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[Continued on next page]

(54) Title: VEHICLE ROOF RETRACTING DEVICE AND VEHICLE HAVING THE SAME

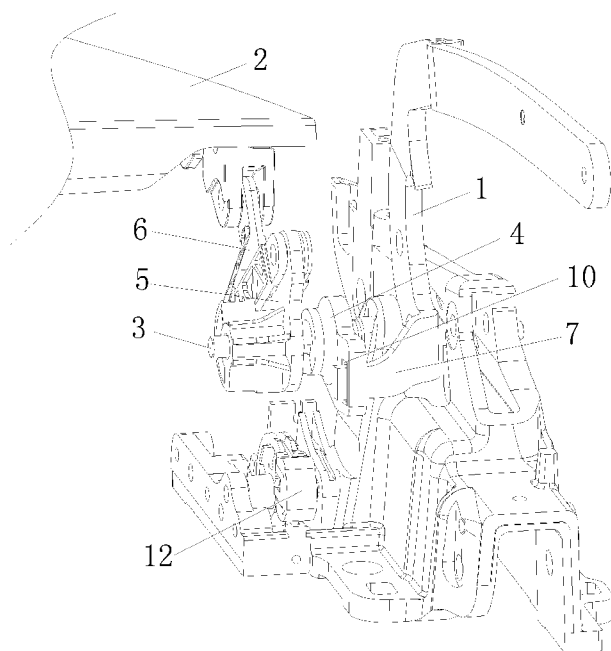


FIG. 1

(57) Abstract: A vehicle roof retracting device comprises a guiding means (1) of the roof, a rear shelf (2), a trunk cover, a principal shaft (3), an adjusting lever (4), an initiative lever (5) and a connecting lever (6). The guiding means (1) of the roof rotates around the principal shaft (3) for actuating the roof to displace between a closed position and a retracted position. The rear shelf (2) provides a space for the passage of the roof when it is opened and conceals a gap between the roof and the trunk cover when it is closed. The adjusting lever (4) is connected to an extension (7) configured to extend transversely from one end of the guiding means (1) of the roof and actuated by the extension (7) to rotate around the principal shaft (3). A protruding part of the adjusting lever (4) is selectively engaged with or disengaged from the initiative lever (5) for actuating the initiative lever (5) to rotate around the principal shaft (3). The connecting lever (6) is configured to connect the initiative lever (5) and the rear shelf (2) for displacing the rear shelf (2) between the opened position and the closed position. A vehicle comprises the above-mentioned vehicle roof retracting device.



(84) **Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM,

TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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VEHICLE ROOF RETRACTING DEVICE AND VEHICLE HAVING THE SAME

CROSS-REFERENCE TO RELATED APPLICATION

- 5 This application claims priority to Chinese Patent Application No. 200810148811.0, filed on September 27, 2008, the entire disclosure of which is incorporated herein by reference.

FIELD OF THE INVENTION

- 10 The present invention relates to vehicles. More particularly, relates to roof retracting devices and vehicles fitted with said device.

BACKGROUND OF THE INVENTION

- 15 Along with the development of social and economic, people pay more attention to the quality of life. And, vehicles fitted with retractable hard tops become an increasing popularity. Such vehicle roofs should ensure the sealed condition in the closed position in order to solve the problem of all-weather suitability. Also, it should be safe and stable during the operation of the hard top.

- 20 Compared with vehicles fitted with at least triple-collapsed roofs, vehicles fitted with double-collapsed roofs are simpler in configuration, but they need longer trunks to accommodate the roofs. But, it is more difficult to drive a vehicle with longer trunks. Thus, a roof retracting device is needed to retract a longer roof into a trunk as short as possible
25 and ensure the sealing performance.

A retractable hard top is disclosed in the Chinese Patent Publication No.CN1293122A. The retractable hard top comprises an upper roof section and a rear roof section which is connected to the upper roof section via a rod assembly. When pivoting the roof into the retracted

position, the upper roof section can move into the interior of the rear roof section and retracts into the accommodation space together with the rear roof section. This patent do not takes into account the sealing performance when the roof is in the closed or retracted position.

5 A retractable hard top of vehicle is disclosed in the Chinese Patent No.CN2880565Y. The hard top comprises a foundation, a first rod which is connected to the front of the foundation, a second rod which is connected to the rear of the foundation, and a third rod which is connected between the first rod and the second rod. The second rod
10 comprises a rear rod and a front rod connected with the rear rod. During operation, the hydraulic system actuates the roof to move between the closed position in which the roof is resting on a frame and the retracted position in which the roof retracts into a roof accommodation space. The patent also does not refer to a mechanism used to ensure sealing
15 performance. Therefore, the vehicle fitted with the hard top does not meet the esthetic and aerodynamic needs.

Moreover, a retractable roof device and the vehicle fitted with the device are disclosed in the Chinese Patent Publication No.CN1750952A. The retractable roof device comprises a rear cover. The
20 rear cover comprises a rear shelf and two closure flaps positioned on both sides of the rear shelf. The rear cover can be opened in order to make space for the passage of the roof and the guiding means of the roof when the roof is displaced between the closed position and the retracted position. And, the rear cover can conceal the gap when the roof is in the
25 closed position or in the detracted position. The rear cover operates together with the roof. In detail, the extension of the guiding means of the roof causes rotation of a cam of a principal axis. Then the cam actuates the rear cover to move via a L-shaped lever. With continuous rotation of the guiding means of the roof, the extension of the guiding means comes

into contact with a pulley nested on the principal axis and causes the pulley to rotate. The rotation of the pulley generates a tractive force on a cable which is fixed to the pulley. At the other end of the cable, this tractive force acts on an actuating mechanism of the closure flaps and
5 further causes opening or closing of the closure flaps. But vehicles fitted with said retractable roof devices suffer from many disadvantages. Firstly, the malfunctions that the start point of the parts is not concurrent and the cable comes out of the preset track in ruinous aftermath such as rupture of the rear shelf and stopping of the roof during operation. Secondly, the
10 retractable roof device which is complicated in configuration needs to be manufactured and assembled in high accuracy. Thirdly, it is difficult to adjust the relation between the trunk cover and the roof. Fourthly, the operation of the retractable roof device is not stable.

15 SUMMARY OF THE INVENTION

The object of the present invention is to provide an improved roof retracting device which is simpler in structure, more reliable and stable in operation, and easier to adjust the relation between the rear shelf and the guiding means of the roof.

20 According to an embodiment of the present invention, the roof retracting device comprises a guiding means of the roof, a rear shelf, a trunk cover, and a principal shaft, said guiding means of the roof rotates around said principal shaft in order to actuate the vehicle roof to displace between the closed position and the retracted position, said rear shelf can
25 be opened in order to make space for the passage of the roof and closed in order to conceal the gap between the vehicle roof and the trunk cover, wherein said roof retracting device further comprises: an adjusting lever, which is connected to an extension configured to extend transversely from one end of said guiding means of the roof and is actuated by the

extension to rotate around said principal shaft; an initiative lever, which is engagable and disengagable with a protruding part of said adjusting lever and is actuated by said adjusting lever to rotate around said principal shaft; and a connecting lever, which is connected between the initiative lever
5 and the rear shelf to displace the rear shelf between the opened position and the closed position.

According to another embodiment of the invention, the present invention also provides a vehicle which comprises aforesaid roof retracting device.

10 The rear shelf operates harmoniously with the guiding means of the roof via the extension of the guiding means, the adjusting lever and the connecting lever. It is easy to adjust the relation between the rear shelf and the guiding means of the roof via the adjusting lever. Accordingly, the roof retracting device becomes more reliable and more stable.

15

BRIEF DESCRIPTION OF THE DRAWINGS

The aforementioned features and advantages of the invention as well as additional features and advantages thereof will be more clearly understood hereinafter as a result of a detailed description of
20 embodiments when taken in conjunction with the drawings.

FIG.1 is a perspective view illustrating an embodiment of the roof retracting device.

FIG.2 is a perspective view illustrating the adjusting lever of the roof retracting device.

25 FIG.3a-3e illustrates side elevations of the operation process of the roof retracting device, respectively.

DETAILED DESCRIPTION OF THE EMBODIMENTS

According to an embodiment of the invention, the roof retracting

device comprises a guiding means 1 of the roof, a rear shelf 2, a trunk cover, a principal shaft 3. The guiding means 1 of the roof rotates around the principal shaft 3 to actuate the vehicle roof to displace between the closed position and the retracted position, the rear shelf 2 can be opened
5 to make space for the passage of the roof and closed to conceal the gap between the vehicle roof and the trunk cover. said the roof retracting device also comprises an adjusting lever 4, an initiative lever 5, and a connecting lever 6. The adjusting lever 4 is connected to the extension 7 configured to transversely extend from one end of the guiding means 1 of
10 the roof, and is actuated by the extension 7 to rotate around the principal shaft 3. The adjusting lever 4 has a protruding part 8 which can be engaged with and disengaged from the initiative lever 5 and drive the initiative lever 5 to rotate around the principal shaft 3. The connecting lever 6 is connected between the initiative lever 5 and the rear shelf 2 to
15 drive the rear shelf 2 to be opened or closed.

The guiding means 1 of the roof is actuated by a hydraulic assembly or a pneumatic assembly to rotate around the principal shaft 3 such that the vehicle roof is actuated to displace between the closed position and the retracted position. In the closed position, the roof is resting on the
20 vehicle frame, and the vehicle fitted with said roof retracting device acts as a common car. In the retracted position, the roof is lodged in the trunk, and the vehicle fitted with said roof retracting device acts as a sports car. The trunk cover can be opened backwards so that the roof can be lodged in the trunk. The trunk cover can be opened forwards in order to lodge
25 luggage into the trunk.

The rear shelf 2 can be in the opened position or in the closed position. When the rear shelf 2 is in opened position, it makes space for the passage of the roof such that the roof can pass through smoothly between the closed position and the retracted position. When in the closed

position, the rear shelf 2 can conceal the gap between the vehicle roof and the trunk cover for the esthetic and aerodynamic needs.

Generally, the rear shelf 2 operates together with the roof. Concretely, the extension 7 of the guiding means 1 is configured to extend transversely from one end of the guiding means 1 of the roof. And, the extension 7 of the guiding means 1 is connected with the adjusting lever 4. When the guiding means 1 of the roof rotates to actuate the roof, the extension 7 of the guiding means 1 will cause rotation of the adjusting lever 4 around the principal shaft 3. The adjusting lever 4 has the protruding part 8 which can be engaged with and disengaged from the initiative lever 5, such that the rotation of the adjusting lever 4 will cause rotation of the initiative lever 5 around the principal shaft 3. The initiative lever 5 is connected to the rear shelf 2 via the L-shaped connecting lever 6. Accordingly, the initiative lever 5 can rotate to open or close the rear shelf 2 via the connecting lever 6.

According to an embodiment of the invention, the adjusting lever 4 is connected to the extension 7 of the guiding means via an adjusting device. The adjusting lever 4 is used to adjust the position between the adjusting lever 4 and the extension 7 of the guiding means. Namely, the adjusting lever 4 is used for adjusting the position between the protruding part 8 of the adjusting lever 4 and the guiding means 1 of the roof.

As shown in FIG2, the adjusting device comprises an adjusting bolt 9 and a long hole 10 formed in the adjusting lever 4. One end of the extension 7 of the guiding means is inserted into the long hole 10 and fixed by the adjusting bolt 9 which is screwed into the long hole 10. Also, the adjusting bolt 9 can be used for adjusting the position between the end of the extension 7 of the guiding means and the long hole 10. The end of the extension 7 of the guiding means can be moved upwardly and downwardly in the long hole 10 in order to adjust the position between

the protruding part 8 of the adjusting lever 4 and the guiding means 1 of the roof, namely the angle between the adjusting lever 4 and the principal shaft 3.

According to an embodiment of the invention, a cam 11 is
5 configured to radially extend from the initiative lever 5. The roof retracting device comprises a resetting lever 12 which can be engaged with and disengaged from the cam 11 of the initiative lever 5. The resetting lever 12 comes into contact with the cam 11 and causes rotation of the initiative lever 5 to close the rear shelf 2 after the roof is retracted
10 into the trunk. The roof retracting device also comprises a resetting spring which is connected to the initiative lever 5. Before the roof comes out of the trunk, the resetting lever 12 is disengaged from the cam 11 and the initiative lever 5 is rotated by the resilience force of the resetting spring to open the rear shelf 2. Preferably, the resetting lever 12 operates together
15 with the trunk cover. For example, the resetting lever 12 operates together with the trunk cover via a cable. When the trunk cover comes into the closed position, the resetting lever 12 comes into contact with the cam 11 of the initiative lever 5 in order to close the rear shelf 2. When the trunk cover comes into the opened position, the resetting lever 12 is disengaged
20 from the cam 11 in order to open the rear shelf 2 via the resetting spring.

The operation of the roof retracting device during retraction of the roof takes place in the following manner. We will describe in detail referring to FIGs.3a-3d.

As shown in FIG.3a, the roof is in the closed position. It is necessary
25 firstly to open the trunk cover so that the roof can be retracted into the trunk. When the trunk cover is opened, the resetting lever 12 is rotated by a connecting mechanism, such as a cable, to a position shown in FIG.3b.

And then, driving mechanism such as a hydraulic assembly or a pneumatic assembly is turned on to rotate the guiding means 1 of the roof

around the principal shaft 3 such that the roof is folded up. During rotation of the guiding means 1 of the roof, the extension 7 which is inserted into the long hole 10 of the adjusting lever 4 rotates the adjusting lever 4 in the anticlockwise direction. When the adjusting lever 4 is rotated to the position as shown in FIG.3c, the protruding part 8 of the adjusting lever 4 comes into contact with the initiative lever 5 so as to actuate the initiative lever 5 to rotate synchronously. Erenow, the protruding part 8 is disengaged from the initiative lever 5. Namely, during the guiding means 1 of the roof rotates from the approximately horizontal position as shown in FIG.3b to the approximately vertical position as shown in FIG.3c, the adjusting lever 4 does not rotate the initiative lever 5 and the rear shelf 2 is still in the closed position.

With continuous rotation of the guiding means 1 of the roof, the protruding part 8 of the adjusting lever 4 comes into contact with the initiative lever 5 and actuates the initiative lever 5 to rotate. The rotation of the initiative lever 5 actuates the rear shelf 2 to displace from the closed position to the opened position via the connecting lever 6, as shown in FIG.3d, so that the roof can be retracted into the trunk.

As shown in FIG.3d-3e, the roof completely is retracted into the trunk when the guiding means 1 of the roof reaches the terminal point. Then, it is necessary to close the trunk cover. When the trunk cover displaces from the opened position to the closed position, the resetting lever 12 is clockwise rotated by a connecting mechanism such as a cable. The resetting lever 12 which is rotated comes into contact with the cam 11 of the initiative lever 5 and rotates the initiative lever 5 in the anticlockwise direction. The rotation of the initiative lever 5 actuates the rear shelf 2 to displace from the opened position to the closed position via the connecting lever 6. During the process, the initiative lever 5 is disengaged from the adjusting lever 4 and the adjusting lever 4 does not

operate together with the initiative lever 5. When the trunk cover is completely closed, the rear cover 2 completely comes into the closed position to conceal the gap in the front of the trunk cover. Then, the retraction of the roof is finished.

5 Contrarily, the operation of the roof retracting device during unfolding of the roof takes place in the following manner. We will describe in detail referring to FIGs.3e-3a.

It is necessary to open the trunk cover backwards in order to unfold the roof from the trunk. During the opening process of the trunk cover,
10 the resetting lever 12 is actuated by the trunk cover to return from the position as shown in FIG.3e to the position as shown in FIG.3d. Thus, the push of the resetting lever 12 against the initiative lever 5 vanishes and the initiative lever 5 is reset by the resetting spring. Namely, the initiative lever 5 is rotated in the clockwise direction. The initiative lever 5 actuates
15 the rear shelf 2 to move to the position as shown in FIG.3d via the connecting lever 6 to make space for the passage of the roof.

And then the guiding means 1 of the roof is rotated in the clockwise direction by the driving mechanism so as to move the roof out of the trunk. At the same time, the extension 7 of the guiding means actuates the
20 adjusting lever 4 to rotate synchronous with the guiding means 1 of the roof. The initiative lever 5 keeps in contact with the protruding part 8 of the adjusting lever 4 via the resetting spring. The initiative lever 5 rotates in the clockwise direction to move the rear shelf 2 to the closed position via the connecting lever 6. Then the initiative lever 5 rotates to the
25 terminal point and does not rotate together with the adjusting lever 4, as shown in FIG.3c.

The guiding means 1 of the roof continues rotating clockwise to unfold the roof. When the roof is rested on the vehicle frame, the trunk cover is closed. During the closing process of the trunk cover, the

resetting lever 12 is rotated to the original position as shown in FIG.3a. Thus, the unfolding of the roof is finished.

As shown in FIG.2, it is convenient to adjust the position between the protruding part 8 of the adjusting lever 4 and the guiding means 1 of the roof by adjusting the position between the end of the extension 7 of the guiding means and the long hole 10 of the adjusting lever 4. Thus it is convenient to adjust the relation between the guiding means 1 of the roof and the rear cover 2. Such roof retracting device works harmoniously and reliably.

10 In order to achieve further improvement in esthetic and aerodynamics of vehicles, it may be necessary to mount closure flaps on both sides of the rear shelf 2 or trunk cover. When the roof is in the closed position, the flaps are retracted in order to make space for the passage in the joint among the C-pillars and the trunk cover and the sides of the vehicle body. When the roof is in the retracted position the flaps are opened in order to conceal the gap (namely, the aforesaid joint among the C-pillars and the trunk cover and the sides of the vehicle body) on both sides of the trunk cover. The flaps can be solely actuated by a driving device or operate together with the trunk cover or the rear shelf 2.

20 The principles of the preferred embodiment described herein is therefore illustrative and not restrictive, the scope of the invention being indicated in the appended claims and all variations which come within the spirit and meaning of the claims are intended be embraced therein.

WHAT IS CLAIMED IS:

1. A vehicle roof retracting device including a guiding means (1) of the roof rotating around a principal shaft (3) for actuating the vehicle roof to displace between a closed position and a retracted position, a rear shelf (2) for providing a space for the passage of the roof when it is opened and for concealing a gap between the vehicle roof and the trunk cover when it is closed, a trunk cover, and said principal shaft(3), wherein said vehicle roof retracting device further comprises:

10 an adjusting lever(4) connected to an extension (7) configured to extend transversely from one end of said guiding means (1) of the roof and actuated by the extension (7) to rotate around said principal shaft(3);

 an initiative lever (5);

 a protruding part (8) of said adjusting lever (4) selectively engaged with or disengaged from the initiative lever (5) for actuating the initiative lever (5) to rotate around said principal shaft(3); and

 a connecting lever (6) connecting the initiative lever (5) and the rear shelf (2) for displacing the rear shelf(2) between the opened position and the closed position.

20 2. The vehicle roof retracting device according to claim 1, wherein said adjusting lever(4) is connected to said extension(7) of the guiding means(1) by an adjusting device for adjusting the position of said adjusting lever(4) relative to said extension(7) of the guiding means(1) of the roof.

25 3. The vehicle roof retracting device according to claim 2, wherein said adjusting device comprises:

 an adjusting bolt(9); and

 a long hole(10) formed in said adjusting lever(4), into which one end of said extension(7) is inserted, and fixed and adjusted the position by

said adjusting bolt(9) screwing into said long hole(10) .

4. The vehicle roof retracting device according to any of claims 1-3, wherein said protruding part(8) of the adjusting lever(4) comes into contact with said initiative lever(5) to open said rear shelf(2) when said
5 guiding means(1) of the roof actuates the vehicle roof to displace from the closed position to the retracted position .

5. The vehicle roof retracting device according to claim 4, wherein said protruding part(8) of the adjusting lever(4) comes into contact with said initiative lever(5) to close said rear shelf(2) when said guiding
10 means(1) of the roof actuates the vehicle roof to displace from the retracted position to the closed position .

6. The vehicle roof retracting device according to claim 5, wherein said roof retracting device further comprises a resetting lever(12) selectively engaged with or disengaged from the cam(11) of said initiative
15 lever(5), which comes into contact with said cam(11) and rotates said initiative lever(5) in order to close said rear shelf(2) after the roof is retracted into the trunk.

7. The vehicle roof retracting device according to claim 6, wherein said roof retracting device further comprises a resetting spring connected
20 to said initiative lever(5) , for actuating rotation of said initiative lever(5) to open said rear shelf(2) when the roof does not come out of the trunk and said resetting lever(12) is disengaged from said cam(11) of said initiative lever(5).

8. The vehicle roof retracting device according to claim 7, wherein
25 said resetting lever(12) operates together with said trunk cover, said resetting lever(12) comes into contact with said cam(11) of said initiative lever(5) to close said rear shelf(2) when said trunk cover comes into the closed position, said resetting lever(12) is disengaged from said cam(11) to open said rear shelf(2) via said resetting spring when said trunk cover

comes into the opened position.

9. A vehicle, wherein said vehicle comprises said roof retracting device according to any of the aforesaid claims.

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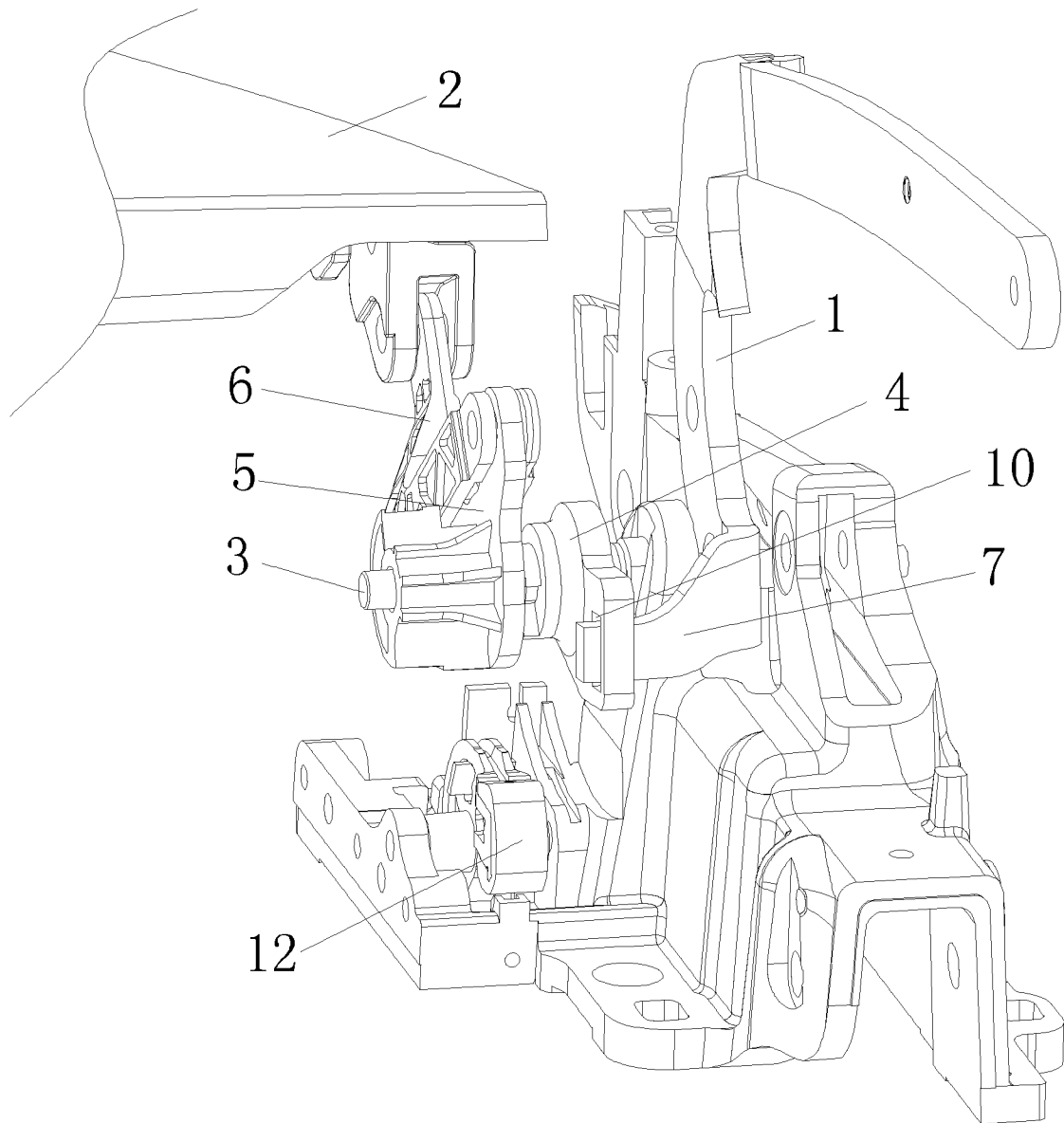


FIG. 1

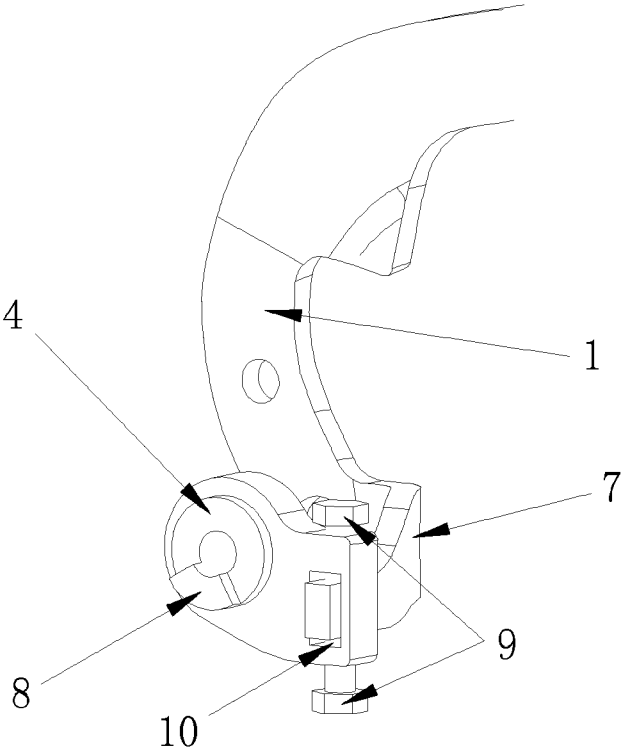


FIG. 2

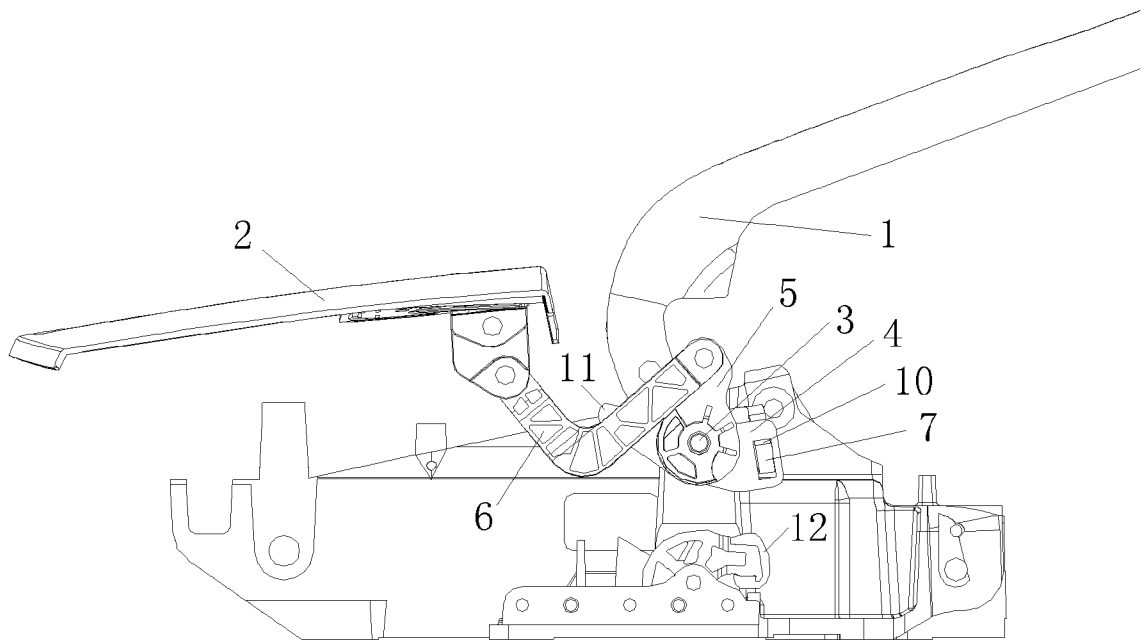


FIG. 3a

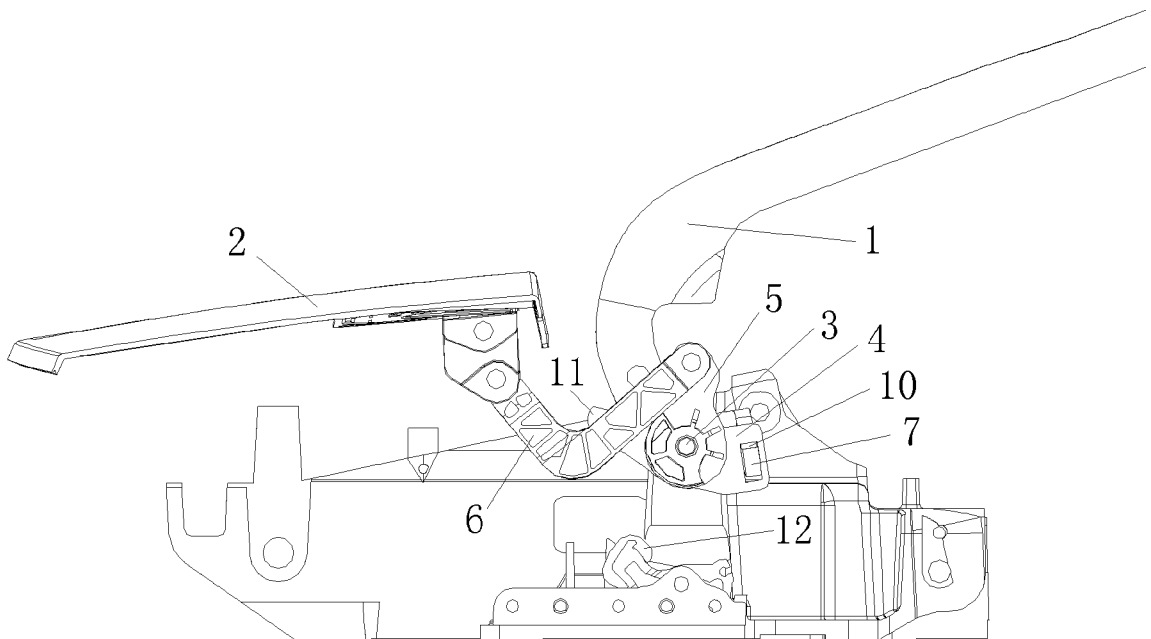


FIG. 3b

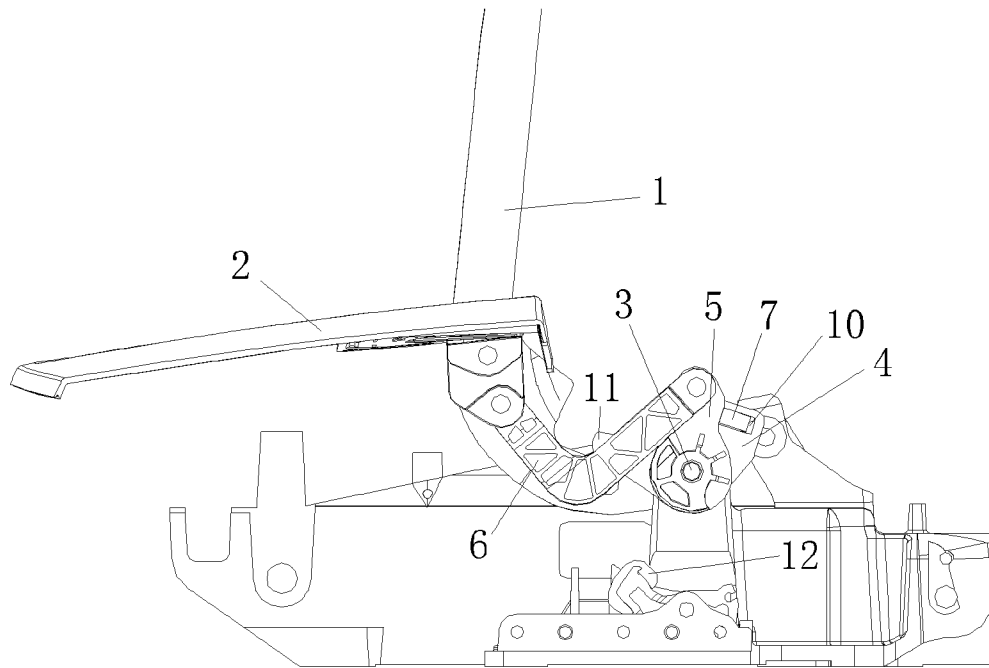


FIG. 3c

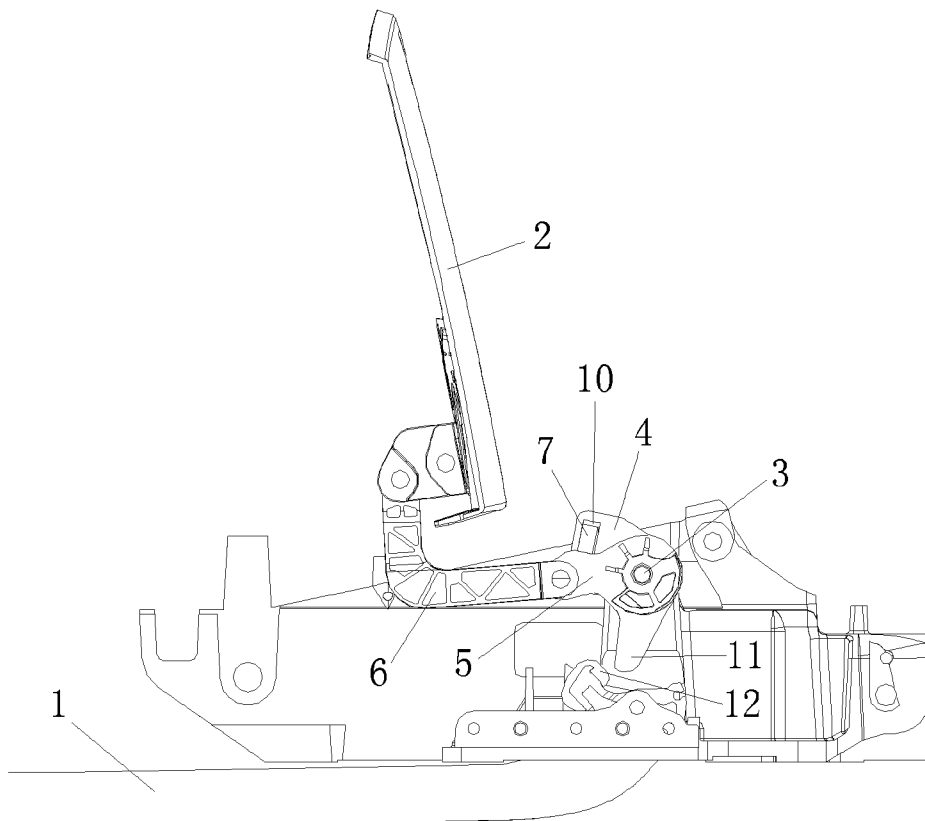


FIG. 3d

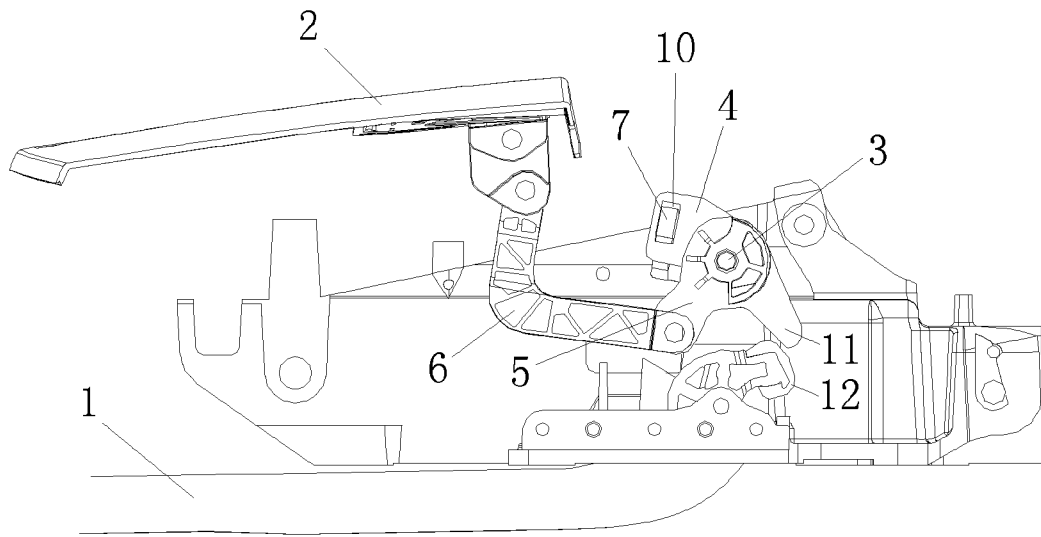


FIG. 3e

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2009/074198

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

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)

IPC: B60J 7

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)

WPI; EPODOC; CNKI; CNPAT: gap, space, clearance, boot, trunk, luggage, baggage, cover, wing?, flap?, plate?, shelf?, arm?, lever?, link?, linkage?

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	US 2007/0182200 A1 (Baumeier et al.) 09 Aug. 2007(09.08.2007) paragraphs [0011]-[0031], figures 1-4	1-9
A	US 2008/0203758 A1 (Brockhoff) 28 Aug. 2008(28.08.2008) the whole document	1-9
A	US 6293605 B2 (Neubrand) 25 Sep. 2001(25.09.2001) the whole document	1-9
A	US 6832804 B2 (Eichholz et al.) 21 Dec. 2004(21.12.2004) the whole document	1-9
A	CN 2880565 Y (BYD CO LTD) 21 Mar. 2007(21.03.2007) the whole document	1-9

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:	“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
“A” document defining the general state of the art which is not considered to be of particular relevance	“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
“E” earlier application or patent but published on or after the international filing date	“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
“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)	“&” document member of the same patent family
“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	

Date of the actual completion of the international search 22 Dec. 2009(22.12.2009)	Date of mailing of the international search report 07 Jan. 2010 (07.01.2010)
Name and mailing address of the ISA/CN The State Intellectual Property Office, the P.R.China 6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088 Facsimile No. 86-10-62019451	Authorized officer CAI, Xiaomin Telephone No. (86-10)62085438

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2009/074198

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
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Continuation of : second sheet A. CLASSIFICATION OF SUBJECT MATTER

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