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(54) **Door system**

(57) The present invention provides a door system (1) comprising a reel (10), a door (2) interconnect at a first end to the reel (10) for winding and unwinding thereupon and one or more guide channels (8). The reel (10) is rotatably mounted on a lever (24) which is pivotally mounted to a pivot axis (P). Thus the reel (10) can pivot about the pivot axis (p) to ensure that, during operation, the point (e) at which the outer layer of the door (2) engages/disengages with the penultimate door layer remains in the same general location with respect to the guide channels (8) and accordingly, the angle (if any) at which the door (2) enters the guide channels (8) remains constant throughout operation.

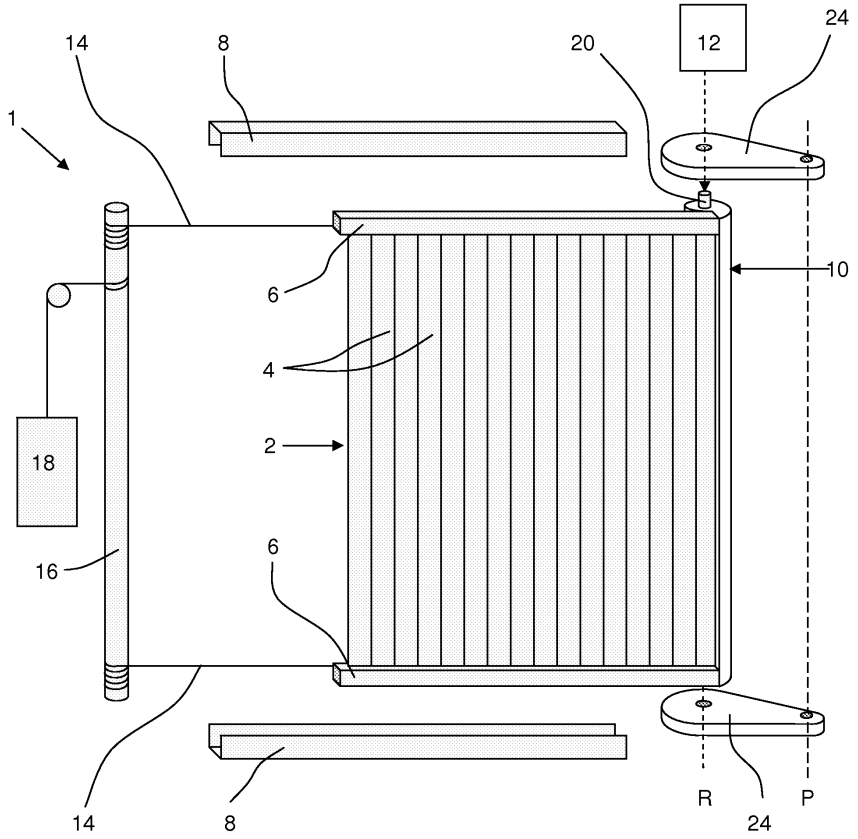

FIG. 1

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Description

[0001] The invention relates to doors systems and, in particular, to an elevator door system comprising a door that is wound upon a vertical axis during an opening operation.

[0002] Such elevator door systems are well known from the prior art and are described, for example, in WO-A2-2005/070807 and WO-A2-2005/070808. Each elevator door is generally formed from a stainless steel sheet or interconnected vertical rigid panels, typically manufactured from a metal. In operation, as the elevator door is opened and closed it is guided across the entrance in guide channels, typically located above and below the entrance to which access is to be controlled by the door system. The plurality of panels or sheet is wound onto and unwound from a vertical axis in the form of a motorised reel whereby the driving force from the motor is transmitted through the reel and onto the door to provide lateral movement thereof.

[0003] As the door is wound and unwound, the diameter at which the outer layer of the door circumscribes the vertical axis continually changes. Accordingly, the angle at which the tangent of the outer layer intersects the plane of the guide channels continually changes. Therefore, during operation the door enters the guide channels at different angles.

[0004] If the door enters the guide channels at an angle, the sudden change in its direction causes localised stress on both the door itself and the guide channels. This results in the production of unwanted noise, especially if the door is composed of interconnected vertical panels, and will damage the aesthetic appearance, and eventually the structure, of the door. These problems are amplified in the prior art since said angle continually changes during operation.

[0005] The objective of the present invention is to improve the operation of the door system and thereby to reduce the stress on the door and the guide channels at the point where the door enters the guide channels. In so doing, the invention drastically reduces the noise generated during operation thereby improving passenger comfort and reduces the structural and aesthetic damage to the door and guide channels which inherently reduces the maintenance costs.

[0006] This objective is achieved by a door system comprising a reel, a door interconnect at a first end to the reel for winding and unwinding thereupon and one or more guide channels. The reel is rotatably mounted on a lever which is pivotally mounted to a pivot axis.

[0007] Thus the reel can pivot about the pivot axis to ensure that, during operation, the point at which the outer layer of the door engages/disengages with the penultimate door layer remains in the same general location with respect to the guide channels and accordingly, the angle (if any) at which the door enters the guide channels remains constant throughout operation.

[0008] Preferably, the pivot axis is inline with a plane defined by the guide channels. Hence, if a force acts on a leading edge of the door, the lever is self-aligning to ensure that the point at which the outer layer of door engages/disengages with the penultimate door layer is always in the plane of the guide channels. Hence, the door smoothly enters the guide channels along the plane thereof without changing direction.

[0009] The door system can further comprise a roller for engaging an outer layer of the door wound upon the reel. Hence, even if the pivot axis is not aligned in the plane defined by the guide channels, the resultant moment of any force acting to the door about the pivot axis can be used to bias the lever towards the roller to ensure that the engagement/disengagement point is always in the plane of the guide channels.

[0010] If the resultant moment about the pivot axis is not sufficient to continually urge the outer layer of the wound door into contact with the roller, resilient means such as a spring can be used to produce the required biasing force on the lever.

[0011] Preferably, the reel is rotatable about a rotation axis and a radius of an outer surface of the reel from the rotation axis gradually increases from a minimum value to a maximum value with a radial step transition therebetween. The height of the radial step is substantially equal to the depth of the door. Accordingly, upon being wound onto the reel, the diameter of the outer layer of the door gradually and smoothly increases without any step transitions which would otherwise cause noise and possibly damage.

[0012] The present invention is hereinafter described by way of a specific example with reference to the accompanying drawings in which:

Figure 1 is an exploded perspective view an elevator door system according to the present invention;
Figure 2 is a cross-section through the reel of the elevator door system of Fig. 1;
Figure 3A is a plan view from above showing the door system of Fig. 1 and Fig. 2 in an almost fully open position;
Figure 3B corresponds to Fig. 3A but shows the door system in an almost fully closed position; and
Figure 4 is similar to Fig. 3A but illustrates a second embodiment of the present invention.

[0013] Fig. 1 is a general perspective view of an elevator door system 1 according to the present invention incorporating a car door 2 which, in use, is used to control access to an elevator car (not shown) through a doorway from a landing within a building. The door 2 is composed of a plurality of vertically aligned panels 4 each of which is preferably extruded from aluminium for its superior strength to weight ratio. The panels 4 are bound at their upper and lower extremities by flexible belts 6 and guided in upper and lower guide channels 8. The belts 6 are attached at one end to a reel 10 mounted at one side of the doorway, rotation of which is controlled by a motor

12 to open and close the door 2. The opposing ends of the belts 6 are attached by cables 14 to a counter-reel 16 which is biased in a door closing direction by a closing weight 18. The reel 10 and counter-reel 16 are contained and retained within opposing door jambs (not shown).

[0014] In operation, the door 2 is unwound from the reel 10 and guided along the guide channels 8 under the influence of the biasing force of the closing weight 18, and optionally by a closing force developed thereon by the motor 12, to close the doorway. To open the door 2, the motor 12 provides an opening force to overcome the biasing force of the closing weight 18 and the door 2 is guided along the guide channels 8 and drawn onto the reel 10.

[0015] If power to the motor 12 is interrupted during operation, the gravitational force acting on the closing weight 18 transmits a force through the counter-reel 16 and cables 14 which is sufficient to overcome the inertia of both the motor 12 and the door 2 to automatically close the door 2, thereby ensuring the safety of any passengers.

[0016] The reel 10 has a central axle 20 which is received within corresponding holes provided in an upper and a lower support lever 24. The central axle 20 defines a rotation axis R about which the reel 10 can rotate to wind and unwind the door. The support levers 24 are mounted on a stationary pivot axis P. The rotation axis R is parallel to but horizontally displaced from the pivot axis P, and accordingly the reel 10 can swing about the pivot axis P.

[0017] Fig. 2 is a cross-section showing in greater detail the reel 10 of the elevator door system 1 of Fig. 1. The reel 10 has a profile which generally corresponds to the shape of an apostrophe. In circumscribing the outer surface of the reel 10, its radius from the rotation axis R gradually increases from a minimum value r_1 to a maximum value r_2 with a radial step transition 22 therebetween. The height (r_2 - r_1) of the radial step 22 is substantially equal to the depth d of the door 2. Accordingly, upon being wound onto the reel 10, the diameter of the outer layer of the door 2 gradually and smoothly increases without any step transitions which would otherwise cause noise and possibly damage.

[0018] The function of the support levers 24 is hereinafter described with reference to Fig. 3. In particular, Fig. 3A shows the door 2 in an almost fully open position with the majority of the door panels 4 having been wound in layers onto the reel 10. For clarity, the door layers have been drawn with spaces therebetween however in practice it will be readily understood that the door layers are tightly wrapped around the reel 10.

[0019] The support levers 24 at any given instant during operation of the door system 1 assume a position which produces the least moment about the pivot axis P. Since the rotational force generated by the motor 12 can be neglected as it has no significant effect on the moment of the system 1 about the pivot axis P, the only external force giving rise to the moment is the biasing force exerted by the closing weight 18 on the cables 14 and the door 2. As shown in Fig. 3A, the biasing force of the closing weight 18 acts along, and the pivot axis P is positioned in, the plane of the guide channels 8 and consequently, during operation, the point E at which the outer layer of door 2 engages/disengages with the penultimate door layer is always in the plane of the guide channels 8. Hence, the door 2 is unwound from the reel 10 directly into the plane of the guide channels 8 without making an angle on entry into the guide channels 8. This smooth operation of the door system 1 reduces the noise generated and damage sustained by the door 2 during operation.

[0020] As the door 2 is unwound from the reel 10 of Fig. 3A in a closing operation, the diameter of the outer layer of the door 2 about the reel 10 gradually decreases. However, as discussed above, in order to minimise the moment about the pivot axis P, the engagement/disengagement point E of the door 2 is always in the plane of the guide channels 8. To satisfy these two conditions, the support lever 24 turns anticlockwise about the pivot axis P as shown in the drawing. Eventually, the door 2 assumes the condition shown in Fig. 3B in which it approaches the fully closed position with the majority of the door panels 4 having been unwound from the reel 10.

[0021] Fig. 4 is similar to Fig. 3 but illustrates an alternative embodiment of the present invention. In place of the vertical panels 4 and belts 6 of the previous embodiment, the door 2 is formed from a sheet of material, preferably stainless steel. Hence, the depth d of the door 2 is substantially reduced and it is no so important that the reel 10 has a profile with a radial step 22 to accommodate the depth d of the door 2. As can be seen from the drawing, the reel 10 has a circular profile and the door 2 is attached thereto by a strap 30. The door system 1 incorporates a closed-loop force transmission system, as described in our co-pending European Patent Application No. 05109847.3, and the tension of the closed-loop force transmission system effectively acts on opposing sides of the wound door 2. Accordingly, it is more difficult in this arrangement to rely on the cancellation of the moment about the pivot axis P to ensure that the engagement/disengagement point E is in the plane of the guide channels 8. Instead, the resultant moment about the pivot axis P tends to bias the support lever 24 anticlockwise. Movement in this direction is restricted by a roller 26, which ensures that the engagement/disengagement point E is always in the plane of the guide channels 8.

[0022] Although the pivot axis P is shown in the plane of the guide channels 8, it need not be in this position. Indeed, instead of using the resultant moment about the pivot axis P to urge the outer layer of the wound door 2 into contact with the roller 26, a spring 28 can be used for this function.

[0023] It will be readily understood that specific features of the described embodiments can be interchanged to give further embodiments according to the present invention. For example, if for some reason it is not possible

to position the pivot axis P of the first embodiment of the invention in line with the plane of the guide channels 8, the roller 26, and optionally the spring 28, of the second embodiment can be incorporated to ensure that the engagement/disengagement point E is always in the plane of the guide channels 8.

[0024] Furthermore, although the invention has been described with particular reference to its application in an automatic elevator door system, it can be applied to any automatic or manual door system.

[0025] Although, the profiled reel 10 of the embodiment shown in Figs. 1-3B has been described specifically with reference to the present invention wherein the rotation axis R of the reel 10 is pivotal about a pivot axis P, it can be used independently of the present invention to improve the performance of a door system in which the rotation axis R is fixed.

Claims

1. A door system (1) comprising, a reel (10), a door (2) interconnect at a first end to the reel (10) for winding and unwinding thereupon and one or more guide channels (8) **CHARACTERISED IN THAT** the reel (10) is rotatably mounted on a lever (24) which is pivotally mounted to a pivot axis (P).

2. A door system (1) according to claim 1, wherein the pivot axis (P) is inline with a plane defined by the guide channels (8).

3. A door system (1) according to claim 1 or claim 2 further comprising a roller (26) for engaging an outer layer of the door (2) wound upon the reel (10).

4. A door system (1) according to claim 3 further comprising resilient means (28) biasing the lever (24) about the pivot axis (P) towards the roller (26).

5. A door system (1) according to any preceding claim, wherein the reel (10) is rotatable about a rotation axis (R) and a radius of an outer surface of the reel (10) from the rotation axis (R) gradually increases from a minimum value (r_1) to a maximum value (r_2) with a radial step transition (22) therebetween.

6. A door system (1) according to claim 5, wherein the radial step transition (22) on the reel (10) has a height (r_2 - r_1) substantially equal to the depth (d) of the door (2).

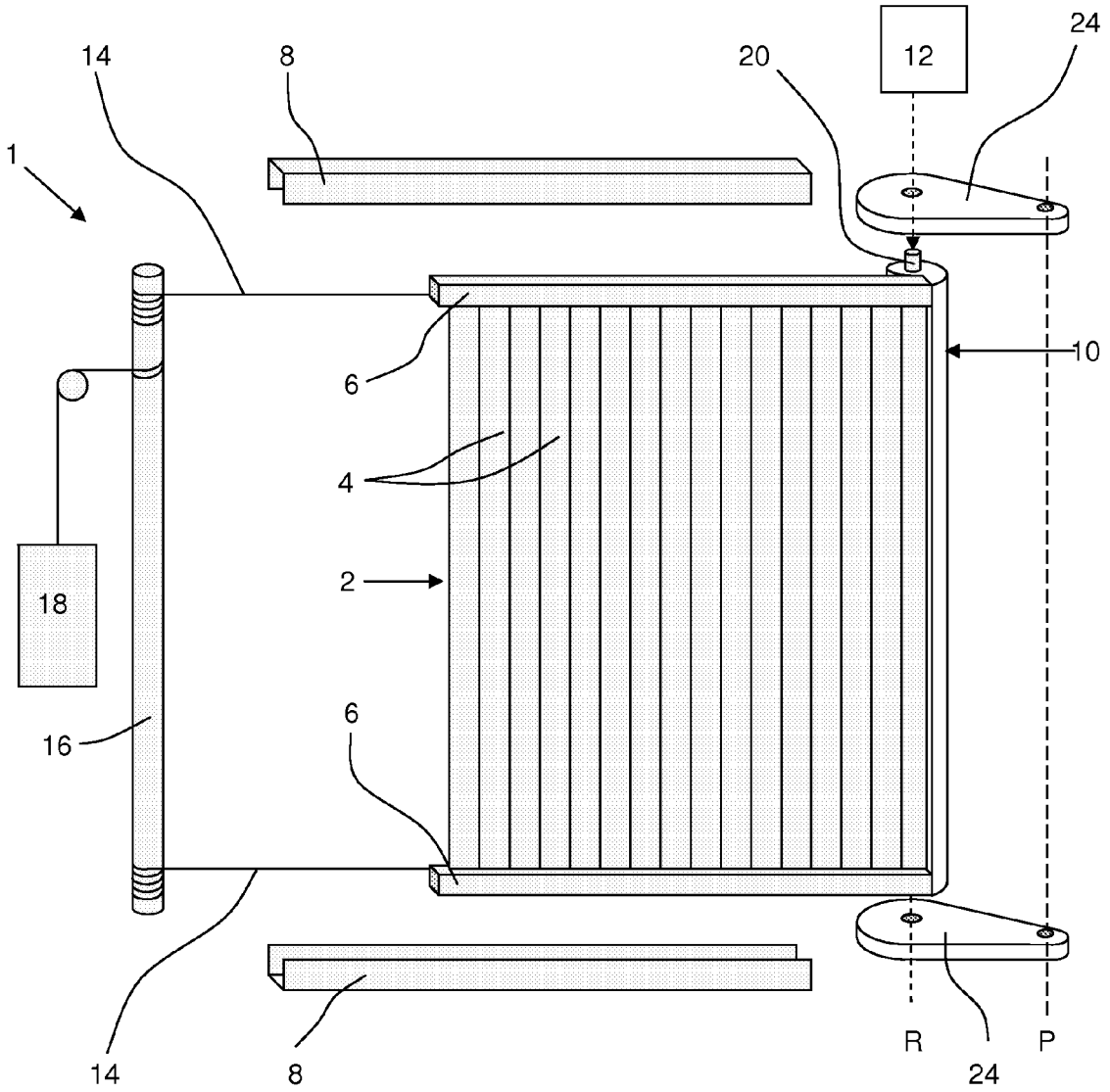

FIG. 1

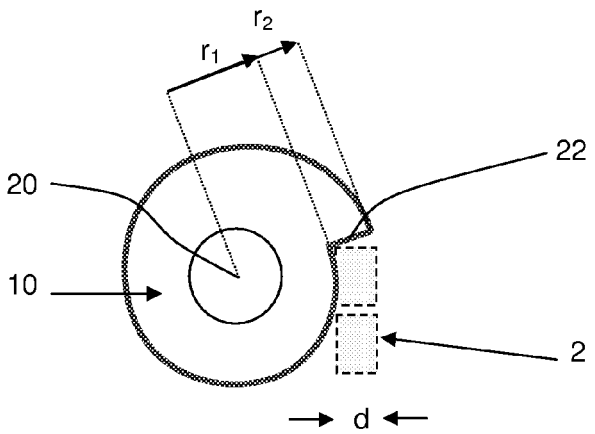

FIG. 2

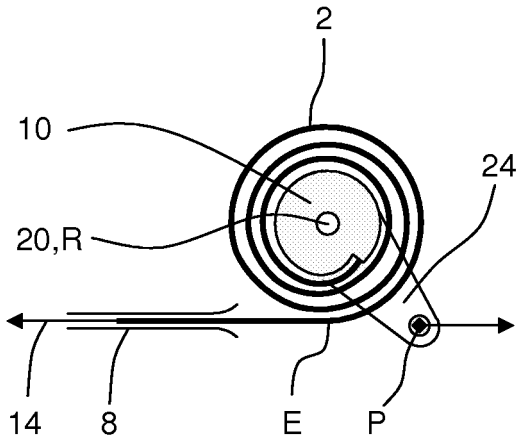

FIG. 3A

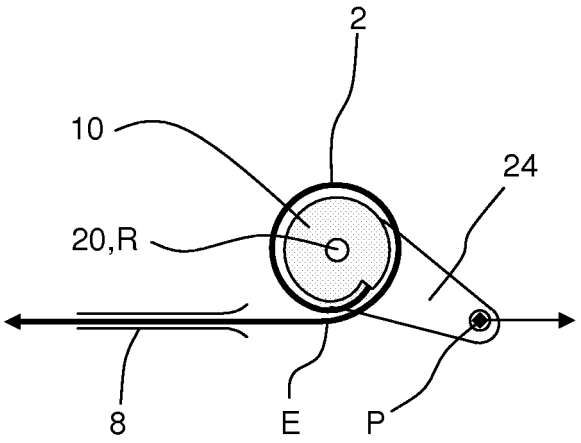

FIG. 3B

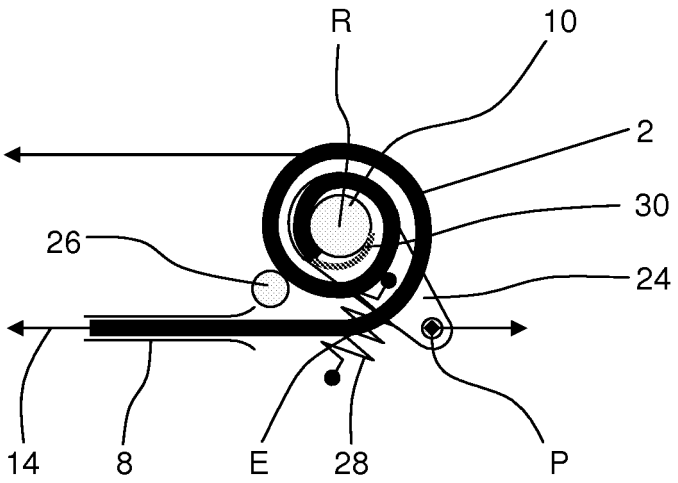

FIG. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 06 12 2347

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 0 033 199 A (PALMER, GLENN ROBERT) 5 August 1981 (1981-08-05) * page 7, line 17 - page 9, line 3 * -----	1-6	INV. B66B13/06 E06B9/11

TECHNICAL FIELDS SEARCHED (IPC)

B66B
E06B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	5 February 2007	ECKENSCHWILLER, A

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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05-02-2007

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0033199 A	05-08-1981	BR 8100194 A	04-08-1981
		FI 810010 A	16-07-1981
		NO 810095 A	16-07-1981
		NZ 195942 A	31-05-1984

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

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2005070807 A2 **[0002]**
- WO 2005070808 A2 **[0002]**
- EP 05109847 A **[0021]**