(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 328 406 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
28.02.2024 Bulletin 2024/09

(21) Application number: **21937342.0**

(22) Date of filing: **22.04.2021**

(51) International Patent Classification (IPC):
E05B 85/12 *(2014.01)* ***E05B 83/36*** *(2014.01)*
E05B 77/36 *(2014.01)*

(52) Cooperative Patent Classification (CPC):
E05B 77/36; E05B 83/36; E05B 85/12

(86) International application number:
PCT/CN2021/088997

(87) International publication number:
WO 2022/222103 (27.10.2022 Gazette 2022/43)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(71) Applicants:
- **Zhejiang Geely Holding Group Co., Ltd.**
  Hangzhou City, Zhejiang 310051 (CN)
- **Geely Automobile Research Institute (Ningbo) Co., Ltd**
  Ningbo, Zhejiang 315336 (CN)

(72) Inventors:
- **ZHANG, Daishuang**
  Hangzhou Bay New District, Ningbo, Zhejiang 315336 (CN)
- **GONG, lijun**
  Hangzhou Bay New District, Ningbo, Zhejiang 315336 (CN)
- **LI, Guanpeng**
  Hangzhou Bay New District, Ningbo, Zhejiang 315336 (CN)
- **XIE, Shengkai**
  Hangzhou Bay New District, Ningbo, Zhejiang 315336 (CN)
- **ZHU, Meiling**
  Hangzhou Bay New District, Ningbo, Zhejiang 315336 (CN)
- **HU, Liangfei**
  Hangzhou Bay New District, Ningbo, Zhejiang 315336 (CN)
- **XIA, Kuansheng**
  Hangzhou Bay New District, Ningbo, Zhejiang 315336 (CN)

(74) Representative: **Kraus & Lederer PartGmbB**
Thomas-Wimmer-Ring 15
80539 München (DE)

(54) VEHICLE DOOR INSIDE OPENING HANDLE ASSEMBLY, VEHICLE DOOR STRUCTURE AND VEHICLE

(57) Disclosed in the present disclosure are a vehicle door inside opening handle assembly, a vehicle door structure and a vehicle. The vehicle door inside opening handle assembly includes a first rotating shaft, a handle structure rotating about the first rotating shaft, a first locking member fixed on the handle structure, a second rotating shaft, a second locking member rotating about the second rotating shaft, and a telescopic member. The opening or closing of the inside opening handle assembly is realized by the handle structure by means of rotating about the first rotating shaft; the second locking member matches the first locking member for locking so as to achieve the locking of the handle structure; one end of the telescopic member is fixedly connected to the second rotating shaft, and the other end of the telescopic member is fixedly connected to the vehicle door; and the telescopic member is capable of extending or retracting in a direction perpendicular to the second rotating shaft. According to the present disclosure, the resistance is small when the vehicle door inside opening handle assembly is opened, and an inside opening handle is prevented from being rapidly closed by means of arranging the telescopic member when the vehicle door inside opening handle assembly is closed, such that the impact abnormal sound caused during closing is avoided, and thus the user experience is improved.

EP 4 328 406 A1

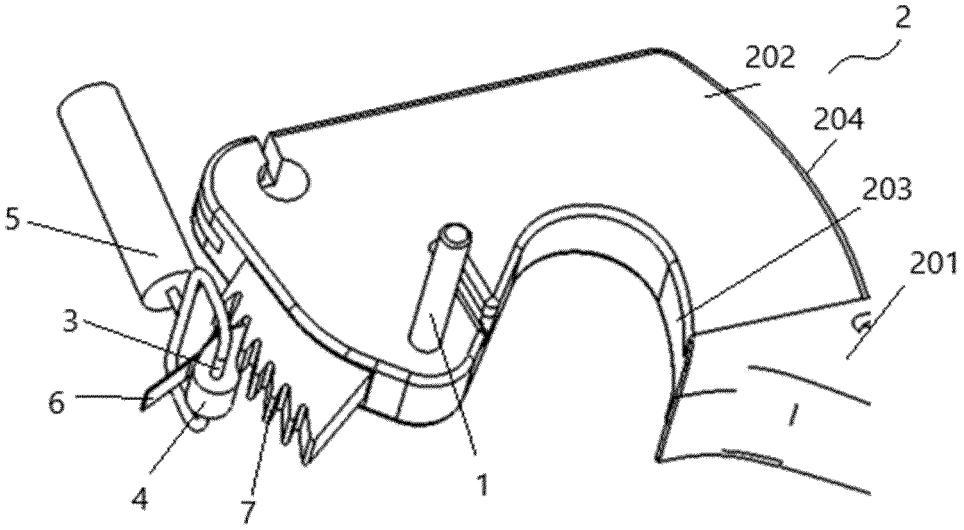

FIG. 1

Description

FIELD

[0001] The present disclosure relates to the technical field of vehicle door handles, and in particular, to an internally openable handle assembly for a vehicle door, a vehicle door structure, and a vehicle.

BACKGROUND

[0002] With refinements of the automotive industry, consumers are demanding higher and higher for perceived quality of automotive parts and have the need for increasing refinements of components.

[0003] The commercially available internally openable handles for a vehicle door are various in shape, but all use a center shaft type. After the internally openable handle is opened, an internal structure, such as internal springs, buffer pads, and other uneven structures, can be visible.

[0004] In addition, most internally openable handles for the vehicle door on the market have a damping feeling when the handle is opened and closed, which may generate abnormal sound during the closing of the handle.

[0005] The existing internally openable handle is required to be further improved in terms of both visual and auditory perception. Therefore, there is an urgent need to provide an internally openable handle for the vehicle door that is good-looking and user-friendly and has good auditory perception.

SUMMARY

[0006] In order to solve the above technical problems, the present disclosure provides an internally openable handle assembly for a vehicle door. The resistance is small when the internally openable handle assembly for the vehicle door is opened, and an extendable member is provided to prevent the internally openable handle from being closed quickly when the internally openable handle assembly for the vehicle door is closed, to avoid impact noise during the closing. Therefore, the resistance is small when the internally openable handle assembly for the vehicle door is opened, and user's experience feeling is improved because of no noise during the closing.

[0007] In order to achieve the above purpose of the present disclosure, the present disclosure provides an internally openable handle assembly for a vehicle door. The internally openable handle assembly for the vehicle door includes a first rotary shaft, a handle structure rotating around the first rotary shaft, a first locking member fixed at the handle structure, a second rotary shaft, a second locking member rotating around the second rotary shaft, and an extendable member. The handle structure is configured to enable opening or closing of the internally openable handle assembly by rotating around the first rotary shaft. The second locking member is cooperatively locked with the first locking member to lock the handle structure. The extendable member has an end fixedly connected to the second rotary shaft and another end configured to be fixedly connected to the vehicle door. The extendable member is extendable or retractable in a direction perpendicular to the second rotary shaft.

[0008] In an embodiment, when the handle structure rotates around the first rotary shaft, the second locking member is driven to be rotatable between an initial position and an open position. The second locking member is positioned at the open position when the handle structure is in an open state.

[0009] In an embodiment, the internally openable handle assembly for the vehicle door further includes an elastic member configured to drive the handle structure in the open state to rotate around the first rotary shaft in a reversed direction until the handle structure returns into a close state.

[0010] In an embodiment, during the rotation of the handle structure around the first rotary shaft in the reversed direction, the second rotary shaft is driven by the handle structure to move away from the extendable member, or is driven by the extendable member to move toward the extendable member.

[0011] In an embodiment, during the rotation of the handle structure around the first rotary shaft in the reversed direction, when an elastic force of the elastic member is greater than a pulling force at which the extendable member is extended, the second rotary shaft is driven by the handle structure to move away from the extendable member until the elastic force of the elastic member is equal to a restoring force at which the extendable member is retracted. The extendable member is pulled by the second rotary shaft synchronously to be extended toward the second rotary shaft.

[0012] In an embodiment, during the rotation of the handle structure around the first rotary shaft in the reversed direction, when an elastic force of the elastic member is smaller than a restoring force at which the extendable member is retracted, the second rotary shaft is driven by the extendable member to move toward the extendable member until the second locking member returns to the initial position.

[0013] In an embodiment, the internally openable handle assembly for the vehicle door further includes a limit member configured to limit a position of the second locking member.

[0014] In an embodiment, the limit member is an elastic sheet.

[0015] In an embodiment, the second locking member is a ratchet mechanism.

[0016] In an embodiment, the extendable member is a damper, and the damper has an end fixedly connected to the second rotary shaft and another end configured to be fixed to the vehicle door. The damper is extendable or retractable in the direction perpendicular to the second rotary shaft.

[0017] In an embodiment, the handle structure includes a handle and a handle base fixedly connected to each other. The handle base is arranged around the first rotary shaft and rotatable around the first rotary shaft. A first arc surface is formed by engaging the handle with the handle base, and is located on an inner side surface of the handle base engaged with the handle and formed into a goose-neck-like structure with an inner notch at the handle base. The first rotary shaft is located on a perpendicular bisector of a connecting line between two points on the first arc surface.

[0018] In an embodiment, the handle base has a second arc surface formed on an outer side surface of the handle base, and the second arc surface is formed with the first rotary shaft as a center of circle.

[0019] In an embodiment, the first locking member is fixedly connected to the handle base and has a gear structure.

[0020] The specific advantages are described below. The internally openable handle assembly for the vehicle door of the present disclosure has a small resistance when the internally openable handle assembly for the vehicle door is opened. The extendable member is provided to prevent the internally openable handle from being closed quickly when the internally openable handle assembly for the vehicle door is closed, to avoid impact noise during the closing. Accordingly, the internally openable handle assembly for the vehicle door has the small resistance during the opening, and the user's experience feeling is provided because of no noise during the closing.

[0021] The present disclosure further provides a vehicle door structure. The vehicle door structure includes a vehicle door sheet metal; a vehicle door interior trim panel fixed on the vehicle door sheet metal and having an opening; and the internally openable handle assembly for the vehicle door as described above. The handle structure includes a handle base that is movable in the opening.

[0022] In an embodiment, the handle structure is engaged with a second arc surface by a goose-neck-like structure that is formed by a first arc surface of the handle structure, in such a manner that the first arc surface and the second arc surface are in close fit with the opening when the handle base moves in the opening.

[0023] The specific advantages of the vehicle door of the present disclosure are described below. When the vehicle door is opened by the internally openable handle assembly for the vehicle door, the internally openable handle assembly for the vehicle door is opened with a small resistance and closed without noise, which improves the user's experience feeling. Moreover, during the opening and closing, a structure of a visible region of the internally openable handle assembly has no change, and thus has a concise shape and a better visual effect.

[0024] The present disclosure further provides a vehicle. The vehicle includes a body and the vehicle door structure described above. The vehicle door structure is disposed on the body.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] In order to clearly explain technical solutions of embodiments of the present disclosure or in the related art, accompanying drawings used in the description of the embodiments or the related art are briefly described below. Obviously, the accompanying drawings as described below are merely some embodiments of the present disclosure. Based on these drawings, other accompanying drawings may be obtained by those skilled in the art without involving creative effort.

FIG. 1 is a perspective structural diagram of an internally openable handle assembly for a vehicle door.

FIG. 2 is a schematic structural diagram of an internally openable handle assembly for a vehicle door.

FIG. 3 is a schematic structural diagram of an internally openable handle assembly for a vehicle door that is assembled on the vehicle door when a handle structure is opened.

FIG. 4 is a schematic structural diagram of an internally openable handle assembly for a vehicle door that is assembled on the vehicle door when a handle structure is closed.

[0026] Reference signs in the drawings are described below:

1 first rotary shaft; 2 handle structure; 201 handle; 202 handle base; 203 first arc surface; 204 second arc surface; 3 second rotary shaft; 4 second locking member; 5 extendable member; 6 limit member; 7 first locking member; 8 vehicle door interior trim panel; 801 opening.

DETAILED DESCRIPTION

[0027] In order to make the objects, technical solutions and advantages of the present disclosure more apparent, the present disclosure will be further described in detail below in combination with accompanying drawings.

[0028] It should be noted that in the specification and claims of the present disclosure and the accompanying drawings, terms such as "first" and "second" are used to distinguish similar objects, rather than to describe a specific sequence or order. In addition, terms "include", "have" and any variation thereof are intended to cover non-exclusive inclusions. In different embodiment modifications, the same components have the same reference signs.

[0029] FIG. 1 is a perspective structural diagram of an internally openable handle assembly for a vehicle door of the present disclosure. The internally openable handle assembly for the vehicle door includes a first rotary shaft 1, a handle structure 2 rotating around the first rotary shaft 1, a first locking member 7 fixed at the handle structure 2, a second rotary shaft 3, a second locking member 4 rotating around the second rotary shaft 3, and an extendable member 5. The handle structure 2 is configured

to enable opening or closing of the internally openable handle assembly by rotating around the first rotary shaft 1.

[0030] In some embodiments, the handle structure 2 may rotate clockwise and counterclockwise around the first rotary shaft 1.

[0031] In some embodiments, the present disclosure may be, but is not limited to that, when the handle structure 2 rotates clockwise around the first rotary shaft 1, the handle structure 2 is configured to open the internally openable handle assembly.

[0032] When the handle structure 2 rotates counterclockwise around the first rotary shaft 1, the handle structure 2 is configured to close the internally openable handle assembly.

[0033] The second locking member 4 is engaged and locked with the first locking member 7 to lock the handle structure 2.

[0034] In some embodiments, when the handle structure 2 rotates clockwise around the first rotary shaft 1, the first locking member 7 synchronously rotates with the handle structure 2 and pushes the second locking member 4 to move, causing the second locking member 4 to rotate counterclockwise around the second rotary shaft 3, during which the first locking member 7 is in sliding fit with the second locking member 4.

[0035] In some embodiments, the second locking member 4 may be a ratchet mechanism, and the first locking member 7 may be a gear structure. The ratchet mechanism is engaged with the gear structure to lock the handle structure 2.

[0036] In some embodiments, in this embodiment of the description, when the handle structure 2 rotates around the first rotary shaft 1, the first locking member 7 synchronously rotates with the handle structure 2.

[0037] The extendable member 5 has an end fixedly connected to the second rotary shaft 3 and another end fixedly connected to the vehicle door.

[0038] In an embodiment, the extendable member 5 may include a fixed portion and an extendable portion.

[0039] The extendable portion has an end connected to the fixed portion and another end fixedly connected to the second rotary shaft 3.

[0040] An end of the fixed portion away from the extendable portion is configured to be fixed to the vehicle door.

[0041] The extendable member 5 is extendable or retractable in a direction perpendicular to the second rotary shaft 3.

[0042] In an embodiment, the extendable portion of the extendable member 5 may be perpendicular to the second rotary shaft 3, enabling the extendable member 5 to be extendable or retractable in a direction perpendicular to the second rotary shaft 3. During extending or retracting of the extendable portion, the extendable portion is slidable relative to the fixed portion in the direction of the extendable portion perpendicular to the second rotary shaft 3. In the internally openable handle assembly for the vehicle door of the present disclosure, the resistance is small when the internally openable handle assembly for the vehicle door is opened, and the extendable member is provided to prevent an internally openable handle from closing quickly when the internally openable handle assembly for the vehicle door is closed, to avoid impact noise during the closing. Therefore, the internally openable handle assembly for the vehicle door is opened with a small resistance and close without noise, which improves user's experience feeling.

[0043] In an embodiment, as illustrated in FIG. 1 and FIG. 2, the extendable member 5 is a damper having an end fixedly connected to the second rotary shaft 3 and another end configured to be fixed to the vehicle door. The damper is configured to be extendable or retractable in the direction perpendicular to the second rotary shaft 3.

[0044] In other embodiments of the present disclosure, the extendable member 5 may be a spring, an air cylinder, or other structures.

[0045] As illustrated in FIG. 1 and FIG. 2, when the handle structure 2 rotates around the first rotary shaft 1, the second locking member 4 is driven by the handle structure 2 to be rotatable between an initial position and an open position. The second locking member 4 is positioned at the open position when the handle structure 2 is in an open state.

[0046] In some embodiments, during the clockwise rotation of the handle structure 2 around the first rotary shaft, the second locking member 4 is driven by the handle structure 2 to rotate counterclockwise from the initial position to the open position. During the counterclockwise rotation of the handle structure 2 around the first rotary shaft, the second locking member 4 is driven by the handle structure 2 to return to the initial position from the open position.

[0047] In some embodiments, the internally openable handle assembly for the vehicle door further includes an elastic member (not shown in the figures). The elastic member is configured to drive the handle structure 2 in the open state to rotate around the first rotary shaft 1 in a reversed direction until the handle structure 2 returns into a close state.

[0048] In an embodiment, the elastic member is arranged around the first rotary shaft 1. When the handle structure 2 is opened, the elastic member has a reaction force. With this arrangement, the handle structure is driven to automatically return after the handle structure 2 is opened.

[0049] In an embodiment, the elastic member may be a torsion spring.

[0050] In some embodiments, as illustrated in FIG. 1 and FIG. 2, during the rotation of the handle structure 2 around the first rotary shaft 1 in the reversed direction, the second rotary shaft 3 is driven by the handle structure 2 to move away from the extendable member 5, or the extendable member 5 is capable of driving the second rotary shaft 3 to move toward the extendable member 5.

[0051] In some embodiments, when an elastic force of

the elastic member is greater than a pulling force at which the extendable member 5 is extended, and the second rotary shaft 3 is driven by the handle structure 2 to move away from the extendable member 5 until the elastic force of the elastic member is equal to a restoring force at which the extendable member 5 is retracted. The extendable member 5 is pulled by the second rotary shaft 3 synchronously to extend toward the second rotary shaft 3.

[0052] In an embodiment, the extendable portion of the extendable member 5 is pulled to extend toward the second rotary shaft 3.

[0053] In some embodiments, when the elastic force of the elastic member is smaller than the restoring force at which the extendable member 5 is retracted, the second rotary shaft 3 is driven by the extendable member 5 to move toward the extendable member 5 until the second locking member 4 returns to the initial position. The second locking member 4 synchronously moves with the second rotary shaft 3 when the second rotary shaft 3 moves.

[0054] As illustrated in FIG. 1 and FIG. 2, the internally openable handle assembly for the vehicle door further includes a limit member 6 configured to limit a position of the second locking member 4.

[0055] In some embodiments, after the second locking member 4 is engaged and locked with the first locking member 7, the limit member 6 is configured to limit and fix the second locking member 4 again, to prevent the second locking member 4 from sliding.

[0056] In an embodiment, the limit member 6 is an elastic sheet.

[0057] In other embodiments of the present disclosure, the limit member 6 is another elastic pressure device, such as a tension spring.

[0058] As illustrated in FIG. 1 and FIG. 2, the handle structure 2 includes a handle 201 and a handle base 202 that are fixedly connected to each other. The handle base 202 is arranged around the first rotary shaft 1 and rotatable around the first rotary shaft 1. A first arc surface 203 is formed by engaging the handle 201 with the handle base 202. The first arc surface 203 is located on an inner side surface of the handle base 202 engaged with the handle 201 and forms a goose-neck-like structure with an inner notch at the handle base 202. The first rotary shaft 1 is located on a perpendicular bisector of a connecting line between two points on the first arc surface 203.

[0059] In some embodiments, a point A and a point B are selected on the first arc surface 203. The point A is connected to the point B, and a perpendicular bisector of a connecting line between the point A and the point B is made.

[0060] During the assembly, a Y-direction position where a center of circle is located may be determined based on information, such as a shape-limiting surface, a component material thickness, a minimum gap, and a minimum structural strength of a vehicle door interior trim panel. Further, a position of the first rotary shaft 1 is determined. The first arc surface 203 is formed with the first rotary shaft 1 as a center of circle.

[0061] In some embodiments, as illustrated in FIG. 1 and FIG. 2, an outer side surface of the handle base 202 has a second arc surface 204. The second arc surface 204 is formed with the first rotary shaft 1 as a center of circle. That is, the first arc surface 203 and the second arc surface 204 are arc surfaces of concentric circles. With this configuration, when the handle structure 2 rotates around the first rotary shaft 1, a distance between the first arc surface and the handle structure 2 and a distance between the second arc surface and the handle structure 2 both remain constant. Therefore, when the internally openable handle assembly is subsequently assembled to the vehicle door, convenient assembly and a more aesthetically pleasing profile are facilitated to be achieved.

[0062] In some embodiments, as illustrated in FIG. 1 and FIG. 2, the first locking member 7 is fixedly connected to the handle base 202. When the handle structure 2 rotates around the first rotary shaft 1, the first locking member 7 and the handle structure 2 rotate synchronously.

[0063] The operation principle of the internally openable handle assembly for the vehicle door is described below.

1) Opening process of the internally openable handle assembly

[0064] During the opening of the internally openable handle, the handle structure 2 rotates clockwise around the first rotary shaft 1. Meanwhile, the first locking member 7 is driven by the handle structure 2 to move synchronously, and the second locking member 4 is pushed by the first locking member 7 to rotate counterclockwise around the second rotary shaft 3 until the handle structure 2 rotates to the internally openable handle assembly to be opened. During the synchronous movement of the second locking member 4 pushed by the first locking member 7, the first locking member 7 is in sliding fit with the second locking member 4. During the opening of the internally openable handle of the present disclosure, the handle structure 2 has the small resistance and is opened smoothly.

[0065] In some embodiments, when the first locking member 7 is the gear structure and the second locking member 4 is the ratchet mechanism, the gear structure pushes the ratchet mechanism, enabling the ratchet mechanism to rotate counterclockwise around the second rotary shaft 3. After the handle structure 2 continues to rotate to open one of teeth, the ratchet mechanism continues to be tightly attached to the teeth of the gear structure under the action of the elastic sheet and this cycle is to be performed on the next tooth until the handle structure 2 rotates to the internally openable handle assembly to be opened.

2) Closing process of the internally openable handle assembly

[0066] When the internally openable handle assembly is fully opened or needs to be closed at any angle, i.e., when the handle structure 2 needs to be closed after rotating to any angle, the elastic member has the elastic force greater than the pulling force at which the extendable member 5 is extended and drives the handle structure 2 to rotate counterclockwise around the first rotary shaft 1, and the handle structure drives the first locking member 7 to move synchronously. Currently, the first locking member 7 applies an acting force to the second locking member 4, enabling the second locking member 4 to drive the second rotary shaft 3 to move simultaneously in a force direction. Moreover, the second rotary shaft 3 pulls the extendable member 5 to move synchronously in the direction perpendicular to the second rotary shaft 3 until the elastic force of the elastic member is equal to the restoring force at which the extendable member 5 is retracted. In this case, the handle structure 2 continues to rotate counterclockwise. When the elastic force of the elastic member is smaller than the restoring force at which the extendable member 5 is retracted, the second rotary shaft 3 is driven by the extendable member 5 to move toward the extendable member 5 until the handle structure 2 is slowly closed. At this time, the second locking member 4 continues to rotate counterclockwise under the action of the second rotary shaft 3 until the second locking member 4 returns to the initial position to prepare for the next cycle. In this process, the handle structure 2 can be slowly closed due to the force of the extendable member 5, thereby avoiding impact noise during the closing.

[0067] With the internally openable handle assembly for the vehicle door according to the present disclosure, when the internally openable handle assembly for the vehicle door is opened, the resistance is small. Moreover, when the internally openable handle assembly for the vehicle door is closed, the internally openable handle is prevented from being quickly closed by providing the extendable member, to avoid the impact noise during the closing. That is, the handle structure 2 of the present disclosure is only subjected to the force of the extendable member 5 during the closing, and is not subjected to an external force of the extendable member during the opening. In this way, with this unidirectional force configuration, the resistance is small when the internally openable handle assembly is opened, and no abnormal sound is generated when the internally openable handle assembly is closed, thereby improving the user's experience feeling.

[0068] The present disclosure further discloses a vehicle door structure. FIG. 3 and FIG. 4 are both perspective partial structural diagrams of an internally openable handle assembly for a vehicle door assembled on the vehicle door. The vehicle door structure includes a vehicle door sheet metal, a vehicle door interior trim panel 8 fixed on the vehicle door sheet metal and having an opening 801, and the internally openable handle assembly for the vehicle door as described above. The handle structure 2 includes the handle base 202 that is movable in the opening 801.

[0069] As illustrated in FIG. 3, the handle structure 2 is engaged with the second arc surface 204 by a gooseneck-like structure that is formed by the first arc surface 203 of the handle structure 2, such that the first arc surface 203 and the second arc surface 204 are in close fit with the opening 801 when the handle base 202 moves in the opening 801.

[0070] In some embodiments, as illustrated in FIG. 3, during the opening or closing of the internally openable handle assembly, i.e., during the rotation of the handle structure 2, the second arc surface 204 is always in close fit with an inner wall of the opening 801 of the vehicle door interior trim panel 8, ensuring that the user only see the second arc surface 204 of the handle structure 2. However, the user is unable to see any other internal structures of the vehicle door sheet metal or any other internal structures of the internally openable handle assembly such as springs, cache pads, and other uneven structures. Therefore, the overall structure is more attractive and more in line with user's aesthetic requirements.

[0071] According to the vehicle door structure of the present disclosure, when the vehicle door is opened by using the internally openable handle assembly for the vehicle door, the internally openable handle assembly for the vehicle door is opened with a small resistance and close without noise, which improves the user's experience feeling. Moreover, during the opening and closing, the structure of the visible region of the internally openable handle assembly has no change, is in a cleaner shape, and has a better visual effect.

[0072] The present disclosure further provides a vehicle. The vehicle includes a body and the vehicle door structure as described above. The vehicle door structure is disposed on the body.

[0073] The above disclosures are only preferred embodiments of the present disclosure, and the scope of the present disclosure are not be limited thereto. Therefore, equivalent variations made in accordance with the claims of the present disclosure are still covered by the present disclosure.

Claims

1. An internally openable handle assembly for a vehicle door, comprising:

   a first rotary shaft (1);
   a handle structure (2) rotating around the first rotary shaft (1), the handle structure (2) being configured to enable an opening or a closing of the internally openable handle assembly by ro-

tating around the first rotary shaft (1);
a first locking member (7) fixed on the handle structure (2);
a second rotary shaft (3);
a second locking member (4) rotating around the second rotary shaft (3), the second locking member (4) being engaged and locked with the first locking member (7) to lock the handle structure (2); and
an extendable member (5) having an end fixedly connected to the second rotary shaft (3) and another end configured to be fixedly connected to the vehicle door, the extendable member (5) being extendable or retractable in a direction perpendicular to the second rotary shaft (3).

2. The internally openable handle assembly according to claim 1, wherein when the handle structure (2) rotates around the first rotary shaft (1), the second locking member (4) is driven by the handle structure (2) to be rotatable between an initial position and an open position, the second locking member (4) is positioned at the open position when the handle structure (2) is in an open state.

3. The internally openable handle assembly according to claim 2, further comprising an elastic member configured to drive the handle structure (2) in the open state to rotate around the first rotary shaft (1) in a reversed direction until the handle structure (2) returns into a closed state.

4. The internally openable handle assembly according to claim 3, wherein during the rotation of the handle structure (2) around the first rotary shaft (1) in the reversed direction, the second rotary shaft (3) is driven by the handle structure (2) to move away from the extendable member (5), or the extendable member (5) is capable of driving the second rotary shaft (3) to move towards the extendable member (5).

5. The internally openable handle assembly according to claim 4, wherein:

during the rotation of the handle structure (2) around the first rotary shaft (1) in the reversed direction, when an elastic force of the elastic member is greater than an extending force at which the extendable member (5) is extended, the second rotary shaft (3) is driven by the handle structure (2) to move away from the extendable member (5) until the elastic force of the elastic member is equal to a retracting force at which the extendable member (5) is retracted; and
the extendable member (5) is pulled by the second rotary shaft (3) synchronously to extend towards the second rotary shaft (3).

6. The internally openable handle assembly according to claim 4, wherein:

during the rotation of the handle structure (2) around the first rotary shaft (1) in the reversed direction, when an elastic force of the elastic member is smaller than a retracting force at which the extendable member (5) is retracted, the second rotary shaft (3) is driven by the extendable member (5) to move towards the extendable member (5) until the second locking member (4) returns to the initial position; and
the second locking member (4) synchronously moves with the second rotary shaft (3).

7. The internally openable handle assembly according to claim 1, further comprising a limiting member (6) configured to limit a position of the second locking member (4).

8. The internally openable handle assembly according to claim 7, wherein the limiting member (6) is an elastic sheet.

9. The internally openable handle assembly according to claim 1, wherein the second locking member (4) is a ratchet mechanism.

10. The internally openable handle assembly according to claim 1, wherein the extendable member (5) is a damper having an end fixedly connected to the second rotary shaft (3) and another end configured to be fixed to the vehicle door, the damper being configured to be extendable or retractable in the direction perpendicular to the second rotary shaft (3).

11. The internally openable handle assembly according to claim 1, wherein:

the handle structure (2) comprises a handle (201) and a handle base (202) that are fixedly connected to each other;
the handle base (202) is sleeved on the first rotary shaft (1) and rotatable around the first rotary shaft (1);
a first arc surface (203) is formed by engaging the handle (201) with the handle base (202), the first arc surface (203) being located on an inner side surface of handle base (202) engaged with the handle (201) and forming a goose-neck-like structure together with an inner notch on the handle base (202); and
the first rotary shaft (1) is located on a perpendicular bisector of a connecting line between any two points on the first circular arc surface (203).

12. The internally openable handle assembly according to claim 11, wherein an outer side surface of the han-

dle base (202) has a second arc surface (204), the second arc surface (204) being formed with the first rotary shaft (1) as a center of circle.

13. The internally openable handle assembly according to claim 11, wherein the first locking member (7) is fixedly connected to the handle base (202) and is a gear structure.

14. A vehicle door structure, comprising:

a vehicle door sheet metal;
a vehicle door interior trim panel (8) fixed on the door sheet metal and having an opening (801); and
the internally openable handle assembly according to any one of claims 1 to 13,
wherein a handle base (202) on a handle structure (2) is movable in the opening (801).

15. The vehicle door structure according to claim 14, wherein the handle structure (2) is engaged with a second arc surface (204) with a goose-neck-like structure formed by a first arc surface (203) on the handle structure (2), to brought the first arc surface (203) and the second arc surface (204) into close fit with the opening (801) when the handle base (202) moves in the opening (801).

16. A vehicle, comprising:

a body; and
the vehicle door structure according to claim 14 or 15, the vehicle door structure being disposed on the body.

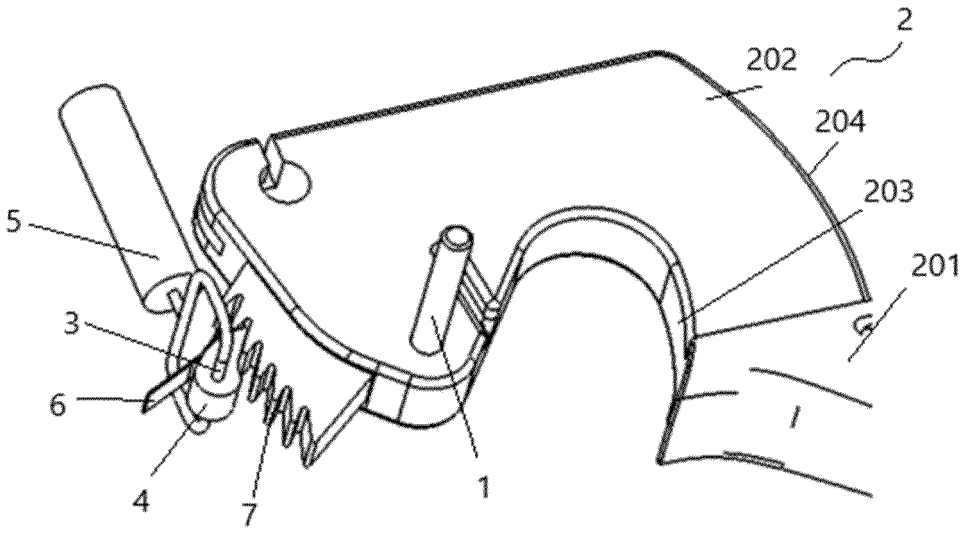

FIG. 1

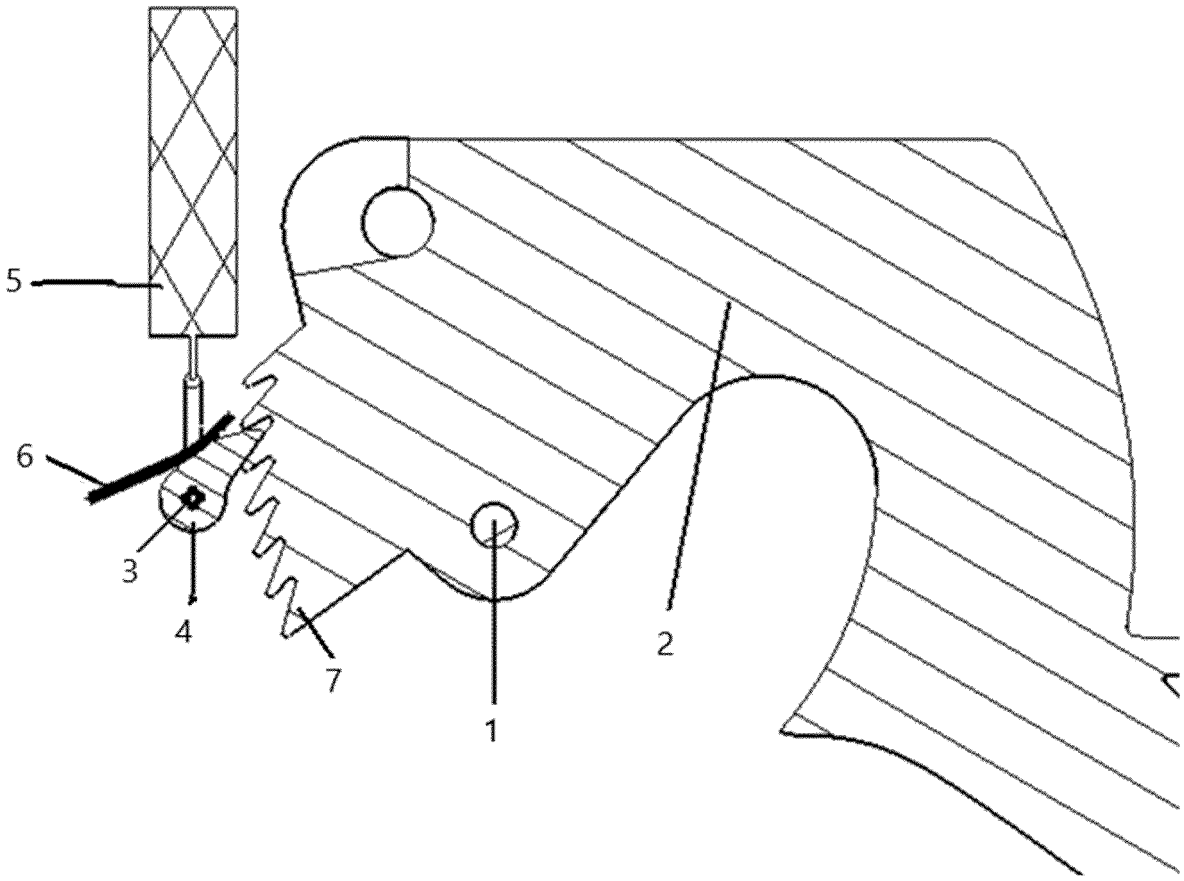

FIG. 2

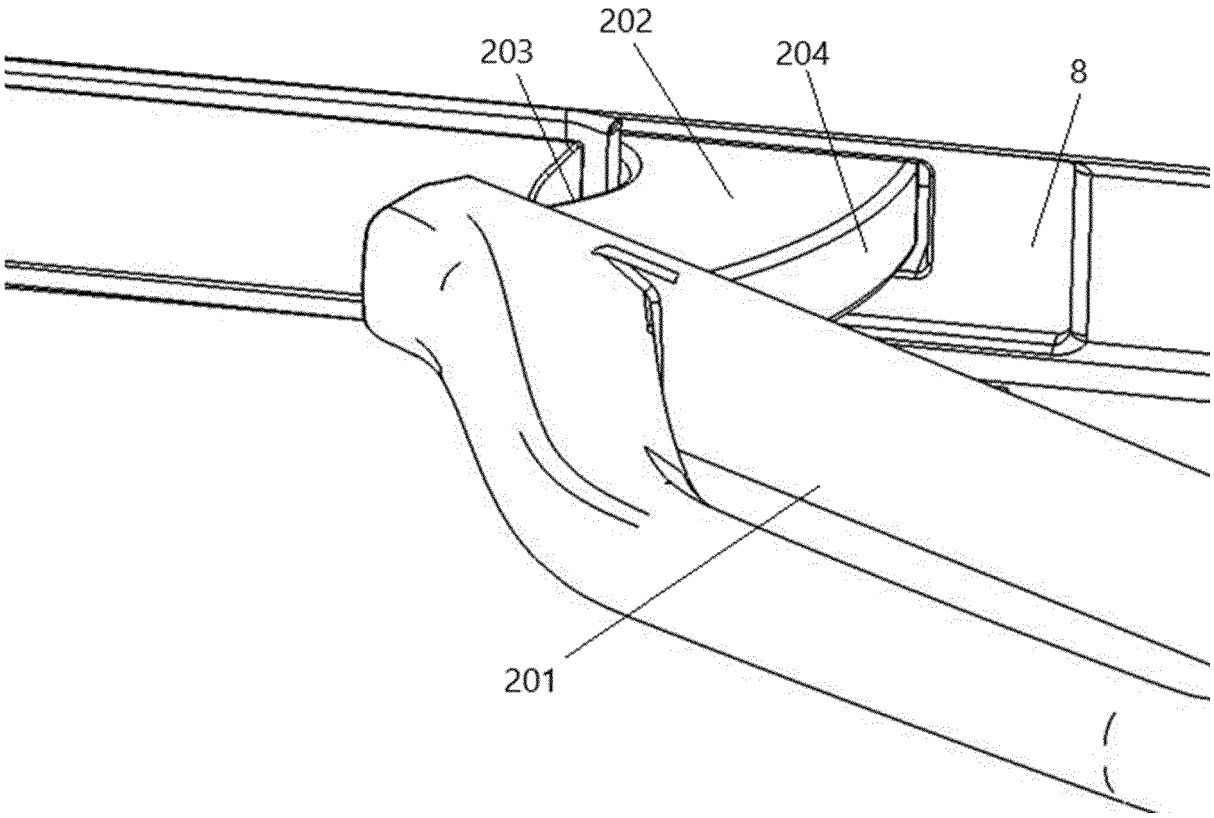

FIG. 3

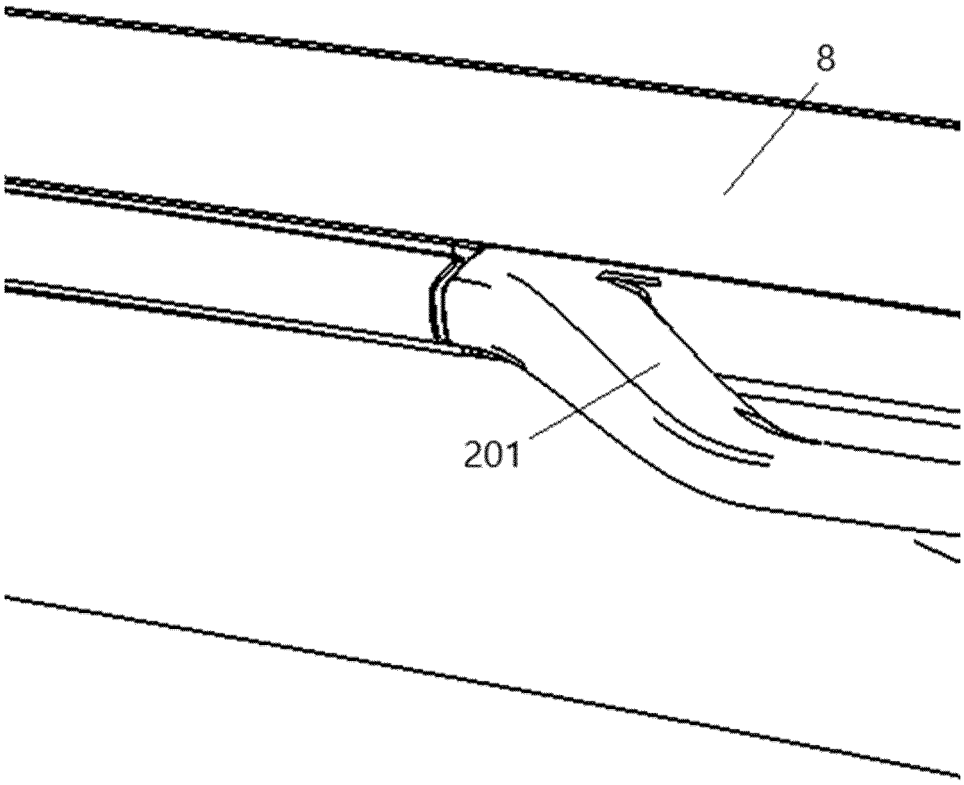

FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2021/088997

A. CLASSIFICATION OF SUBJECT MATTER

E05B 85/12(2014.01)i; E05B 83/36(2014.01)i; E05B 77/36(2014.01)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)

E05B 83/36; E05B 83/00; E05B 85/12; E05B 85/10; E05B 77/36; E05B 65/12; E05B 65/20

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)

CNABS; CNTXT; CNKI; VEN: 手柄, 把手, 棘齿, 棘轮, 齿轮, 阻尼, 伸缩, 拉伸, 收缩, 异响, 撞击, 缓, 慢, 噪音, 声响, 碰撞, handle+, ratchet, gear, damp+, buffer, telescopic, stretch, contraction, noise, impact

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 207392956 U (GEELY AUTOMOBILE RESEARCH INSTITUTE (NINGBO) CO., LTD. et al.) 22 May 2018 (2018-05-22) description, paragraphs [0031]-[0048], and figures 1-6	1-16
A	CN 102011527 A (MITSUI MINING & SMELTING CO.) 13 April 2011 (2011-04-13) entire document	1-16
A	CN 212614212 U (GUIZHOU HUAYANG AUTO PARTS CO., LTD.) 26 February 2021 (2021-02-26) entire document	1-16
A	JP 2011052497 A (MITSUI KINZOKU ACT CORP.) 17 March 2011 (2011-03-17) entire document	1-16
A	WO 2012050212 A1 (ALPHA CORP. et al.) 19 April 2012 (2012-04-19) entire document	1-16

☐ 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
22 December 2021	**13 January 2022**

Name and mailing address of the ISA/CN	Authorized officer
China National Intellectual Property Administration (ISA/CN) **No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088, China**	
Facsimile No. **(86-10)62019451**	Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2021/088997

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	207392956	U	22 May 2018	None			
CN	102011527	A	13 April 2011	CN	103031996	A	10 April 2013
				CN	103031996	B	29 July 2015
				CN	102011527	B	12 June 2013
CN	212614212	U	26 February 2021	None			
JP	2011052497	A	17 March 2011	JP	4826853	B2	30 November 2011
WO	2012050212	A1	19 April 2012	US	2013168979	A1	04 July 2013
				US	9181734	B2	10 November 2015
				JP	2012087473	A	10 May 2012
				JP	5752913	B2	22 July 2015

Form PCT/ISA/210 (patent family annex) (January 2015)