

HINGE, WINDOW USING SAME AND METHOD FOR MAKING SAME

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is priority to the following patent properties: Chinese

5 Patent Application CN 201510520271.4, filed on Aug. 21, 2015, the above application is hereby incorporated by reference herein as if set forth in its entirety.

BACKGROUND

1. Technical Field

[0002] The present disclosure generally relates to a hinge, a method for making

10 the hinge and a window having the hinge.

2. Description of Related Art

[0003] Traditional windows include a casement, a frame and a hinge. The casement can be connected with the frame directly by the hinge.

[0004] Referring to FIG. 1, the hinge includes a sliding rail 10 fixed on the frame,
15 a pulling bar 20 fixed on the casement, a sliding element 101 movably mounted in the sliding rail 10, a first connecting plate 30, a second connecting plate 40, a third connecting plate 50 and a fixing element 60. One end of the first connecting plate 30 is rotatably connected with the sliding element 101, the opposite end of the first connecting plate 30 is rotatably connected with one end of the pulling bar 20. One end of the

second connecting plate 40 is rotatably connected with one end of the sliding rail 10, the opposite end of the second connecting plate 40 is connected with a middle of the pulling bar 20. One end of the third connecting plate 50 is rotatably connected with the sliding element 101, the opposite end of the third connecting plate 50 is rotatably connected with
5 a middle of the second connecting plate 40. The fixing element 60 is riveted on the end of the sliding rail 10 through a punching process.

[0005] The end of the pulling bar 2 contacting with the fixing element 60 has a triangular tip. When the pulling bar 2 closes the sliding rail 10, the location of the tip can be used to confirm the dimension of the pulling bar 2 and the dimension of the fixing
10 element 60 matching with the pulling bar 2. However, the precision of the dimension of the pulling bar 20 is low during the production, and the tip also has low precision, such that some hinges may scratch edges of vertical planes of the fixing element 60, and the pulling bar 20 cannot close the sliding rail 10.

[0006] Referring to FIGD. 2-4, the fixing element 60 has two vertical planes 601
15 and a horizontal plane 602 riveted on the sliding rail through the punching process. The two vertical planes 601 cooperatively form an angle. The traditional method of making the hinge includes a pore 603 forming process, that is, the pore 603 can be formed on the horizontal plane 602, then portions of a bottom of the sliding rail 10 can be punched into the pore 603 through a punching machine, forming a lug 604 received in the pore 603,

such that the sliding rail 1 can be connected with the fixing element 60, and the fixing strength between the fixing element 60 and the sliding rail 1 can be strong. However, the lug 604 has carved edges 605, after the hinge is opened and closed tens of thousands of times, the curved edges 605 may cause the lug 604 shake in the pore 603, at worst, the
5 lug 604 may escaped from the pore 603, such that the hinge could not work.

[0007] Therefore, a need exists in the industry to overcome the described problems.

SUMMARY

[0008] The disclosure is to offer a hinge, a method for making the hinge and a
10 window having the hinge.

[0009] A hinge for a window comprises a sliding rail fixed on a frame of the window, a sliding element movably mounted in the sliding rail, a pulling bar fixed on a casement of the window, a connecting plate, a fixing element mounted on an end of the sliding rail. The pulling bar is driven by the sliding element to move relative to the
15 sliding rail and rotate in a direction to do an angular movement. The pulling bar is connected with the sliding element through the connecting plate. When the window is closed, a first end of the pulling bar is received in the fixing element, the fixing element includes a first surface, a second surface and a third surface, the first surface and the second surface cooperatively form a first angle, the third surface is a horizontal plane and

perpendicular to the first surface or the second surface, the third surface defines a first lug, the sliding rail defines a second lug, the second lug is mounted in the first lug.

[0010] Preferably, a gap is existed between a horizontal plane of the second lug and a bottom of the sliding rail.

5 **[0011]** Preferably, edges of the second lug perpendicular to an axis of the sliding rail have tangents, forming vertical cross sections on edges of the second lug, a fixing strength between the fixing element and the and sliding rail along the axis of the sliding rail is improved by the cross sections of the second lug.

[0012] Preferably, the end of the pulling bar received in the fixing element has a
10 first side and a second side, the first side and the second side cooperatively form a second angle, the second angle is smaller than the first angle.

[0013] Preferably, the highest point of the second angle is nearest to the fixing element during the movement of the pulling bar than the other points on the fixing element, and the highest point of the second angle does not contact with the fixing
15 element.

[0014] Preferably, the first side and the second side have concave arcs.

[0015] Preferably, the sliding element includes a sliding plate movably mounted in the sliding rail, a supporter located between the sliding plate and the bottom of the sliding rail, an elastic element mounted between the supporter and the sliding plate, and a

sliding cover. The sliding cover covers the sliding rail. The sliding plate, the supporter and the sliding cover move simultaneously. The sliding element move smoothly in the sliding rail. The sliding plate has a first fixing hole, and the sliding cover has a second fixing hole corresponding to the first fixing hole, the connecting element is connected
5 with the sliding cover and the sliding plate through the first fixing hole and the second fixing hole.

[0016] A window comprises a frame, a casement and a hinge used to open or close the casement, the hinge includes a sliding rail fixed on a frame of the window, a sliding element movably mounted in the sliding rail, a pulling bar fixed on a casement of
10 the window, a connecting plate, a fixing element mounted on an end of the sliding rail. The pulling bar is driven by the sliding element to move relative to the sliding rail and rotate in a direction to do an angular movement. The pulling bar is connected with the sliding element through the connecting plate. When the window is closed, a first end of the pulling bar is received in the fixing element. The fixing element includes a first
15 surface, a second surface and a third surface, the first surface and the second surface cooperatively form a first angle, the third surface is a horizontal plane and perpendicular to the first surface or the second surface, the third surface defines a first lug, the sliding rail defines a second lug, the second lug is mounted in the first lug.

[0017] Preferably, a gap is existed between a horizontal plane of the second lug

and a bottom of the sliding rail.

[0018] Preferably, edges of the second lug perpendicular to an axis of the sliding rail have tangents, forming vertical cross sections on the edges of the second lug, a fixing strength between the fixing element and the and sliding rail along the axis of the sliding
5 rail is improved by the cross sections of the second lug.

[0019] Preferably, the end of the pulling bar resisting the fixing element has a first side and a second side, the first side and the second side cooperatively form a second angle, the second angle is smaller than the first angle.

[0020] Preferably, the highest point of the second angle is nearest to the fixing
10 element during the movement of the pulling bar than the other points of the fixing element, and the highest point of the second angle does not contact with the fixing element.

[0021] Preferably, the first side and the second side have concave arcs.

[0022] Preferably, the sliding element includes a sliding plate movably mounted
15 in the sliding rail, a supporter located between the sliding plate and the bottom of the sliding rail, an elastic element mounted between the supporter and the sliding plate, and a sliding cover. The sliding cover covers the sliding rail. The sliding plate, the supporter and the sliding cover move simultaneously. The sliding element move smoothly in the sliding rail. The sliding plate has a first fixing hole, and the sliding cover has a second

fixing hole, the connecting element is connected with the sliding plate and the sliding cover through the first fixing hole and the second fixing holes.

[0023] A method for making the hinge of a window, comprises the following steps: a fixing element and a sliding rail are prepared; the fixing element is inserted into a sliding groove of the sliding rail; the sliding rail is laid face down on a punching machine; a punching groove is formed by a knife element of the punching machine through a punching process, a first lug is formed on the fixing element, and a second lug corresponding to the first lug is formed on the sliding rail, the first lug and the second lug are formed on the opposite side of the punching groove, the second lug is mounted in the first lug; a sliding element is prepared, the sliding element is movably mounted on the sliding element; and a pulling bar is prepared, the pulling bar is mounted on the sliding element, wherein edges of the knife element perpendicular to an axis of the sliding rail have cutting edges, edges of the second lug form tangents through the cutting edges of the knife element, such that portions of the second lug near the tangents form vertical cross sections.

[0024] Preferably, a gap is existed between a surface of the second lug and a bottom of the sliding rail.

[0025] It follows that, parts of the sliding rail can be punched to form a second lug by a knife element having cutting edges, and the second lug has vertical cross

sections, such that the second lug can be tightly engaged in the first lug of the fixing element, and the fixing strength between the fixing element and the sliding rail can be improved. Compared to the traditional method of making the hinge, the method as describes in the invention does not have to form pore on the horizontal surface of the fixing element, such that the fixing element can be made easily than the traditional fixing element, and the production efficiency can be improved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] Many aspects of the present embodiments can be better understood with reference to the following drawings. The components in the drawings are not necessarily drawn to scale, the emphasis instead being placed upon clearly illustrating the principles of the present embodiments. Moreover, in the drawings, all the views are schematic, and like reference numerals designate corresponding parts throughout the several views.

[0027] FIG. 1 is an isometric view of a traditional hinge.

[0028] FIG. 2 is an isometric view of a traditional fixing element and a sliding rail.

[0029] FIG. 3A is an assembled isometric view of the traditional fixing element mounted on the sliding rail shown in FIG.2.

- [0030]** FIG. 3B is an exploded isometric view of the traditional fixing element and the sliding rail shown in FIG.3A.
- [0031]** FIG. 4 is a cross-section view taken along line A of FIG. 3A.
- [0032]** FIG. 5 is an isometric view of a hinge according to an exemplary
5 embodiment.
- [0033]** FIG. 6 is an isometric view of a fixing element and a sliding rail of the hinge according to an exemplary embodiment.
- [0034]** FIG. 7A is an assembled isometric view of the fixing element mounted on the sliding rail shown in FIG.6.
- 10 **[0035]** FIG. 7B is an exploded isometric view of the fixing element and the sliding rail shown in FIG.7A.
- [0036]** FIG. 7C is a bottom isometric view of the fixing element mounted on the sliding rail.
- [0037]** FIG. 8 is a cross-section view taken along line B of FIG. 7A.
- 15 **[0038]** FIG. 9 is a cross-section view of FIG. 7A, but viewed from another aspect.
- [0039]** FIG. 10 is an isometric view of a sliding plate of the hinge according to an exemplary embodiment.
- [0040]** FIG. 11 is an isometric view of a supporter of the hinge according to an exemplary embodiment.

[0041] FIG. 12 is an isometric view of an elastic element of the hinge according to an exemplary embodiment.

[0042] FIG. 13A is a plan view of the sliding plate mounted in the sliding rail shown in FIG. 10.

5 **[0043]** FIG. 13B is a cross-section view of the sliding plate mounted in the sliding rail shown in FIG. 13A.

[0044] FIG. 13C is a cross-section view of the sliding plate mounted in the sliding rail shown in FIG. 13A, but viewed from another aspect.

[0045] FIG. 14 is an isometric view of a sliding element of the hinge according to
10 an exemplary embodiment.

[0046] FIG. 15 is an isometric view of another sliding plate of the hinge according to another exemplary embodiment.

[0047] FIG. 16 is an isometric view of a sliding cover mounted with the sliding plate shown in FIG. 15.

15 **[0048]** FIG. 17A is a plan view of the sliding plate shown in FIG. 15 mounted in the sliding rail shown in FIG. 1.

[0049] FIG. 17B is a cross-section view of the sliding plate mounted in the sliding rail shown in FIG. 17A.

[0050] FIG. 17C is a cross-section view of the sliding plate mounted in the

sliding rail shown in FIG. 17A, but viewed from another aspect.

[0051] FIG. 18 is a relative motion isometric view of the fixing element and the pulling bar, according to another exemplary embodiment.

[0052] FIG. 19 is a flow chart of a method for making a hinge of window
5 according to an exemplary embodiment.

[0053] FIG. 20 is an isometric view of a window according to an exemplary embodiment.

DETAILED DESCRIPTION

10 **[0054]** The disclosure is illustrated by way of example and not by way of limitation in the figures of the accompanying drawings, in which like reference numerals indicate similar elements. It should be noted that references to “an” or “one” embodiment in this disclosure are not necessarily to the same embodiment, and such references can mean “at least one” embodiment.

15 **[0055]** With reference to FIG. 5, the hinge includes a sliding rail 1, a pulling bar 2, a sliding element 3, a connecting plate 4, and a fixing element 5.

[0056] With reference to FIG. 5 and FIG. 20, the sliding rail 1 can be fixed on a bottom of a frame 7 of a window. In at least one exemplary, the sliding rail 1 can be fixed on the frame 7 through a screw (not shown). The sliding rail 1 has a slide groove

11 extending from one side end of the sliding rail 1 to an opposite side end along an axis of the sliding rail 1, and the fixing element 5 is mounted on one side end of the sliding rail 1. The pulling bar 2 can be fixed on a bottom of a casement 8 of the window. In at least one exemplary, the pulling bar 2 can be fixed on the casement 8 through a screw (not shown). The sliding element 3 can be movably mounted in the sliding groove 11 and slide along the axis of the sliding groove 11.

[0057] The pulling bar 2 can be rotatably connected with the sliding element 3 through the connecting plate 4. The pulling bar 2 can be driven by the sliding element 3 to move relative to the sliding rail 1, and rotate in a chosen direction to achieve an angular movement. An angular between two lines can be changed during the angular movement, and the changing of the angular includes a rotation having a fixed highest point and a changing of an angular without a fixed highest point. In at least one exemplary embodiment, the angular movement can change the angular between the pulling bar 2 and the sliding rail 1 to open or close the window. In at least one exemplary embodiment, the connecting plate 4, the sliding element 3 and the pulling bar 2 can be rotatably connected with each other through rivets.

[0058] Referring to FIGS. 10-11, the sliding element 3 includes a sliding plate 31, a supporter 33 and an elastic element 34. The sliding plate 31 can be mounted in the sliding rail 1 and move relative to the sliding rail 1. The sliding plate 3 defines two

guiding grooves 311 located at two opposite sides of the sliding plate 31 contacting with the sliding rail 1. The guiding grooves 311 can be fitted within the sliding groove 11. A limiting structure 36 and a fixing hole 312 can be formed on the sliding plate 31. The connecting element 4 can be mounted in the fixing hole 312. The supporter 33 can be mounted in the limiting structure 36.

[0059] Referring to FIG. 11, preferably, the supporter 33 can be a post, a cross section of the post can be a convex structure. The supporter 33 can include a first post 331 and a second post 332. The second post 332 can be formed on a middle of the first post 331. The first post 331 can be integrally formed with the second post 332.

10 **[0060]** Referring to FIG. 12, preferably, the elastic element 34 can be a spring, a bottom end of the elastic element 34 can resist on a top surface of the first post 331, and be coiled around the second post 332.

[0061] Referring to FIGS. 13A-13C, the limiting structure 36 can be mounting hole. The mounting hole can include a first mounting hole 361 and a second mounting hole 362. The first mounting hole 361 can extend downwardly from a top surface of the slide plate 31. The second mounting hole 362 can extend upwardly from a bottom surface of the sliding plate 31. The second mounting hole 362 can be connected with the first mounting hole 361. A diameter of the first mounting hole 361 is smaller than a diameter of the second mounting hole 362. The supporter 33 can be received in the

second mounting hole 362 and pass through the first mounting hole 361. The elastic element 34 can be received in the second mounting hole 362.

[0062] When the supporter 33 is mounted in the mounting hole, the first post 331 and the elastic element 34 can be received in the second mounting hole 362, the second
5 post 332 can be received in the first mounting 361, and a top end of the elastic element 34 opposite to the bottom end of the elastic element 34 can resist on a top part of the second mounting hole 362.

[0063] The supporter 33 can be located between the sliding plate 31 and the bottom of the sliding rail 1, and received in the limiting structure 36. The elastic
10 element 34 can be positioned on the supporter 33. When the sliding plate 31 is sliding along the sliding rail 1, the supporter 33 can be driven by the sliding plate 31 to move simultaneously with the sliding plate 31.

[0064] One end of the elastic element 34 can be fixed with the supporter 33, the opposite end of the elastic element 34 can resist on the sliding plate 34, and the elastic
15 element 34 is pressed and in a pressed stage. The sliding plate 1 may be worn when the sliding plate 1 slides on the sliding rail 1 for a long time, such that a thickness of the sliding plate 31 is decreased. The elastic element 34 can support the sliding plate 31 upwardly, even the thickness of the sliding plate 31 is decreased, the elastic element 34 can also support the sliding plate 31 to maintain at a limited maximum height of the

sliding groove 11, such that the sliding plate 31 would not shake in an up-and-down direction and can stably slide along the sliding rail 1.

[0065] In at least one exemplary embodiment, the supporter 33 and the elastic element 34 can be located in the limiting structure 36, such that the supporter 33 and the elastic element 34 can move simultaneously along the sliding plate 31. The two opposite ends of the elastic element 34 can support the sliding plate 31 and the supporter 33 respectively, such that the sliding plate 31 would not shake even when the thickness of the sliding plate 31 is decreased, and the sliding element 3 can move smoothly in the sliding rail 1.

10 **[0066]** In at least on exemplary embodiment, the elastic element 34 can be a stainless steel shrapnel having elastic, the spring, or a plastic shrapnel.

[0067] Referring to FIG.14, the sliding element 3 further includes a sliding cover 32. The sliding cover 32 can be fixed on the sliding plate 31, and resist on the sliding rail 1. The sliding plate 31 defines a first fixing hole 312, the sliding cover 32 also defines a second fixing holes 322. The first fixing hole 312 corresponds to the second fixing holes 322. The connecting element 4 can be located in the first fixing holes 312 and the second fixing holes 322 through a screw or a rivet.

[0068] In at least one exemplary embodiment, the connecting element 4 would not directly contacted with the sliding plate 31 and a horizontal plane of the sliding plate

31 due to the sliding cover 32, such that a friction between edges of the connecting element 4 and the edges of the sliding rail 1 can be decreased. The connecting element 4 and the sliding rail 1 are always made of metal, the friction between metals can produce loud noise, and a resistance between metals is much bigger than a resistance between a metal and a plastic. After the sliding cover 32 is mounted on the sliding plate 31, the connecting element 4 can be directly contacted with the sliding cover 32, the connecting element 4 only rubs against the sliding cover 32, the sliding cover 32 can be made of a plastic, such that a resistance between the sliding cover 32 and the connecting element 4 is much smaller than the resistance between metals.

10 **[0069]** In at least one exemplary embodiment, the sliding cover 32 can form a third mounting hole 321 corresponding to the first mounting hole 361, the third mounting hole 321 and the first mounting hole 361 can have the same diameter. The second post 332 of the supporter 33 can pass through the third mounting hole 321 and the first mounting hole 361 by increasing a height of the second post 332. The supporter 33, the sliding plate 31 and the sliding cover 32 can be fixed along a sliding direction of the sliding element 3 when the second post 332 passes through the third mounting hole 321, and the fixing strength between the sliding cover 32 and the sliding plate 31 can be improved.

[0070] Furthermore, after the sliding cover 32 is mounted on the sliding plate 31,

the sliding cover 32 and two guiding grooves 311 formed on the two opposite edges of the sliding plate 31 can cooperatively form two sliding chutes 37. The sliding chutes 37 can be mounted in the sliding rail 1.

[0071] Furthermore, a height and a width of the sliding chutes 37 can be confirmed according to two extension parts of the two opposite side edges of the sliding rail 1 perpendicular to the axis of the sliding rail 1.

[0072] In at least one exemplary embodiment, the connecting plate 4 can be mounted on the sliding element 3 through the first fixing hole 312 and the second fixing hole 322, and the connecting plate 4 can be connected with the sliding plate 31 and the sliding cover 32 through the first fixing hole 312 and the second fixing hole 322.

[0073] Please referring to FIGS. 15-16 and 17A-17C, in at least one exemplary embodiment, the number of the limiting structure 36 can be two, such that the number of the first mounting hole 361 and the number of the second mounting hole 362 can also be two respectively, and the two first mounting holes 361 can be located on the two opposite sides of the first fixing hole 312, the two second mounting holes 362 can be located on the two opposite sides of the first fixing hole 312. Meanwhile, the supporters 33 and the elastic elements 34 mounted in the limiting structures 36 can be two respectively.

[0074] In at least one exemplary embodiment, the hinge can include a plurality of limiting structures 36.

[0075] Furthermore, please referring to FIGS. 7A-7C, the fixing element 5 can include a first surface 501, a second surface 502 and a third surface 503. The first surface 501 and the second surface 502 cooperatively form a first angle, the third surface 503 can be a horizontal plane and perpendicular to the first surface 501 or the second surface 502. The third surface 503 can form a first lug 51, the bottom of the sliding rail 1 can form a second lug 12. The second lug 12 can be fixed in the first lug 51.

[0076] Two opposite edges of the second lug 12 perpendicular to the axis of the sliding rail 1 can have tangents X, portions of the second lug 12 near the tangents X can form vertical cross sections, the cross sections of the second lug 12 do not have curved edges.

[0077] Please referring to FIG. 6 and comparing to FIG. 2, in at least one exemplary embodiment, the third surface 503 of the fixing element 5 does not form holes, such that a process forming holes can be omitted, and the fixing element 5 can be made easily than the traditional fixing element, and the production efficiency can be improved.

[0078] The tangents X of the second lug 12 can enable the edges of the second lug 12 to form vertical cross sections, rather than curved cross sections, the vertical cross sections of the second lug 12 are in the same plane, such that the fixing strength along the axis of the sliding rail 1 between the fixing element 5 and the sliding rail 1 can be improved. When the fixing element 5 is punched to be mounted on the sliding rail 1, a

shape and a structure of a knife element of a punching machine (not shown) can be adjusted to form the tangents X on the second lug 12. The edges of the knife element can form cutting edges, the cutting edges can cut off the sliding rail 1 during the punching process, forming the vertical cross sections on the second lug 12.

5 **[0079]** Please referring to FIGS. 7C, 8 and 9, a gap 6 can be formed between a protruded top surface of the second lug 12 and the bottom surface of the sliding rail 1. The gap 6 could enhance a fixing strength between the second lug 12 and the edges of the first lug 51, and also bear an expansive force between the second lug 12 and the edges of the first lug 51, such that the hinge is easier to adapt to the environment temperature.

10 **[0080]** Furthermore, the second lug 12 and the first lug 51 can be rectangular block. A dimension of the second lug 12 is smaller than a dimension of the first lug 51.

[0081] Furthermore, please referring to FIG. 18, the pulling bar 2 defines a first end 21. The first end 21 includes a first side and a second side, the first side and the second side can have concave arcs 211 respectively, such that Y formed on the first side
15 or the second side can be defined as a point nearest to the first surface 501 or the second surface 502 than the other points formed on the first end 21. When the pulling bar 2 moves relative to the sliding rail 1 until the window is closed, Y can move towards the first surface 501 or the second surface 502, and Y could not directly contact with the first surface 501 and the second surface 502, such that the other points formed on the first end

21 cannot directly contact with the first surface 501 and the second surface 502. As the first end 21 of the pulling bar 2 cannot directly contact with the fixing element 5, there is no friction existed between the fixing element 5 and the pulling bar 2, and the pulling bar 2 can move smoothly relative to fixing element 5 until the window is closed or opened.

5 **[0082]** In at least one exemplary embodiment, when the pulling bar 2 is forced to move relative to the sliding rail 1 until the window is closed, the pulling bar 2 also rotate in the chosen direction to do the angular movement, meanwhile, the first end 21 of the pulling bar 2 can move towards the fixing element 5. And the first surface 501 and the second surface 502 cooperatively form the first angle, during the movement of the pulling
10 bar 2, the first end 21 can move relative to the first angle and be received in the first angle, and Y cannot directly contact with the fixing element 5, such that the other parts of the pulling bar 2 could not directly contact with the fixing element 5, such that there is no friction existed between the fixing element 5 and the pulling bar 2 during the movement of the pulling bar 2.

15 **[0083]** Furthermore, the first side and the second side formed on the first end 21 of the pulling bar cooperatively form a second angle, the second angle is smaller than the first angle.

[0084] In at least one exemplary embodiment, when the window is closed, the second angle can be located in the first angle, and the second angle must be smaller than

the first angle, such that the first end 21 of the pulling bar 2 can be positioned and received in the first angle of the fixing element 5.

[0085] Furthermore, during the movement of the pulling bar 2, the highest point of the second angle can be a point of the pulling bar 2 closest to the fixing element 5, and
5 the highest point of the second angle would not contact with the fixing element 5.

[0086] In at least one exemplary embodiment, when the pulling bar 2 move towards the fixing element 5 until the window is closed, the highest point of the second angle can also move towards the fixing element 5 until be received in the first angle of the fixing element 5. During the closing process, the pulling bar 2 cannot contact with
10 the fixing element 5, as the pulling bar 2 can move curvilinearly relative to the fixing element 5, the highest point of the second angle cannot contact with the fixing element 5 during the movement of the pulling bar 2, the other points of the pulling bar 2 cannot contact with the fixing element 5.

[0087] In at least one exemplary embodiment, the movement of the pulling bar 2
15 can be affected by the centers, the diameters and the arc lengths of the arcs 211, such that the centers, the diameters and the arc lengths of the arcs 211 should be proper.

[0088] In at least one exemplary embodiment, the movement of the first end 21 of the pulling bar 2 relative to the sliding rail 1 can be fixed after a dimension of the connecting plate 4 and a fixing position of the connecting plate 4 located on the pulling

bar 2 are fixed. The movement of the pulling bar 2 relative to the sliding rail 1 near the fixing element 5 is similar to a straight line movement. A dimension and a shape of the pulling bar 2 should be confirmed, such that dimensions and shapes of the first surface 501 and the second surface 502 of the fixing element 5 can be confirmed according to the pulling bar 2, and vice versa.

[0089] Here, it is assumed that lengths of the first surface 501 and the second surface 502 are confirmed, and a degree of the first angle between the first surface 501 and the second surface 502 is fixed, in at least one exemplary embodiment, the degree of the angle can be 120° , such that when the window is closed, no matter what the length of the pulling bar 2, a theoretical point can be formed on the pulling bar 2 during the closing movement, and the movement of the theoretical point can be located on the first surface 501 and the second surface 502 of the fixing element 5. The theoretical point can be assumed as Y, Y should be a point nearest to the fixing element 5 during the movement of the pulling bar 2. In at least one exemplary embodiment, Y can be formed on the arcs 211. Particularly, arcs 211 can begin from Y, distances between the other points on the arcs 211 and the fixing element 5 are all longer than a distance between Y and the fixing element 5. The arcs 211 can extend to two opposite edges of the pulling bar 2 respectively.

[0090] A flowchart is presented according to an exemplary embodiment. The

method is provided by way of example, as there are a variety of ways to carry out the method. The method described below can be carried out using the configurations illustrated in FIG. 19, for example, and various elements of the figures are referenced in explaining method. Each block shown in FIG. 19 represents one or more process,
5 methods or subroutines, carried out in the method. Furthermore, the order of blocks is illustrative only and the blocks can change according to the present disclosure. Additional blocks can be added or fewer blocks can be utilized, without departing from this disclosure. The method for making the hinge can begin at block 1901.

[0091] At block 1901, the fixing element 5 and the sliding rail 1 are made
10 respectively.

[0092] At block 1902, the fixing element 5 can be inserted in a sliding groove 11 of the sliding rail 1.

[0093] At block 1903, the sliding rail 1 can be laid face down on a punching machine, the punching machine can have a knife element.

15 **[0094]** At block 1904, the knife element can be punched down at a chosen position to form a punching groove 13.

[0095] The punching groove 13 can be formed by the punching process, and a first lug 51 can be formed on the fixing element 5 and a second lug 12 can be formed on the sliding rail 1 by the punching process, the first lug 51 and the second lug 12 both

corresponds to the punching groove 13. The first lug 51 and the second lug 12 can be formed on the opposite side of the punching groove 13. The second lug 12 can be mounted in the first lug 51.

[0096] The fixing element 5 can include a first surface 501, a second surface 502 and a third surface 503. The first surface 501 and the second surface 502 can cooperatively form a first angle, the first surface 501 and the second surface 502 can be vertical planes, the third surface 503 can be horizontal planes perpendicular to the first surface 501 and the second surface 502.

[0097] Two opposite edges of the knife element perpendicular to the sliding rail 1 can have cutting edges, the cutting edges can enable the edges of the punching groove 13 to form tangents X, such that edges of the punching groove 13 can form vertical cross sections, the cross sections of the punching groove 13 do not have curved edges.

[0098] In at least one exemplary embodiment, the fixing element 5 can be perpendicularly fixed in the sliding groove 11 and partly received in the sliding groove 11, such that the fixing element 5 cannot shake in the sliding groove 11.

[0099] In at least one exemplary embodiment, the cross sections of the second lug 12 can prevent the sliding rail 1 from moving along an axis of the sliding rail 1, such that the sliding rail 1 would not shake.

[00100] In at least one exemplary embodiment, the cutting edges of the knife

element can be formed on the two opposite edges of the knife element. The cutting edges are taller than a horizontal plane of the knife element, the taller parts of the cutting edges cannot be thicker than a thickness of the bottom of the sliding rail 1. The cutting edges can cut the bottom of the sliding rail 1 when the knife element is punched down on the sliding rail 1 during the punching process, forming the tangents X; the knife element is continue to be punched down on the sliding rail 1, the portions of the sliding rail 1 between the tangents X can be deformed due to the knife element, forming the first lug 51, the second lug 12 and the punching groove 13.

[00101] Furthermore, referring to FIG. 6C, a gap 8 can be located between a punching plane of the punching groove 13 and a bottom of the sliding rail 1.

[00102] In at least one exemplary embodiment, the gap 8 can be formed by a further punching process after the tangents are formed. The gap 8 can ensure that the hinge can be adapted to different ambient temperatures.

[00103] At block 1905, the sliding element 3 is provided, and can be movably mounted on the sliding rail 1.

[00104] At block 1906, the pulling bar 2 is provided, and mounted on the sliding element 3.

[00105] Referring to FIG. 20 and FIG. 2, the window includes the hinge, the pulling bar 2 can be fixed on a bottom of the casement 8, the sliding rail 1 can be fixed on

a bottom of the frame 7. The connecting plate 4 can be located between the sliding rail 1 and the pulling bar 2.

[00106] When user pushes the casement 8 to open the window, the sliding element 3 can move in the sliding rail 1 along an axis of the sliding rail 1. When user pulls the casement 8 to close the window, the sliding element 3 can move back along the sliding rail 1.

[00107] When mounting the window, firstly, the sliding rail 1 can be fixed on the bottom of the frame 7, the fixing element 5 can be located at a corner of the frame 7. Then, the pulling bar 2 can be mounted on the bottom of the casement 8. When user pushes the window to open the window, the casement 8 and the pulling bar 2 can be driven to move, such that the pulling bar 2 and the frame 7 can cooperatively form an angle, when the casement 8 moves to a suitable position, user can stop pushing the window. When user pulls the window to open the window, the casement 8 and the pulling bar 2 can be driven to move back, the angle between the pulling bar 2 and the frame 7 can be decreased, such that the window can be closed.

[00108] The pulling bar 2 can be received in the first angle of the fixing element 5 when the window is closed.

[00109] The sliding element 3 can slide along the sliding rail 1 during the closing or the opening process, and the friction between the sliding element 3 and the connecting

plate 4 can be a friction between a metal and a plastic, compared with the friction between metals, the sliding element 3 and the connecting plate 4 can have a higher wear-resistance, and would not produce loud, shrill noise.

[00110] Furthermore, the elastic element 34 can be located between the sliding
5 element 3 and the sliding rail 1. The sliding element 3 may be worn, the elastic element 34 can support the sliding element 3, such that the sliding element 3 would not shake in the sliding rail at the up-and-down direction.

[00111] The tangents X of the second lug 12 enable the portions of the second lug
12 near the tangents X to form vertical cross sections, the cross sections of the second lug
10 12 can be mounted in the first lug 51 of the fixing element 5. The fixing element 5 can be firmly mounted in the sliding rail 1 due to the vertical cross sections of the second lug 12, and the fixing element 5 would not shake in the sliding rail 1.

[00112] Although the features and elements of the present disclosure are
described as embodiments in particular combinations, each feature or element can be
15 used alone or in other various combinations within the principles of the present disclosure to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.

CLAIMS

What is claimed is:

1. A hinge for a window, comprising,

a sliding rail fixed on a frame of the window;

5 a sliding element movably mounted in the sliding rail;

a pulling bar fixed on a casement of the window, the pulling bar being driven by the sliding element to move relative to the sliding rail and rotate in a direction to do an angular movement;

a connecting plate, the pulling bar being connected with the sliding element through
10 the connecting plate; and

a fixing element mounted on an end of the sliding rail, when the window being closed, a first end of the pulling bar being received in the fixing element, the fixing element including a first surface, a second surface and a third surface, the first surface and the second surface cooperatively forming a first angle, the third surface being a
15 horizontal plane and perpendicular to the first surface or the second surface, the third surface defining a first lug, the sliding rail defining a second lug, the second lug being mounted in the first lug.

2. The hinge for a window of claim 1, wherein a gap is existed between a horizontal plane of the second lug and a bottom of the sliding rail.

3. The hinge for a window of claim 1, wherein edges of the second lug perpendicular to an axis of the sliding rail have tangents, forming vertical cross sections on the edges of the second lug, a fixing strength between the fixing element and the sliding rail along the axis of the sliding rail is improved by the cross sections of the second lug.
- 5 4. The hinge for a window of claim 1, wherein the first end of the pulling bar received the fixing element has a first side and a second side, the first side and the second side cooperatively form a second angle, the second angle is smaller than the first angle.
5. The hinge for a window of claim 4, wherein the highest point of the second angle is nearest to the fixing element than the other points of the pulling bar during the movement
- 10 of the pulling bar, and the highest point of the second angle does not contact with the fixing element.
6. The hinge for a window of claim 3, wherein the first side and the second side has concave arcs.
7. The hinge for a window of claim 2, wherein the sliding element comprises a sliding
- 15 plate movably mounted in the sliding rail, a sliding plate movably mounted in the sliding rail, a supporter located between the sliding plate and the bottom of the sliding rail, an elastic element mounted between the supporter and the sliding plate and a sliding cover, the sliding plate, the sliding cover and the supporter move simultaneously, the sliding element moves smoothly in the sliding rail, the sliding cover covers the sliding rail, the

sliding plate has a first fixing hole, and the sliding cover has a second fixing hole corresponding to the first fixing hole, the connecting element is connected with the sliding cover and the sliding plate through the first fixing hole and the second fixing hole.

8. A window, comprising:

5 a frame, a casement and a hinge used to open or close the casement, the hinge including:

a sliding rail fixed on a frame of the window;

a sliding element movably mounted in the sliding rail;

a pulling bar fixed on a casement of the window, the pulling bar being driven by the
10 sliding element to move relative to the sliding rail and rotate in a direction to do an angular movement;

a connecting plate, the pulling bar being connected with the sliding element through the connecting plate; and

a fixing element mounted on an end of the sliding rail, when the window being
15 closed, a first end of the pulling bar being received in the fixing element, the fixing element including a first surface, a second surface and a third surface, the first surface and the second surface cooperatively forming a first angle, the third surface being a horizontal plane and perpendicular to the first surface or the second surface, the third surface defining a first lug, the sliding rail defining a second lug, the second lug being
20 mounted in the first lug.

9. The window of claim 8, wherein a gap is existed between a horizontal plane of the second lug and a bottom of the sliding rail.
10. The window of claim 8, wherein edges of the second lug perpendicular to an axis of the sliding rail have tangents, forming vertical cross sections on the edges of the second
5 lug, a fixing strength between the fixing element and the and sliding rail along the axis of the sliding rail is improved by the cross sections of the second lug.
11. The window of claim 8, wherein the first end of the pulling bar resisting the fixing element has a first side and a second side, the first side and the second side cooperatively form a second angle, the second angle is smaller than the first angle.
- 10 12. The window of claim 11, wherein the highest point of the second angle is nearest to the fixing element than the other points of the pulling bar during the movement of the pulling bar, and the highest point of the second angle does not contact with the fixing element.
13. The window of claim 11, wherein the first side and the second side have concave
15 arcs.
14. The window of claim 9, wherein the sliding element comprises a sliding plate movably mounted in the sliding rail, a sliding plate movably mounted in the sliding rail, a supporter located between the sliding plate and the bottom of the sliding rail, an elastic element mounted between the supporter and the sliding plate and a sliding cover, the

sliding plate, the sliding cover and the supporter move simultaneously, the sliding element moves smoothly in the sliding rail, the sliding cover covers the sliding rail, the sliding plate has a first fixing hole, and the sliding cover has a second fixing hole corresponding to the first fixing hole, the connecting element is connected with the sliding cover and the sliding plate through the first fixing hole and the second fixing hole.

15. A method for making the hinge of a window, comprising:

preparing a fixing element and a sliding rail;

inserting the fixing element into a sliding groove of the sliding rail;

laying the sliding rail face down on a punching machine, the punching machine having a knife element;

forming a punching groove by the knife element through a punching process, forming a first lug on the fixing element by the punching process, and forming a second lug on the sliding rail by the punching process, the first lug and the second lug being formed on the opposite side of the punching groove, the second lug being mounted in the first lug;

preparing a sliding element, mounting the sliding element movably on the sliding element; and

preparing a pulling bar, fixing the pulling bar on the sliding element, wherein edges of the knife element perpendicular to an axis of the sliding rail have cutting edges, edges

of the second lug form tangents by the cutting edges of the knife element, such that portions of the second lug near the tangents form vertical cross sections.

16. The method for making the hinge of claim 15, wherein a gap is existed between a surface of the second lug and a bottom of the sliding rail.

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