

Access Gates Configured With Vertically Rotatable Flap Barriers

Field of Invention

[001] The present invention relates to access gates configured with vertically rotatable flap barriers with gate passage widths ranging from 50 cm to 110cm. The flap barriers configurable for gate passage widths of 70 cm to 110 cm are formed by a composite of two parts for controlling human passage through the access gate. In particular, these two flap components are rotatable in a non-telescoping manner.

Background

[002] A gate is used to control entry to or exit from a designated area, such as a mass transit station, airport lounge, office lobby, concert hall, car park and so on. An oscillatory barrier element is usually used to restrict or allow passage through the gate. Known types of gates are: turnstiles, horizontal or vertical pivoted barrier gates, and vertically rotatable flap gates.

[003] Vertically rotatable flap gates found in mass transit or rail system, for example, generally allow high human traffic volumes; they are preferred, for example, for their compact sizes and allowing bi-directional passage. For example, US Patent No. 7,617,974, assigned to Automatic Systems, discloses an automatic gate employing a pair of vertically rotatable flaps to permit human passage with a valid ticket. In another example, US Patent No. 8,020,603, assigned to Magnetic Auto Control GmbH, discloses a similar automatic gate but with each flap barrier comprising two telescoping vanes.

[004] These public transport gates are required to cater for different passage widths, for example to allow wheelchair access. It can thus be seen that there exists a need for another type of automatic gate that are easily configurable for different passage widths, allows for high human traffic volumes, are compact in size, easy to assemble and disassemble, and yet reliable.

Summary

[005] The following presents a simplified summary to provide a basic understanding of the present invention. This summary is not an extensive overview of the invention, and is not intended to identify key features of the invention. Rather, it is to present some of the inventive concepts of this invention in a generalised form as a prelude to the detailed description that is to follow.

[006] The present invention seeks a system for configuring an automated access gate with vertically rotatable flap barriers with passage widths ranging from substantially 50 cm to substantially 110 cm. With a cabinet width of substantially 28 cm, these gates are compact and easily re-configurable for passage widths of substantially 50 - 90 cm. With a cabinet width of substantially 35 cm, the passage width is increased to substantially 110 cm. For passage widths of substantially 70 - 110 cm, each flap barrier is configured with a supplementary flap that is rotatably actuated in a non-telescoping manner and at a lagging speed with respect to the flap barrier.

[007] In one embodiment, the present invention provides an automated access gate comprising two cabinets. Each cabinet houses a flap barrier linkage and drive mechanisms comprising: a flap barrier being substantially trapezoid-shaped with the height of the trapezoid being substantially a width W of the cabinet; a mounting arm for supporting the flap barrier, wherein a lower end of the mounting arm is connected to a flap pivot, which is located near a base of a support frame of the associated cabinet; a connecting rod having a distal pivot and a proximal pivot, with the distal pivot being connected to the mounting arm; and a drive plate having two connection points, the first connection point being a drive pivot and the second connection point being joined to the proximal pivot of the connecting rod; wherein when the drive plate is driven at the drive pivot in a first direction, the connecting rod pushes the mounting arm to rotate about the flap pivot, causing the flap barrier to extend out of the cabinet to restrict passage through the access gate, and when the drive plate is driven in a second direction opposite the first direction, the flap barrier is retracted within the width of the cabinet to allow unobstructed passage through the gate.

[008] In one embodiment of the automated access gate, the gate passage width is substantially 50 cm when the width of each cabinet is substantially 28 cm. When the gate

passage width is increased to substantially 70 cm to 110 cm, the gate further comprises: a supplementary flap barrier having a hollow interior to receive an upper portion of the flap barrier; a supplementary mounting arm for supporting the supplementary flap barrier, wherein a lower end of the supplementary mounting arm is also connected to the flap pivot; and a supplementary connecting rod having a distal pivot and a proximal pivot, with the distal pivot being connected to the supplementary mounting arm and the proximal pivot is connected to a pivot on the drive plate; wherein when the drive plate is driven in either the first or second direction, the supplementary flap barrier is actuated to rotate about the flap pivot to lag behind the rotary motion of the flap barrier.

[0009] In another embodiment of the automated access gate, when the width of the cabinet is increased to substantially 35 cm, the gate passage width is increased to substantially 110 cm, whilst the mounting bracket remains the same size.

[0010] In another embodiment, the present invention provides a kit for configuring an automated access gate, comprising: a flap barrier being substantially trapezoid-shaped with the height of the trapezoid being substantially a width W of a cabinet housing the gate linkage and drive mechanisms; a mounting arm for supporting the flap carrier, wherein a lower end of the mounting arm is for connection to a flap pivot located on a support frame of the cabinet; a connecting rod having a distal pivot and a proximal pivot, with the distal pivot for connection to the mounting arm; and a drive plate having two connection points, the first connection point being a drive pivot and the second connection point for joining to the proximal pivot of the connecting rod; wherein when the drive plate is operable to be driven at the drive pivot in a first direction, the connecting rod is operable to actuate the mounting arm to rotate about the flap pivot to cause the flap barrier to extend out of the cabinet to restrict passage through the access gate, and when the drive plate is operable to be driven in a second direction opposite the first direction, the flap barrier is retracted within the width of the cabinet to allow unobstructed passage through the access gate.

[0011] In another embodiment of the gate kit, it further comprises: a supplementary flap barrier having a hollow interior to receive an upper portion of the flap barrier; a supplementary mounting arm for supporting the supplementary flap barrier, wherein a lower end of the supplementary mounting arm is also connectable to the flap pivot; and a supplementary connecting rod having a distal pivot and a proximal pivot, with the distal

pivot connectable to the supplementary mounting arm and the proximal pivot is connectable to a pivot on the drive plate; wherein when the drive plate is operable to be driven in either the first or second direction, the supplementary flap barrier is actuatable to rotate about the flap pivot to lag behind the rotary motion of the flap barrier.

Brief Description of the Drawings

[0012] This invention will be described by way of non-limiting embodiments of the present invention, with reference to the accompanying drawings, in which:

[0013] FIG. 1A illustrates conventional access gates located at a typical mass transit station configured with various passage widths; FIG. 1B illustrates a side view of a cabinet shown in FIG. 1A;

[0014] FIG. 2A illustrates an access gate with a passage width of 50 cm according to an embodiment of the present invention, showing arrangement of the linkage and drive mechanisms, with the flap barrier in an extended position to stop passage through the gate; FIG. 2B illustrates the access gate with the flap barrier in a retracted position; and FIG. 2C illustrates a rear elevation of the access gate with the flap in the retracted position;

[0015] FIG. 3A illustrates a front elevation of an access gate with a passage width of 70 cm according to another embodiment of the present invention; and FIGS. 3B-3D illustrate arrangement of the linkage and drive mechanisms;

[0016] FIGS. 4A-4C illustrate arrangement of the linkage and drive mechanisms of an access gate with a passage width of 90 cm according to another embodiment of the present invention; and

[0017] FIG. 5A illustrates a front elevation of an access gate with a passage width of 110 cm according to yet another embodiment of the present invention, and FIGS. 5B-5D illustrate arrangement of the linkage and drive mechanisms.

Detailed Description

[0018] One or more specific and alternative embodiments of the present invention will now be described with reference to the attached drawings. It shall be apparent to one skilled in the art, however, that this invention may be practised without such specific details. Some of the details may not be described at length so as not to obscure the invention. For ease of reference, common reference numerals or series of numerals will be used throughout the figures when referring to the same or similar features common to the figures.

[0019] FIG. 1A shows two access gates used in a typical mass transit station. Each gate 10, 20 comprises two cabinets 12; in FIG. 1A, two adjacent gates 10, 20 share a common cabinet 12. Gate 10 has a passage width P of 50 cm and requires a pair of flap barrier 14, whilst the passage width of gate 20 is 70 cm but requires a pair of telescoping flap barriers 16, 18, when the cabinet width W is 28 cm. Each cabinet 12 houses an assembly of linkage and drive mechanisms that holds the associated flap barrier 14, 16, 18 inside the cabinet. In use, the pair of flap barriers 14, 16, 18 is operated in synch and the flap barriers are extended out of the cabinets to stop human passage through the space between the two associated cabinets 12, or are retracted into the cabinets to allow human passage. Also housed inside each of the cabinets is the drive mechanism, however, a control system of the gate may be housed in one of the cabinets or in a remote control box. As shown in FIG. 1B, the control system includes, *inter alia*, a ticket reader 30 and a display screen 32 for communicating information to a commuter entering or exiting through the gate 10, 20. For safety purposes, there is a gap of substantially 4 or 5 cm between the pair of extended flap barriers.

[0020] In some geographical locations, the passage widths of 50 and 70 cm are generally sufficient; some of these access gates may be complemented with gates having wider passage widths, which are operable manually by authorized personnel at the transit station; these gates with passage widths of substantially 90 or 110 cm or more are necessary to allow unobstructed movement of commuters on wheelchairs/strollers or commuters carrying bicycles or luggage; preferably, these gates with wide passage for wheelchairs/strollers/luggage are automated and ergonomically designed. In addition, there

is a need to improve on the drive mechanisms of the flap barrier, for example, for energy, space and cost saving purposes.

[0021] FIG. 2A shows one half of a gate 100a with a flap barrier 154 in an extended position according to an embodiment of the present invention. As shown in FIG. 2A, the gate 100a is configured for a passage width P of substantially 50 cm when the cabinet 12 is substantially 28 cm wide. FIG. 2B shows the access gate with the flap barrier 154 in a retracted position, whilst FIG. 2C shows a rear elevation of the access gate. As shown in FIGs. 2A-2C, the gate 100a is made up of at least a support frame 110, a drive pivot 130, the flap barrier 154 that is rotatable about a flap pivot 150, and a guide and roller assembly for allowing the flap barrier 154 to vertically oscillate about the flap pivot 150. The flap pivot 150 is located on the support frame 110 near to a mounting base of the support frame 110 and on the same side as the gate passage. The drive pivot 130 is also located on the support frame 110 but spaced apart from the flap pivot and at a relatively small distance above the flap pivot 150. Journaled about the drive pivot 130 is a two-connection driver plate 132, with the drive pivot 130 defining the first connection and the second connection being connected to a proximal pivot 142 of a connecting rod 140. A distal pivot 144 of the connecting rod 140 is pivoted to a flap barrier mounting arm 152, with the flap barrier mounting arm 152 being pivoted about the flap pivot 150. As shown in FIGs. 2A-2C, the flap barrier 154 is substantially trapezoidal in shape with the height of the trapezoid being substantially the width W of the cabinet 12. In practice, the height of the trapezoid is made slightly smaller, of substantially ΔW , than the width W of the cabinet. This is to provide allowances for thickness of the sheet metal that forms the cabinet 12 and for air gap between the flap barrier and the sheet metal of the cabinet; ΔW is substantially 1 cm when the sheet metal thickness is substantially 2 mm. In one embodiment the cabinet and gate mechanisms are pre-assembled as a unit and is configured to be installed at a site by fixing the support frame 110 to the ground by means of a mounting bracket 112.

[0022] As shown in FIG. 2A, when the flap barrier 154 is in the extended position, the position of the drive plate 132 is located by a stopper 170; also in this position, the drive plate 132 is detected by a proximity sensor 171. When the flap barrier 154 is retracted into the cabinet 12, the home position of the drive plate 132 is located by another stopper 174 and the drive plate is detected by another proximity sensor 175. Preferably, the stoppers 170, 174 have soft contact surfaces, such as provided by an elastomer or a fluid damper

device, so that the extreme end positions of the flap barriers are determinate and are reached without any impact noise. In addition, the mounting of the stoppers 170, 174 allow fine adjustments of the flap barriers 154 at their end positions. As can be seen more clearly in FIG. 2B, the guide and roller assembly is made up of a vertical guide plate 190 that is mounted on an upper portion of the support frame 110. The guide plate 190 has a curved edge 192 with its radius of curvature centred at the flap pivot 150. In use, the flap barrier mounting plate 152 is guided to move along the curved edge 192 of the guide plate 190 by a pair of pinch rollers 196. Preferably, the guide plate 190 also has a concentric curved slot 194. As will be appreciated in later embodiments, the curved edge of the concentric slot 194 can be used with another pair of pinch rollers 196a for guiding movement of a supplementary flap barrier component when the passage width P is increased to 70 cm and more.

[0023] FIG. 2C shows the rear side of the support frame 110 and shows more clearly a drive motor 134 coupled to a gearbox 135. The output of the gearbox 135 defines the drive pivot 130. The drive motor 134 may be a brushless or brushed DC motor, AC motor, etc. whilst the gear box 135 may be a planetary gear coupled to a bevel gear so that the output is orthogonal to the input; the arrangement of this motor-gear subassembly is compact when compared to an inline motor-gear assembly. In use, the drive motor is reversible, that is, the output is bidirectional so that it can actuate the flap barrier 154 to move from its retracted or home position to the extended position and vice versa. In use, the motor-gear assembly provides a torque to hold the flap barriers 154 in their extended positions and thus prevents the flap barriers from being displaced from their extended positions during forced entry through the gate 100a; yet, when the flap barriers 154 are closing, obstruction to their movements is sensed and, for safety purposes, the control system is configured to retract the flap barriers 154 into the cabinets.

[0024] In one embodiment, the flap barrier 154 is biased to the retracted or home position by a resilient member 180, such as a tension spring. As shown in FIG. 2A, the tension spring is shown to bias the flap barrier mounting arm 152 against the support frame 110 so that during electric power failure, the flap barriers 154 are retracted into the cabinets 12. In the present invention, the configuration of the linkage and drive mechanisms of the flap barrier 154 allows the drive torque of the drive motor 134 to be reduced compared to that

using telescoping flap barriers, meaning the drive motor 134 is a step size smaller than the conventional configuration designed by the same applicant.

[0025] FIG. 3A shows a front view of a gate 100b according to another embodiment of the present invention. As shown in FIG. 3A, the gate passage width P is increased to 70 cm and flap barrier requires a supplementary flap barrier 157 to occupy a void space 156 between a top portion of the flap barrier 154 and the cabinet 12 when the width W of the cabinet remains at 28 cm. In the present invention, the supplementary flap barrier 157 is configured to move in a non-telescoping manner in relation to flap barrier 154. In use, rotary motion of the supplementary flap barrier 157 trails or lags behind the rotary extending motion of the flap barrier 154 so that both the flap barrier 154 and supplementary flap barrier 157 form a complete barrier across the gate passage. When the flap barrier 154 and supplementary flap barrier 157 are actuated to retract into the cabinet, the motion of the supplementary flap barrier 157 also lags behind the motion of the flap barrier 154. In contrast, the flap components in US Patent No. 8,020,603 are configured as substantially sector-like vanes, with the outer vane being hollow and arranged to receive the inner vane in a telescopic manner. Even in this embodiment of the present invention, the drive motor 134 is also a step size smaller than that designed by the same applicant in an equivalent gate using a pair of telescoping flap barriers.

[0026] FIGs. 3B-3D show arrangement of the linkage and drive mechanisms for the gate 100b. The linkage and drive mechanisms of gate 100b are similar to those for gate 100a, except that there is a supplementary mounting arm 153 for supporting the supplementary flap barrier 157, additional pinch rollers 196a for guiding motion of the supplementary flap barrier 157 and a supplementary connecting rod 141 connected to the drive plate 132. In an embodiment, the supplementary flap barrier 157, supplementary mounting arm 153 and pinch rollers 196a are assembled as a sub-unit. An advantage of the gate 100b is that it is re-configurable as a gate of 50 cm passage width by simple removal of the supplementary flap sub-assembly; in a similar manner, the previous gate 100a of 50 cm passage width is also easily and quickly re-configured as a gate of 70 cm passage width by adding on the supplementary flap sub-assembly without changing the size of the motor-gear subassembly. In other words, the gates 100a and 100b are inter-configurable with little additional costs.

[0027] A proximal end of the supplementary connecting rod 141 is connected at pivot 143 on the drive plate 132 whilst a distal end is connected at pivot 145 on the supplementary mounting arm 153. As seen in FIGs. 3B and 3C, the radial distance of the pivot 143 from the drive pivot 130 is smaller than the radial distance of the pivot 142 from the drive pivot 130 so that rotary motion of the supplementary flap barrier 157 also lags behind the rotary motion of the flap barrier 154 in a non-telescoping manner.

[0028] FIGs. 4A-4C show arrangement of the linkage and drive mechanisms for a gate 100c according to another embodiment of the present invention with the gate passage width P being increased to 90 cm. The gate 100c uses linkage and drive mechanisms similar to those for gates 100a, 100b and cabinets of 28 cm width, except that the supplementary flap barrier 157 has a bigger area and the connection points on the drive plate 132 are re-positioned with respect to the drive pivot 130, with the radial distance of the pivot 143 still smaller than the radial distance of pivot 142 from the drive pivot 130; this also means re-positioning the pivots 144, 145 on the flap mounting arms 152, 153 and changing the lengths of the connecting rods 140, 141. Advantageously, the linkage and drive mechanisms allow the gate 100c to be re-configured for passage width of 50 or 70 cm with little additional costs. Another advantage of the gate 100c is that it is wide enough for a commuter on a wheelchair to pass unaided through an automated gate.

[0029] FIG. 5A shows a front elevation of a gate 100d according to yet another embodiment of the present invention, with the gate passage width being increased to 110 cm. FIGs. 5B-5D show arrangement of the linkage and drive mechanisms of the gate 100d. As shown in FIGs. 5A-5D, the linkage and drive mechanisms of the gate 100d are similar to those of the above gates 100a-100c, except that the flap barriers 154 and 157 have bigger surface areas and the cabinet width W is increased to 35 cm. Due to increase in the weights of the flap barriers 154, 157, the drive motor 134 and gear box 135 are one step bigger than those used in the above gates 100a-100c. However, the brackets 112 for mounting the support frame 110 to the ground are of one common size for all the above gates 100a-100d. An advantage of the gate 100d is that it allows a generously wide passage of 110 cm.

[0030] While specific embodiments have been described and illustrated, it is understood that many changes, modifications, variations and combinations thereof could be made to

the present invention without departing from the scope of the invention. For example, the flap barrier mounting arm can be integrally formed with the associated flap barrier to form a single member; in a similar manner, the supplementary flap barrier and supplementary mounting arm can be assembled as a sub-assembly. In addition, the connecting arm 140, 141 may be made adjustable so that the distance between the proximal and distal pivots is adjustable, for example, to allow fine adjustments to the positions of the flap barriers 154, 157 during assembling, testing and commissioning.

CLAIMS:

1. An automated access gate comprising two cabinets, with each cabinet housing a flap barrier linkage and driving mechanism, each of the linkage and driving mechanism comprising:

a flap barrier being substantially trapezoid-shaped with the height of the trapezoid being substantially a width W of the cabinet;

a mounting arm for supporting the flap barrier, wherein a lower end of the mounting arm is connected to a flap pivot, which is located near a base of a support frame of the associated cabinet;

a connecting rod having a distal pivot and a proximal pivot, with the distal pivot being connected to the mounting arm;

a supplementary flap barrier having a face area which is less than half that of the flap barrier, wherein the supplementary flap barrier is hollow and is arranged to receive an upper portion of the flap barrier;

a supplementary mounting arm for supporting the supplementary flap barrier, wherein a lower end of the supplementary mounting arm is also connected to the flap pivot;

a supplementary connecting rod having a distal pivot and a proximal pivot, with the distal pivot being connected to the supplementary mounting arm; and

a drive plate having three connection points, the first connection point being a drive pivot, the second connection point being joined to the proximal pivot of the connecting rod and the third connection point being joined to the proximal pivot of the supplementary connecting rod;

wherein when the drive plate is driven at the drive pivot in a first direction, the connecting rod pushes the mounting arm to rotate about the flap pivot, causing the flap barrier to extend out of the cabinet to restrict passage through the access gate, and when the drive plate is driven in a second direction opposite the first direction, the flap barrier is retracted within the width of the cabinet to allow unobstructed passage through the gate; and wherein the supplementary flap barrier is actuated to rotate about the flap pivot to lag behind the rotary motion of the flap barrier so that the supplementary flap barrier covers a void space between a top portion of the flap barrier and the associated cabinet to give the flap barrier extending across the passage of the access gate a complete face area when the flap barrier is extended out of the associated cabinet.

2. An automated gate according to claim 1, wherein the gate passage width P is substantially 70 or 90 cm when the width W of the cabinet is substantially 28 cm.
3. An automated gate according to claim 1, wherein the gate passage width P is increased to substantially 110 cm when the width of the cabinet is increased to substantially 35 cm.
4. An automated gate according to claim 3, wherein a motor of a motor-gear assembly for actuating the drive pivot is a step bigger than the motor for actuating the gate according to claim 1 or 2.
5. An automated gate according to any one of the preceding claims, wherein each support frame of each cabinet is operable to be fixed to the ground by a mounting bracket irrespective of the gate passage width P .
6. A kit for configuring an automated access gate comprising:
 - a flap barrier being substantially trapezoid-shaped with the height of the trapezoid being substantially a width W of a cabinet housing the gate linkage and drive mechanisms;
 - a mounting arm for supporting the flap carrier, wherein a lower end of the mounting arm is for connection to a flap pivot located on a support frame of the cabinet;
 - a connecting rod having a distal pivot and a proximal pivot, with the distal pivot for connection to the mounting arm;
 - a supplementary flap barrier having a face area which is less than half that of the flap barrier, wherein the supplementary flap barrier is hollow and is arranged to receive an upper portion of the flap barrier;
 - a supplementary connecting rod having a distal pivot and a proximal pivot, with the distal pivot being connectable to the supplementary mounting arm and the proximal pivot is connectable to a pivot on the drive plate;
 - a supplementary connecting rod having a distal pivot and a proximal pivot, with the distal pivot being connectable to the supplementary mounting arm; and

a drive plate having three connection points, the first connection point being a drive pivot, the second connection point for joining to the proximal pivot of the connecting rod and the third connection point for joining to the proximal pivot of the supplementary connecting rod;

wherein when the drive plate is operable to be driven at the drive pivot in a first direction, the connecting rod is operable to actuate the mounting arm to rotate about the flap pivot to cause the flap barrier to extend out of the cabinet to restrict passage through the access gate, and when the drive plate is operable to be driven in a second direction opposite the first direction, the flap barrier is retracted within the width of the cabinet to allow unobstructed passage through the access gate; and wherein the supplementary flap barrier is actuatable to rotate about the flap pivot to lag behind the rotary motion of the flap barrier so that the supplementary flap barrier covers a void space between a top portion of the flap barrier and the associated cabinet to give the flap barrier extending across the passage of the access gate a complete face area when the flap barrier is extended out of the associated cabinet.

7. A kit according to claim 6, further comprising:
 - a motor-gear subassembly for actuating the drive pivot; and
 - a mounting bracket for fixing an associated support frame of each cabinet.