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(71) Applicant: **Changchun Kuoer Technology Co., Ltd.**
Changchun, Jilin 130012 (CN)

(72) Inventors:
- **LIU, Kuotian**
  Changchun
  Jilin 130012 (CN)
- **CHEN, Dapeng**
  Changchun
  Jilin 130012 (CN)

(74) Representative: **v. Bezold & Partner Patentanwälte - PartG mbB**
Akademiestraße 7
80799 München (DE)

(54) OPENING DEVICE USED IN SLIDING WINDOW AND SLIDING WINDOW

(57) The present invention provides an opening device for a sliding window and a sliding window, where the opening device includes a base (3), a rotation shaft (4), a pulling cable (2), a locking mechanism, a lead screw (7), a screw nut (8), a guiding member, a first friction member (5), a second friction member (6), and an elastic member. The rotation shaft (4) is mounted on the base (3). The pulling cable (2) is wound on the rotation shaft (4). The locking mechanism is provided between the base (3) and the rotation shaft (4). The lead screw (7) rotates with the rotation shaft (4). The screw nut (8) engages with the lead screw (7). The guiding member is fixed on the base (3), and confining rotation of the screw nut (8). The first friction member (5) is sleeved on the lead screw (7), rotates with the lead screw (7), and moves along an axial direction of the lead screw (7). The second friction member (6) is fixedly mounted on the base (3), and is in frictional engagement with the first friction member (5). The elastic member is provided between the first friction member (5) and the screw nut (8). When the rotation shaft (4) rotates in a first direction, the pulling cable (2) is unwound from the rotation shaft (4), and the screw nut (8) rotates toward the second friction member (6) and presses the elastic member, so that a friction force between the first friction member (5) and the second friction member (6) may increase.

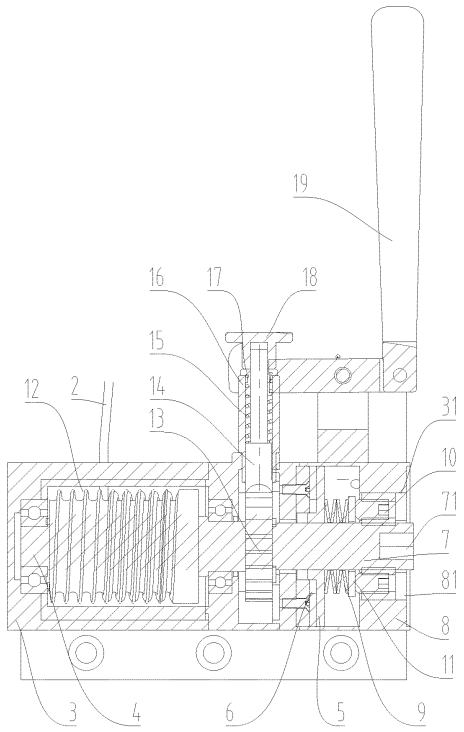

Figure 4

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Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the priority of the Chinese patent application No. 201610642725.X, filed with the Chinese Patent Office on August 08, 2016 and entitled "OPENING DEVICE FOR SLIDING WINDOW AND SLIDING WINDOW", which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] The present invention relates to the technical field of sliding windows, and in particular to an opening device for a sliding window. In addition, the present invention further relates to a sliding window that uses the foregoing opening device.

BACKGROUND

[0003] A sliding window is a novel window in which a window sash can be opened in a vertical direction, and is gradually adopted in the field of building construction. A sliding window mainly includes a sliding opening sash, a window frame, and an opening device. The window frame further includes vertical frames and horizontal frames. A redirection guiding member is mounted on the vertical frame. A guiding member is mounted on a surface at which the sliding opening sash fits with the vertical frame. The guiding member is inserted into the redirection guiding member and can move up and down along the redirection guiding member. A pulling cable in the opening device is connected to the sliding opening sash, and the pulling cable pulls the sliding opening sash to move up and down along the redirection guiding member. Generally, a driving motor is provided as the power member of the sliding window. The driving motor rotates and drives a corresponding transmission mechanism and the pulling cable, thereby achieving opening and closing of the sliding window. However, when a power failure or other situations occurs in a building, the driving motor cannot rotate, and therefore the sliding opening sash cannot be normally opened or closed.

[0004] In order to realize a normal open or close of a sliding window in a case of power failure, the utility model patent No. 201420424671.6 discloses a "POWERLESS OPENING SYSTEM OF SLIDING WINDOW". FIG. 1 is an overall schematic diagram of a powerless opening device. FIG. 2 is a side schematic diagram of the powerless opening device. FIG. 3 is a schematic diagram of a damping device in the powerless opening device. As shown in FIG. 1 to FIG. 3, the powerless opening device includes a case 01, a crank 02, a ratchet shaft 03, a pulling cable pulley 04, a ratchet 05, a pawl 06, a pressure spring 07, a friction plate 08, a friction ring 09, and a button 010. The ratchet shaft 03 is rotatably connected to the case 01. The pulling cable pulley 04, the ratchet 05, and the friction plate 08 are fixed on the ratchet shaft 03. The crank 02 is fixedly connected to the ratchet shaft 03 and extends outside of the case 01. One end of the pawl 06 is coupled to the pressure spring 07, and the other end of the pawl 06 is connected to the button 010. The friction ring 09 is also fixedly connected to the button 010. One end of the pulling cable 012 that is connected to the sliding opening sash 011 is fixedly connected to the pulling cable pulley 04. When the pawl 06 is pressed by the pressure spring 07 to abut against the ratchet 05, the ratchet 05 cooperates with the pawl 06 to prevent the ratchet shaft 03 from rotating, thus preventing the pulling cable 012 wound on the ratchet shaft 03 from being released. The sliding opening sash 011 is in a stationary status. When the button 010 is pressed down to a certain degree, the ratchet system is unlocked. Due to a gravity force of the sliding opening sash 011, the pulling cable 012 pulls the ratchet shaft 03 to rotate, and is unwound from the ratchet shaft 03; consequently, the sliding opening sash 011 moves downwardly. As the button 010 is pressed down, the friction ring 09 is in contact with the friction plate 08 and so as to generate a sliding frictional resistance, thereby preventing the sliding opening sash 011 from moving downwardly too quickly.

[0005] However, when the foregoing powerless opening device is used, a magnitude of the friction force produced by the friction ring 09 and the friction plate 08 is determined by a pressing pressure of the button 010. However, in actual operations, it is very difficult for an operator to control pressure of the button 010. Therefore, the friction force generated between the friction ring 09 and the friction plate 08 also changes as the pressure of the button 010 changes. As a result, it is also relatively difficult to control a declining speed of the sliding opening sash 011. If the friction force is smaller than a traction force that is applied by the sliding opening sash on the pulling cable 012, the declining speed of the sliding opening sash 011 during the declining process will become faster and faster, and a lower frame and a side frame of a window may be seriously impacted when the sliding opening sash 011 reaches the lower frame of the window, resulting in a local deformation or damage to the window. Therefore, it is a problem to be resolved by a person skilled in the art to provide an opening device that can still work in a power off state and that can effectively control a falling speed of a sliding opening sash.

SUMMARY

[0006] To resolve a problem that a prior art powerless opening device cannot provide sufficient friction force to reduce an impacting force of a sliding opening sash on a window frame when the sliding opening sash moves downwardly, the present invention provides a novel opening device for a sliding window. In addition, the present invention further provides a sliding window that uses the foregoing opening device.

[0007] The present invention provides an opening de-

vice for a sliding window, comprising a base, a rotation shaft, a pulling cable, and a locking mechanism; wherein the rotation shaft is rotatably mounted on the base; the pulling cable is wound on the rotation shaft; and the locking mechanism is configured to control a rotation of the rotation shaft with respect to the base, characterized in that the opening device further comprises:

a lead screw connected to the rotation shaft and rotating with the rotation shaft;
a screw nut threadably engaged with the lead screw;
a guiding member guiding the screw nut to move along an axial direction of the lead screw, thus confining a rotation of the screw nut, where in the guiding member is fixedly provided on the base;
a first friction member sleeved on the lead screw, rotating with the lead screw, and being movable along the axial direction of the lead screw;
a second friction member fixedly mounted on the base and in frictional engagement with the first friction member, wherein the second friction member and the screw nut are respectively provided at two sides of the first friction member; and
an elastic member provided between the first friction member and the screw nut, wherein
when the rotation shaft rotates in a first direction, the pulling cable is unwound from the rotation shaft, and the screw nut rotates towards the second friction member and presses the elastic member.

[0008] Optionally, the screw nut is provided with a threaded hole, and further comprises an adjustment screw that is threadably engaged with the threaded hole and abuts against the elastic member.

[0009] Optionally, an adjustment plate located between the elastic member and the adjustment screw is further included.

[0010] Optionally, the elastic member is a disk spring having a through hole; and the disk spring is sleeved on the lead screw via the through hole.

[0011] Optionally, the lead screw is coaxially disposed with the rotation shaft and is fixedly connected to the rotation shaft.

[0012] Optionally, the guiding member is a guide limiting hole provided in the base.

[0013] Optionally, a reel on which the pulling cable is wound is further included, wherein the reel is fixedly sleeved on the rotation shaft; and the reel has a helical groove for accommodating the pulling cable.

[0014] Optionally, an end portion of the rotation shaft and/or the lead screw has a groove for engaging a handle.

[0015] Optionally, the locking mechanism includes: a ratchet fixedly mounted on the rotation shaft or the lead screw, a pawl cooperating with the ratchet, and a sleeve fixedly mounted on the base; and the locking mechanism further includes a pressure spring, a spring positioning nut, a lever retaining pad, and a handle, wherein the spring positioning nut is fixed at an end portion of the sleeve that is away from the ratchet, and has a through hole for passing-through of the pawl; the pawl passes through the sleeve and the spring positioning nut, with one end of the pawl cooperating with the ratchet and the other end being provided with the lever retaining pad; the pressure spring is mounted in the sleeve, with one end of the pressure spring abutting against the pawl and the other end abutting against the spring positioning nut, so that the pawl engages/locks with the ratchet; the handle is hingedly mounted on the base, and one end of the handle abuts against a lower end of the lever retaining pad.

[0016] The present invention provides a sliding window, comprising a sliding opening sash and an opening device described previously, with a pulling cable of the opening device being connected to the sliding opening sash.

[0017] The opening device provided in the present invention includes a pulling cable, a base, a rotation shaft, a first friction member, a second friction member, a lead screw, a screw nut, and an elastic member. When the pulling cable is unwound from the rotation shaft, the rotation shaft drives the lead screw to rotate, and the lead screw rotates to drive the screw nut to move towards the second friction member. Because one end of the elastic member abuts against the screw nut, and the other end abuts against the first friction member, during the moving process of the screw nut, the elastic member is compressed and deformed so as to make the first friction member abut against the second friction member. As the rotation shaft continues to rotate, the elastic member is increasingly compressively deformed, and a deformational force acted on the first friction member is also gradually increased. Therefore, a friction force generated between the first friction member and the second friction member gradually increases. During a declining process of the sliding opening sash, the friction force is gradually increased to be greater than a traction force of the pulling cable, so that a speed of the sliding opening sash is decreased to a certain degree when the sliding opening sash moves down to a lowest point, thereby preventing a lower frame and a side frame of a window from being seriously impacted due to an excessively great falling speed of the sliding opening sash, thereby reducing a possibility that the window may be deformed or damaged.

[0018] According to an embodiment of the present invention, the screw nut is provided with a threaded hole, and an adjustment screw is mounted in the threaded hole, with one end of the adjustment screw abutting against the elastic member and capable of rotating with respect to the threaded hole. Therefore, an initial deformation degree of the elastic member can be adjusted according to a magnitude of the pulling force on the pulling cable by the sliding opening sash, so as to be adapted with sliding opening sashes of different dimensions or weights.

[0019] The sliding window provided in the present in-

vention uses the foregoing opening device, may achieve beneficial effects as mentioned above, and the details thereof are not provided herein again.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] To more clearly describe the background or the technical solutions of the present invention, the prior art or specific embodiments will be briefly described below in combination with accompanying drawings. Obviously, the accompanying drawings in combination with specific embodiments are merely used for an easy understanding of the present invention. For persons ordinarily skill in the art, other drawings can be derived according to these accompanying drawings without a creative effect.

FIG. 1 is an overall schematic diagram of a powerless opening device;
FIG. 2 is a side schematic diagram of a powerless opening device;
FIG. 3 is a schematic diagram of a damping device in a powerless opening device;
FIG. 4 is a cross-sectional view of an opening device for a sliding window according to an embodiment of the present invention;
FIG. 5 is a side view of an opening device for a sliding window according to an embodiment of the present invention; and
FIG. 6 is a front view of a sliding window according to an embodiment of the present invention.

[0021] In FIG. 1 to FIG. 3: 01-case, 02-crank, 03-ratchet shaft, 04-pulling cable pulley, 05-ratchet, 06-pawl, 07-pressure spring, 08-friction plate, 09-friction ring, 010-button, 011-sliding opening sash, 012-pulling cable;
[0022] In FIG. 4 to FIG. 6: 1-sliding opening sash, 2-pulling cable, 3-base, 31-guide limiting hole, 4-rotation shaft, 5-first friction member, 6-second friction member, 7-lead screw, 71-groove, 8-screw nut, 81-threaded hole, 9-disk spring, 10-adjustment screw, 11-adjustment plate, 12-reel, 13-ratchet, 14-pawl, 15-spring, 16-sleeve, 17-spring positioning nut, 18-lever retaining pad, 19-handle, 20-opening device, 21-movable pulley, 22-driving motor, 23-side frame.

DETAILED DESCRIPTION

[0023] The technical solutions in the embodiments of the present invention are described in detail with reference to the accompanying drawings in the embodiments of the present invention.
[0024] FIG. 4 is a cross-sectional view of an opening device for a sliding window according to an embodiment of the present invention; FIG. 5 is a side view of an opening device according to an embodiment of the present invention. FIG. 5 is a side view of an opening device for a sliding window according to an embodiment of the present invention. It can be seen from FIG. 4 that the opening device in this embodiment includes a pulling cable 2, a base 3, a rotation shaft 4, a first friction member 5, a second friction member 6, a lead screw 7, a screw nut 8, a disk spring 9, and a locking mechanism.
[0025] The base 3 is provided with a mounting chamber. The rotation shaft 4 is mounted in the mounting chamber of the base 3 by using a bearing and may rotate with respect to the base 3. One end of the pulling cable 2 is fixedly connected to the rotation shaft 4, and the other end is connected to the sliding opening sash 1 or a driving device that drives the sliding opening sash 1 to move. The locking mechanism is mounted between the base 3 and the rotation shaft 4 to control a rotation of the rotation shaft. The lead screw 7 is coaxially disposed with the rotation shaft 4 and is fixedly connected to the rotation shaft 4. The rotation shaft 4 drives the lead screw 7 to rotate together.
[0026] A right side of the base 3 has a guide limiting hole 31. An extension direction of the guide limiting hole 31 is parallel to the axial direction of the lead screw 7 and the rotation shaft 4. The screw nut 8 is mounted in the guide limiting hole 31, and may move along the extension direction of the guide limiting hole 31. The guide limiting hole 31 limits the screw nut 8 to rotate along a circumferential direction. The lead screw 7 is threadably connected to the screw nut 8. Using the foregoing structure, when the lead screw 7 rotates, the screw nut 8 translates along an axial direction of the lead screw 7 by a guiding action of the guide limiting hole 31.
[0027] A deformation direction of the disk spring 9 is parallel to an extension direction of the lead screw 7. One end of the disk spring 9 abuts against the screw nut 8, and the other end abuts against the first friction member 5. The second friction member 6 is fixedly mounted on the base 3. A friction surface of the first friction member faces a friction surface of the second friction member 6. The first friction member 5 is splined to the lead screw 7, and may move along the axial direction of the lead screw 7.
[0028] In addition, a corresponding activation member is further provided on the opening device. When the activation member is activated, under a gravity force of the sliding opening sash 1, the pulling cable 2 is unwound from the rotation shaft 4 and drives the rotation shaft 4 to rotate. The screw nut 8 moves towards the second friction member 6 under a driving action of the lead screw 7 and a guiding action of the guide limiting hole 31. Because the second friction member 6 is fixedly mounted on the base 3, when the screw nut 8 arrives at a certain position, the disk spring 9 will deform and enable the friction surface of the first friction member 5 to be in contact with and engage with the friction surface of the second friction member 6. Due to a spline connection, the first friction member 5 rotates as the lead screw 7 rotates. Relative slip occurs between the friction surface of the first friction member 5 and the friction surface of the second friction member 6, thus generating a friction force. However, because the friction force is smaller than a trac-

tion force that is acted on the pulling cable 2 by the sliding opening sash 1, the sliding opening sash 1 continues to move downwardly and drives the pulling cable 2 to be unwound.

[0029] As the rotation shaft 4 continues to rotate, a distance between the screw nut 8 and the second friction member 6 is gradually reduced. A deformation degree of the disk spring 9 becomes greater under the squeezing action of the screw nut 8 and the second friction member 6, and therefore, the resulted elastic deformational force becomes greater. The deformational force generated by the disk spring 9 is acted on the first friction member 5, so that the friction force between the friction surface of the first friction member 5 and the friction surface of the second friction member 6 is gradually increased. When the pulling cable 2 is unwound to a certain degree, the friction force generated between the first friction member 5 and the second friction member 6 will be the same as the traction force that is acted on the pulling cable 2 by the sliding opening sash 1, and a declining speed of the sliding opening sash 1 reaches its maximum. At this time, the pulling cable 2 continues to be unwound.

[0030] As the pulling cable 2 continues to be unwound, the screw nut 8 continues to approach the second friction member 6, the deformation degree of the disk spring 9 is further increased, the friction force between the first friction member 5 and the second friction member 6 becomes greater than the traction force that is acted on the pulling cable 2 by the sliding opening sash 1, the declining speed of the sliding opening sash 1 is lowered, and a unwinding speed of the pulling cable 2 is also lowered. Finally, when the sliding opening sash 1 moves to a lowest point, unwinding of the pulling cable 2 is basically completed.

[0031] Using the foregoing opening device, the speed of the sliding opening sash 1 has already been lowered when the sliding opening sash 1 moves to the lowest point. Therefore, impacts on a lower frame of a window and corresponding members may be reduced. In specific implementations, if the distance between the screw nut 8 and the second friction member 6, a friction coefficient between the friction surface of the first friction member 5 and the friction surface of the second friction member 6, and an elastic deformation coefficient of the disk spring 9 are reasonably selected, the speed of the sliding opening sash 1 may also be reduced to be nearly zero when the sliding opening sash 1 moves to the lowest point, and an impacting force may also be reduced to minimum.

[0032] The disk spring 9 of the opening device in this embodiment serve as an elastic member to generate deformation and increase the friction force. As shown in FIG. 4, a plurality of disk springs 9 stacking together are used in this embodiment to increase an elastic force, so as to reduce a radial dimension of the lead screw 7 as much as possible, thereby further reduce a dimension of the entire opening device. Each disk spring 9 is provided with a central through hole, and is sleeved on the lead screw 7 via the through hole. It may be conceivable that to ensure a deformation, each disk spring 9 should be able to move along the axial direction of the lead screw 7. Certainly, in other embodiments, other types of elastic member may alternatively be used to replace with the disk spring 9.

[0033] As stated above, the rotation shaft 4 and the lead screw 7 in the opening device of this embodiment are coaxially and fixedly disposed. In practical productions, the rotation shaft 4 and the lead screw 7 may be integrally formed. Certainly, in other implementations, the rotation shaft 4 and the lead screw 7 may not be coaxially disposed. For example, the rotation shaft 4 and the lead screw 7 may be disposed to be parallel but not coaxial, with gears being provided at corresponding portions of the rotation shaft 4 and the lead screw 7; these two gears are meshed with each other, and the rotation shaft 4 drives the lead screw 7 to rotate via the meshing of the gears.

[0034] As shown in FIG. 5, the screw nut 8 in this embodiment further has a threaded hole 81. In addition, the screw nut 8 is further provided with an adjustment screw 10. The adjustment screw 10 is threadably engaged with the threaded hole 81, and one end of the adjustment screw 10 abuts against the disk spring 9. In practical production applications, as the dimension of the sliding opening sash 1 varies, the corresponding weight will also vary. Weight variation of the sliding opening sash 1 causes the traction force acted on the pulling cable to be different. The foregoing threaded hole 81 and adjustment screw 10 are provided such that the deformation degree of the disk spring 9 may be adjusted according to an actual weight of the sliding opening sash 1 and a specific condition of the disk spring 9, thereby adaptively adjusting a magnitude of the friction force. As shown in FIG. 4 and FIG. 5, adjustment screws 10 are provided both at an upper side and a lower side of the screw nut 8, ensuring an even deformation of the disk spring 9. To further ensure an even deformation in a circumferential direction of the disk spring 9, an adjustment plate 11 is further provided in this embodiment. The adjustment plate 11 is a ring-shaped plate having a through hole. The adjustment plate 11 is sleeved on the lead screw 7 and is located between the disk spring 9 and the adjustment screw 10. The adjustment screw 10 adjusts the deformation degree of the disk spring 9 by adjusting a position of the adjustment plate 11. As shown in FIG. 4 and FIG. 5, the adjustment screw 10 used in this embodiment is a countersunk screw. The countersunk screw is mounted in the threaded hole 81 and is not exposed. Therefore, sharp protruding portions of the entire opening device may be avoided/reduced. That is, a possibility of damage due to sharp protruding portions may be reduced.

[0035] In this embodiment, what confines the rotation of the screw nut 8 is the guide limiting hole 31 provided in the base 3. In other embodiments, other structural guiding members may be alternatively used to replace the guide limiting hole 31.

[0036] In addition, as shown in FIG. 4, to make sure

that the pulling cable 2 may be properly wound on the rotation shaft 4, a reel 12 sleeved on the rotation shaft 4 is further included. A wiring slot for positioning the pulling cable 2 is provided on the reel 12.

[0037] As shown in FIG. 4, the locking mechanism includes a ratchet 13, a pawl 14, a sleeve 16, a pressure spring 15, a spring positioning nut 17, and a handle 19. The ratchet 13 is fixedly sleeved on the rotation shaft 4 or the lead screw 7, and may rotate as the rotation shaft 4 rotates. The pawl 14 and the pressure spring 15 are mounted in the sleeve 16. One end of the pawl 14 is engaged with ratchet teeth of the ratchet 13. The spring positioning nut 17 is mounted at a top end of the sleeve 16. The spring positioning nut 17 and the pawl 14 are clamped with the pressure spring 15 to compress the pressure spring 15. A deformational force generated by the compression of the pressure spring 15 is acted on the pawl 14, so that the pawl 14 is engaged with ratchet teeth. In addition, the other end of the pawl 14 extends outside the sleeve 16 and is provided with a lever retaining pad 18. The handle 19 is hingedly connected onto the base 3, with one end of the handle 19 abutting against a lower end of the lever retaining pad, and the other end being an operating end. When being turned to a right side, the handle 19 drives the lever retaining pad 18 and the pawl 14 to move upward and releases the engagement between the pawl 14 and the ratchet 13, thereby activating the opening device. When the handle 19 is released, the pawl 14 moves downwards under a deformational force of the pressure spring 15 and meshes/engages with the ratchet 13 again. It may be conceived that in other embodiments, other types of activation members such as a bolt may be disposed.

[0038] FIG. 6 is a front view of a sliding window according to an embodiment of the present invention. As shown in FIG. 5, the sliding window in this embodiment has the sliding opening sash 1, a side frame 23, a horizontal frame, and the foregoing opening device 20. The sliding opening sash 1 moves up and down along the side frame 23. Specifically, a driving motor 22 and a pulley block are further provided in this embodiment. The foregoing opening device 20 is connected to a movable pulley 21 in the pulley block, so as to control the sliding opening sash 1 of the sliding window to be opened in cases of, such as, a power failure. In addition, in some cases in which electric wires are inconvenient to be arranged, the opening device 20 in this embodiment may also be directly used to drive the window to open or close, without providing the driving motor 22. To open or close the window, a power member driving the pulling cable 2 to get wound should be further disposed on the opening device 20. As shown in FIG. 4, a groove 71 for mounting a crank 02 may be further provided at an end portion of the lead screw 7. With the groove 71 and the crank 02, the lead screw 7 and the rotation shaft 4 may be driven to rotate, so that the pulling cable 2 may be wound onto the rotation shaft 4. In other embodiments, the winding of the pulling cable 2 may be achieved by using other power members.

[0039] The opening device and the sliding window in the embodiments of the present invention are described above in detail. Principles and implementations of the present invention are described herein with specific embodiments. The foregoing descriptions of the embodiments are merely intended to help to understand the core concept of the present invention. All other embodiments derived by persons of ordinary skill in the art without departing from the principles of the present invention and without an inventive effort shall fall within the protection scope of the present invention.

Claims

1. An opening device for a sliding window, comprising a base (3), a rotation shaft (4), a pulling cable (2), and a locking mechanism, wherein
the rotation shaft (4) is rotatably mounted on the base (3); the pulling cable (2) is wound on the rotation shaft (4); and the locking mechanism is configured to control a rotation of the rotation shaft (4) with respect to the base (3), **characterized in that** the opening device further comprises:

   a lead screw (7) connected to the rotation shaft (4) and rotating with the rotation shaft (4);
   a screw nut (8) threadably engaged with the lead screw (7);
   a guiding member guiding the screw nut (8) to move along an axial direction of the lead screw (7), thus confining a rotation of the screw nut (8), wherein the guiding member is fixedly disposed on the base (3);
   a first friction member (5) sleeved on the lead screw (7), rotating with the lead screw (7), and being movable along the axial direction of the lead screw (7);
   a second friction member (6) fixedly mounted on the base (3) and in frictional engagement with the first friction member (5), wherein the second friction member (6) and the screw nut (8) are respectively provided at two opposite sides of the first friction member (5); and
   an elastic member provided between the first friction member (5) and the screw nut (8), wherein
   when the rotation shaft (4) rotates in a first direction, the pulling cable (2) is unwound from the rotation shaft (4), and the screw nut (8) rotates towards the second friction member (6) and presses the elastic member.

2. The opening device for a sliding window according to claim 1, **characterized in that**:
the screw nut (8) is provided with a threaded hole (81), and further comprises an adjustment screw (10)

that is threadably engaged with the threaded hole (81) and abuts against the elastic member.

3. The opening device for a sliding window according to claim 2, **characterized in that**:
the opening device further comprises an adjustment plate (11) provided between the elastic member and the adjustment screw (10).

4. The opening device for a sliding window according to claims 1 to 3, **characterized in that**:
the elastic member is a disk spring (9) having a through hole, wherein the disk spring (9) is sleeved on the lead screw (7) via the through hole.

5. The opening device for a sliding window according to claim 4, **characterized in that**:
the lead screw (7) is coaxially disposed with the rotation shaft (4) and is fixedly connected to the rotation shaft (4).

6. The opening device for a sliding window according to claim 5, **characterized in that**:
the guiding member is a guide limiting hole (31) provided in the base (3).

7. The opening device for a sliding window according to claim 6, **characterized in that**:
the opening device further comprises a reel (12) on which the pulling cable (2) is wound, wherein the reel (12) is fixedly sleeved on the rotation shaft (4); and the reel (12) has a helical groove for accommodating the pulling cable (2).

8. The opening device for a sliding window according to claim 7, **characterized in that**:
an end portion of the rotation shaft (4) and/or the lead screw (7) has a groove (71) for engaging a crank.

9. The opening device for a sliding window according to any one of claims 1 to 3, **characterized in that** the locking mechanism comprises:

a ratchet (13) fixedly mounted on the rotation shaft (4) or the lead screw (7), a pawl (14) cooperating with the ratchet (13), and a sleeve (16) fixedly mounted on the base (13); wherein
the locking mechanism further comprises a pressure spring (15), a spring positioning nut (17), a lever retaining pad (18), and a handle (19), wherein
the spring positioning nut (17) is fixedly mounted at an end portion of the sleeve (16) that is away from the ratchet (13), and has a through hole for passing-through of the pawl (14);
the pawl (14) passes through the sleeve (16) and the spring positioning nut (17), with one end of the pawl (14) cooperating with the ratchet (13), and the other end being provided with the lever retaining pad (18);
the pressure spring (15) is mounted in the sleeve (16), with one end of the pressure spring (15) abutting against the pawl (14), and the other end abutting against the spring positioning nut (17), so that the pawl (14) locks with the ratchet (13); and
the handle (19) is hingedly mounted on the base (3), and one end of the handle (19) abuts against a lower end of the lever retaining pad (18).

10. A sliding window, **characterized by** comprising a sliding opening sash (1) and an opening device (20) according to any one of claims 1 to 9, whererin the pulling cable (2) of the opening device (20) is connected with the sliding opening sash (1).

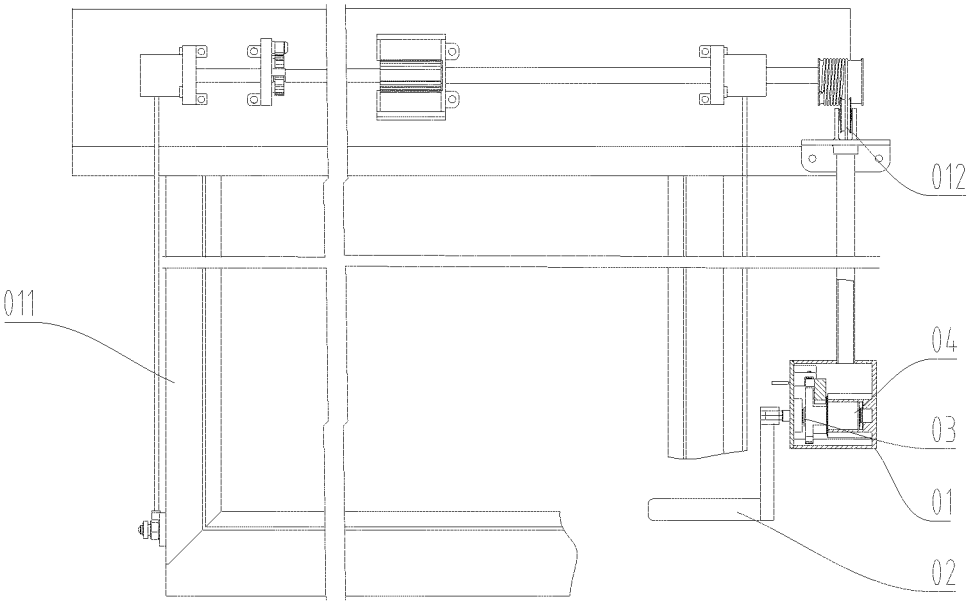

Figure 1

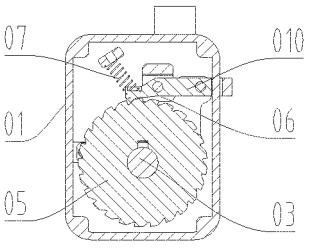

Figure 2

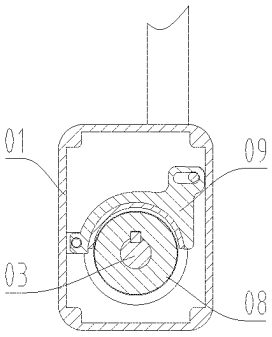

Figure 3

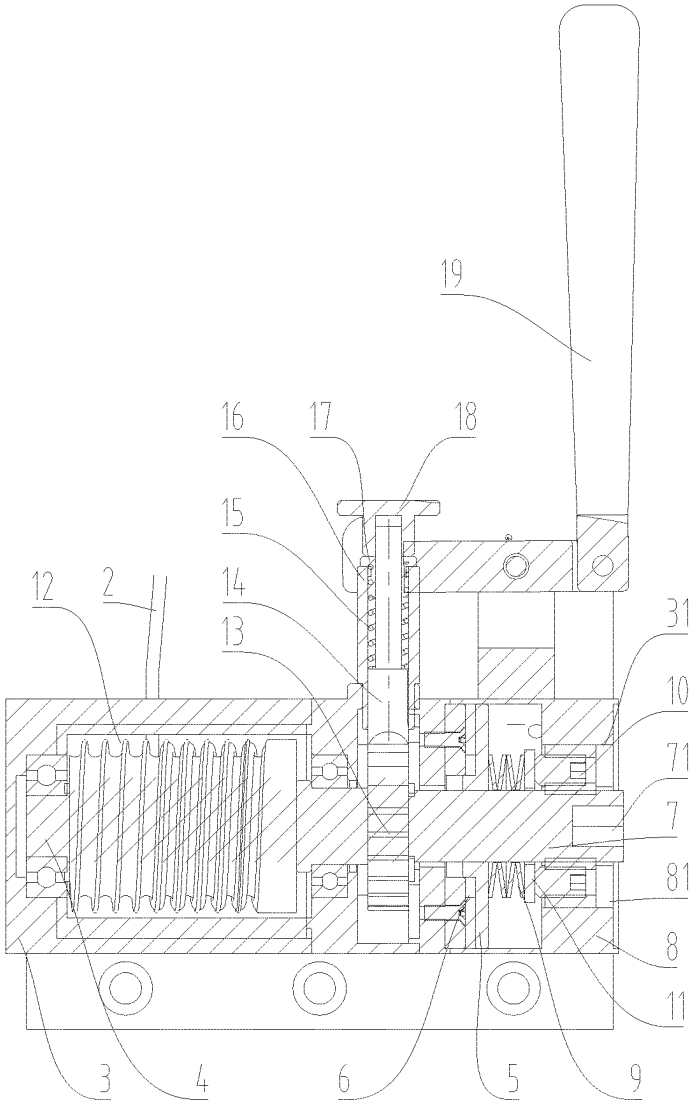

Figure 4

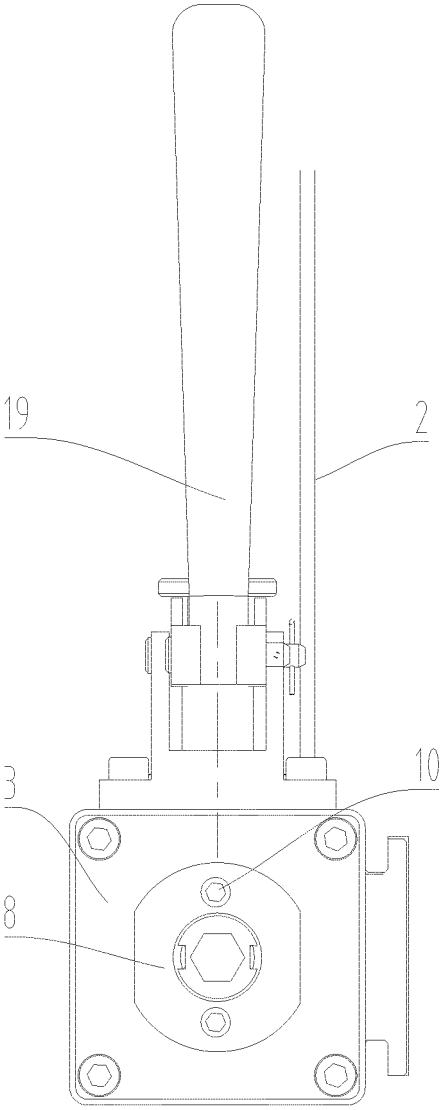

Figure 5

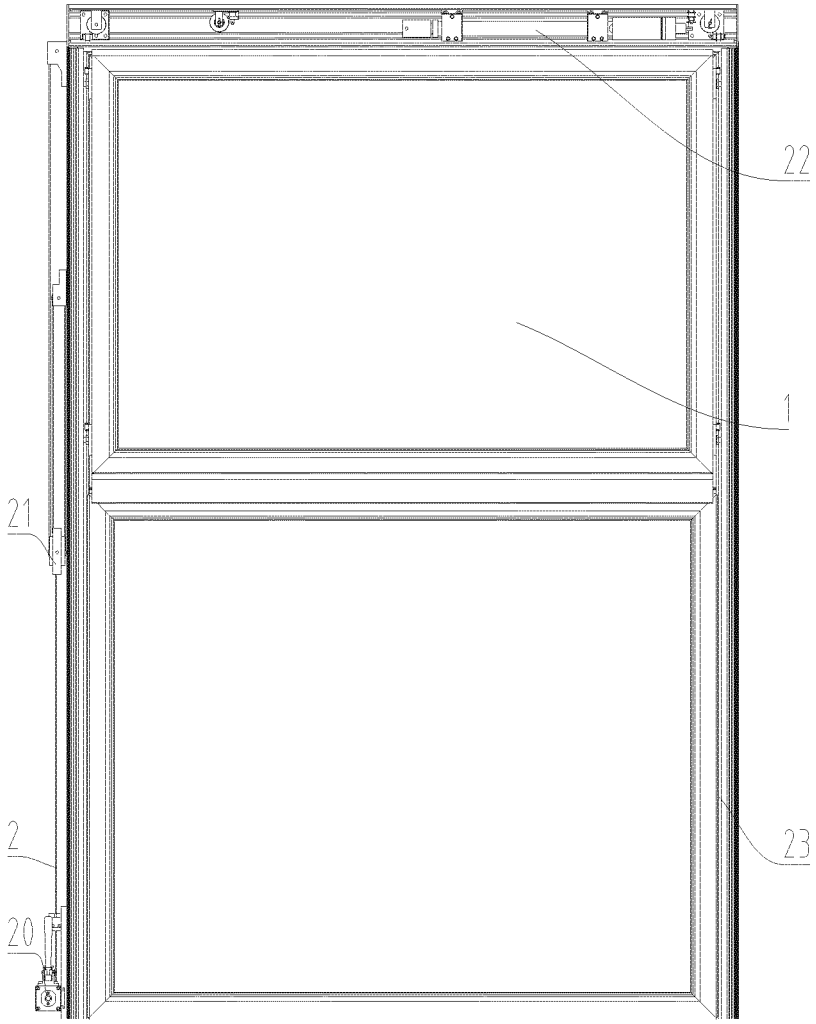

Figure 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2017/077032

A. CLASSIFICATION OF SUBJECT MATTER

E05F 11/48 (2006.01) i; E05F 1/16 (2006.01) i; E06B 3/44 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

E05F, E06B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI, CNPAT, CNKI: traction, pawl, door, window, fan, shaft, rotate, cable, rope, strand, draw, lock, spring, lead screw, friction, speed, adjust, buffer, detent, ratchet wheel

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 204024296 U (CHANGCHUN KUOER TECHNOLOGY CO., LTD.), 17 December 2014 (17.12.2014), the whole document	1-10
A	CN 1995671 A (ZHANG, Juncheng), 11 July 2007 (11.07.2007), the whole document	1-10
A	CN 103748305 A (ASSA ABLOY ENTRANCE SYSTEMS AB), 23 April 2014 (23.04.2014), the whole document	1-10
A	JP 2014181554 A (UMEDA, Y.), 29 September 2014 (29.09.2014), the whole document	1-10

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
02 June 2017 (02.06.2017)	**19 June 2017 (19.06.2017)**
Name and mailing address of the ISA/CN: State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No.: (86-10) 62019451	Authorized officer **ZHOU, Dong** Telephone No.: (86-10) **62084880**

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2017/077032

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 204024296 U	17 December 2014	None	
CN 1995671 A	11 July 2007	None	
CN 103748305 A	23 April 2014	WO 2013000698 A1	03 January 2013
		CN 103748305 B	18 May 2016
		US 2014190085 A1	10 July 2014
		EP 2726694 A1	07 May 2014
JP 2014181554 A	29 September 2014	None	

Form PCT/ISA/210 (patent family annex) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 201610642725X **[0001]**
- WO 201420424671 A **[0004]**