

SECTIONAL DOOR STRUCTURE

FIELD OF THE INVENTION

[0001] The present invention relates to a sectional door structure, and more particularly, to a sectional door structure that can be opened and closed smoothly. When the door is closed, the door panels of the door are flattened automatically.

BACKGROUND OF THE INVENTION

[0002] FIG. 1, FIG. 2 and FIG. 3 show a conventional sectional door. When the door is to be opened, a cable reel 1A is driven by a motor 1 to roll up a cable 1B and pull up a lower door body 2. Rollers 2A on the sides of the lower door body 2 are pulled to roll within guide grooves 3A of door posts 3. An upper door body 4 is pivotally connected to the lower door body 2. As shown in FIG. 4 and FIG. 5, when the door is to be opened, the upper and lower door bodies 4, 2 are folded at an angle θ_N . When the door is to be closed, the motor 1 drives the cable reel 1A to release the cable 1B reversely. Then, the door is closed by relying on the weight. As shown in FIG. 3, the lower door body 2 and the upper door body 4 are pivoted through a single axle. Referring to FIG. 3 and FIG. 4, the folding or unfolding action of the upper and lower door bodies 4, 2 is affected by whether the rollers 2A move up or down linearly within the guide grooves 3A. For the rollers 2A to roll up and down within the guide grooves 3A, the rollers 2A are loosely fitted with the guide grooves 3A. The rollers 2A are deflected and roll against the walls of the guide grooves 3A. The upper and lower door bodies 4, 2 cannot be folded or unfolded at the same angle, so the door cannot be opened and closed smoothly. As shown in FIG. 3, the closing action of the upper and lower door bodies 4, 2 is completed by weight. Since the upper and lower door bodies 4, 2 do not have a mechanism to flatten the door panels, the door panels are prone to unevenness. This leads to more security considerations to the locking of the door when it is closed. As a result, it is necessary to exert external force to flatten the door panels or to provide a mechanism for flattening the door panels.

SUMMARY OF THE INVENTION

[0003] The primary object of the present invention is to provide a sectional door structure, comprising a door frame, a motor, at least one cable reel, an upper door body, a lower door body, two or more pivot joints, and at least one cable.

[0004] The door frame includes a pair of door posts and a cross beam connected to upper ends of the pair of door posts. The pair of door posts have a pair of guide grooves on opposing sides thereof.

[0005] The motor is disposed on an upper end of an inner side of the door frame. The motor drives a rotating shaft.

[0006] The cable reel is disposed on the upper end of the inner side of the door frame. The cable reel includes a drum driven by the rotating shaft.

[0007] The upper door body has an upper side and a lower side opposite to the upper side. The upper side is pivotally connected to an underside of the cross beam.

[0008] The lower door body has an upper side, left and right sides connected to two ends of the upper side, a pair of rollers that are disposed lower sections of the left and right sides and fitted in the pair of guide grooves, and at least one cable stopper that is disposed on a lower section of an inner surface of the lower door body and corresponds in position to the drum of the cable reel.

[0009] The pivot joints are pivotally connected between the lower side of the upper door body and the upper side of the lower door body. The pivot joints each have an upper base connected to the lower side of the upper door body and a lower base connected to the upper side of the lower door body. Gears are provided on gear brackets located between the upper base and the lower base. The gears on the gear brackets mesh with each other. At least one connector having two axles is pivotally connected between the gears of the upper base and the lower base.

[0010] The cable has one end connected to the cable stopper and another end connected to the cable reel. When the drum rolls up the cable, the rollers of the lower door body are pulled to move upward along the guide grooves.

[0011] Preferably, when the drum of the cable reel is driven by the rotating shaft of the motor to roll up the cable, the rollers of the lower door body are moved upward within the guide grooves. At this time, because the upper side of the upper door body is pivotally connected to the cross beam, the axis of the upper door body is tilted at an angle relative to the horizontal line, and the axis of the lower door body is tilted at the same angle relative to the horizontal line. Because the gears of the upper base and the lower base of the pivot joint mesh with each other to form a linkage function, the angle tilted by the upper door body is

equal to the angle tilted by the lower door body until the upper door body and the lower door body are fully folded to open the door. On the contrary, when the motor controls the drum of the cable reel to release the cable, through the weight of the upper and lower door bodies, the upper door body is swung down and the rollers of the lower door body are moved downward along the guide grooves. Through the pivot joints, the upper door body and the lower door body are linked to be unfolded, and the angle tilted by the upper door body is equal to the angle tilted by the lower door body until the upper door body and the lower door body are fully unfolded. Regardless of whether the upper door body and the lower door body are folded or unfolded relative to each other, during the movement of the upper door body and the lower door body that are linked and controlled by the pivot joints⁰, the angle tilted by the upper door body is equal to the angle tilted by the lower door body. In addition to improving the smoothness of the opening/closing action, the door panels of the upper door body and the lower door body can be automatically flattened when the door is closed.

[0012] Preferably, the thickness of the upper door body and the lower door body defines a center line perpendicular to the ground according to the center of gravity. The centers of the gears on the upper base and the lower base of the pivot joint and the pivot center of the upper side of the upper door body and the underside of the cross beam are on the center line. When the upper door body and the lower door body are unfolded to close the door, the gravity of the upper door body and the lower door body will naturally fall downward, perpendicular to the ground. Besides, through the pivot joints, the door panels of the upper door body and the lower door body are perpendicular to the ground, thereby achieving the effect of flattening the door panels of the upper door body and the lower door body when the door is closed.

[0013] Preferably, the upper base and the lower base of the pivot joint each have a pair of gear brackets. The pair of gear brackets each have the gears. The centers of the gears of the pair of gear brackets each have a through pivot hole. A pivot rod is inserted through the pivot holes of the gears for connecting the arm-shaped connector to the pair of gear brackets. The upper base and the lower base are securely pivoted by the arm-shaped connector. When one of the upper base and the lower base swings, the gears of the gear brackets mesh with each other stably, so that the other one of the upper base and the lower base also swings at the same angle. Furthermore, during the process of folding or unfolding the upper door body and the lower door body, the angle tilted by the upper door body is equal to the angle tilted by the lower door body.

[0014] Preferably, at least one pair of electric door bolts are provided on the upper ends of the left and right sides of the lower door body. The pair of door bolts each have a lock tongue that can be moved back and forth toward the corresponding door post. When the upper door body and the lower door body are in a closed state, the lock tongues of the pair of door bolts are locked to the locking holes of the door posts, such that the door is closed and locked.

[0015] Preferably, a decorative panel is secured on the outer surface of the lower side of the upper door body. The decorative panel extends downward beyond the outer surface of the lower door body. The decorative panel does not affect the folding or unfolding operations of the upper door body and the lower door body when opening or closing the door. When the door is closed, the decorative panel forms a cover decoration on the outside of the door for the pivot joints.

[0016] Preferably, a shield panel is pivoted to the inner surface of the lower side of the upper door body. The shield panel extends downward beyond the inner surface of the lower door body. During the process of opening or closing the door, one end of the shield panel is movable on the surface of the lower door body without affecting the folding or unfolding operations of the upper door body and the lower door body. When the door is closed, the shield panel faces and covers the pivot joints.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] FIG. 1 is a perspective view of a conventional sectional door structure;

[0018] FIG. 2 is an exploded view of the upper and lower door bodies of the conventional sectional door structure;

[0019] FIG. 3 is a schematic view of the conventional sectional door structure, wherein the door panels are uneven when the door is closed by weight;

[0020] FIG. 4 is a schematic view of the conventional sectional door structure, illustrating the folding process of the upper and lower door bodies;

[0021] FIG. 5 is a schematic view of the conventional sectional door structure, illustrating that the upper and lower door bodies are fully folded to open the door;

[0022] FIG. 6 is a perspective view of the present invention;

[0023] FIG. 7 is an exploded view of the upper and lower door bodies of the present invention;

[0024] FIG. 8 is an enlarged view of circle A of FIG. 6;

[0025] FIG. 9 is an exploded view of the pivot joint of the present invention;

[0026] FIG. 10 is a side schematic view of the present invention when the door is closed;

[0027] FIG. 11 is a side schematic view of the present invention, illustrating the folding process of the upper and lower door bodies;

[0028] FIG. 12 is a side schematic view of the present invention, illustrating that the upper and lower door bodies are fully folded to open the door;

[0029] FIG. 13 is an exploded view of the present invention, wherein the upper door body is equipped with the decorative panel and the shield panel;

[0030] FIG. 14 is a perspective view of the present invention, wherein the outer surface of the door is decorated with the decorative panel;

[0031] FIG. 15 is side schematic view of the present invention, wherein the upper door body is equipped with the decorative panel and the shield panel;

[0032] FIG. 16 is a side schematic view of the present invention, illustrating the folding process of the upper and lower door bodies when the upper door body is equipped with the decorative panel and the shield panel;

[0033] FIG. 17 is a side schematic view of the present invention, illustrating that the upper and lower door bodies are fully folded to open the door when the upper door body is equipped with the decorative panel and the shield panel;

[0034] FIG. 18 is an enlarged view of circle B of FIG. 13; and

[0035] FIG. 19 is a perspective view of the present invention, wherein the inner surface of the door is decorated with the shield panel.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0036] Embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings.

[0037] As shown in FIG. 6 through FIG. 10, the present invention discloses a sectional door structure, comprising a door frame 10, a motor 20, at least one cable reel 30, an

upper door body 40, a lower door body 50, two or more pivot joints 60, and at least one cable 70.

[0038] The door frame 10 includes a pair of door posts 11 and a cross beam 12 connected to the upper ends of the pair of door posts 11. The pair of door posts 11 have a pair of guide grooves 110 on opposing sides thereof.

[0039] The motor 20 is located on the upper end of the inner side of the door frame 10. The motor 20 drives a rotating shaft 21.

[0040] The cable reel 30 is located on the upper end of the inner side of the door frame 10. The cable reel 30 includes a drum 31 driven by the rotating shaft 21.

[0041] The upper door body 40 may be optionally fitted with door panels made of different materials (e.g. steel, glass). The upper door body 40 has an upper side 41 and a lower side 42 opposite to the upper side 41. The upper side 41 is pivotally connected to the underside of the cross beam 12.

[0042] The lower door body 50 may be optionally fitted with door panels made of different materials (e.g. steel, glass). The lower door body 50 has an upper side 51, left and right sides 52 connected to two ends of the upper side 51, a pair of rollers 53 that are disposed on the lower sections of the left and right sides 52 and fitted in the pair of guide grooves 110, and at least one cable stopper 54 that is disposed on the lower section of the inner surface of the lower door body 50 and corresponds in position to the drum 31 of the cable reel 30.

[0043] The pivot joints 60 are pivotally connected between the lower side 42 of the upper door body 40 and the upper side 51 of the lower door body 50. The pivot joints 60 each have an upper base 61 connected to the lower side 42 of the upper door body 40 and a lower base 62 connected to the upper side 51 of the lower door body 50. Gears 611, 621 are provided on gear brackets 610, 620 located between the upper base 61 and the lower base 62. The gears 611, 621 mesh with each other. At least one connector 63 having two axles is pivotally connected between the gears 611, 621 of the upper base 61 and the lower base 62.

[0044] The cable 70 is a wide flexible cable, which may be replaced with a rope or cord. One end of the cable 70 is connected to the cable stopper 54, and the other end of the cable 70 is connected to the cable reel 30. When the drum 31 rolls up the cable 70, the rollers 53 of the lower door body 50 are pulled to move upward along the guide grooves 110.

[0045] As shown in FIG. 6 and FIG. 11, when the drum 31 of the cable reel 30 is driven by the rotating shaft 21 of the motor 20 to roll up the cable 70, the rollers 53 of the lower door body 50 are moved upward within the guide grooves 110. At this time, because the upper side 41 of the upper door body 40 is pivotally connected to the cross beam 12, the axis of the upper door body 40 is tilted at an angle α_N relative to the horizontal line H, and the axis of the lower door body 50 is tilted at an angle β_N relative to the horizontal line H. Because the gears 611, 621 of the upper base 61 and the lower base 62 of the pivot joint 60 mesh with each other to form a linkage function, the angle α_N is equal to the angle β_N ($\alpha_N = \beta_N$). As shown in FIG. 12, when the upper door body 40 and the lower door body 50 are fully folded, the angle α_0 between the axis of the upper door body 40 and the horizontal line H is equal to the angle β_0 between the axis of the lower door body 50 and the horizontal line H. On the contrary, as shown in FIG. 11, when the motor 20 controls the drum 31 of the cable reel 30 to release the cable 70, through the weight of the upper and lower door bodies 40, 50, the upper door body 40 is swung down and the rollers 53 of the lower door body 50 are moved downward along the guide grooves 110. Through the pivot joints 60, the upper door body 40 and the lower door body 50 are linked to be unfolded, and the angle α_N is equal to the angle β_N ($\alpha_N = \beta_N$). As shown in FIG. 10, the upper door body 40 and the lower door body 50 are fully unfolded. As shown in FIG. 10, FIG. 11 and FIG. 12, regardless of whether the upper door body 40 and the lower door body 50 are folded or unfolded relative to each other, during the movement of the upper door body 40 and the lower door body 50 that are linked and controlled by the pivot joints 60, the angle α_N is equal to the angle β_N ($\alpha_N = \beta_N$). In addition to improving the smoothness of the opening/closing action, the door panels of the upper door body 40 and the lower door body 50 can be automatically flattened when the door is closed.

[0046] According to the above embodiment, preferably, as shown in FIG. 10, the thickness of the upper door body 40 and the lower door body 50 defines a center line C_0 perpendicular to the ground according to the center of gravity. The centers of the gears 611, 621 on the upper base 61 and the lower base 62 of the pivot joint 60 and the pivot center C_1 of the upper side 41 of the upper door body 40 and the underside of the cross beam 12 are on the center line C_0 . When the upper door body 40 and the lower door body 50 are unfolded to close the door, the gravity of the upper door body 40 and the lower door body 50 will naturally fall downward, perpendicular to the ground. Besides, through the pivot joints 60, the door panels of the upper door body 40 and the lower door body 50 are perpendicular to the ground,

thereby achieving the effect of flattening the door panels of the upper door body 40 and the lower door body 50 when the door is closed.

[0047] According to the above embodiment, preferably, as shown in FIG. 8 and FIG. 9, the upper base 61 and the lower base 62 of the pivot joint 60 each have a pair of gear brackets 610, 620. The pair of gear brackets 610, 620 each have the gears 611, 621. The centers of the gears 611, 621 of the pair of gear brackets 610, 620 each have a through pivot hole 612, 622. A pivot rod 64 is inserted through the pivot holes 612, 622 of the gears 611, 622 for connecting the arm-shaped connector 63 to the pair of gear brackets 610, 620. The upper base 61 and the lower base 62 are securely pivoted by the arm-shaped connector 63. As shown in FIG. 8 and FIG. 11, when one of the upper base 61 and the lower base 62 swings, the gears 611, 621 of the gear brackets 610, 620 mesh with each other stably, so that the other one of the upper base 61 and the lower base 62 also swings at the same angle. Furthermore, during the process of folding or unfolding the upper door body 40 and the lower door body 50, the angle α_N is equal to the angle β_N ($\alpha_N = \beta_N$).

[0048] According to the above embodiment, preferably, as shown in FIG. 6 and FIG. 7, at least one pair of electric door bolts 55 are provided on the upper ends of the left and right sides 52 of the lower door body 50. The pair of door bolts 55 each have a lock tongue 550 that can be moved back and forth toward the corresponding door post 11. As shown in FIG. 6, when the upper door body 40 and the lower door body 50 are in a closed state, the lock tongues 530 (referring to FIG. 7) of the pair of door bolts 55 are locked to the locking holes (not shown) of the door posts 11, such that the door is closed and locked.

[0049] According to the above embodiment, preferably, as shown in FIG. 13, FIG. 14 and FIG. 15, a decorative panel 80 is secured on the outer surface of the lower side 42 of the upper door body 40. The decorative panel 80 extends downward beyond the outer surface of the lower door body 50. As shown in FIG. 16 and FIG. 17, the decorative panel 80 does not affect the folding or unfolding operations of the upper door body 40 and the lower door body 50 when opening or closing the door. As shown in FIG. 14 and FIG. 15, when the door is closed, the decorative panel 80 forms a cover decoration for the pivot joints 60 on the outside of the door.

[0050] According to the above embodiment, preferably, as shown in FIG. 13, FIG. 15, FIG. 18 and FIG. 19, a shield panel 90 is pivoted to the inner surface of the lower side 42 of the upper door body 40 with a plurality of hinges 43. The shield panel 90 extends downward beyond the inner surface of the lower door body 50. As shown in FIG. 16 and FIG. 17, during

the process of opening or closing the door, one end of the shield panel 90 is movable on the surface of the lower door body 50 without affecting the folding or unfolding operations of the upper door body 40 and the lower door body 50. As shown in FIG. 15 and FIG. 19, when the door is closed, the shield panel 90 faces and covers the pivot joints 60.

[0051] Although particular embodiments of the present invention have been described in detail for purposes of illustration, various modifications and enhancements may be made without departing from the spirit and scope of the present invention. Accordingly, the present invention is not to be limited except as by the appended claims.

WHAT IS CLAIMED IS:

1. A sectional door structure, comprising:

a door frame, including a pair of door posts and a cross beam connected to upper ends of the pair of door posts, the pair of door posts having a pair of guide grooves on opposing sides thereof;

a motor, disposed on an upper end of an inner side of the door frame, the motor driving a rotating shaft;

at least one cable reel, disposed on the upper end of the inner side of the door frame, the cable reel including a drum driven by the rotating shaft;

an upper door body, having an upper side and a lower side opposite to the upper side, the upper side being pivotally connected to an underside of the cross beam;

a lower door body, having an upper side, left and right sides connected to two ends of the upper side, a pair of rollers that are disposed lower sections of the left and right sides and fitted in the pair of guide grooves, and at least one cable stopper that is disposed on a lower section of an inner surface of the lower door body and corresponds in position to the drum of the cable reel;

two or more pivot joints, pivotally connected between the lower side of the upper door body and the upper side of the lower door body, the pivot joints each having an upper base connected to the lower side of the upper door body and a lower base connected to the upper side of the lower door body, gears being provided on gear brackets located between the upper base and the lower base, the gears on the gear brackets meshing with each other, at least one connector having two axles being pivotally connected between the gears of the upper base and the lower base;

at least one cable, having one end connected to the cable stopper and another end connected to the cable reel, wherein when the drum rolls up the cable, the rollers of the lower door body are pulled to move upward along the guide grooves.

2. The sectional door structure as claimed in claim 1, wherein a thickness of the upper door body and the lower door body defines a center line perpendicular to the ground according to the center of gravity, and centers of the gears on the upper base and the lower base of the pivot joint and a pivot center of the upper side of the upper door body and the underside of the cross beam are on the center line.

3. The sectional door structure as claimed in claim 1, wherein the upper base and the lower base of the pivot joint each have a pair of gear brackets, the pair of gear brackets each have the gears, centers of the gears of the pair of gear brackets each have a through pivot hole, and a pivot rod is inserted through the pivot holes of the gears for connecting the arm-shaped connector to the pair of gear brackets.

4. The sectional door structure as claimed in claim 1, wherein at least one pair of electric door bolts are provided on upper ends of the left and right sides of the lower door body, and the pair of door bolts each have a lock tongue that can be moved back and forth toward a corresponding one of the door posts.

5. The sectional door structure as claimed in claim 1, wherein a decorative panel is secured on an outer surface of the lower side of the upper door body, and the decorative panel extends downward beyond an outer surface of the lower door body.

6. The sectional door structure as claimed in claim 1, wherein a shield panel is pivoted to an inner surface of the lower side of the upper door body, and the shield panel extends downward beyond the inner surface of the lower door body.