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(54) HINGE PROVIDING CUSHIONING EFFECT AND APPARATUS PROVIDED WITH THE HINGE

(57) A hinge providing a cushioning effect, comprising a first component (12), a second component (14), a main spring (16), a connecting piece (18), a damper component (20), a connecting component (22), and a locking spring (24). The second component (14) is pivotally connected to the first component (12) and is fixedly connected to a main body. The main spring (16) is connected to the connecting piece (18) arranged within the first component (12) and to the first component (12). The connecting piece (18) is connected to the main spring (16) and to the second component (14). The damper component (20) comprises a damper body (200), a telescoping rod (202), a return spring (204), a limiting piece (206), and a third rotary shaft (208).

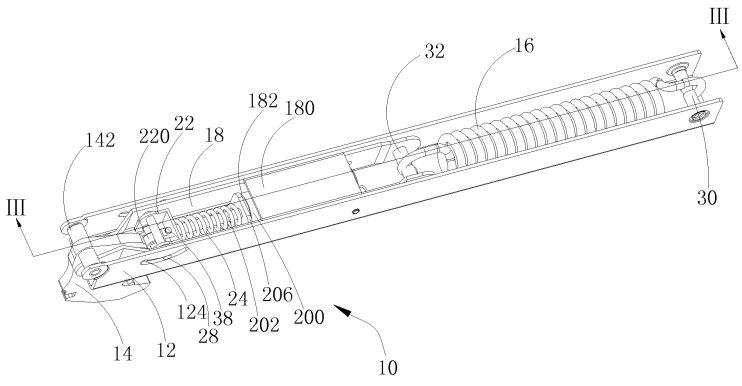

Fig. 1

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Description

FIELD

[0001] The present disclosure relates to a hinge, and particularly to a hinge having a buffering effect and a device having the hinge.

BACKGROUND

[0002] A hinge applied to a drop-down door of an oven at present does not have an effect of a door self-closing. That is, a manipulator is required to push or pull the door hard in whole processes of opening and closing the door, thus resulting in a poor door-closing experience.

SUMMARY

[0003] The present disclosure aims to implement a solution of a hinge of an oven having a good performance, so as to improve at least one of using effects of the hinge in the related art. Thus, the present disclosure intends to provide the hinge, which may close a door body relying on an elastic force of the hinge when the door body is closed to a certain degree, and may also achieve an automatic closing process in a gentle and noise-free manner through a damper.

[0004] The present disclosure is to propose a device having the hinge further.

[0005] The hinge having a buffering effect according to a preferable embodiment of a first aspect of the present disclosure includes a first assembly, a second assembly, a main spring, a connecting piece, a damper assembly, a connecting assembly and a locking spring. The first assembly and the second assembly are configured to be fixed to a device body and a drop-down door respectively and rotatably connected by means of a first rotary shaft, so that the drop-down door is configured to be rotatably pulled downwards with respect to the device body. The first assembly is configured to be a rectangular casing and includes a first end rotatably connected with the second assembly and a second end opposite to the first end. The first assembly has a first guiding groove adjacent to the first end, and the second assembly is provided with a cam portion. The main spring is disposed in the first assembly and a first end of the main spring is fixedly connected with the second end of the first assembly. The connecting piece is disposed in the first assembly, and the connecting piece is connected with a second end of the main spring and rotatably connected with the second assembly by means of a second rotary shaft. The connecting piece is provided with an upper cover so as to be fitted with the first assembly to form a cavity, and the connecting piece has a second guiding groove. The damper assembly includes a damper body, an extending and retracting rod, a return spring, a position limiting piece and a third rotary shaft. The damper body is located in the cavity and has a third guiding groove. The extending and retracting rod extends from the damper body towards the second assembly. The return spring is fitted over the extending and retracting rod and disposed in the damper body. The position limiting piece is fixed in the first assembly, and the position limiting piece is penetrated by the extending and retracting rod. The third rotary shaft connects the damper body with the connecting piece. The third rotary shaft is rotatably and slidably disposed in the second guiding groove and the third guiding groove. The connecting assembly is disposed between the second assembly and the extending and retracting rod. The connecting assembly is fixedly connected with the extending and retracting rod. The connecting assembly is connected with the connecting piece by means of a fourth rotary shaft. The fourth rotary shaft is rotatably and slidably disposed in the first guiding groove. The connecting assembly includes a driven pulley. The locking spring is fitted over the extending and retracting rod and disposed between the position limiting piece and the connecting assembly so as to allow the driven pulley to keep rotatable contact with the cam portion. The cam portion has a balanced stage, a critical stage and a buffered-closing stage in a rotation process of the second assembly from a position where a largest opening angle is formed between the first assembly and the second assembly to the first assembly, in which the cam portion is successively fitted with the driven pulley in these stages. In the balanced stage, the locking spring is in a compressed state and changes to a reset state, the return spring is in a natural state, the damper body is motionless in the cavity, the main spring is in a stretched state and changes to a reset state, and a tensioning force produced by the main spring is balanced with a load weight of the hinge. In the critical stage, the locking spring is in the compressed state and changes to the reset state, the return spring is in the natural state, the damper body slides in the cavity in a direction towards the second end, the main spring is in the stretched state, and the tensioning force produced by the main spring is larger than the load weight of the hinge. In the buffered-closing stage, the locking spring is in the compressed state and changes to the reset state, the return spring is in the natural state, the extending and retracting rod is retracted into the damper body, the main spring is in the stretched state and changes to the reset state, the tensioning force produced by the main spring is larger than the load weight of the hinge and the damper body has a reverse buffering effect.

[0006] In the hinge according to embodiments of the present disclosure, as the main spring is adopted, a weight of the drop-down door may be balanced when the drop-down door is pulled downwards, thus realizing effects of stable opening and stable closing. In addition, as the locking spring and the damper assembly are adopted, the drop-down door may be closed automatically and slowly, thus improving a using experience of a user.

[0007] In some embodiments, the first assembly includes a bottom plate and side walls extending upwards

from two sides of the bottom plate. The first guiding groove is formed in each of the two side walls and has an arc shape.

[0008] In some embodiments, the connecting piece includes two side sheets tightly attached to the side walls respectively and the upper cover joint to the two side sheets.

[0009] In some embodiments, the cavity has a rectangular shape, the damper body has a cylindrical shape, and shapes of the damper body and the cavity are matched with each other so as to allow the damper body to slide in the cavity.

[0010] In some embodiments, the position limiting piece has an L shape and includes a bottom sheet fixedly connected with the bottom plate and a blocking sheet extending upwards from the bottom sheet, and the blocking sheet is penetrated by the extending and retracting rod.

[0011] In some embodiments, the connecting assembly includes a connecting body fixedly connected with the extending and retracting rod and the driven pulley disposed to the connecting body. The connecting body and the connecting piece are connected by means of the fourth rotary shaft slidably disposed in the first guiding groove. The connecting body is provided with a fixed shaft, the driven pulley has an annular shape and is fitted over the fixed shaft, and the driven pulley keeps being rotatably connected with the cam portion.

[0012] In some embodiments, corresponding to the balanced stage, the drop-down door is configured to rotate by an angle of 50°-70°.

[0013] In some embodiments, corresponding to the critical stage, the drop-down door is configured to rotate by an angle of 10°-15°.

[0014] In some embodiments, corresponding to the buffered-closing stage, the drop-down door is configured to rotate by an angle of 10°-25°.

[0015] A device according to a preferable embodiment of a second aspect of the present disclosure includes a device body, a drop-down door and a hinge configured for the device according to the above embodiments.

[0016] In the device according to embodiments of the present disclosure, as the main spring is adopted, a weight of the drop-down door may be balanced when the drop-down door is pulled downwards, thus realizing effects of stable opening and stable closing. In addition, as the locking spring and the damper assembly are adopted, the drop-down door may be closed automatically and slowly, thus improving a using experience of a user.

[0017] Additional aspects and advantages of embodiments of present disclosure will be given in part in the following descriptions, become apparent in part from the following descriptions, or be learned from the practice of the embodiments of the present disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] These and other aspects and advantages of embodiments of the present disclosure will become apparent and readily appreciated from descriptions made with reference to the following drawings.

Fig. 1 is a perspective view of a hinge having a buffering effect according to an embodiment of the present disclosure.

Fig. 2 is an exploded view of a hinge having a buffering effect according to an embodiment of the present disclosure.

Fig. 3 is a sectional view of the hinge having the buffering effect in Fig. 1 along line III-III.

Fig. 4 is a perspective view of a first assembly of a hinge having a buffering effect according to an embodiment of the present disclosure.

Fig. 5 is a perspective view of a stepped piece of a hinge having a buffering effect according to an embodiment of the present disclosure.

Fig. 6 is a perspective view of a connecting piece of a hinge having a buffering effect according to an embodiment of the present disclosure.

Fig. 7 is a perspective view of a connecting body of a hinge having a buffering effect according to an embodiment of the present disclosure.

DETAILED DESCRIPTION

[0019] Embodiments of the present disclosure will be described in detail and examples of the embodiments will be illustrated in the drawings, where same or similar reference numerals are used to indicate same or similar members or members with same or similar functions. The embodiments described herein with reference to drawings are explanatory, illustrative, and used to generally understand the present disclosure. The embodiments shall not be construed to limit the present disclosure.

[0020] In the specification, it is to be understood that terms such as "central," "longitudinal," "lateral," "length," "width," "thickness," "upper," "lower," "front," "rear," "left," "right," "vertical," "horizontal," "top," "bottom," "inner," "outer," "clockwise," and "counterclockwise" should be construed to refer to the orientation as then described or as shown in the drawings under discussion. These relative terms are for convenience of description and do not require that the present disclosure be constructed or operated in a particular orientation. In addition, terms such as "first" and "second" are used herein for purposes of description and are not intended to indicate or imply relative importance or significance or to imply the number of indicated technical features. Thus, the feature defined with "first" and "second" may comprise one or more of this feature. In the description of the present disclosure, "a plurality of' means two or more than two, unless specified otherwise.

[0021] In the present specification, unless specified and defined otherwise, it is to be illustrated that the terms "mounted," "connected," "coupled" and the like are used broadly, and may be, for example, fixed connections, de-

tachable connections, or integral connections; may also be mechanical or electrical connections; may also be direct connections or indirect connections via intervening structures; may also be inner communications or interaction relation of two elements, which can be understood by those skilled in the art according to specific situations.

[0022] In the present disclosure, unless specified or limited otherwise, a structure in which a first feature is "on" or "below" a second feature may include an embodiment in which the first feature is in direct contact with the second feature, and may also include an embodiment in which the first feature and the second feature are not in direct contact with each other, but are contacted via an additional feature formed therebetween. Furthermore, a first feature "on," "above," or "on top of' a second feature may include an embodiment in which the first feature is right or obliquely "on," "above," or "on top of' the second feature, or just means that the first feature is at a height higher than that of the second feature; while a first feature "below," "under," or "on bottom of' a second feature may include an embodiment in which the first feature is right or obliquely "below," "under," or "on bottom of' the second feature, or just means that the first feature is at a height lower than that of the second feature.

[0023] Various embodiments and examples are provided in the following description to implement different structures of the present disclosure. In order to simplify the present disclosure, certain elements and settings will be described. However, these elements and settings are only by way of example and are not intended to limit the present disclosure. In addition, reference numerals may be repeated in different examples in the present disclosure. This repeating is for the purpose of simplification and clarity and does not refer to relations between different embodiments and/or settings. Furthermore, examples of different processes and materials are provided in the present disclosure. However, it would be appreciated by those skilled in the art that other processes and/or materials may be also applied.

[0024] Referring to Fig. 1 to Fig. 3, a hinge 10 having a buffering effect according to a preferable embodiment of the present disclosure includes a first assembly 12, a second assembly 14, a main spring 16, a connecting piece 18, a damper assembly 20, a connecting assembly 22 and a locking spring 24. The first assembly 12 and the second assembly 14 are configured to be fixed to a device body and a drop-down door respectively and are rotatably connected by means of a first rotary shaft 142, so that the drop-down door may be rotatably pulled downwards with respect to the device body. The first assembly 12 is configured to be a rectangular casing and includes a first end 120 rotatably connected with the second assembly 14 and a second end 122 opposite to the first end 120. The first assembly 12 is provided with a first guiding groove 124 adjacent to the first end 120, and the second assembly 14 includes a cam portion 140. The main spring 16 is disposed in the first assembly 12 and has a first end fixedly connected with the second end 122. The connecting piece 18 is disposed in the first assembly 12. The connecting piece 18 is connected with a second end of the main spring 16 and further rotatably connected with the second assembly 14 by means of a second rotary shaft 26. The connecting piece 18 is provided with an upper cover 180 so as to be fitted with the first assembly 12 to form a cavity 182, and the connecting piece 18 is provided with a second guiding groove 184. The damper assembly 20 includes a damper body 200, an extending and retracting rod 202, a return spring 204, a position limiting piece 206 and a third rotary shaft 208. The damper body 200 is located in the cavity 182 and provided with a third guiding groove 20a. The extending and retracting rod 202 extends from the damper body 200 towards the second assembly 14. The return spring 204 is fitted over the extending and retracting rod 202 and disposed in the damper body 200. The position limiting piece 206 is fixed in the first assembly 12, and the position limiting piece 206 is penetrated by the extending and retracting rod 202. The third rotary shaft 208 connects the damper body 200 with the connecting piece 18. The third rotary shaft 208 is rotatably and slidably disposed in the second guiding groove 184 and the third guiding groove 20a. The connecting assembly 22 is disposed between the second assembly 14 and the extending and retracting rod 202. The connecting assembly 22 is fixedly connected with the extending and retracting rod 202. The connecting assembly 22 is connected with the connecting piece 18 by means of a fourth rotary shaft 28. The fourth rotary shaft 28 is rotatably and slidably disposed in the first guiding groove 124. The connecting assembly 22 includes a driven pulley 220. The locking spring 24 is fitted over the extending and retracting rod 202 and disposed between the position limiting piece 206 and the connecting assembly 22, so that the driven pulley 220 may keep rotatable contact with the cam portion 140. The cam portion 140 has a balanced stage, a critical stage and a buffered-closing stage in a rotation process of the second assembly 14 from a position where a largest opening angle is formed between the first assembly 12 and the second assembly 14 to the first assembly 12, and the cam portion 140 is successively fitted with the driven pulley 220 in these stages. In the balanced stage, the locking spring 24 is in a compressed state and changes to a reset state, the return spring 204 is in a natural state, the damper body 200 is motionless in the cavity 182, the main spring 16 is in a stretched state and changes to a reset state, and a tensioning force produced by the main spring 16 is balanced with a load weight of the hinge 10. In the critical stage, the locking spring 24 is in the compressed state and changes to the reset state, the return spring 204 is in the natural state, the damper body 200 slides in the cavity 182 in a direction towards the second end 122, the main spring 16 is in the stretched state, and the tensioning force produced by the main spring 16 is larger than the load weight of the hinge 10. In the buffered-closing stage, the locking spring 24 is in the compressed state and changes to the reset state, the return spring

204 is in the natural state, the extending and retracting rod 202 is retracted into the damper body 200, the main spring 16 is in the stretched state and changes to the reset state, the tensioning force produced by the main spring 16 is larger than the load weight of the hinge 10 and the damper body 200 has a reverse buffering effect.

[0025] In the hinge according to preferable embodiments of the present disclosure, as the main spring 16 is adopted, it is possible to balance a weight of the drop-down door when pulling the drop-down door downwards, thus realizing stable opening and stable closing. In addition, as the locking spring 24 and the damper assembly 20 are adopted, the drop-down door may be closed automatically and slowly, thus improving a using experience of a user.

[0026] Referring to Fig. 4, in the present embodiment, the first assembly 12 has a substantially rectangular shape. The first assembly 12 includes the first end 120 and the second end 122 opposite to the first end 120. The first assembly 12 further includes a bottom plate 126 and side walls 128 extending upwards from two sides of the bottom plate 126 respectively. The first guiding groove 124 is formed in each of the two side walls 128 and has an arc shape, and extends substantially along a length direction of the first assembly 12. The first guiding groove 124 includes a first end point 1240 and a second end point 1242 opposite to the first end point 1240.

[0027] Thus, it is possible to coordinate a moving track of the connecting assembly 22 by adopting the arc-shaped first guiding groove 124.

[0028] Referring to Fig. 5, specifically, the main spring 16, the connecting piece 18, the damper assembly 20, the connecting assembly 22 and the locking spring 24 are accommodated in the first assembly 12. The first assembly 12 has a groove 128a in the bottom plate 126 adjacent to the first end 120, and the groove 128a is parallel with an axial direction of the first assembly 12. The groove 128a has a U shape. The first assembly 12 and the second assembly 14 are connected by means of the first rotary shaft 142 at the first end 120. The first assembly 12 is configured to rotate relative to the second assembly 14 around the first rotary shaft 142 and also to drive the connecting piece 18 to move synchronously. The second assembly 14 is configured to swing in the groove 128a relative to the first assembly 12. The first assembly 12 is connected with a fifth rotary shaft 30 at the second end 122, and the fifth rotary shaft 30 is parallel with the first rotary shaft 142. A tail end of the connecting piece 18 away from the first end 120 is connected with a connecting shaft 32 parallel with the fifth rotary shaft 30. The main spring 16 is connected with the fifth rotary shaft 30 and the connecting shaft 32. The second assembly 14 is connected to a stepped piece 36 by means of a sixth rotary shaft 34 parallel with the second rotary shaft 26. The stepped piece 36 includes a fifth side 360 and a sixth side 362 opposite to the fifth side 360. The second assembly 14 is located between the fifth side 360 and the sixth side 362. The sixth rotary shaft 34 passes through the fifth side 360 and the sixth side 362 to be connected with the second assembly 14. The fifth side 360 and the sixth side 362 are connected and joint by means of a first step surface 364. Above the first step surface 364, the fifth side 360 and the sixth side 362 are connected and joint by means of a second step surface 366. The stepped piece 36 has a U shape, and the first step surface 364 and the second step surface 366 forms a stepped shape. The first step surface 364 is configured to be wedged in the groove 128a, and the second step surface 366 is configured to abut against the bottom plate 126 of the first assembly 12.

[0029] Referring to Fig. 6, in the present embodiment, the connecting piece 18 is accommodated in the first assembly 12 and includes two side sheets 186 and the upper cover 180 jointed to the two side sheets 186. The two side sheets 186 are tightly attached to the two side walls 128 of the first assembly 12 respectively. The upper cover 180 is parallel with the bottom plate 126 of the first assembly 12, the upper cover 180 is fitted with the first assembly 12 to form the cavity 182, and the damper body 200 is configured to slide in the cavity 182. The second assembly 14 is configured to have a sheet shape, located in the connecting piece 18, and extends into the groove 128a. The connecting piece 18 and the second assembly 14 are connected by means of the second rotary shaft 26 parallel with the first rotary shaft 142. The connecting piece 18 connects the main spring 16 with the second assembly 14, and a connecting point of the connecting piece 18 and the second assembly 14 deviates from the first rotary shaft 142 of the second assembly 14, so that the second assembly 14 may drive the connecting piece 18 to move when the second assembly 14 rotates relative to the first assembly 12, so as to stretch the main spring 16.

[0030] Thus, the connecting piece 18 provided with the upper cover 180 performs a position limitation to the damper body 200.

[0031] In the present embodiment, the cavity 180 has a rectangular shape, the damper body 200 has a cylindrical shape, and shapes of the damper body 200 and the cavity 182 are matched with each other so as to enable the damper body 200 to slide in the cavity 182.

[0032] In the present embodiment, the position limiting piece 206 has an L shape and includes a bottom sheet 206a fixedly connected with the bottom plate 126 and a blocking sheet 206b extending upwards from the bottom sheet 206a, and the blocking sheet 206b is penetrated by the extending and retracting rod 202.

[0033] Thus, the position limiting piece 206 performs a position limitation to the damper body 200. The connecting piece 18, the position limiting piece 206 and the third rotary shaft 208 cooperate to define a moving range of the damper body 200, thus proving a simple structure and convenient assembling and disassembling.

[0034] Specifically, the connecting piece 18, the position limiting piece 206 and the third rotary shaft 208 disposed in the second guiding groove 184 and the third

guiding groove 20a define a sliding travel of the damper body 200. A position limitation of the damper body 200 is performed by means of the connecting piece 18, the position limiting piece 206 and the third rotary shaft 208. The damper body 200 is configured to move in an axial length range of the third guiding groove 20a in a linear and reciprocating manner. When the drop-down door is opened to a largest angle, the third rotary shaft 208 is located at a rightmost end of the third guiding groove 20a. The extending and retracting rod 202 extends from the damper body 200, and a tail end of the extending and retracting rod 202 is fixed with the connecting assembly 22 by means of a threaded pin 38. The damper body 200 is configured as a hydraulic damper.

[0035] Referring to Fig. 7, in the present embodiment, the connecting assembly 22 includes a connecting body 222 and the driven pulley 220 disposed to the connecting body 222, and the connecting body 222 is fixedly connected with the extending and retracting rod 202. The connecting body 222 and the connecting piece 18 are connected by means of the fourth rotary shaft 28 slidably disposed in the first guiding groove 124. The connecting body 222 is provided with a fixed shaft 2220, the driven pulley 220 has an annular shape and is fitted over the fixed shaft 2220, and the driven pulley 220 keeps contacting the cam portion 140. The driven pulley 220 may rotate with treating the fourth rotary shaft 28 as its axis, and thus it is guaranteed that the driven pulley 220 keeps contacting the cam portion 140 constantly. The connecting body 222 includes a third side 2222, a fourth side 2224 opposite to the third side 2222, and a blocking surface 2226 perpendicular to the third side 2222 and the fourth side 2224 and located between the third side 2222 and the fourth side 2224. The fixed shaft 2220 is formed between the third side 2222 and the fourth side 2224. The blocking surface 2226 has a hole 2228 in a center thereof, and the hole 2228 is configured to be fitted with the extending and retracting rod 202. The extending and retracting rod 202 rightly passes through the hole 2228, and the threaded pin 38 mounted to the extending and retracting rod 202 blocks the blocking surface 2226. The connecting body 222 is formed integrally, and the cam portion 140 has concave and convex portions having various contacts with the driven pulley 220.

[0036] Accordingly, the connecting piece 18 and the connecting assembly 22 are connected by means of the fourth rotary shaft 28 and the fourth rotary shaft 28 is slidably disposed in the first guiding groove 124. The connecting piece 18 drives the fourth rotary shaft 28 to slide in the first guiding groove 124.

[0037] The first assembly 12 is disposed to the drop-down door, and the second assembly 14 is disposed to the device body. When the hinge 10 operates, a position of the second assembly 14 is constant, and the first assembly 12 may rotate around the first rotary shaft 142 by a certain angle and drive the connecting piece 18 connected to the second assembly 14 to move synchronously, so that the main spring 16 connected to the connecting piece 18 may be stretched. Under actions of the main spring 16 and the damper assembly 20, the drop-down door may be closed automatically and slowly.

[0038] Specifically, the balanced stage represents that the hinge 10 transfers from a position n1 to a position n2, the critical stage represents that the hinge 10 transfers from the position n2 to a position n3, and the buffered-closing stage represents that the hinge 10 transfers from the position n3 to a position n4. When the second assembly 14 is located at the position n1 with respect to the first assembly 12, the hinge 10 has the largest opening angle, and the drop-down door is opened to the largest angle. When the second assembly 14 is located at the position n4 with respect to the first assembly 12, the hinge 10 has a smallest opening angle and a door body is in a closed state.

[0039] When the second assembly 14 is located at the position n1 with respect to the first assembly 12, the connecting piece 18 drives the fourth rotary shaft 28 to reach the first end point 1240, the third rotary shaft 208 is located at a right end of the third guiding groove 20a, the main spring 16 is stretched by the connecting piece 18 so as to be in the stretched state, and the tensioning force of the main spring 16 is balanced with the load weight of the hinge 10. When the hinge 10 operates in an angle a, i.e. in the balanced stage from the position n1 to the position n2, as the tensioning force of the main spring 16 is balanced with the load weight of the hinge 10, the drop-down door may be motionless at any position in this range, in which case an external force of human is required for closing the drop-down door.

[0040] When the second assembly 14 is located at the position n2 with respect to the first assembly 12, the tensioning force of the main spring 16 is larger than the load weight of the hinge 10. When the hinge 10 operates in an angle b, i.e. in the critical stage from the position n2 to the position n3, the connecting piece 18 connected with the main spring 16 slides in a direction towards the main spring 16, and hence the damper body 200 slides, so that the third rotary shaft 208 slides towards a leftmost end of the third guiding groove 20a, i.e. the hinge 10 may automatically drive the drop-down door to rotate rapidly in a closing direction, in which case the drop-down door may be closed automatically without the external force.

[0041] When the second assembly 14 is located at the position n3 with respect to the first assembly 12, the tensioning force of the main spring 16 is larger than the load weight of the hinge 10, the third rotary shaft 208 is located at the leftmost end of the third guiding groove 20a, and the return spring 204 restores to the natural state from the compressed state. When the hinge 10 operates in an angle c, i.e. in the buffered-closing stage from the position n3 to the position n4, the connecting piece 18 connected with the main spring 16 continues sliding in the direction towards the main spring 16, the extending and retracting rod 202 starts to be retracted into the damper body 200, and hence the damper body 200 generates a reverse buffering force, so as to slow down a rotation speed of

the door body driven by the hinge 10, so that the drop-down door rotates in a slow and uniform speed, in which case the drop-down door may be closed automatically in a gentle manner, instead of being rebounded rapidly.

[0042] When the second assembly 14 is located at the position n4 with respect to the first assembly 12, the hinge 10 has the smallest opening angle, and the door body is in the closed state. In this case, the main spring 16, the locking spring 24 and the return spring 204 are all in the natural state.

[0043] When the hinge 10 is opened from the position n4 to any position in a range of the angle C under an action of an external force (which is usually applied by human), the damper body 200 slides in a direction towards the second assembly 14, and the return spring 204 applies a resistance force to the damper body 200 to allow a hydraulic oil in the damper body 200 to reset. When the external force is withdrawn, as the tensioning force of the main spring 16 is larger than the load weight of the hinge 10, the drop-down door rotates in a direction towards the main spring 16, that is, the drop-down door will still be closed in a slow and uniform speed, i.e. the hinge 10 will still return to the position n4.

[0044] In the present embodiment, corresponding to the balanced stage, the hinge 10 is located at a position between the position n1 and the position n2, in which case the tensioning force produced by the main spring 16 is balanced with the load weight of the hinge 10, and thus the drop-down door may be stopped at any position in a range of the angle a. Corresponding to the balanced stage, the drop-down door is configured to rotate by an angle of 50°-70°, that is, the range of the angel a is 50°-70°.

[0045] In the present embodiment, corresponding to the critical stage, the hinge 10 is located at a position between the position n2 and the position n3, in which case the tensioning force produced by the main spring 16 is larger than the load weight of the hinge 10, and thus the hinge may rotate from the position n2 to the position n3 rapidly in a range of the angle b. Corresponding to the critical stage, the drop-down door is configured to rotate by an angle of 10°-15°, that is, the range of the angel b is 10°-15°.

[0046] In the present embodiment, corresponding to the buffered-closing stage, the hinge 10 is located at a position between the position n3 and the position n4, in which case the tensioning force produced by the main spring 16 is larger than the load weight of the hinge 10, and thus the hinge may rotate from the position n3 to the position n4 slowly in the range of the angle c. Corresponding to the buffered-closing stage, the drop-down door is configured to rotate by an angle of 10°-25°, that is, the range of the angel c is 10°-25°.

[0047] Thus, the drop-down door may be closed automatically and slowly in a designed angle range, thus improving the using experience of the user.

[0048] Certainly, numerical values above are provided as examples, so as to aid in illustrating a manner in which the automatic and slow closing of the drop-down door in a certain opening and closing angle is realized by means of the hinge 10, but are not used to limit the present disclosure.

[0049] A device in a preferable embodiment of the present disclosure includes a device body and a drop-down door. The device includes the above hinge 10. The first assembly 12 is fixedly disposed to the drop-down door, and the second assembly 14 is fixedly disposed to the device body. Optionally, the device is an oven. Certainly, the oven only serves as an example, but is not used to limit the present disclosure. Thus, the drop-down door of the device may be closed automatically and slowly, which prevents the drop-down door of the device from being damaged due to a rapid closing caused by overexertion.

[0050] Reference throughout this specification to "an embodiment," "some embodiments," "an illustrative embodiment" "an example," "a specific example," or "some examples," means that a particular feature, structure, material, or characteristic described in connection with the embodiment or example is included in at least one embodiment or example of the present disclosure. Thus, the appearances of the phrases in various places throughout this specification are not necessarily referring to the same embodiment or example of the present disclosure. Furthermore, the particular features, structures, materials, or characteristics may be combined in any suitable manner in one or more embodiments or examples.

[0051] Although embodiments of the present disclosure have been shown and illustrated, it shall be understood by those skilled in the art that various changes, modifications, alternatives and variants without departing from the principle and intention of the present disclosure are acceptable. The scope of the present disclosure is defined by the claims or its equivalents.

Claims

1. A hinge having a buffering effect, comprising:

a first assembly and a second assembly, the first assembly comprising a first end rotatably connected with the second assembly and a second end opposite to the first end, the first assembly having a first guiding groove adjacent to the first end, the second assembly being provided with a cam portion;

a main spring disposed in the first assembly, a first end of the main spring being fixedly connected with the second end of the first assembly;

a connecting piece disposed in the first assembly, connected with a second end of the main spring and further rotatably connected with the second assembly by means of a second rotary shaft, the connecting piece being provided with an upper cover so as to be fitted with the first

assembly to form a cavity, the connecting piece having a second guiding groove;
a damper assembly, comprising:

a damper body located in the cavity and having a third guiding groove;
an extending and retracting rod extending from the damper body towards the second assembly;
a return spring fitted over the extending and retracting rod and disposed in the damper body;
a position limiting piece fixed in the first assembly and penetrated by the extending and retracting rod; and
a third rotary shaft connecting the damper body with the connecting piece, and rotatably and slidably disposed in the second guiding groove and the third guiding groove;

a connecting assembly disposed between the second assembly and the extending and retracting rod, the connecting assembly being fixedly connected with the extending and retracting rod, the connecting assembly being connected with the connecting piece by means of a fourth rotary shaft, the fourth rotary shaft being rotatably and slidably disposed in the first guiding groove, the connecting assembly comprising a driven pulley; and
a locking spring fitted over the extending and retracting rod and disposed between the position limiting piece and the connecting assembly so as to allow the driven pulley to keep rotatable contact with the cam portion,
wherein the cam portion has a balanced stage, a critical stage and a buffered-closing stage in a rotation process of the second assembly from a position where a largest opening angle is formed between the first assembly and the second assembly to the first assembly, and the cam portion is successively fitted with the driven pulley in these stages;
in the balanced stage, the locking spring is in a compressed state and changes to a reset state, the return spring is in a natural state, the damper body is motionless in the cavity, the main spring is in a stretched state and changes to a reset state, and a tensioning force produced by the main spring is balanced with a load weight of the hinge;
in the critical stage, the locking spring is in the compressed state and changing to the reset state, the return spring is in the natural state, the damper body slides in the cavity in a direction towards the second end, the main spring is in the stretched state, and the tensioning force produced by the main spring is larger than the load weight of the hinge;
in the buffered-closing stage, the locking spring is in the compressed state and changes to the reset state, the return spring is in the natural state, the extending and retracting rod is retracted into the damper body, the main spring is in the stretched state and changes to the reset state, the tensioning force produced by the main spring is larger than the load weight of the hinge and the damper body generates a reverse buffering effect.

2. The hinge having the buffering effect according to claim 1, wherein the first assembly comprises a bottom plate and side walls extending upwards from two sides of the bottom plate, and the first guiding groove is formed in each of the two side walls and has an arc shape.

3. The hinge having the buffering effect according to claim 2, wherein the connecting piece comprises two side sheets tightly attached to the side walls respectively and the upper cover joint to the two side sheets.

4. The hinge having the buffering effect according to claim 1, wherein the cavity has a rectangular shape, the damper body has a cylindrical shape, and shapes of the damper body and the cavity are matched with each other so as to allow the damper body to slide in the cavity.

5. The hinge having the buffering effect according to claim 2, wherein the position limiting piece ha an L shape, the position limiting piece comprises a bottom sheet fixedly connected with the bottom plate and a blocking sheet extending upwards from the bottom sheet, and the blocking sheet is penetrated by the extending and retracting rod.

6. The hinge having the buffering effect according to claim 1, wherein the connecting assembly comprises a connecting body fixedly connected with the extending and retracting rod and the driven pulley disposed to the connecting body, the connecting body and the connecting piece are connected by means of the fourth rotary shaft slidably disposed in the first guiding groove, the connecting body is provided with a fixed shaft, the driven pulley has an annular shape and is fitted over the fixed shaft, and the driven pulley keeps being rotatably connected with the cam portion.

7. The hinge having the buffering effect according to any one of claims 1 to 6, wherein corresponding to the balanced stage, a drop-down door is configured to rotate by an angle of 50°-70°.

8. The hinge having the buffering effect according to

any one of claims 1 to 6, wherein corresponding to the critical stage, a drop-down door is configured to rotate by an angle 10°-15°.

9. The hinge having the buffering effect according to any one of claims 1 to 6, wherein corresponding to the buffered-closing stage, a drop-down door is configured to rotate by an angle of 10°-25°.

10. The hinge having the buffering effect according to claim 1, wherein the first assembly is configured as a rectangular casing.

11. A device, comprising a device body, a drop-down door and a hinge configured for the device according to any one of claims 1 to 10, the first assembly and the second assembly of the hinge are configured to be fixed to the device body and the drop-down door respectively and are rotatably connected by means of a first rotary shaft, so that the drop-down door is configured to be rotatably pulled downwards with respect to the device body.

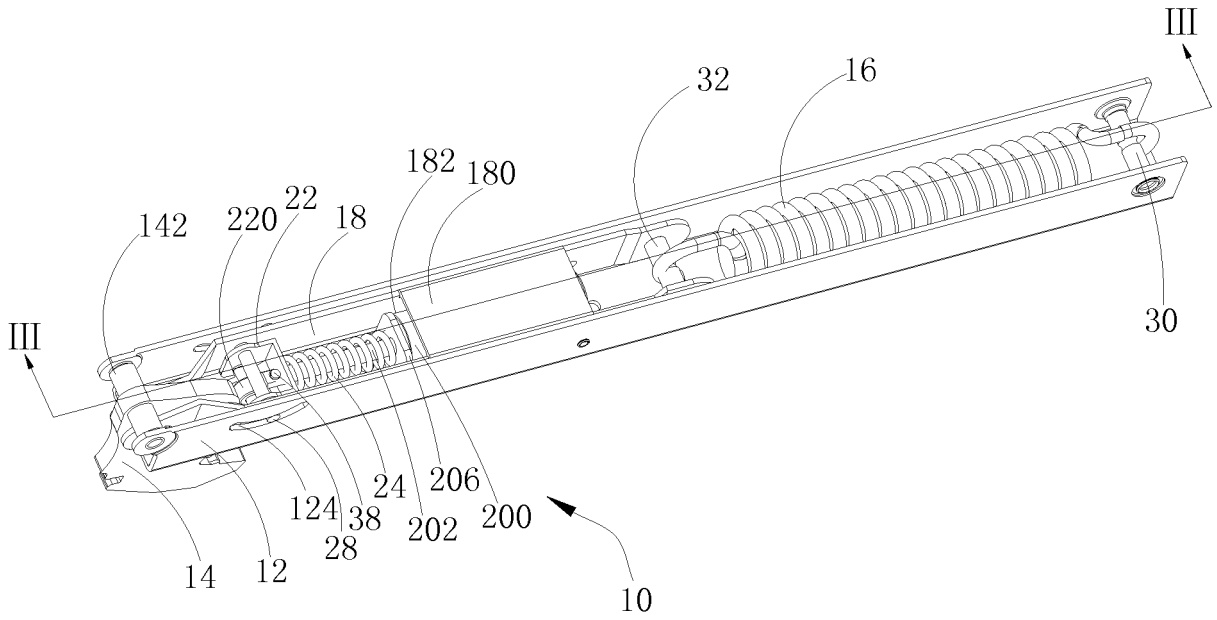
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Fig. 1

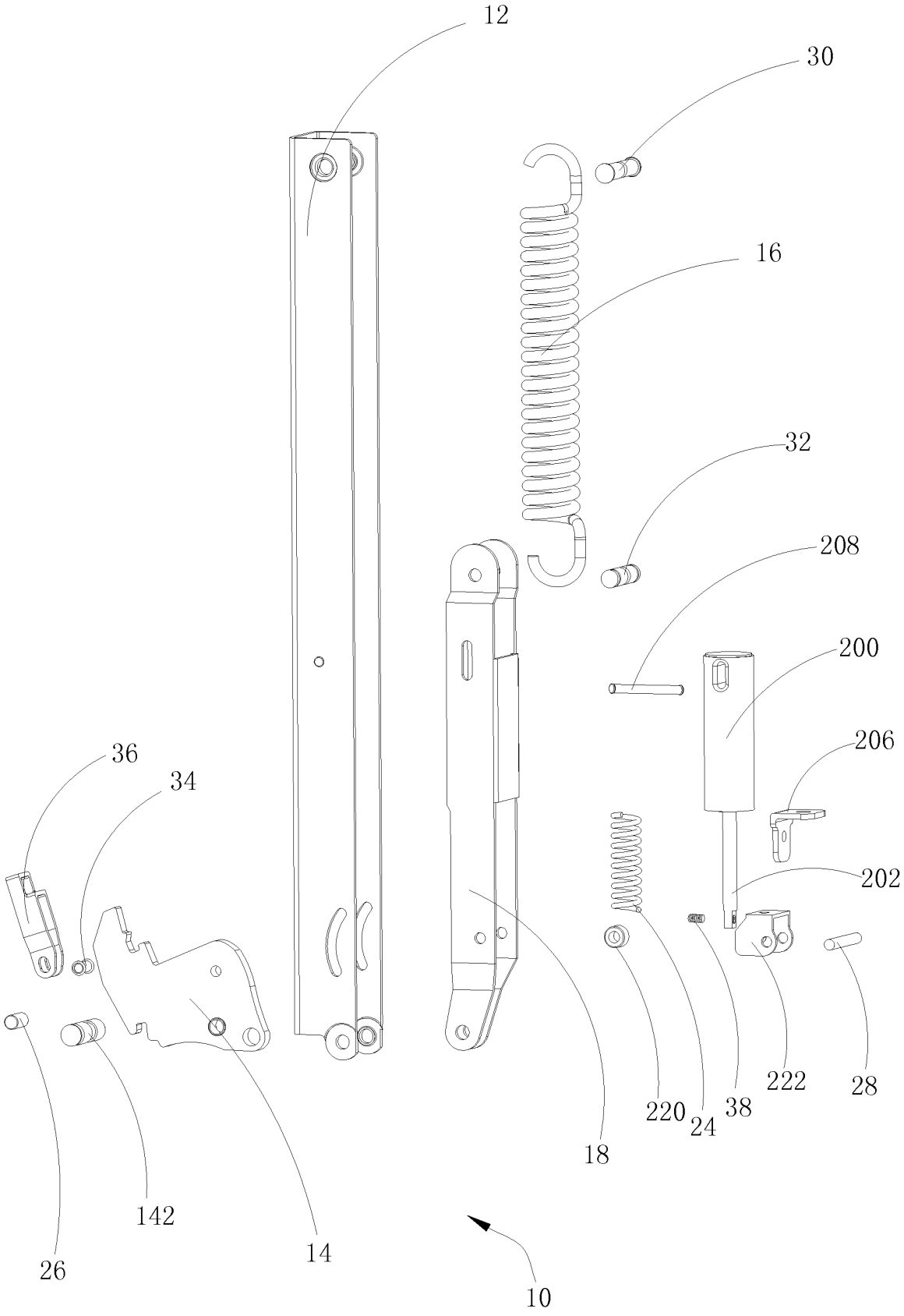

Fig. 2

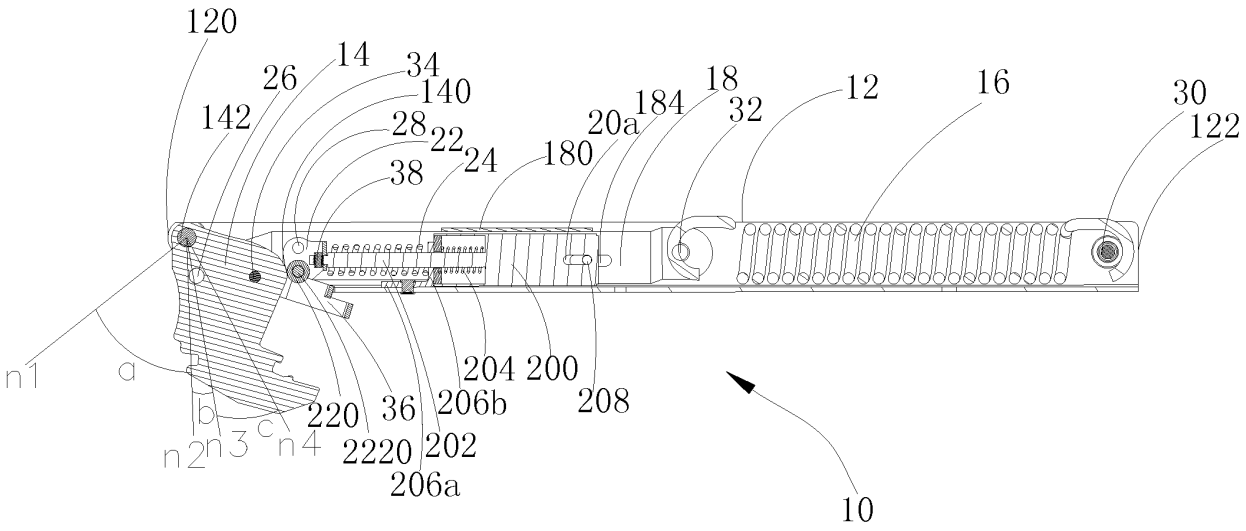
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Fig. 3

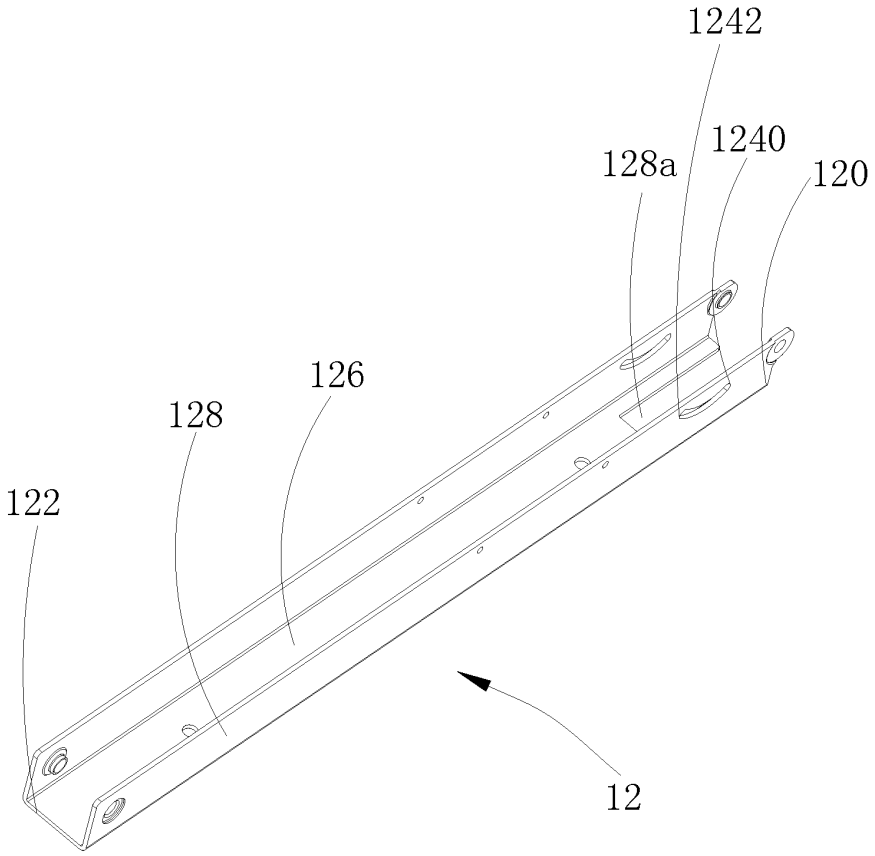
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Fig. 4

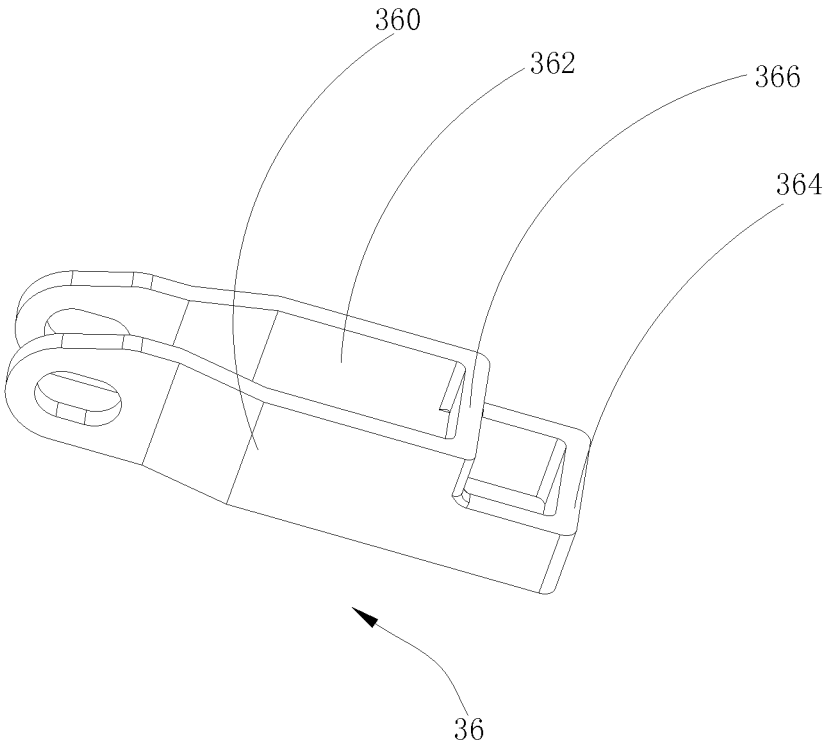

Fig. 5

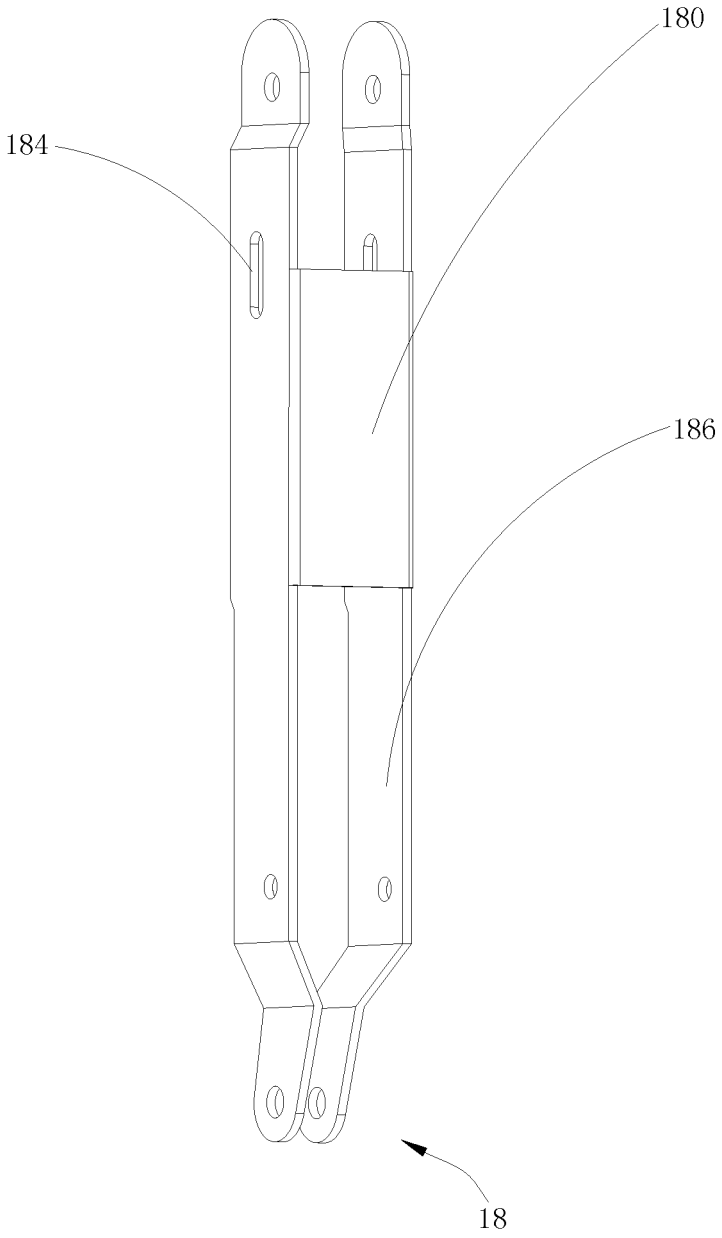

Fig. 6

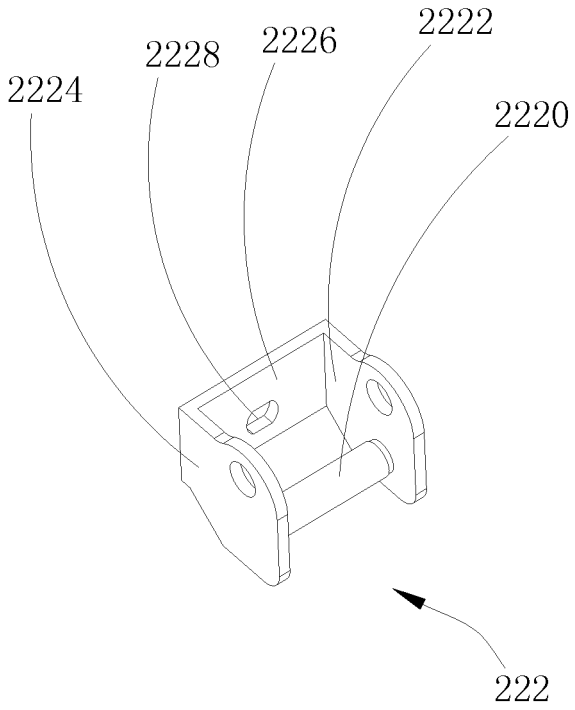

Fig. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2015/077724

A. CLASSIFICATION OF SUBJECT MATTER

E05F 3/20 (2006.01) i; E05F 1/12 (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

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)
CNPAT, CNKI, WPI, EPODOC: buffer, damping, spring, balance, hinge, channel guide, conduit ferrule, guide barrel, guide canal, guide slot, guided groove, quide path, guide groove, cam, critical, driven pulle, driven wheel, following pulle, engaged 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 103225456 A (ZOU, Zhong), 31 July 2013 (31.07.2013), the whole document	1-11
A	US 2003162509 A1 (SAMSUNG ELECTRONICS CO., LTD.), 28 August 2003 (28.08.2003), the whole document	1-11
A	CN 103032004 A (ZOU, Zhong), 10 April 2013 (10.04.2013), the whole document	1-11

☐ 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
01 October 2015 (01.10.2015)	**29 October 2015 (29.10.2015)**
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 **ZHAO, Jie** Telephone No.: (86-10) **62085192**

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2015/077724

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		GB 201201395 D0	14 March 2012
		GB 2504917 A	19 February 2014
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		CN 202659015 U	09 January 2013
		GB 201116913 D0	16 November 2011
		GB 2495154 A	03 April 2013
		WO 2013064001 A1	10 May 2013
		GB 2495154 B	08 July 2015

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