A STEPLESS SLIDING DOORS SYSTEM

TECHNICAL FIELD

The present invention relates to the field of sliding doors. More particularly, the invention relates to a stepless sliding door system.

BACKGROUND ART

The term "**sliding doors system**" refers herein as to two or more sliding doors opened / closed by sliding one door in parallel to the other.

Fig. 1a is a front view which schematically illustrates a sliding doors system in a closed state, according to the prior art. Fig. 1a also defines a cross-section A-A. **Fig. 1b** is a top view which schematically illustrates the cross-section A-A of Fig. 1a. In order to facilitate the understanding, the projection lines are not drawn in the cross-section figure 1b.

As illustrated in Fig. 1b, in the closed state of the sliding doors system, the front panels 38a and 38b of the sliding doors 10a and 10b are not in the same plane. In other words, in the closed state of the sliding doors system, the doors generate a "step". The step is pointed out by reference numeral 40.

Fig. 2a is a front view which schematically illustrates the sliding doors system of Fig. 1 in an open state. Fig. 2a also defines a cross-section B-B. **Fig. 2b** is a top view which schematically illustrates the cross-section B-B of Fig. 2a. In order to facilitate understanding, the projection lines are not drawn in the cross-section figure.

SUMMARY OF THE INVENTION

An aspect of the invention is defined in the independent claim. Some optional features of the invention are defined in the dependent claims.

Therefore, it may be possible to provide a stepless sliding doors system, i.e., a sliding doors system in which upon closing the doors, the doors are situated such that their front panels are situated at the same plane.

Other advantages of the system will become apparent as the description proceeds.

The present disclosure is directed to a stepless sliding doors system, comprising: two sliding doors (10), at least one of them comprising: two vertical poles (30); means (50) for rotating each of the vertical poles (30); to each side of the vertical poles (30) is firmly connected a hand-connector (36); each of the hand-connectors (36) pivotally connected to a rail-cart (18) having two rollers (42); each of the rail-carts (18) comprising a horizontal hinge (58) disposed between the rollers (42), and a vertical springy hinge (70), for applying pulling or pushing force of the rollers on a rail thereof, thereby allowing placing the sliding doors of the system such that their front panels are in the same plane when in the closed state of the doors, and shifting the doors one along the other in the open state thereof, and additionally preventing the wheels deviating from a rail in the case of slight deformations.

In one exemplary arrangement there is provided a stepless sliding door system, comprising:

two sliding doors (10a, 10b) disposed in a closed state thereof on the same plane, along an upper and lower parallel rails (16), at least one of the doors having:

- a chassis (46) connected to the sliding door;
- two vertical rotatable poles (30);
- two pairs of rail-carts (18);
- two pairs of hand-connectors (36a, 36b), each of the hand-connectors firmly connected in one end thereof to one of the vertical rotatable poles (30), and pivotally connected in the other end thereof to one of the rail-carts (18);
- two spiral rotation assemblies (72a, 72b), each comprising a vertically shiftable tube (50) in which one of the vertical rotatable poles (30) is disposed, for rotating each of the vertical poles (30) by 90 degrees upon shifting the vertically shiftable tube (50); and
- a transverse rod (60, 54), connecting the vertically shiftable tube (50) of each of the spiral rotation assemblies (72a, 72b), for allowing simultaneous shifting of the vertically shiftable tube (50);

thereby upon vertically shifting one of the vertically shiftable tubes (50), simultaneously rotating the vertical poles (30), resulting in distancing the chassis from the pair of rails (16), thereby placing the sliding door in parallel to the other sliding door, distantly from the other sliding door, thereby allowing sliding the door in parallel to the other door of the sliding door system such that the doors do not block each other.

According to one exemplary arrangement, the transverse rod comprises: a telescopic rod (60) having a tube (22) and two shafts (24a, 24b), each pivotally connected to one of the vertical poles (30); and a hinge (20) for pivotally connecting the tube (22) to the chassis. The system may further comprise an electric motor (52), for shifting one of the vertically shiftable tubes (50), thereby automating sliding the doors.

According to another exemplary arrangement, the transverse rod comprises: a horizontal bar (54), firmly connected to the vertically shiftable tubes (50), thereby upon vertically shifting one of the vertically shiftable tubes (50), simultaneously shifting the other tube. The system may further comprise an electric motor, for vertically shifting the horizontal bar (54) or the vertically shiftable tube (50).

According to one exemplary arrangement, the chassis (46) hangs on the upper of the pair of rails. According to another exemplary arrangement, the chassis stands on the lower of the pair of rails.

According to one exemplary arrangement, each of the rail-carts is gyroscopic.

According to one exemplary arrangement, each of the rail-carts (18) comprises:

- a vertical springy hinge (70) comprising:
  - a tube (32);
  - a vertical rod (56) disposed in the tube (32);
  - a spring (34), for applying pulling or pushing force on the vertical rod (56);
  - setting means (74), for setting an operation of the spring (34) to push or pull the vertical rod (56); and
  - fixing means (76), for fixing the vertical hinge to the chassis (46);
- a base (64);
- a horizontal hinge (58), for pivotally connecting the vertical hinge (70) to the base (64);
- two rollers (42) pivotally connected to the base (64) from each side of the horizontal hinge (58);

thereby increasing the ability of the rollers (42) to stay on a rail (16) in the case of deformations of the rail.

According to another exemplary arrangement, each of the rail-carts (18) comprises:

- a base (64);
- a ball bearing (62), for connecting the base (64) to a corresponding hand-connector (36);
- two rollers (42) connected to the base (64) from each side of the ball bearing (62); and
- a spring (34), for applying pulling or pushing force on the base (64);

thereby increasing the ability of the rollers (42) to stay on a rail (16) in the case of deformations of the rail.

In yet another aspect, the present disclosure provides for a stepless sliding door system, comprising:

two sliding doors (10), at least one comprising:

- two vertical poles (30);
- to each side of the vertical poles (30) is firmly connected a hand-connector (36);
- each of the hand-connectors (36a, 36b) is pivotally connected a rail-cart (18) having two rollers (42);
- each of the rail-carts (18) comprises a horizontal hinge (58) disposed between the rollers (42), and a vertical springy hinge (70) for applying pulling or pushing force of the rollers on a rail thereof;
- means for rotating each of the vertical poles (30) by 90 degrees, in the form of a motorized telescopic rod (84, 82a, 82b) pivotally connected to the hand connectors (36a, 36b) or to the rail carts (18);

thereby allowing placing the sliding doors of the system in the same plane when in the closed state of the doors, and shifting the doors one along the other in the open state thereof, and additionally preventing the wheels deviating from a rail in the case of slight deformations.

The reference numbers have been used to point out elements in the embodiments described and illustrated herein, in order to facilitate the understanding of the invention. They are meant to be merely illustrative, and not limiting. Also, the foregoing embodiments

of the invention have been described and illustrated in conjunction with systems and methods thereof, which are meant to be merely illustrative, and not limiting.

BRIEF DESCRIPTION OF DRAWINGS

Exemplary, non-limiting embodiments, features, aspects and advantages of the present invention are described herein in conjunction with the following drawings:

Fig. 1a is a front view which schematically illustrates a sliding doors system in a closed state, according to the prior art.

Fig. 1b is a top view which schematically illustrates the cross-section A-A of Fig. 1a.

Fig. 2a is a front view which schematically illustrates the sliding doors system of Fig. 1 in an open state. Fig. 2a also defines a cross-section B-B.

Fig. 2b is a top view which schematically illustrates the cross-section B-B of Fig. 2a.

Fig. 3a is a front view which schematically illustrates a stepless sliding doors system, according to one embodiment of the invention.

Fig. 3b is a top view which schematically illustrates the cross-section C-C of Fig. 3a.

Fig. 3c is a cross-section that schematically illustrates the first step of opening the right door 10b of the sliding doors system of Figs. 3a and 3b.

Fig. 3d is a cross-section that schematically illustrates the second step of opening the right door 10b of the sliding doors system of Figs. 3a and 3b.

Fig. 4a is a top view which schematically illustrates the state of Fig. 3b.

Fig. 4b is a top view which illustrates the state of Fig. 3c.

Fig. 4c is a front view thereof.

Fig. 5a is a perspective view of a mechanism for distancing and approaching a sliding door, according to one embodiment of the invention.

Fig. 5b is a zoomed view thereof.

Fig. 6 is a back view which comprehensively illustrates a mechanism for distancing and approaching a sliding door, according to one embodiment of the invention.

Fig. 7 illustrates the mechanism of Fig. 6, wherein the handle has been pushed upwards.

As mentioned, it may be possible to provide a stepless sliding doors system, i.e., a sliding doors system in which upon closing the doors, the doors are situated in the same plane.

Fig. 3a is a front view which schematically illustrates a sliding doors system, according to one embodiment of the invention. Fig. 3a also defines a cross-section C-C. **Fig. 3b** is a top view which schematically illustrates the cross-section C-C of Fig. 3a. Reference numeral 38a denotes the front panel of the left door 10a, and reference numeral 38b denotes the front panel of the right door 10b.

As can be seen in Fig. 3b, in the closed state of the sliding doors, the front panels 38a and 38b are situated in the same plane, i.e., without a "step".

Fig. 3c is a cross-section that schematically illustrates the first step of opening the right door 10b of the sliding doors system of Figs. 3a and 3b. In this step, the right door 10b is pushed outwards, until the lanes of the doors do not meet each other.

Fig. 3d is a cross-section that schematically illustrates the second step of opening the right door 10b of the sliding doors system of Figs. 3a and 3b. In this step, the right door 10b is pushed leftwards. This is possible as the right door does not meet the left door.

Figs. 4a, 4b and 4c detail a mechanism for distancing a sliding door from a rail, according to one embodiment of the invention.

Fig. 4a is a top view which schematically illustrates the state of Fig. 3b, and **Fig. 4b** is a top view which illustrates the state of Fig. 3c. **Fig. 4c** is a front view thereof.

The mechanism comprises a chassis 46 which is firmly connected to a door 10. Also seen in these Figs. are vertical poles 30, the role of which is detailed hereinafter.

Each of the two hand-connectors 36a and 36b is pivotally connected in one end thereof by pivot 26a to a rail-cart 18, which rolls on rail 16. Each of the hand-connectors is firmly connected in the other end thereof to a vertical pole 30.

CLAIMS

1. A stepless sliding door system, comprising:

two sliding doors (10a, 10b) arranged for disposal in a closed state thereof on the same plane, along upper and lower parallel rails (16), at least one of said doors having:

- a chassis (46) arranged to be connected to said sliding door;
- two vertical rotatable poles (30);
- two pairs of rail-carts (18);
- two pairs of hand-connectors (36a, 36b), each of the hand-connectors arranged to be firmly connected in one end thereof to one of said vertical rotatable poles (30), and to be pivotally connected in the other end thereof to one of said rail-carts (18);
- two spiral rotation assemblies (72a, 72b), each comprising a vertically shiftable tube (50) arranged for one of said vertical rotatable poles (30) to be disposed in, for rotating each of said vertical poles (30) by 90 degrees upon shifting said vertically shiftable tube (50); and
- a transverse rod (60, 54), arranged to connect the vertically shiftable tube (50) of each of said spiral rotation assemblies (72a, 72b), for allowing simultaneous shifting of the vertically shiftable tubes (50);

wherein the stepless sliding door is arranged such that, in use, upon vertically shifting one of said vertically shiftable tubes (50), simultaneously rotating said vertical poles (30), resulting in distancing said chassis from said pair of rails (16), thereby placing said sliding door in parallel to the other sliding door, distantly from the other sliding door, thereby allowing sliding said door in parallel to the other door of said sliding door system such that the doors do not block each other.

2. The system according of claim 1, wherein said transverse rod comprises:

- a telescopic rod (60) having a tube (22) and two shafts (24a, 24b), each arranged to be pivotally connected to one of said vertical poles (30); and
- a hinge (20) for pivotally connecting said tube (22) to said chassis.

3. The system according of claim 2, further comprising an electric motor (52), for shifting one of said vertically shiftable tubes (50), thereby to automate sliding said doors.

4. The system according of claim 1, wherein said transverse rod comprises:
   - a horizontal bar (54), arranged to be firmly connected to said vertically shiftable tubes (50), thereby upon vertically shifting one of said vertically shiftable tubes (50) in use, simultaneously shifting the other tube.

5. The system according to claim 4, further comprising an electric motor, for vertically shifting said horizontal bar (54) or said vertically shiftable tube (50).

6. The system according of claim 1, arranged for said chassis (46) to hang on the upper of said pair of rails.

7. The system according of claim 1, arranged for said chassis to stand on the lower of said pair of rails.

8. The system according of claim 1, wherein each of said rail-carts is gyroscopic.

9. The system according of claim 1, wherein each of said rail-carts (18) comprises:
   - a vertical springy hinge (70) comprising:
     - a tube (32);
     - a vertical rod (56) arranged to be disposed in said tube (32);
     - a spring (34), for applying pulling or pushing force on said vertical rod (56);
     - setting means (74), for setting an operation of said spring (34) to push or pull said vertical rod (56); and
     - fixing means (76), for fixing said vertical hinge to said chassis (46);
   - a base (64);
   - a horizontal hinge (58), for pivotally connecting said vertical springy hinge (70) to said base (64);
   - two rollers (42) arranged to be pivotally connected to said base (64) from each side of said horizontal hinge (58);

   thereby increasing an ability, in use, of said rollers (42) to stay on a rail (16) in the case of deformations of said rail.

10. The system according of claim 1, wherein each of said rail-carts (18) comprises:

- a base (64);
- a ball bearing (62), for connecting said base (64) to a corresponding hand-connector (36);
- two rollers (42) arranged to be connected to said base (64) from each side of said ball bearing (62); and
- a spring (34), for applying pulling or pushing force on said base (64);

thereby increasing an ability, in use, of said rollers (42) to stay on a rail (16) in the case of deformations of said rail.