. The automatic ramp according to claim 5, wherein

the detector comprises a proximity sensor, a force sensor, a light sensor, a contact sensor or a combination of any of these sensors for detecting obstruction to movement of the automatic ramp.

- 5 7. The automatic ramp according to claim 5 or 6, wherein
the detector is mounted along a side of the ramp main frame, the first ramp board
or the second ramp board for detecting external resistance to expansion of the
automatic ramp.
- 10 8. The automatic ramp according to claim 7, wherein
the automatic ramp is configured to halt its expansion if experiencing the
resistance beyond 3kGf, 5kGf, 7kGf, 9kGf, 11kGf or any larger force (f).
- 15 9. The automatic ramp according to any of the preceding claims, wherein
at least one parts of the automatic ramp is weatherproof.
10. The automatic ramp according to claim 8, wherein
the electric motor is shield by the ramp main frame for preventing water spillage.
- 20 11. The automatic ramp according to any of the preceding claims, wherein
a top surface of the ramp main frame, the first ramp board or the second ramp
board is roughened.
- 25 12. A vehicle for transporting passengers, the vehicle comprising:
a floor for parking a wheelchair; and
the automatic ramp of claim 1 connected to the floor for providing a substantially
continuous surface from the floor to first ramp board or a ground.
- 30 13. The vehicle according to claim 12 further comprising
a joint for detachably fastening the automatic ramp to the floor.
14. The vehicle of claim 12 or 13 further comprising

a holder below the floor for keeping the automatic ramp of claim 1 inside by making a top surface of the automatic ramp to be at the substantially at the same level as the floor.

- 5 15. The vehicle of any of the preceding claims 12 to 14 further comprising a door whose bottom edge is operable to be in close proximity with the automatic ramp upon for sealing.