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(54) **HINGE ASSEMBLY AND DOOR STRUCTURE**

(57) The present invention discloses a hinge assembly and a door structure, relates to the technical field of hardware fittings, and solves the problem of how to improve the reliability and flexibility of door rotation. The technical solution is characterized by including: door frame shaft bases each having a first main shaft hole and a first guide slot; a joint base which is of a curved plate structure with shaft channels being arranged at two ends respectively and upper and lower end faces being provided with limit posts matching the first guide slot in the door frame shaft base, one of the shaft channels being rotatably connected to the first main shaft holes; hooks rotatably mounted to the upper and lower end faces of the joint base. The reliability and flexibility of the structure is improved through a two-phase door opening operation.

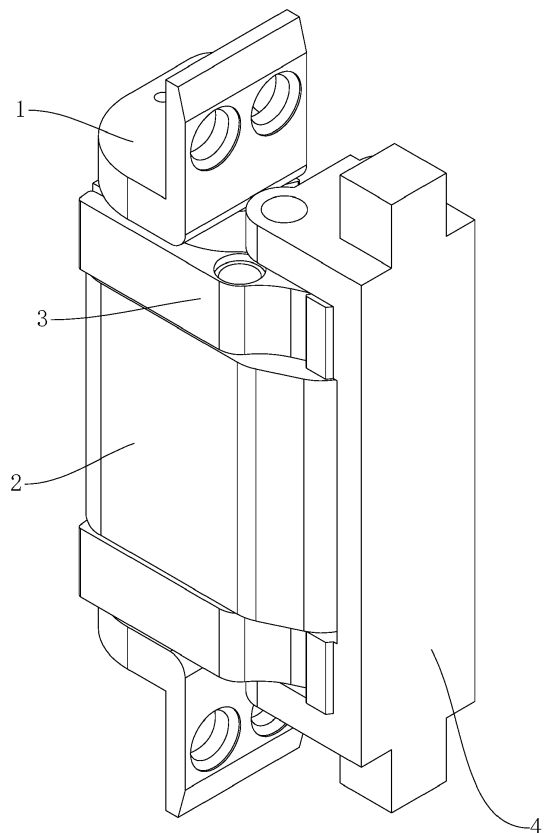


Fig. 1

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Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The application claims priority to Chinese patent application No. CN202211567402.0, filed on December 7, 2022, the entire contents of which are incorporated herein by reference.

TECHNICAL FIELD

[0002] The present invention relates to the field of hardware fittings, and in particular to a hinge assembly and a door structure.

BACKGROUND

[0003] A hinge assembly belongs to hardware fittings category. Different hinge structures need to be provided at different rotational connection positions. Commonly used hinges include metal hinges, pivot hinges, and so on.

[0004] An interior door or entry door for home decoration may be made of wood, aluminium alloy, steel, etc. Generally speaking, the weight (gravity) of a door itself is large, and opening of the door are limited to a certain range.

[0005] For example, after an entry door available in the market is mounted in place with hinges, its opening angle is interfered with by the door body and door frame, so that the door body can only be opened by about 90 degrees, and further opening is impossible. Based on the limitation of this operation, it is necessary to improve the existing hinges.

SUMMARY

[0006] The purpose of the present invention is to solve the technical problems of the related art at least to some extent, aiming at the defects of the prior art, and to provide a hinge assembly and a door structure having the hinge assembly, which feature a two-phase door opening operation and a larger range of door opening angle.

[0007] In order to solve the above technical problem, the technical solution adopted by the present invention is as follows. A hinge assembly includes:

door frame shaft bases each configured to be fixedly mounted to a door frame and having a first main shaft hole and a first guide slot;

a joint base which is of a curved plate structure with shaft channels being arranged at two ends respectively and upper and lower end faces being provided with limit posts matching the first guide slot in the door frame shaft base, one of the shaft channels being rotatably connected to the first main shaft holes;

hooks rotatably mounted to the upper and lower end

faces of the joint base; and

a door body shaft base, which is configured to be fixedly mounted to a door body and provided with hook grooves for the ends of the hooks to snap-fit in place and a second main shaft hole for a rotary connection with the shaft channel at the other end of the joint base,

where the door body shaft base, the hooks and the joint base are immobile relative to each other and rotate together relative to the door frame shaft bases to realize a first phase of movement under the limitation of the first guide slot, then the hooks are deformed and disengaged from the hook grooves, and the door body shaft base proceeds to realize a second phase of movement with the second main shaft hole as an axis of rotation.

[0008] Optionally, the door frame shaft base includes a corner base part and a flat base part, one side of a right-angle bend of the corner base part is provided with a fixing hole, the base part is disposed on the other side of the right-angle bend, and the first guide slot has a radian of 64 degrees.

[0009] Optionally, the curved plate structure of the joint base includes a first rotating plate part, a second rotating plate part, an inclined plate part and an inner bending plate part, the shaft channel of the first rotating plate part and the shaft channel of the inner bending plate part have the same projection distance from the second rotating plate part, the first rotating plate part and the second rotating plate part form a right-angle bend, the inclined plate part and the inner bending plate part form a right-angle bend, and the inclined plate part is configured as a transition between the second rotating plate part and the inner bending plate part.

[0010] Optionally, the second rotating plate part and the inclined plate part form a bend of 155 degrees, and the lengths of the inclined plate part and the second rotating plate part are configured to reduce the distance between the door frame shaft base and the door body shaft base such that the door frame shaft base and the door body shaft base adjoin each other or are close to each other.

[0011] Optionally, there are two of the hooks in total each rotatably connected to an intersection between the second rotating plate part and the inclined plate part, each hook has a rotating shaft portion serving as a fulcrum and is provided with a lever arm and a catching part, and the lever arm conforms to and presses against an exterior cambered surface of the flat base part.

[0012] Optionally, there are two of the hook grooves in total arranged with one above the other in the door body shaft base, and an engaging force of the hooks on the hook grooves is greater than the friction force between the limit posts and the first guide slots.

[0013] Optionally, a torsion spring is provided over a rotating shaft of the hook to press an end of the catching part of the hook against a cambered surface of the hook

groove.

[0014] A door structure is provided with the above hinge assembly.

[0015] Optionally, the cambered surface of the hook groove of the door body shaft base is provided with a force sensor, the door body is provided with a controller and an electronic lock, the force sensor feeds back a signal to the controller, and the controller controls locking and unlocking of the electronic lock.

[0016] Optionally, the controller determines a force applied at the end of the catching part of the hook according to an amplitude of the signal fed back by the force sensor and sends out a warning signal or a dummy signal in response to sensing that the applied force is less than a preset value;

the warning signal enables an alarm through the electronic lock or an alarm apparatus; and the dummy signal enables a visual alarm through an indicator light.

[0017] Compared with the background art, the technical effects of the present invention are mainly embodied in the following aspects.

1. First and foremost, the opening of the door is different from traditional operation. This technical solution features two movement stages (phases of movement). By using the hinge assembly in this technical solution, the door body can be rotated in a first phase of movement to achieve a half-open (not fully open) state, and then opened further such that the hooks are disengaged from the hook grooves, allowing the door body to be opened to the maximum extent, that is, close to 180 degrees.
2. The implementation is based on multi-axis switching, which is more reliable and flexible in operation and can avoid movement interference, thus improving the smoothness and stability of operation.
3. The whole structure is compact and less space-consuming, and can be installed in a concealed manner.
4. For the door structure, a working state of components can be detected, and the working state can be fed back, so as to further improve the safety performance and reliability of the door. The comprehensive performance is significantly improved.

BRIEF DESCRIPTION OF DRAWINGS

[0018]

Fig. 1 is a schematic diagram of Embodiment I;
Fig. 2 is an exploded view of Embodiment I;
Fig. 3 is a side view of Embodiment I;
Fig. 4 is a sectional view taken along a section line A-A in Fig. 3;
Fig. 5 is a schematic diagram of Embodiment II;

Fig. 6 is a sectional view taken along a section line B-B in Fig. 5;

Fig. 7 is a schematic diagram of Embodiment III;

Fig. 8 is a schematic diagram of the use state of a first phase of movement according to Embodiments II and III; and

Fig. 9 is a schematic diagram of the use state of a second phase of movement according to Embodiments II and III.

[0019] List of reference numerals: 1. Door frame shaft base; 11. First main shaft hole; 12. First guide slot; 13. Corner base part; 14. Flat base part; 15. Fixing hole; 2. Joint base; 21. First rotating plate part; 22. Second rotating plate part; 23. Inclined plate part; 24. Inner bending plate part; 25. Shaft channel; 26. Limit post; 3. Hook; 31. Lever arm; 32. Catching part; 4. Door body shaft base; 41. Hook groove; 42. Second main shaft hole; 51. Force sensor; 52. Controller; 53. Electronic lock; 6. Door frame; 7. Door body; 8. Torsion spring.

DETAILED DESCRIPTION

[0020] The specific implementations of the present invention will be described in detail below by referring to the accompanying drawings, so as to make the technical solution of the present invention easier to understand.

Embodiment I.

[0021] A hinge assembly, as shown in Figs. 1 and 2, includes:

door frame shaft bases 1 each configured to be fixedly mounted to a door frame 6 and having a first main shaft hole 11 and a first guide slot 12. The door frame shaft base 1 includes a corner base part 13 and a flat base part 14. One side of a right-angle bend of the corner base part 13 is provided with a fixing hole 15. The base part 14 is disposed on the other side of the right-angle bend, and as can be seen in Fig. 4, the first guide slot 12 has a radian of 64 degrees. The corner base 13 can be embedded in the door frame 6 in a concealed manner by fitting a screw into the fixing hole 15. Although screws, rotating shafts, etc. are not shown in the accompanying drawings the accompanying drawings have provided sufficient information for understanding this embodiment. In an example of this technical solution, taking 64-degree as a preferred example does not exclude other examples in which the first guide slot 12 has a radian above or below 64 degrees. There are two door frame shaft bases 1 provided in total, which are symmetrically distributed with one above the other.

[0022] There is one joint base 2 provided in total which is of a curved plate structure with shaft channels 25 being arranged at two ends respectively and upper and lower end faces being provided with limit posts 26 matching the first guide slot 12 in the door frame shaft base 1. One of the shaft channels 25 is rotatably connected to the first

main shaft holes 11. The limit post 26 can be fixed through a thread connection or interference fitting. Specifically, the curved plate structure of the joint base 2 includes a first rotating plate part 21, a second rotating plate part 22, an inclined plate part 23 and an inner bending plate part 24. The shaft channel 25 of the first rotating plate part 21 and the shaft channel 25 of the inner bending plate part 24 have the same projection distance from the second rotating plate part 22. The first rotating plate part 21 and the second rotating plate part 22 form a right-angle bend. The inclined plate part 23 and the inner bending plate part 24 form a right-angle bend. The inclined plate part 23 is configured as a transition between the second rotating plate part 22 and the inner bending plate part 24.

[0023] For the designing of the joint base 2, to facilitate spatial arrangement, the second rotating plate part 22 and the inclined plate part 23 form a bend of 155 degrees, and the lengths of the inclined plate part 23 and the second rotating plate part 22 are configured to reduce the distance between the door frame shaft base 1 and a door body shaft base 4 such that the door frame shaft base 1 and the door body shaft base 4 adjoin each other or are close to each other.

[0024] With the structure of the joint base 2, the whole structure is compact and small. On the premise of retaining original functions, opening and closing can be realized with a larger range.

[0025] Referring to Figs. 2, 3 and 4, there are two hooks 3 provided in total, which are rotatably mounted to the upper and lower end faces of the joint base 2. Each hook is rotatably connected to an intersection between the second rotating plate part 22 and the inclined plate part 23. Each hook 3 has a rotating shaft portion serving as a fulcrum and is provided with a lever arm 31 and a catching part 32. The lever arm 31 conforms to and presses against an exterior cambered surface of the flat base part 14. Here, the structure is reinforced, the thickness is increased, and the structural reliability during assembly and rotation is improved. The lever arm 31 of the hook 3 can be configured to provide an arm of force to maintain a balance, thus allowing the hook 3 to be in a stable state. Through the snap-fit function of the hook 3, door opening can be realized in two phases, and the first phase of movement for opening and closing of the door 7 can be realized without requiring the hook 3 to be disengaged from the hook groove 41.

[0026] In Figs. 2 and 4, the door body shaft base 4 is configured to be fixedly mounted to the door body 7 and provided with hook grooves 41 for the ends of the hooks 3 to snap-fit in place and a second main shaft hole 42 for a rotary connection with the shaft channel 25 at the other end of the joint base 2. There are two of the hook grooves 41 in total arranged with one above the other in the door body shaft base 4, and an engaging force of the hooks 3 on the hook grooves 41 is greater than the friction force between the limit posts 26 and the first guide slots 12.

[0027] During operation, the door body shaft base 4,

the hooks 3 and the joint base 2 are immobile relative to each other and rotate together relative to the door frame shaft bases 1 to realize a first phase of movement under the limitation of the first guide slot 12, then the hooks 3 are deformed and disengaged from the hook grooves 41, and the door body shaft base 4 proceeds to realize a second phase of movement with the second main shaft hole 42 as an axis of rotation.

10 Embodiment II.

[0028] A door structure, as shown in Figs. 5 and 6, is provided with the hinge assembly described above. Actions and working states are shown in Figs. 8 and 9.

15 Embodiment III.

[0029] Based on the above embodiments and with reference to Fig. 7, a torsion spring 8 is provided over a rotating shaft of the hook 3 to press an end of the catching part 32 of the hook 3 against a cambered surface of the hook groove 41. By arranging the torsion spring 8, the catching part 32 has rotary potential energy, such that the end of the catching part can abut against the cambered surface of the hook groove 41, which facilitates the snap-fit action.

[0030] The hook 3 may be made of metal, engineering plastics or other rigid or deformable or restorable materials.

30 Embodiment IV

[0031] On the basis of the above technical solution, other optimized implementations can be obtained.

[0032] For example, the cambered surface of the hook groove 41 of the door body shaft base 4 is provided with a force sensor 51, the door body 7 is provided with a controller 52 and an electronic lock 53, the force sensor 51 feeds back a signal to the controller 52, and the controller 52 controls locking and unlocking of the electronic lock 53. The force sensor 51 is a stress sensing device (surface-mounted resistance strain gauge). By arranging such device on the cambered surface, a service life can be determined in response to a change in the pressure of the hook 3.

[0033] Finally, the controller 52 determines a force applied at the end of the catching part 32 of the hook 3 according to an amplitude of the signal fed back by the force sensor 51 and sends out a warning signal or a dummy signal in response to sensing that the applied force is less than a preset value. The controller 52 can be a minimum system of single-chip microcomputer, or other CPU devices, and is mainly used for signal processing. The processing method is comparative processing, which is simple. A database needs to be established to store detected data, or a data table is created, and data can be retrieved through comparative analysis, that is, the data corresponding to the end of the service life of

the hook 3 in reality are taken as a warning value for subsequent operation. After the hook 3 is replaced with a new one, a user can be notified in response to the data of the new hook 3 reaching the warning value again.

[0034] The above data can also be represented as warning signals. The warning signal enables an alarm through the electronic lock 53 or an alarm apparatus. If an alarm appears, the electronic lock 53 can be kept in a normally open state to facilitate maintenance later.

[0035] The warning signal in this technical solution is a high-level or high-potential signal, such as a 2.5 V level square signal. In addition, a dummy signal may also be used. The dummy signal refers to a low-level signal or null signal. The dummy signal enables a visual alarm through an indicator light. Specifically, the indicator light is connected to the controller 52, and when no signal is collected by the controller 52, or when a dummy signal is collected, the controller 52 supplies electrical power to switch on the indicator light. The indicator light is an LED lamp.

[0036] To sum up, for the above implementation, first and foremost, the opening of the door is different from traditional operation. This technical solution features two movement stages (phases of movement). By using the hinge assembly in this technical solution, the door body 7 can be rotated in a first phase of movement to achieve a half-open (not fully open) state, and then opened further such that the hooks 3 are disengaged from the hook grooves 41, allowing the door body 7 to be opened to the maximum extent, that is, close to 180 degrees. The implementation is based on multi-axis switching, which is more reliable and flexible in operation and can avoid movement interference, thus improving the smoothness and stability of operation. The whole structure is compact and less space-consuming, and can be installed in a concealed manner. For the door structure, a working state of components can be detected, and the working state can be fed back, so as to further improve the safety performance and reliability of the door. The comprehensive performance is significantly improved.

[0037] The core idea of double-axis rotation is adopted instead of conventional designs and traditional ideas, such that the door body 7 can be opened by nearly 180 degrees.

[0038] Of course, the above are only typical examples of the present invention. The present invention may also have many other specific implementations, and any technical solution obtained by equivalent substitution or equivalent transformation falls within the scope of protection of the present invention.

Claims

1. A hinge assembly, **characterized by** comprising:

door frame shaft bases (1) each configured to be fixedly mounted to a door frame (6) and hav-

ing a first main shaft hole (11) and a first guide slot (12);

a joint base (2) which is of a curved plate structure with shaft channels (25) being arranged at two ends respectively and upper and lower end faces being provided with limit posts (26) matching the first guide slot (12) in the door frame shaft base (1), one of the shaft channels (25) being rotatably connected to the first main shaft holes (11);

hooks (3) rotatably mounted to the upper and lower end faces of the joint base (2); and a door body shaft base (4) configured to be fixedly mounted to a door body (7) and having hook grooves (41) and second main shaft holes (42), the hook grooves (41) each being configured for an end of the hook (3) to snap-fit in place, and the second main shaft holes (42) each being configured for a rotary connection with the shaft channel (25) at the other end of the joint base (2), wherein the door body shaft base (4), the hooks (3) and the joint base (2) are immobile relative to each other and rotate together relative to the door frame shaft bases (1) to realize a first phase of movement under the limitation of the first guide slot (12), then the hooks (3) are deformed and disengaged from the hook grooves (41), and the door body shaft base (4) proceeds to realize a second phase of movement with the second main shaft hole (42) as an axis of rotation.

2. The hinge assembly according to claim 1, **characterized in that** the door frame shaft base (1) comprises a corner base part (13) and a flat base part (14), one side of a right-angle bend of the corner base part (13) is provided with a fixing hole (15), the base part (14) is disposed on the other side of the right-angle bend, and the first guide slot (12) has a radian of 64 degrees.

3. The hinge assembly according to claim 2, **characterized in that** the curved plate structure of the joint base (2) comprises a first rotating plate part (21), a second rotating plate part (22), an inclined plate part (23) and an inner bending plate part (24), the shaft channel (25) of the first rotating plate part (21) and the shaft channel (25) of the inner bending plate part (24) have the same projection distance from the second rotating plate part (22), the first rotating plate part (21) and the second rotating plate part (22) form a right-angle bend, the inclined plate part (23) and the inner bending plate part (24) form a right-angle bend, and the inclined plate part (23) is configured as a transition between the second rotating plate part (22) and the inner bending plate part (24).

4. The hinge assembly according to claim 3, **characterized in that** the second rotating plate part (22)

and the inclined plate part (23) form a bend of 155 degrees, and the lengths of the inclined plate part (23) and the second rotating plate part (22) are configured to reduce the distance between the door frame shaft base (1) and the door body shaft base (4) such that the door frame shaft base (1) and the door body shaft base (4) adjoin each other or are close to each other. 5

5. The hinge assembly according to claim 3, **characterized in that** there are two of the hooks (3) in total each rotatably connected to an intersection between the second rotating plate part (22) and the inclined plate part (23), each hook (3) has a rotating shaft portion serving as a fulcrum and is provided with a lever arm (31) and a catching part (32), and the lever arm (31) conforms to and presses against an exterior cambered surface of the flat base part (14). 10 15
6. The hinge assembly according to claim 5, **characterized in that** there are two of the hook grooves (41) in total arranged with one above the other in the door body shaft base (4), and an engaging force of the hooks (3) on the hook grooves (41) is greater than the friction force between the limit posts (26) and the first guide slots (12). 20 25
7. The hinge assembly according to claim 6, **characterized in that** a torsion spring (8) is provided over a rotating shaft of the hook (3) to press an end of the catching part (32) of the hook (3) against a cambered surface of the hook groove (41). 30
8. A door structure, **characterized by** comprising the hinge assembly according to any one of claims 1-7. 35
9. The door structure according to claim 8, **characterized in that** the cambered surface of the hook groove (41) of the door body shaft base (4) is provided with a force sensor (51), the door body (7) is provided with a controller (52) and an electronic lock (53), the force sensor (51) feeds back a signal to the controller (52), and the controller (52) controls locking and unlocking of the electronic lock (53). 40 45
10. The door structure according to claim 9, **characterized in that** the controller (52) determines an applied force according to an amplitude of the signal fed back by the force sensor (51), the applied force is the stress at the end of the catching part (32) of the hook (3), and the controller sends out a warning signal or a dummy signal in response to sensing that the applied force is less than a preset value; 50
the warning signal enables an alarm through the electronic lock (53) or an alarm apparatus; and the dummy signal enables a visual alarm through an indicator light. 55

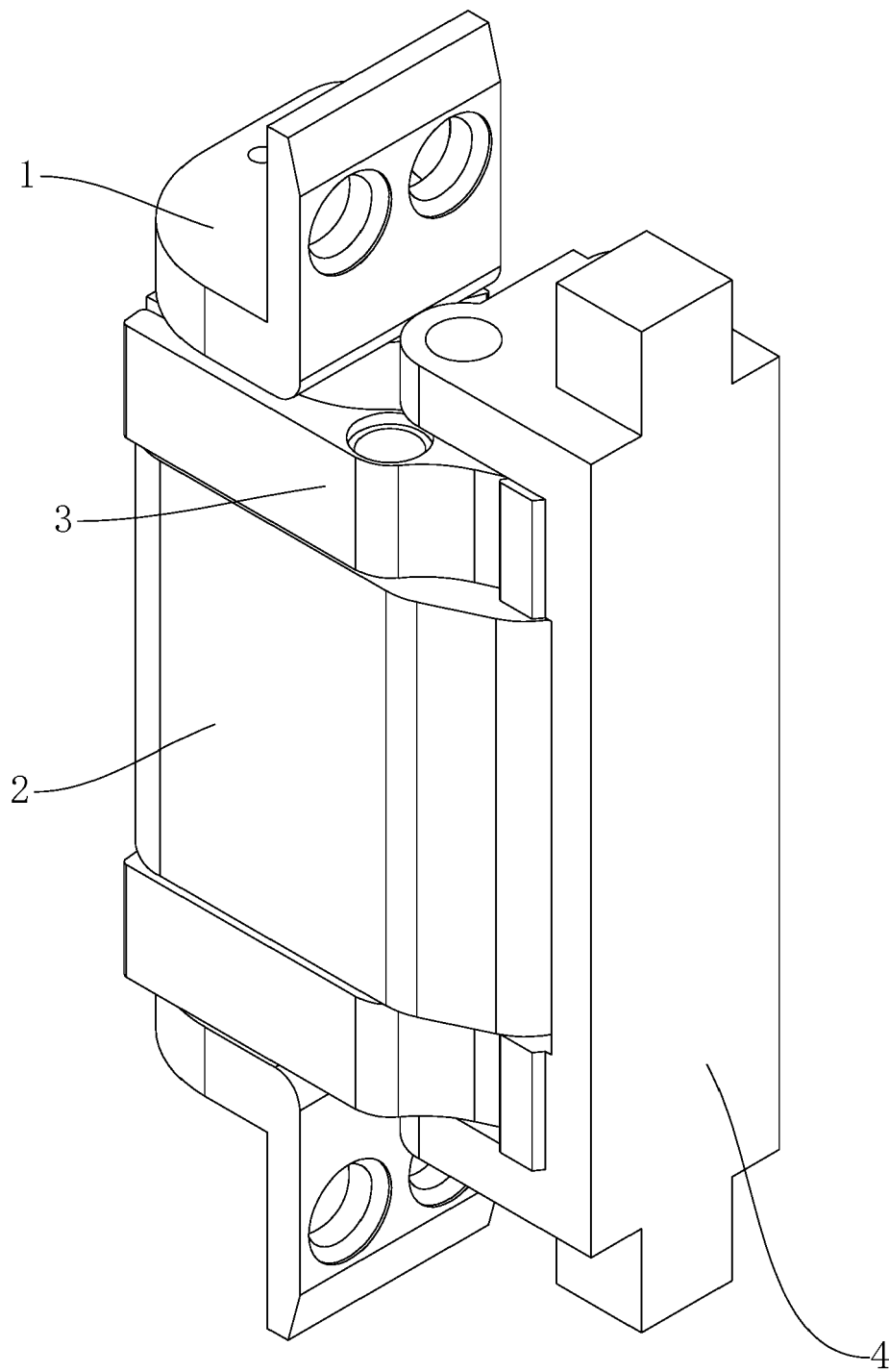


Fig. 1

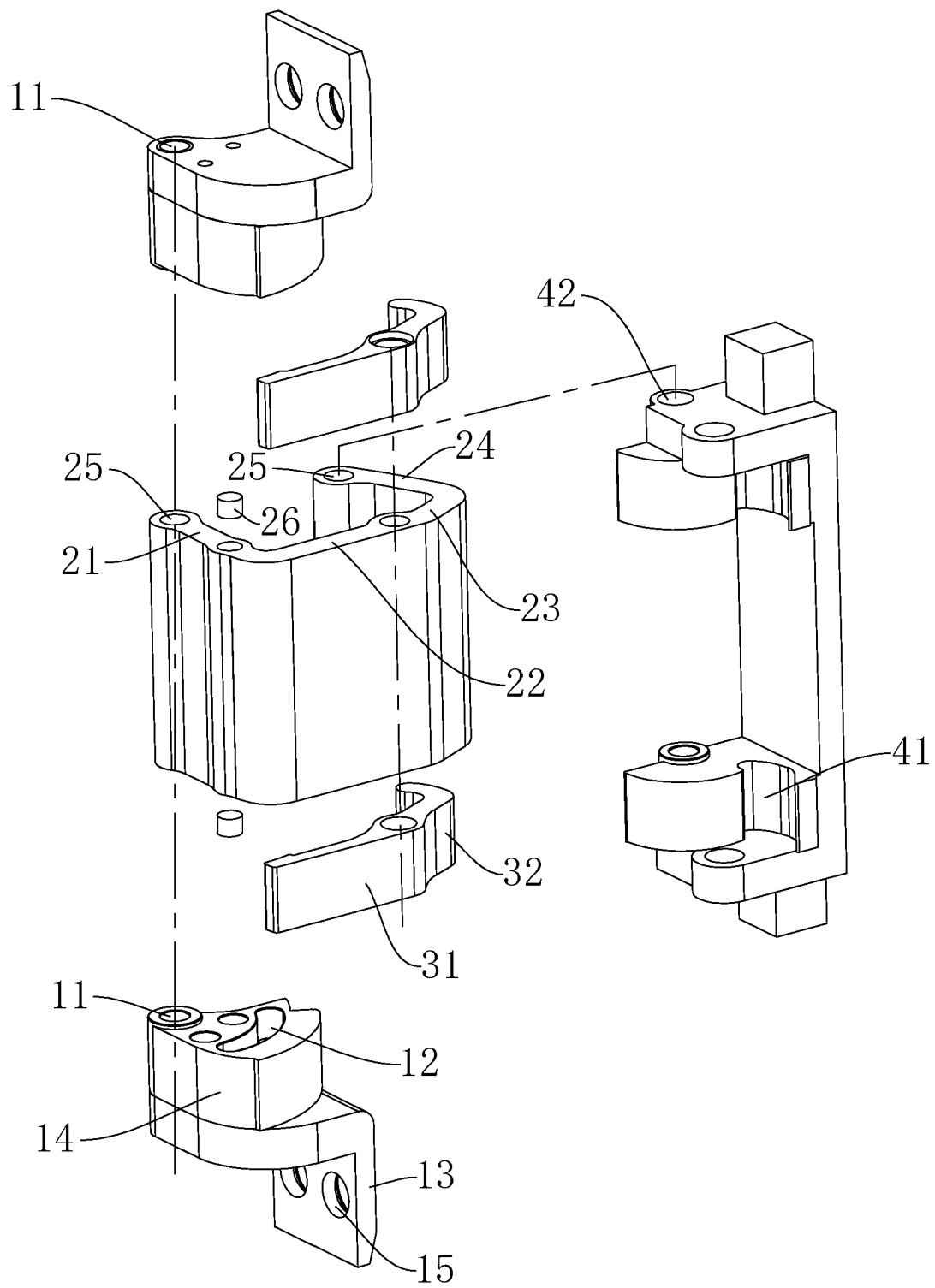


Fig. 2

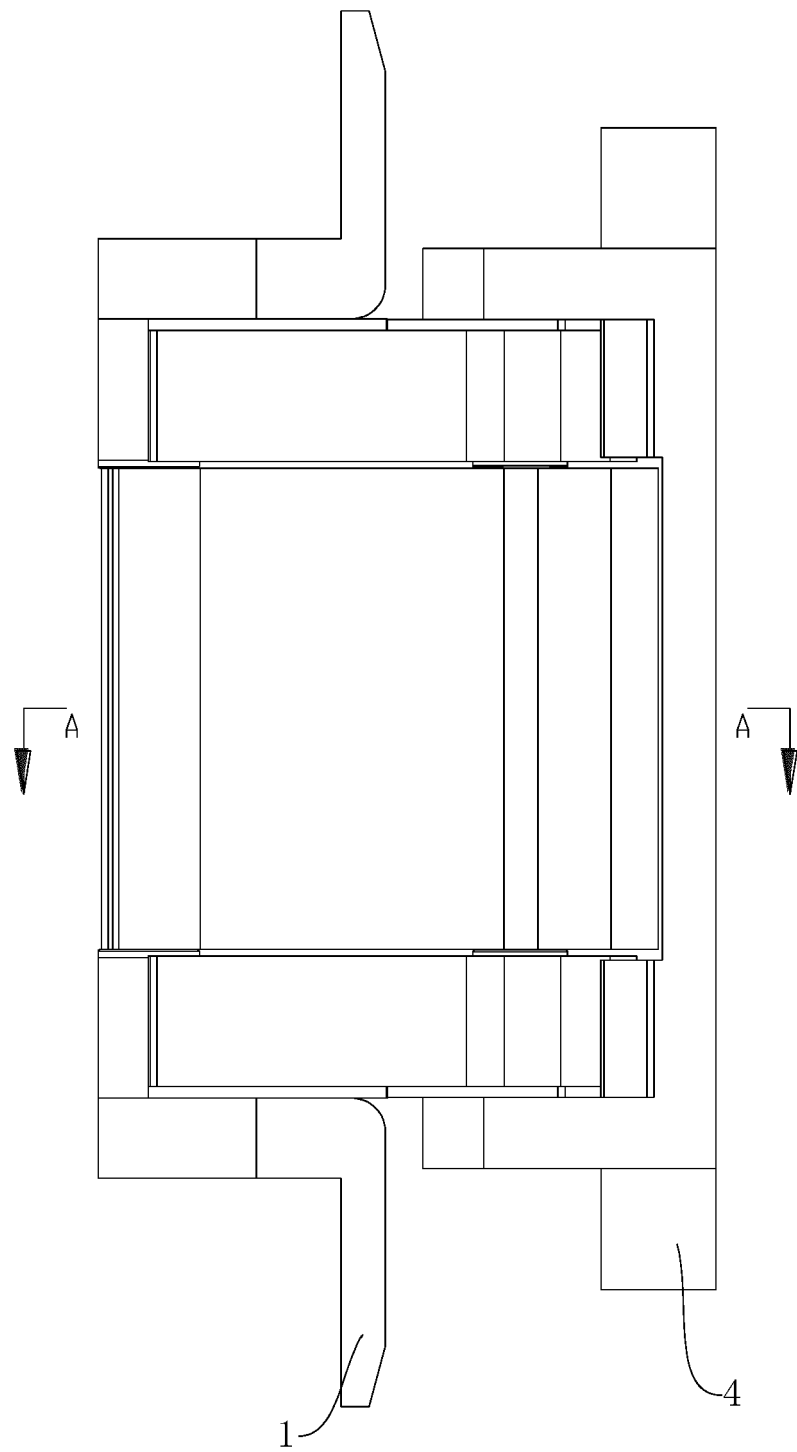
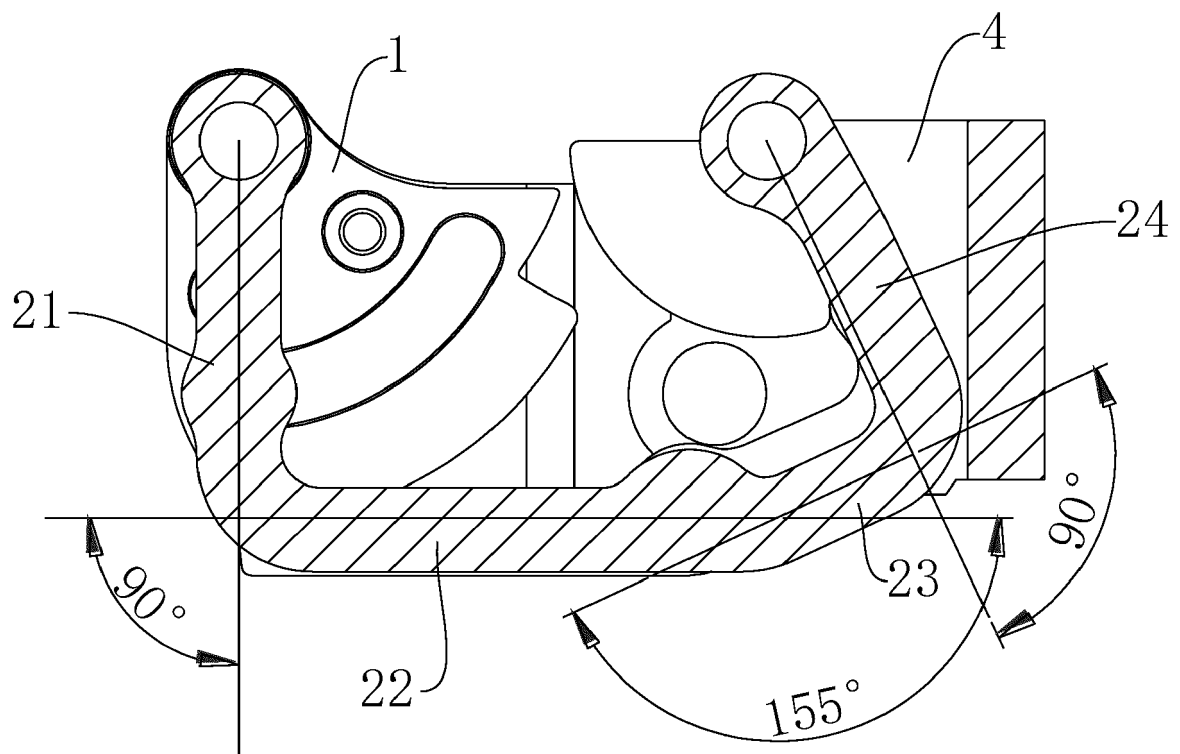


Fig. 3



A-A

Fig. 4

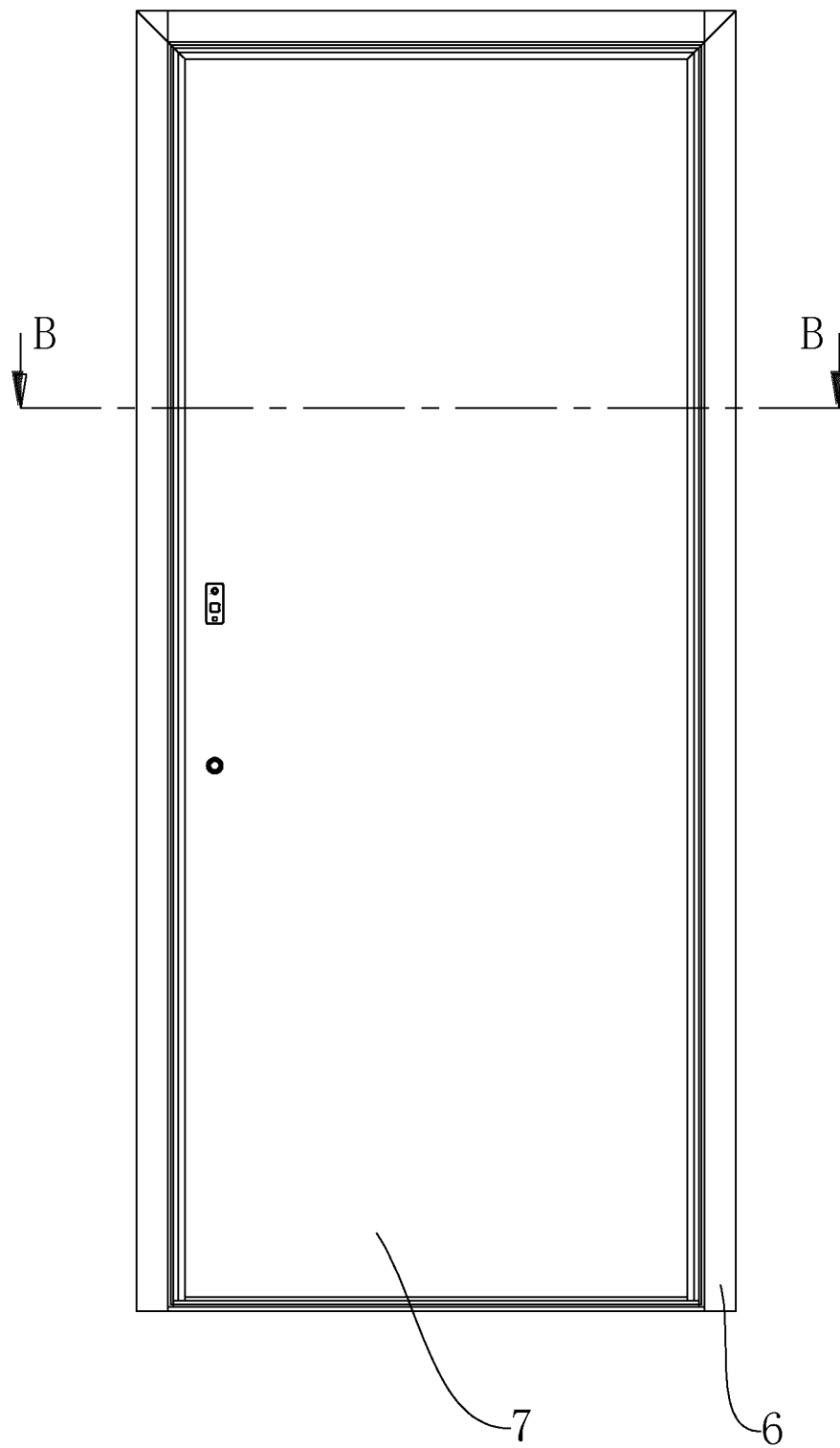


Fig. 5

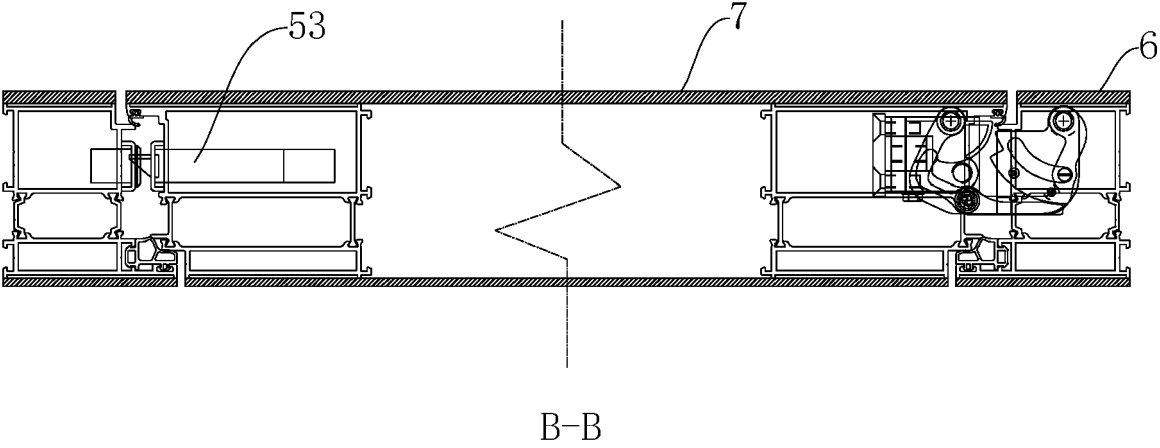


Fig. 6

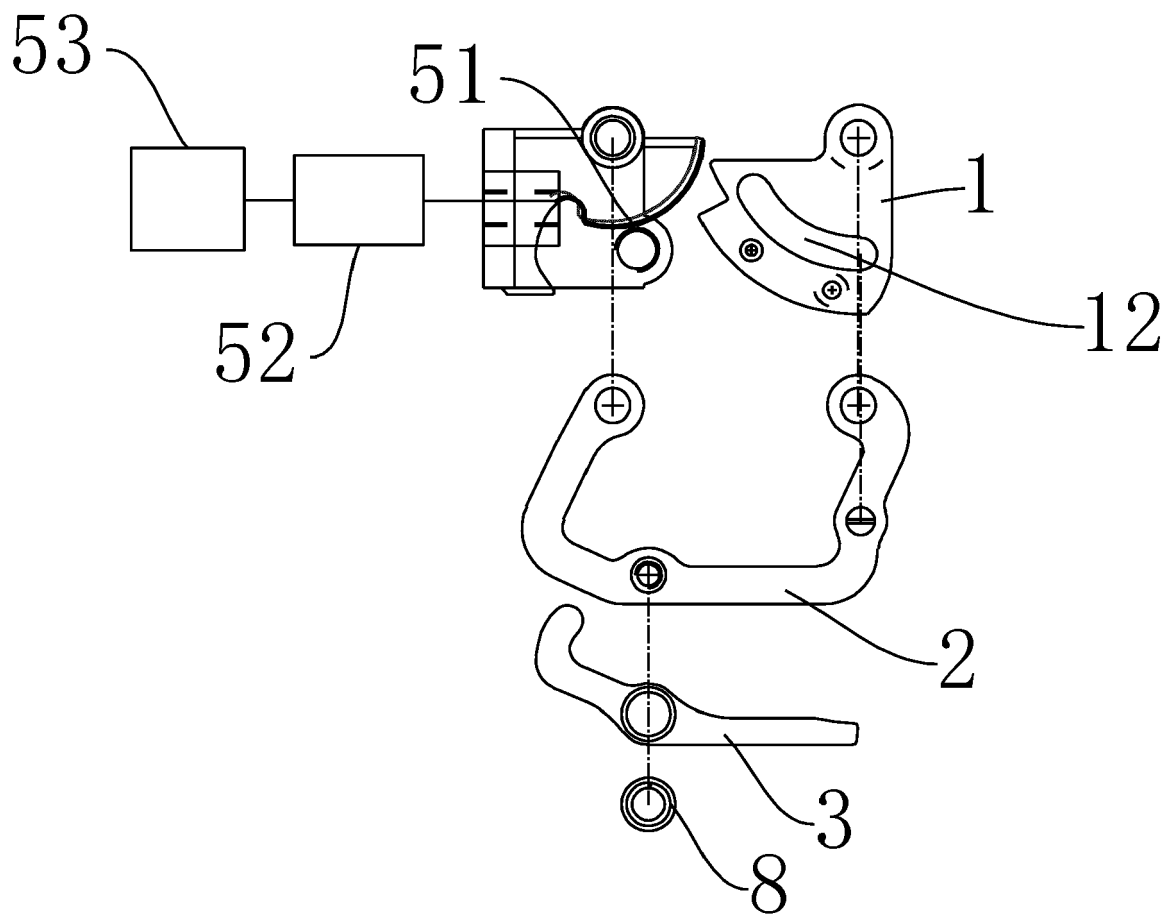


Fig. 7

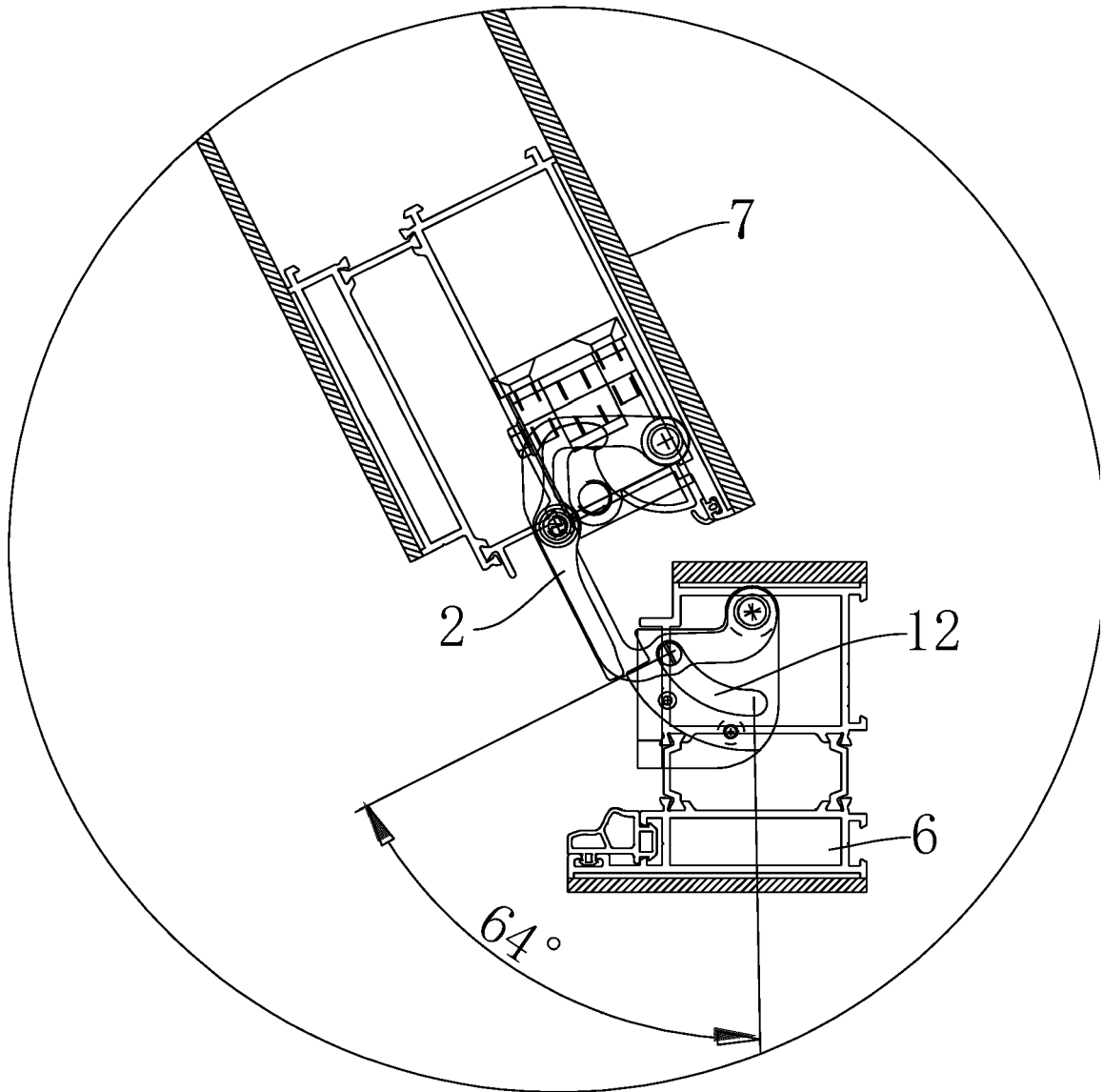


Fig. 8

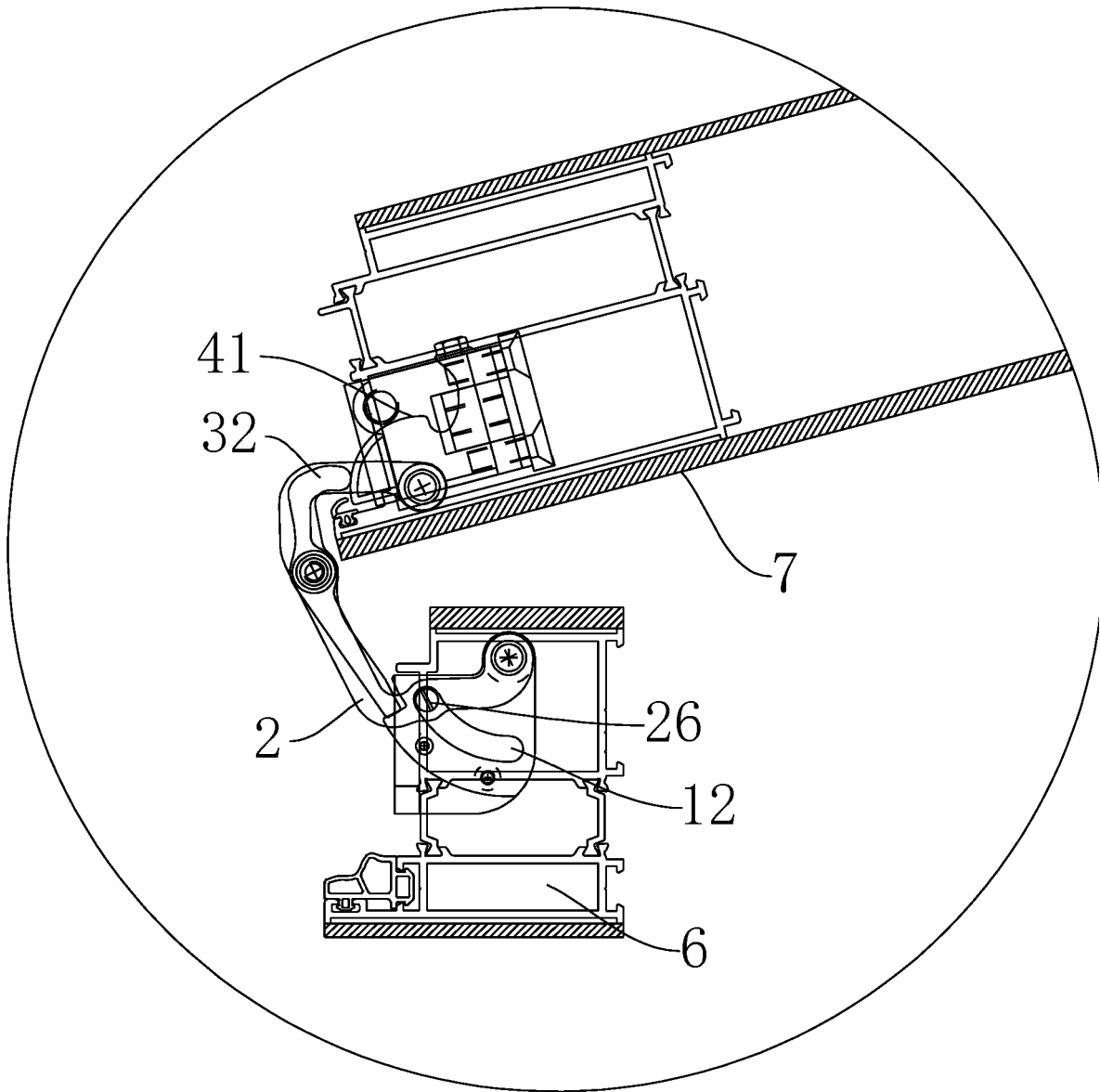


Fig. 9



EUROPEAN SEARCH REPORT

Application Number

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EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 1 834 059 B1 (HAHN GMBH & CO KG DR [DE]) 4 March 2009 (2009-03-04)	1-6, 8	INV.
A	* paragraph [0001]; figures 1-7 * * paragraph [0020] - paragraph [0034] * -----	7, 9, 10	E05D3/12 E05D5/06
A	GB 2 203 483 A (FORD MOTOR CO) 19 October 1988 (1988-10-19) * figures 1-2e * -----	1-8	
A	DE 10 2008 027219 B3 (SIMONSWERK GMBH [DE]) 16 July 2009 (2009-07-16) * figures 5, 6 * -----	7	
			TECHNICAL FIELDS SEARCHED (IPC)
			E05D
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 4 September 2023	Examiner Berote, Marc
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 23 16 6644

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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04-09-2023

	Patent document cited in search report	Publication date	Patent family member(s)	Publication date	
10	EP 1834059	B1	04-03-2009	AT 424498 T	15-03-2009
			CN 101076647 A		21-11-2007
			DE 202005000064 U1		24-05-2006
15			DK 1834059 T3		29-06-2009
			EP 1834059 A1		19-09-2007
			PL 1834059 T3		31-08-2009
			RU 2369710 C2		10-10-2009
			WO 2006072331 A1		13-07-2006
20	-----				
	GB 2203483	A	19-10-1988	NONE	

	DE 102008027219 B3		16-07-2009	AT 506828 A2	15-12-2009
				CH 698960 A2	15-12-2009
25				DE 102008027219 B3	16-07-2009
				IT 1394895 B1	20-07-2012

30					
35					
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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 202211567402 [0001]