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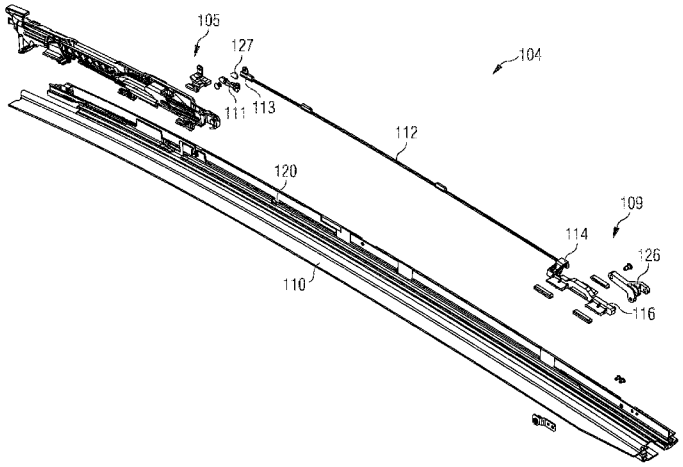
(54) **Title**: DRIVE MECHANISM FOR A VEHICLE AND METHOD FOR MOVING PANELS FOR A VEHICLE

FIG 7



(57) **Abstract**: A drive mechanism for a first (101) and a second (102) movable panel for a vehicle(100)comprises: - a first slide mechanism (105) for moving the first movable panel (101), the first slide mechanism (105) being movable in a first direction (106) for tilting the first movable panel (101) and being movable in the first direction (106) for displacing the first movable panel (101) in the first direction (106) relative to the second movable panel (102), - a second slide mechanism (109), the second slide mechanism (109) being disposed within a guide rail (110) and being movable relative to the guide rail (110) for moving the second movable panel (102), - the second slide mechanism (109) comprising a locking lever (111), - the locking lever (111) being coupled to the first slide mechanism (105) during a first state of movement to transmit a movement of the first slide mechanism (105) to the second slide mechanism (109), and - the locking lever (111) being locked to the guide rail (110) during further states of movement of the first slide mechanism (105), such that the second slide mechanism (109) is unmovable with respect to the guide rail (110).

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Description

DRIVE MECHANISM FOR A VEHICLE AND METHOD FOR MOVING PANELS FOR A VEHICLE

Field of Technology

The invention relates to a drive mechanism for a first and a second movable panel for a vehicle. Further, the invention relates to a method for moving a first and a second movable panel for a vehicle.

Background

Vehicles can be equipped with a roof opening in the roof of the vehicle, which is closed by one or more panels. A sliding roof device with two panels is known from DE 10 2012 010 148 A1. The rear panel of the described device is tiltable.

It is desirable to specify a drive mechanism for a first and a second movable panel that allows a secure locking of the second panel. Further, it is desirable to specify a method for moving a first and a second movable panel that allows a secure locking of the second movable panel.

Summary of the Invention

According to at least one embodiment of the invention, a drive mechanism for a first and a second movable panel for a vehicle comprises a first slide mechanism for moving the first movable panel. The first slide mechanism is movable in a first direction for tilting the first movable panel and

being movable in the first direction for displacing the first movable panel relative to the second movable panel. The drive mechanism comprises a second slide mechanism. The second slide mechanism is disposed within a guide rail for moving the second movable panel. The second slide mechanism comprises a locking lever. The locking lever is coupled to the first slide mechanism during a first state of movement to transmit a movement of the first slide mechanism to the second slide mechanism. The locking lever is locked with the guide rail during further states of movement of the first slide mechanism such that the second slide mechanism is unmovable with respect to the guide rail.

The locking lever of the second slide mechanism allows a secure locking of the second movable panel when the first movable panel is displaced with respect to the second movable panel in the first direction. On the other hand, the locking lever is used to couple the first slide mechanism with the second slide mechanism to tilt the second movable panel when the first movable panel is in a position in front of the second movable panel. Hence, the locking lever is used for transmitting a movement of the first slide mechanism during the first state of movement and to lock the second slide mechanism in the further states of movement to lock a movement of the second slide mechanism relative to the guide rail.

According to at least one embodiment a method for moving a first and a second movable panel for a vehicle comprises:

- moving a first slide mechanism in a first direction and thereby moving a second slide mechanism, and thereby
- tilting the first movable panel,

- tilting the second movable panel,
- tilting the second movable panel back, and afterwards
- locking the second slide mechanism,
- moving the first slide mechanism in the first direction relative to second slide mechanism, and thereby
- moving the first movable panel above the second movable panel and displacing the first movable panel in the first direction with respect to the second movable panel.

The first slide mechanism and the second slide mechanism are coupled such that the moving of the first slide mechanism moves the second slide mechanism for opening the movable panels. It is possible to first tilt the first movable panel and then tilt the second movable panel such that both panels are tilted. Before a displacement of the first movable panel in the first direction with respect to the second movable panel the movable panel is tilted back. Then the second slide mechanism is locked such that a movement of the second slide mechanism relative to a guide rail is blocked. Afterwards the movement of the first movable panel above the second movable panel is possible. Hence, by actively driving only the first slide mechanism it is possible to tilt the first movable panel as well as the second movable panel and afterwards lock the second movable panel and move the first movable panel relative to the second movable panel in the first direction.

The described mechanism and method enable a secure movement of both panels, in particular of the rear panel. Furthermore, the described mechanism and method enable a secure fastening of the rear panel.

Brief Description of the Drawings

Various embodiments of the present invention will be described with reference to the attached drawings. In the drawings, like reference symbols are used for like elements.

Figure 1 schematically shows a roof of a vehicle in accordance with an embodiment of the invention.

Figures 2A to 2C schematically show a drive mechanism in accordance with an embodiment of the invention.

Figures 3A to 3C schematically show the drive mechanism in a further position.

Figures 4A to 4C schematically show the drive mechanism in a further position.

Figures 5A to 5C schematically show the drive mechanism in a further position.

Figures 6A to 6C schematically show the drive mechanism in a further position.

Figure 7 schematically shows an exploded view of a drive mechanism in accordance with an embodiment of the present invention.

Figure 8 shows a flow chart of a method for moving movable panels in accordance with an embodiment of the invention.

Detailed Description of the Drawings

Figure 1 shows a roof 103 of a vehicle 100. The roof 103 comprises a roof opening 130. The roof opening 130 can be closed by a first panel 101 and a second panel 102. The first movable panel 101 is also called "front panel". The first panel 101 is arranged closer to a windshield 131 of the vehicle 100 and a second panel 102 in a closed position of the panels 101 and 102 as shown in Figure 1. The second panel 102 is also called "rear panel" and is arranged behind the first panel 101 in a first direction 106 (Figure 2A). The first panel 101 is arranged between the windshield 131 and the second panel 102 in the first direction 106 in the closed position.

The panels 101 and 102 are part of an externally guided sun roof. It is possible to tilt the first panel 101. It is possible to tilt the second panel 102 as well. Further, it is possible to move the first panel 101 above the second panel 102 and in the first direction 106 to free the roof opening 130 in a front part.

Figures 2A, 2B and 2C show a drive mechanism 104 for moving the first panel 101 and the second panel 102 in a closed position of the panels 101 and 102.

The drive mechanism 104 comprises a first slide mechanism 105 for moving the first panel 101. The drive mechanism 104 comprises a second slide mechanism 109 for moving the second panel 102. The first slide mechanism 105 and the second slide mechanism 109 each are guided in a guide rail 110. The guide rail 110 is fixed to the vehicle body of the vehicle 100.

The drive mechanism 104 is arranged at both sides of the roof opening 130. The drive mechanism 104 is formed correspondingly on both sides. Hence, only one side is described in the following. The other side is designed accordingly.

The guide rail 110 comprises a recess 120. The recess 120 is arranged behind a locking lever 111 of the second slide mechanism 109 in the first direction 106. The locking lever 111 is not engaged with the recess 120 in the closed position of the first and the second panel 101 and 102. The second slide mechanism 109 further comprises a sled 116 with a slotted guide 121. A tilt lever 126 is coupled at one end with the slotted guide and at the other end with the second movable panel 102.

By moving the first slide mechanism 105 in the first direction 106 it is possible to tilt the rear edge of the first panel 101 in a third direction 108 which is substantially perpendicular to the first direction 106. By moving the second slide mechanism 109 in the first direction 106 it is possible to tilt the rear edge of the second panel 102 in the third invention 108. By moving the respective slide mechanism 105 and 109 in a second direction 107, which is contrary to the first direction 106, the respective panels 101 and 102 are tilted back to the closed position.

The slotted guide 121 of the sled 116 comprises a flat part 122, an inclining part 123, a further flat part, a declining part 124 and a further flat part 125 along the first direction 106. In the closed position of the second panel 102 the tilt lever 126 is coupled with the sled 116 at the flat part 125.

The locking lever 111 is coupled with the first slide mechanism 105 by a pin 118. The locking lever 111 is in a position, in which the locking lever 111 is locked to the first slide mechanism 105 along the first and the second direction.

The pin 118 is part of the first mechanism 105. Due to the coupling of the locking lever 111 and the pin 118 a movement of the first slide mechanism 105 in the first direction 106 is transmitted to the second slide mechanism 109. Only the first slide mechanism 105 is connected to a driving cable 115. The driving cable 115 transmits a movement of an electric motor to the first drive mechanism 105. The second drive mechanism 109 is not connected directly to a drive cable. The movement of the electric motor is transmitted to the second slide mechanism 109 by the connection of the first slide mechanism 105 and the second slide mechanism 109 by the locking lever 111 and the pin 118.

As shown in Figure 2C the locking lever 111 is arranged at a first end 113 of a rod 112. The rod 112 extends along the first direction 106 between the first end 113 and a second end 114 that is connected to the sled 116.

Figures 3A, 3B and 3C show the drive mechanism 104 in a position in which the panel 101 is tilted. The panel 102 is in the same position as shown in Figures 2A to 2C.

The first slide mechanism 105 is moved in the first direction 106. Due to the engagement of the locking lever 111 and the pin 118 the movement of the first slide mechanism 105 is transmitted via the rod 112 to the second slide mechanism

109. The second slide mechanism moves relative to the tilt lever 126 in the first direction 106. As the tilt lever 126 is arranged in the flat part 125 the movement of the sled 116 does not result in a movement of the second panel 102.

The locking lever 111 moves relative to the guide rail 110 and hence comes closer to the recess 120.

Figures 4A, 4B and 4C show the drive mechanism 104 in a position in which both panels 101 and 102 are tilted.

The first drive mechanism 105 is moved further in the first direction 106. Due to the engagement of both slide mechanisms 105 and 109 via the pin 118, the locking lever 111 and the rod 112, the second slide mechanism 109 is moved in the first direction 106 as well.

For tilting the second 102 the tilt lever 126 moves along the declining part 124. The tilt lever 126 is further supported on the guide rail 110 (not explicitly shown). Hence, the movement of the tilt lever 126 along the declining part 124 results in a rotation of the tilt lever 126. The rotation of the tilt lever 126 leads to a tilting of the rear edge of the second panel 102. The tilt lever 126 is pivotally coupled with the second panel 102 as well.

Figures 5A, 5B and 5C show the mechanism 104 at a beginning of the opening phase of the first panel 101. The first slide mechanism 105 and the second slide mechanism 109 are further moved in the first direction 106. The locking lever 111 is still engaged with the first slide mechanism 105.

The coupling of the tilt lever 126 with the sled 116 is moved along the inclining part 123 of the slotted guide 121. Hence the second panel 102 is tilted back in a position that corresponds to the closed position of Figures 1 and 2A to 2C.

The locking lever 111 is moved close to the recess 120.

Figures 6A, 6B and 6C show the drive mechanism 104 in an open position in which the first panel 101 is moved above the second panel 102 and in the first direction 106.

The first slide mechanism 105 and the second slide mechanism 109 are decoupled. By moving the first slide mechanism 105 in the first direction 106 the locking lever 111 comes in the region of the recess 120. The locking lever 111 is forced into the recess 120 by a spring force of a spring 127 (Figure 7). In particular, the spring 127 is supported on the rod 112 with one end and on the locking lever 111 with another end.

The locking lever 111 is in a position, in which the locking lever 111 is locked to the guide rail 110 along the first and the second direction. Hence, the lever 111 is rotated and the pin 118 can move out of a slotted guide 117 of the lever 111.

The slotted guide 117 is shaped such that the pin 118 and the lever 111 cannot be moved relative to each other when the pin 118 is in the slotted guide 117 and the lever 111 is not in the recess 120. When the lever 111 is tilted such that a projecting part 119 of the lever 111 is moved into the recess 120, the pin 118 can decouple from the lever 111. Afterwards a movement of the first slide mechanism 105 with the pin 118 relative to the lever 111 and the second slide mechanism 109 is possible.

The first slide mechanism 105 is moved in the first direction with respect to the second slide mechanism 109 to move the first panel 101 with respect to the second panel 102 in the first direction 106.

The second slide mechanism 109 is locked to the guide rail 110 by the engagement of the projecting part 119 of the lever 111 and the recess 120 of the guide rail 110. Hence, a movement of the second slide mechanism 109 with respect to the guide rail 110 along the first direction is blocked. The tilt lever 126 is arranged at the flat part 122 of the slotted guide 121. The second panel 102 is locked against the movement in the first direction 106.

For moving the panels in the closed position as shown in Figure 1 and Figures 2A to 2C a movement of the first slide mechanism 105 and the second slide mechanism 109 is conducted the other way around as described. The first slide mechanism 105 moves in the second direction 107 relative to the second slide mechanism 109 for bringing the panel 101 in the tilted position. The pin 118 comes in contact with the slotted guide 117 of the locking lever 111 and rotates the locking lever 111 out of the recess 120. Afterwards the first slide mechanism 105 and the second slide mechanism 109 are connected again and the movement of the first slide mechanism 105 in the second direction 107 is transmitted to the second slide mechanism 109. Hence, before closing both panels the panel 102 is tilted as shown in Figures 4A to C. Afterwards the second panel 102 is in the closed position at first and then the first panel 101 comes in the closed position as well.

Figure 7 shows an exploded view of the drive mechanism 104.

The first drive mechanism 105 may be a conventional drive mechanism. The conventional drive mechanism for the first panel 101 is extended by the second drive mechanism 109 for tilting the second panel 102.

With the drive mechanism 104 it is possible to tilt the front panel 101 and keep the second panel 102 in the closed position. It is further possible to move the second panel 102 to have both panels 101 and 102 tilted. During the tilting of the panel 101 the rear panel does not move due to the flat part 125 and the slotted guide 121 of the sled 116. Afterwards the second panel 102 is tilted at the end of the first panels' stroke. The panel 102 closes when the opening phase of the panel 101 starts. When the second panel 102 is tilted back in the closed position the first slide mechanism 105 and the second slide mechanism 109 are disconnected.

The second slide mechanism 109 must not move during the opening of the front panel 101 above the second panel 102. The locking lever 111, which is linked with the sled 116 of the second slide mechanism 109 is used for locking the second slide mechanism 109. The locking lever 111 is commanded by the first slide mechanism 105. Both mechanisms 105 and 109 are linked during the tilted phase and at the beginning of the front panel opening phase. When the rear panel has closed again, then both mechanisms 105 and 109 disconnect with the locking lever 111 positioned in the recess 120 of the guide rail 110. For example, the recess 120 is a hole in the guide rail 110. Due to the tilt function of the rear panel 102 a ventilation of the rear part of the vehicle is possible.

Figure 8 shows a flowchart of a method for moving the first and the second panel 101 and 102.

In a step 201 the first slide mechanism 105 is moved in the first direction 106 and thereby moves the second slide mechanism 109. Due to the movement of the first slide mechanism 105 and the second slide mechanism 109 in the first direction the first panel 101 and the second panel 102 each are tilted. During a further movement of the first slide mechanism 105 and the second slide mechanism 109 in the first direction the second movable panel is tilted back in the closed position.

In a step 202 the second slide mechanism 109 is locked such that a further movement of the second slide mechanism in the first direction is blocked. In particular, a further movement of the second slide mechanism 109 in the first direction 106 or in the second direction 107 with respect to the guide rail 110 is blocked. The first slide mechanism 105 and the second slide mechanism 109 are disconnected.

In a step 203 the first slide mechanism 105 is moved relative to the second slide mechanism 109 in the first direction 106. By moving the first slide mechanism 105 in the first direction 106 relative to the second slide mechanism 109 the first movable panel 101 is moved above the second movable panel 102 and is displaced in the first direction 106 with respect to the second movable panel.

For connecting the second slide mechanism 109 with the first slide mechanism the locking lever 111 is latched with the pin 118. For disconnecting the first slide mechanism 105 and the second slide mechanism 109 the pin 118 is moved out of the

slotted guide 117 of the locking lever 111. When the pin 118 is not arranged in the slotted guide 117 a movement of the first slide mechanism relative to the second slide mechanism in the first direction 106 and the second 107 is permitted.

Claims

1. A drive mechanism for a first (101) and a second (102) movable panel for a vehicle (100), comprising:
- a first slide mechanism (105) for moving the first movable panel (101), the first slide mechanism (105) being movable in a first direction (106) for tilting the first movable panel (101) and being movable in the first direction (106) for displacing the first movable panel (101) in the first direction (106) relative to the second movable panel (102),
- a second slide mechanism (109), the second slide mechanism (109) being disposed within a guide rail (110) and being movable relative to the guide rail (110) for moving the second movable panel (102),
- the second slide mechanism (109) comprising a locking lever (111),
- the locking lever (111) being coupled to the first slide mechanism (105) during a first state of movement to transmit a movement of the first slide mechanism (105) to the second slide mechanism (109), and
- the locking lever (111) being locked to the guide rail (110) during further states of movement of the first slide mechanism (105), such that the second slide mechanism (109) is unmovable with respect to the guide rail (110).

2. The drive mechanism according to claim 1, wherein the first slide mechanism (105) is movable relative to the second slide mechanism (109) in the further states of movement.

3. The drive mechanism according to claim 1 or 2, wherein the second slide mechanism (109) comprises a rod (112), the locking lever (111) being arranged at one end (113) of the rod (112).

4. The drive mechanism according to any of claims 1 to 3, wherein the locking lever (111) being rotatable to move between a first and a second position, the locking lever (111) being locked to the first slide mechanism (105) in the first position and the locking lever (111) being locked to the guide rail (110) in the second position.

5. The drive mechanism according to any of claims 1 to 4, wherein the locking lever (111) comprises a slotted guide (117) and the first slide mechanism (105) comprises a pin (118), the pin (118) being releasably coupleable with the slotted guide (117).

6. The drive mechanism according to any of claims 1 to 5, wherein the locking lever (111) comprises a projecting part (119) and the guide rail (110) comprises a recess (120), the projecting part (119) being releasably coupleable with the recess (120) for locking the locking lever (111) relative to the guide rail (110).

7. The drive mechanism according to any of claims 1 to 6, comprising a spring (127), the spring (127) being arranged at the locking lever (111) for urging a spring force on the locking lever (111) in direction to the guide rail (110).

8. The drive mechanism according to any of claims 1 to 7, wherein the second slide mechanism (109) comprises a slotted guide (121), the slotted guide (121) of the second slide mechanism (109) comprising along the first direction (106) a flat part (122), a subsequent inclining part (123), a subsequent declining part (124) and a subsequent flat part (125).

9. The drive mechanism according to claim 8, comprising a tilt lever (126), the tilt lever (126) being pivotally supported on the guide rail (110) and being coupled with the slotted guide (121) of the second slide mechanism (109) for tilting the second movable panel (102).

10. The drive mechanism according to claims 3 and 8, wherein the second slide mechanism (109) comprises a sled (116), the slotted guide (121) of the second slide mechanism (109) being arranged at the sled (116) and the sled (116) being connected with the rod (112).

11. The drive mechanism according to any of claims 1 to 10, wherein the first slide mechanism (105) is movable relative to the guide rail (110) independent from the second slide mechanism (109) during the further states of movement.

12. The drive mechanism according to any of claims 1 to 11, wherein the first slide mechanism (105) is coupled to a drive cable (115).

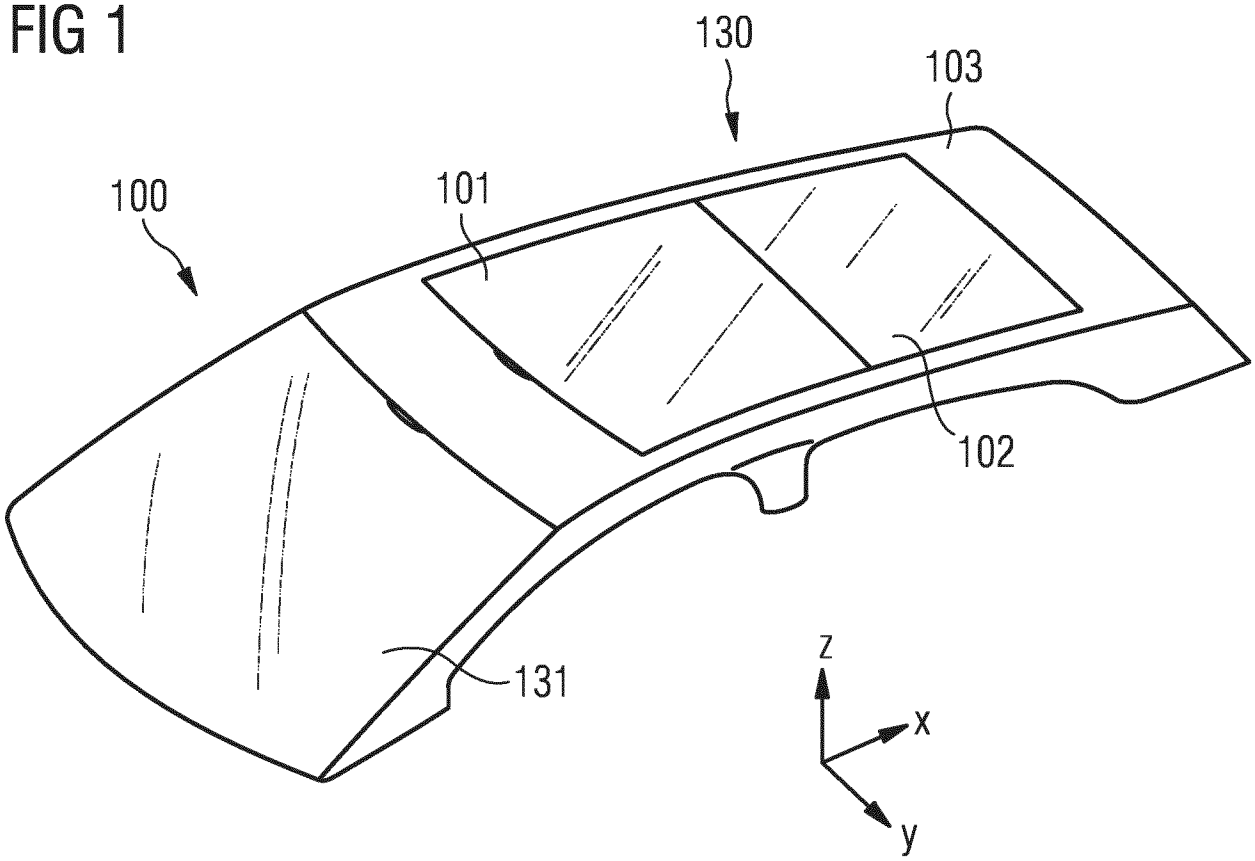
13. Method for moving a first (101) and a second (102) movable panel for a vehicle (100), comprising:
- moving a first slide mechanism (105) in a first direction (106) and thereby moving a second slide mechanism (109), and thereby
- tilting the first movable panel (101),
- tilting the second movable panel (102),
- tilting the second movable panel back (102), and afterwards
- locking the second slide mechanism (109),

- moving the first slide mechanism (105) in the first direction (106) relative to second slide mechanism (109), and thereby
- moving the first movable panel (101) above the second movable panel (102) and displacing the first movable panel (101) in the first direction (106) with respect to the second movable panel (102).

14. The method according to claim 13, comprising:
- latching a locking lever (111) of the second slide mechanism (109) with the first slide mechanism (105) for moving the second slide mechanism (109).

15. The method according to claim 13 or 14, comprising:
- moving a pin (118) of the first slide mechanism (105) out of a slotted guide (117) of the locking lever (111) to permit the movement of the first slide mechanism (105) in the first direction (106) relative to second slide mechanism (109).

FIG 1



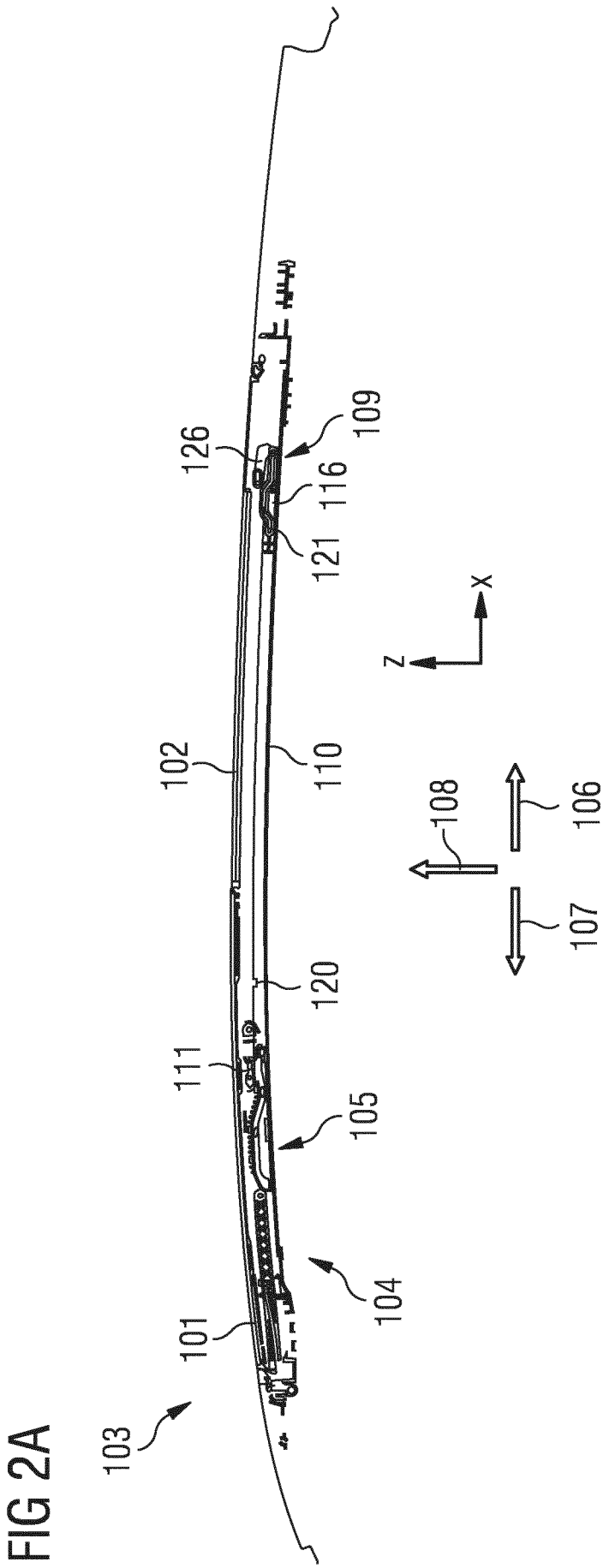


FIG 2A

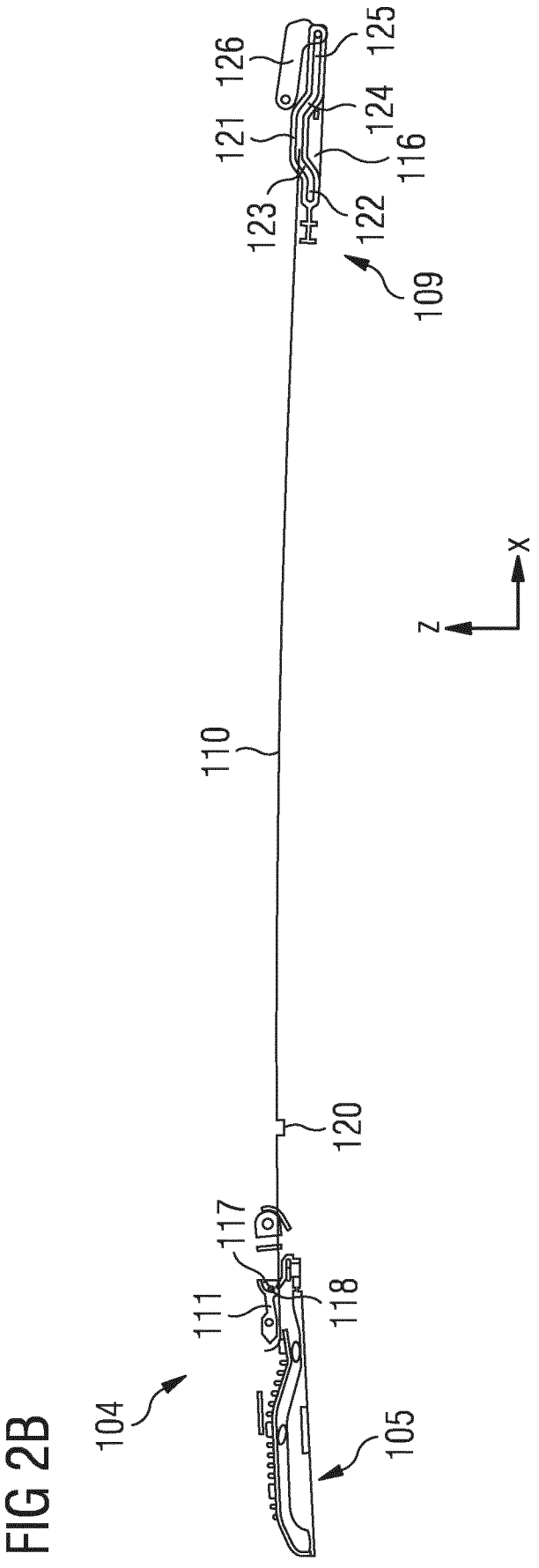


FIG 2B

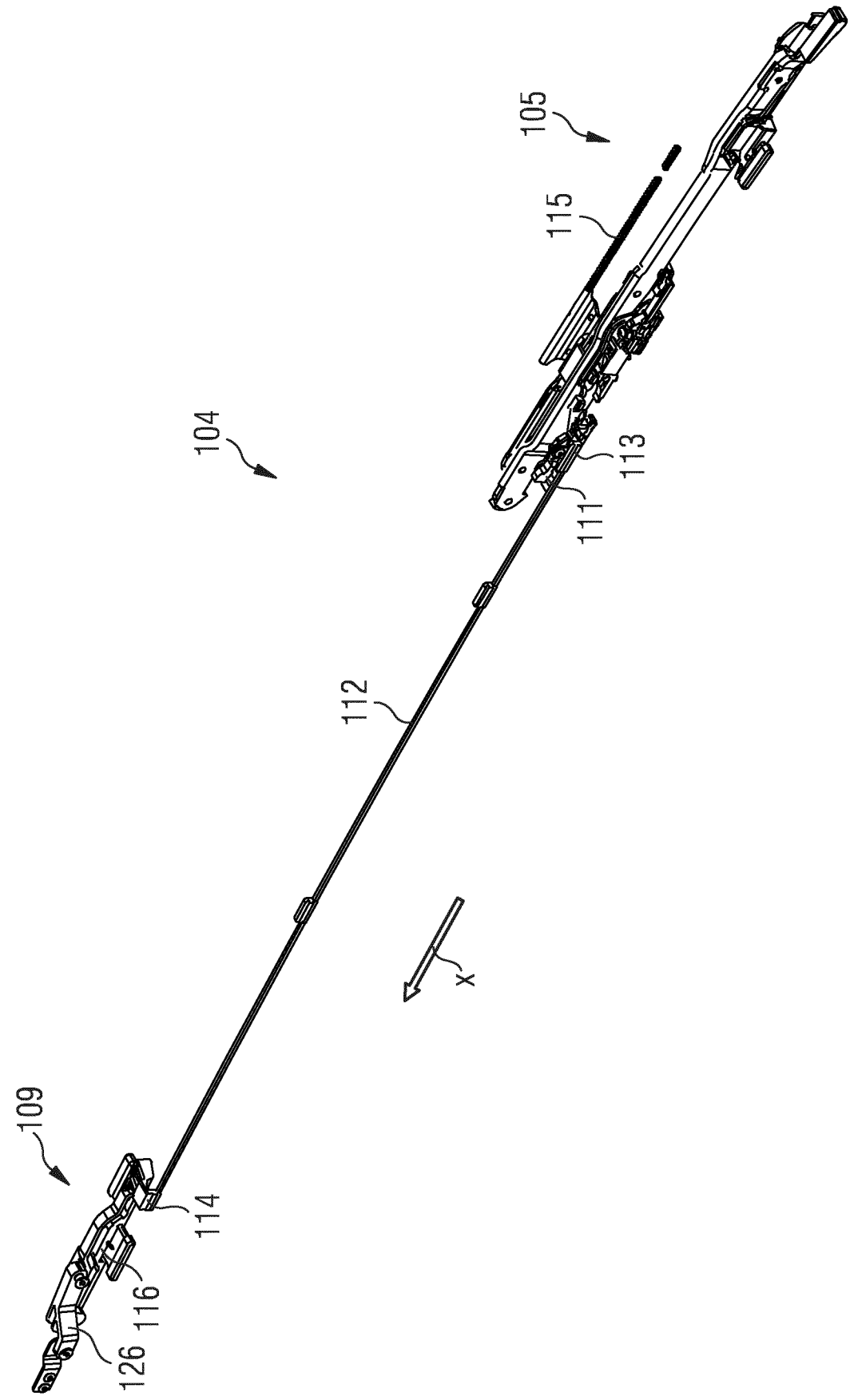


FIG 2C

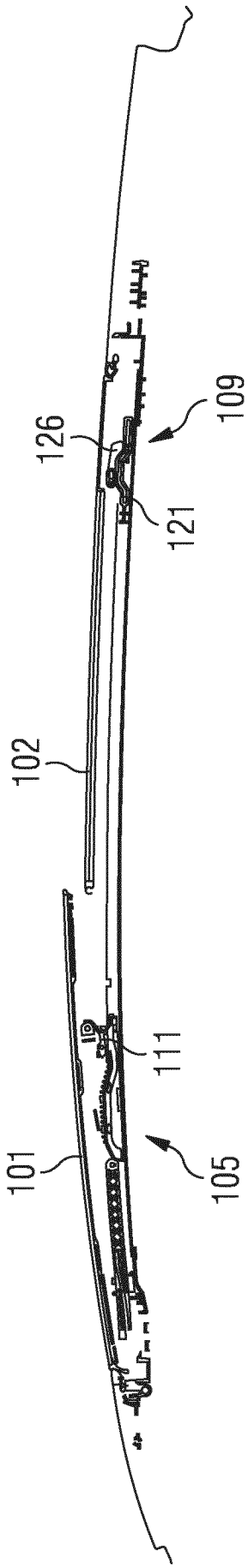


FIG 3A

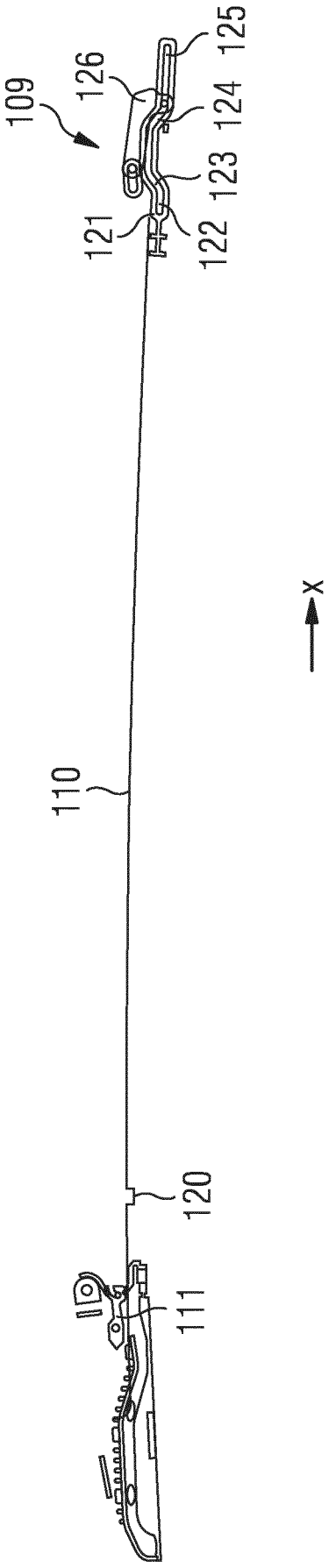


FIG 3B

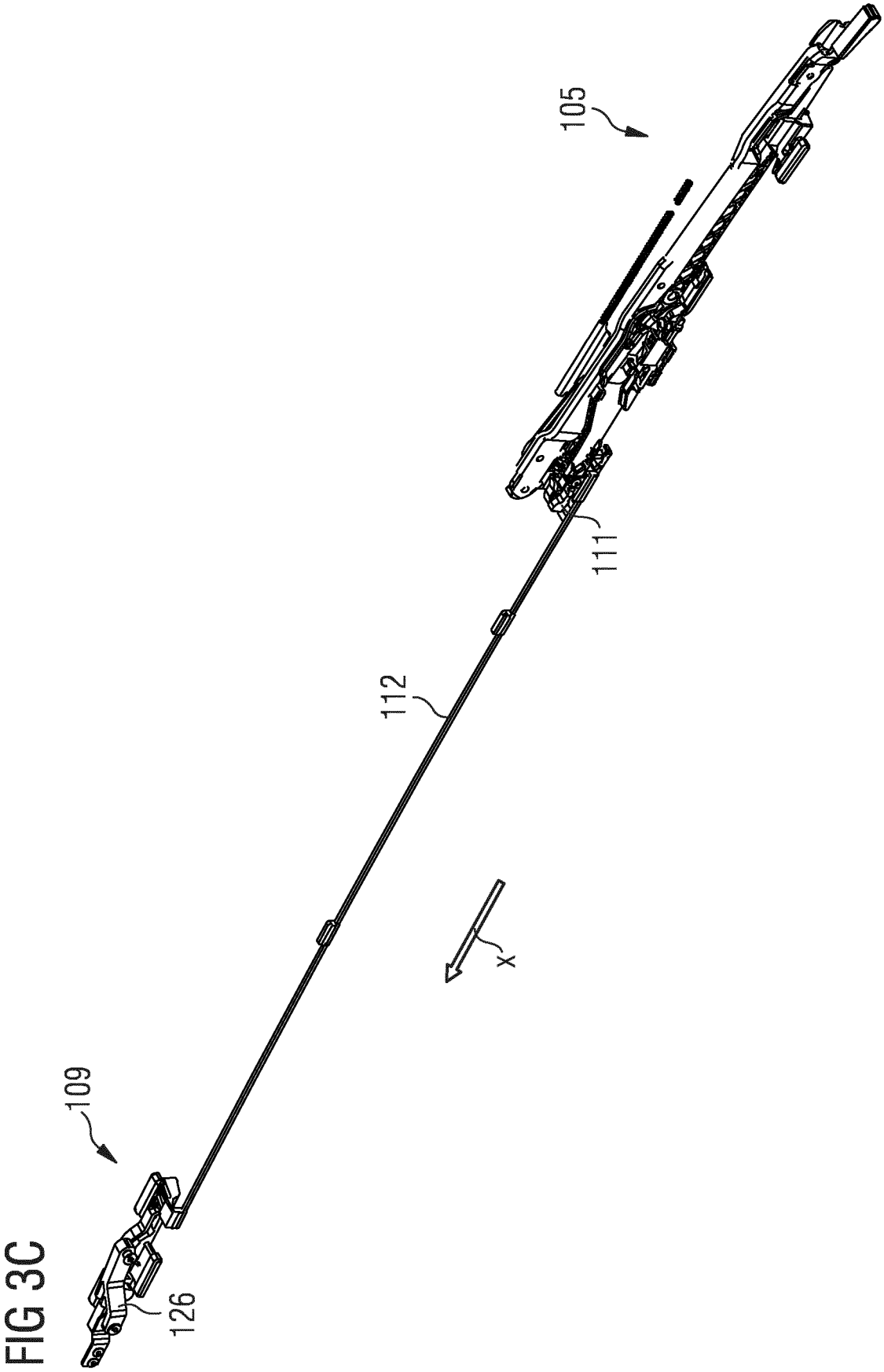


FIG 3C

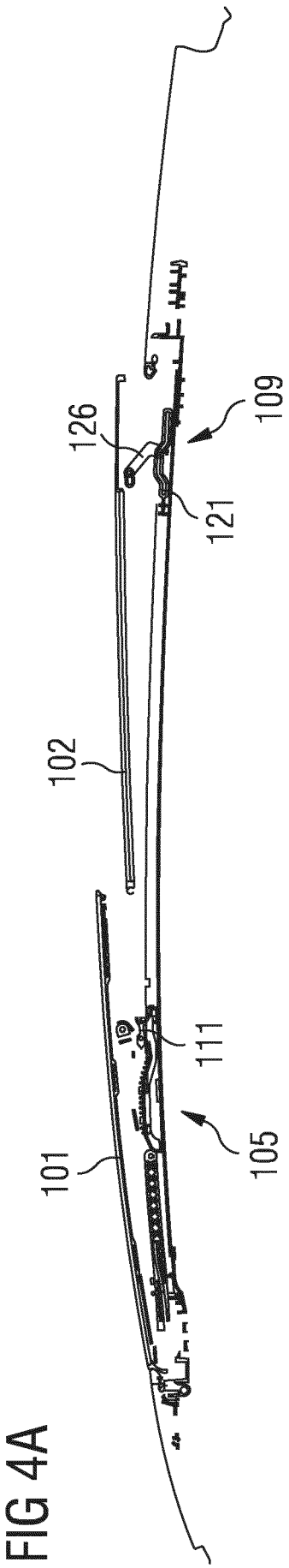


FIG 4A

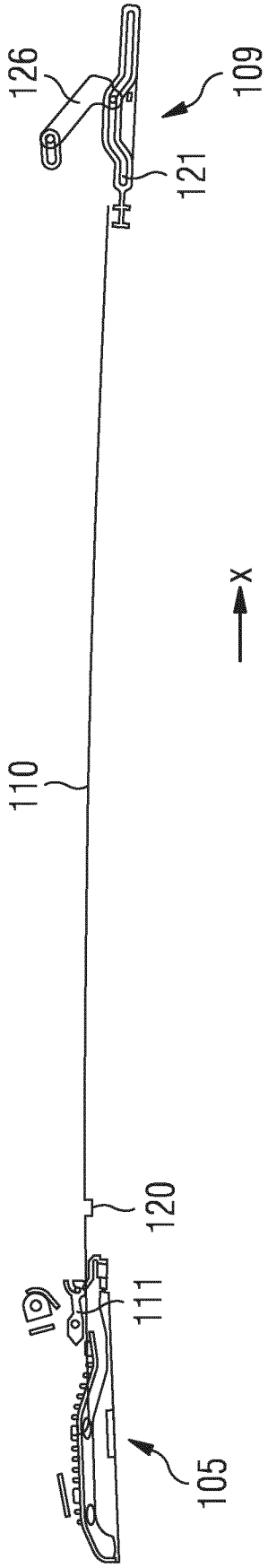


FIG 4B

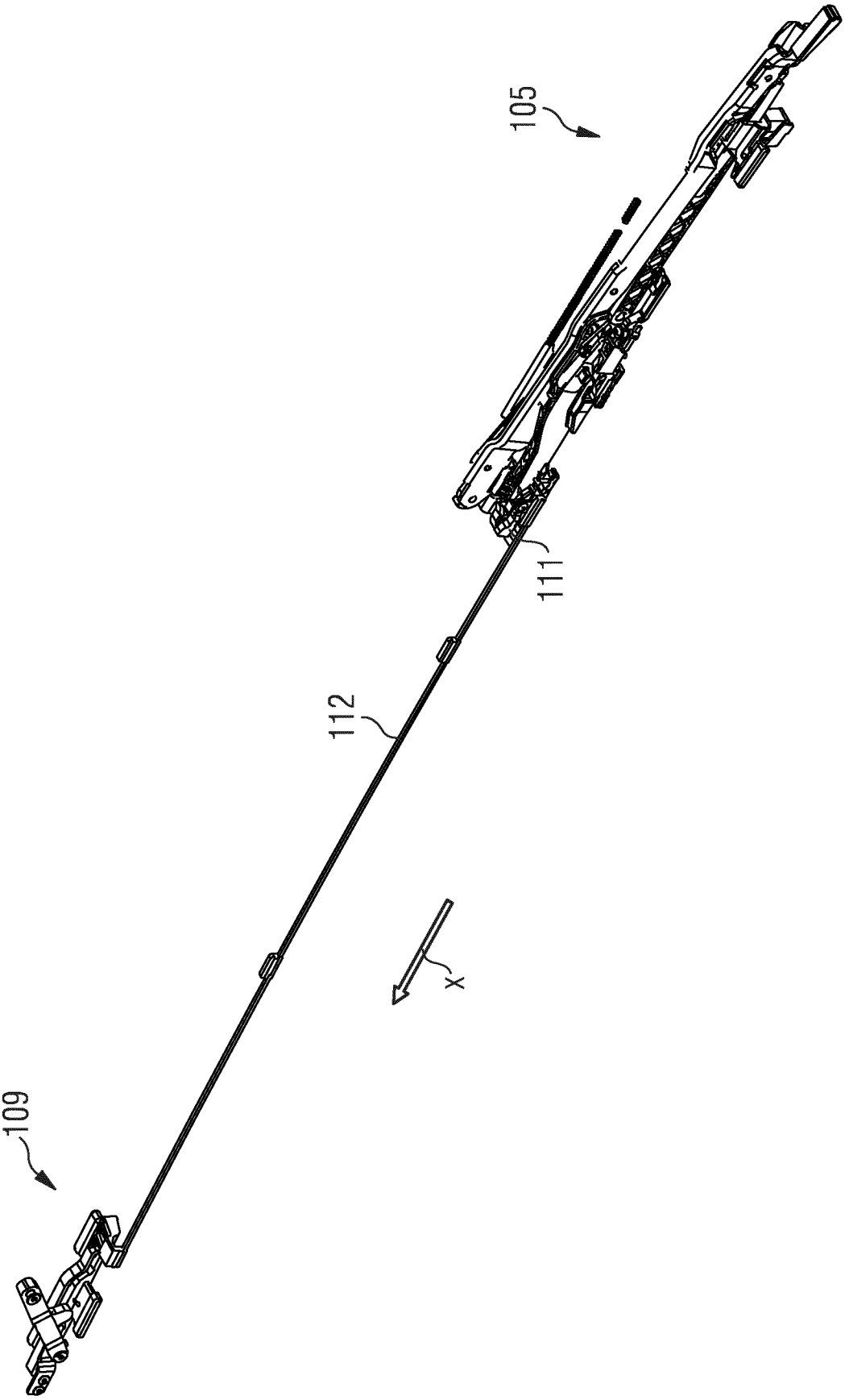


FIG 4C

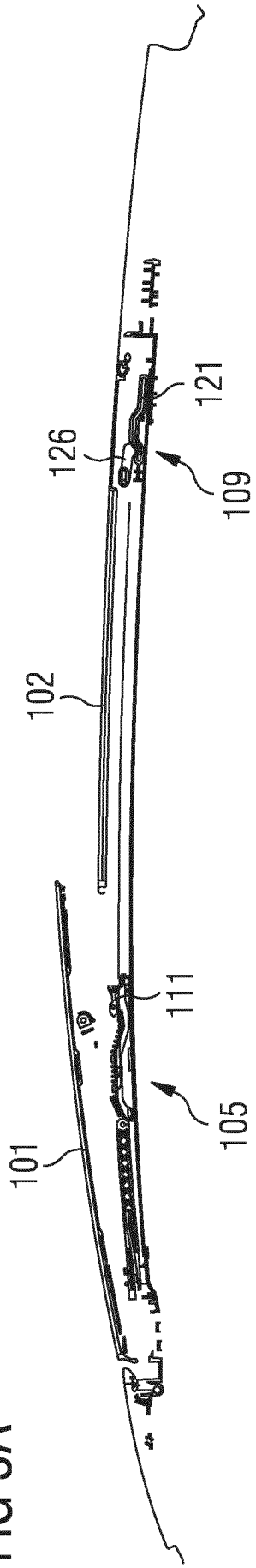


FIG 5A

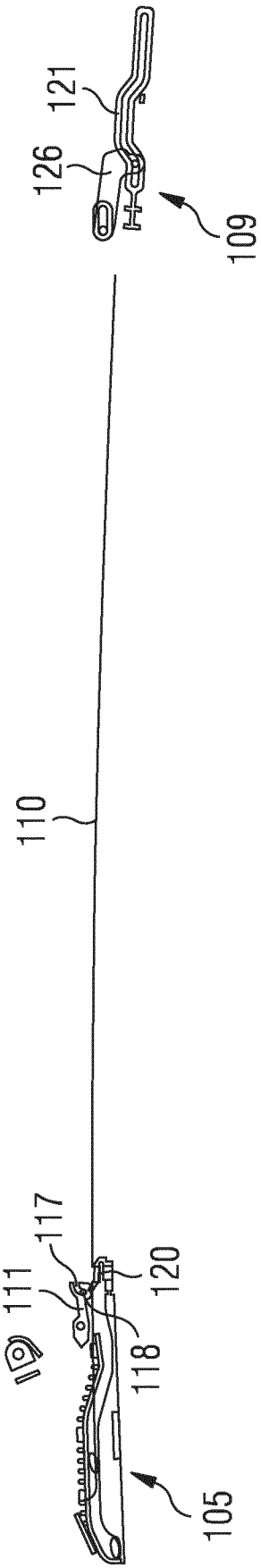


FIG 5B

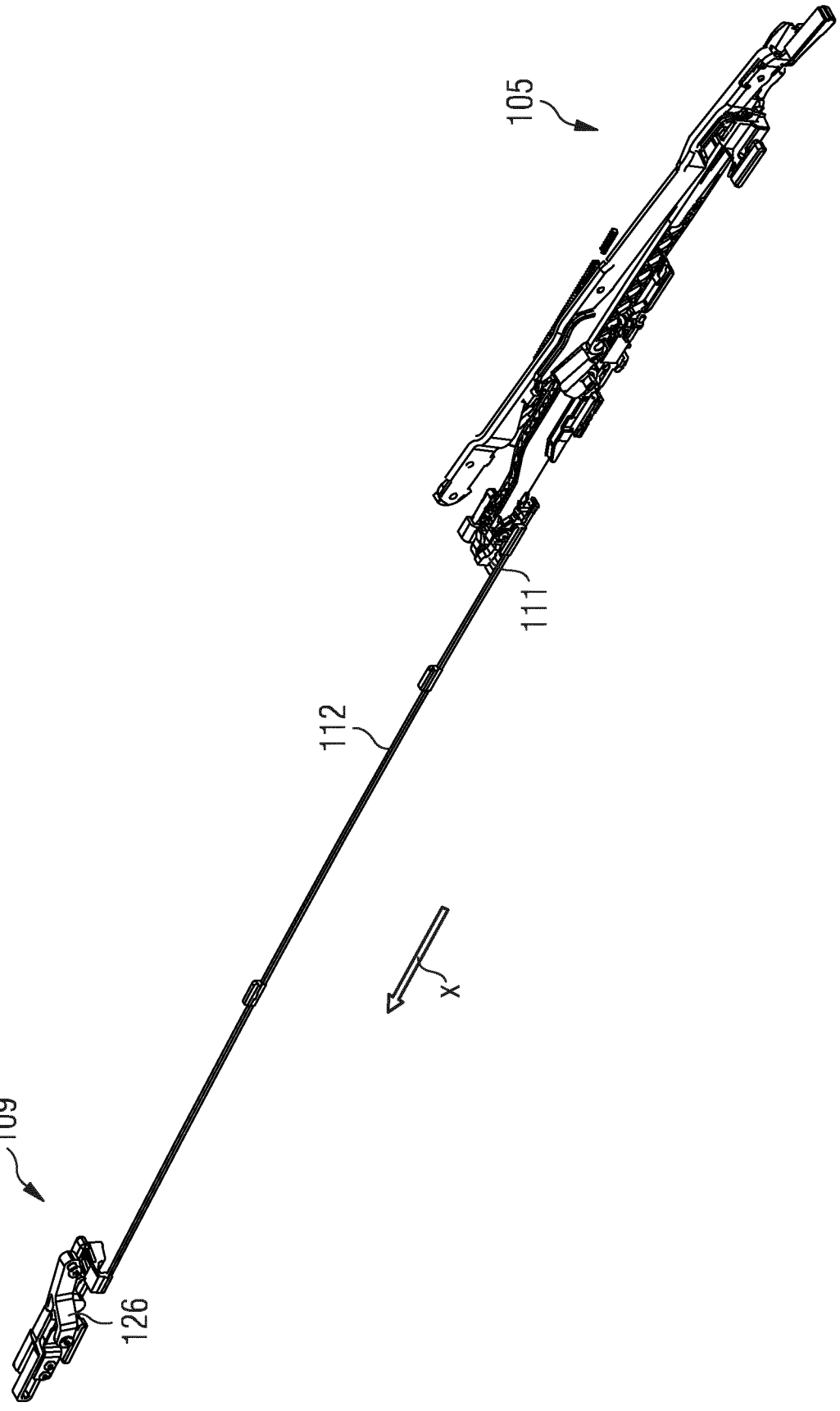


FIG 5C

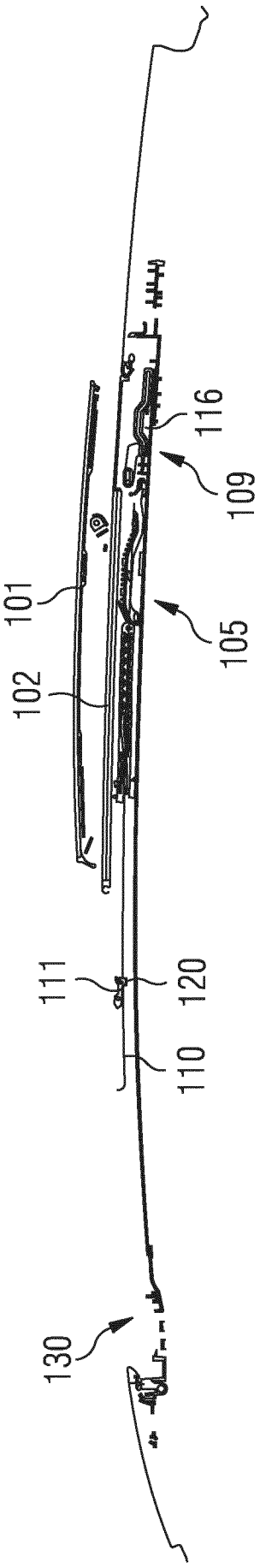


FIG 6A

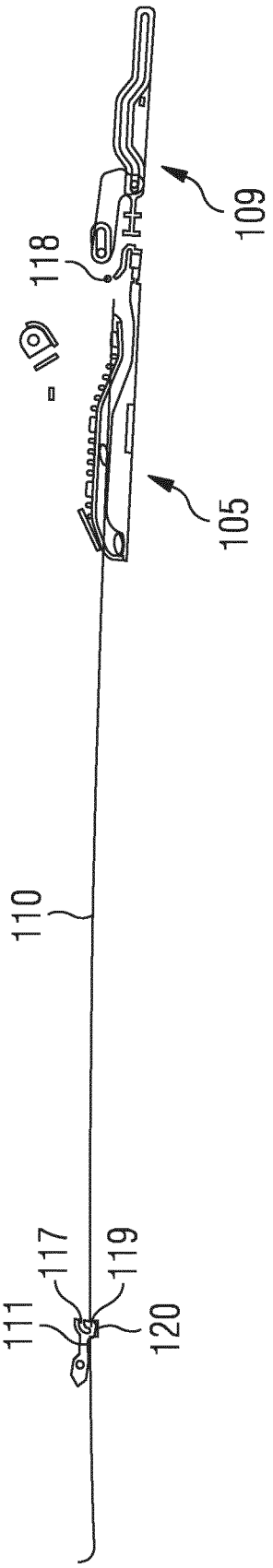


FIG 6B

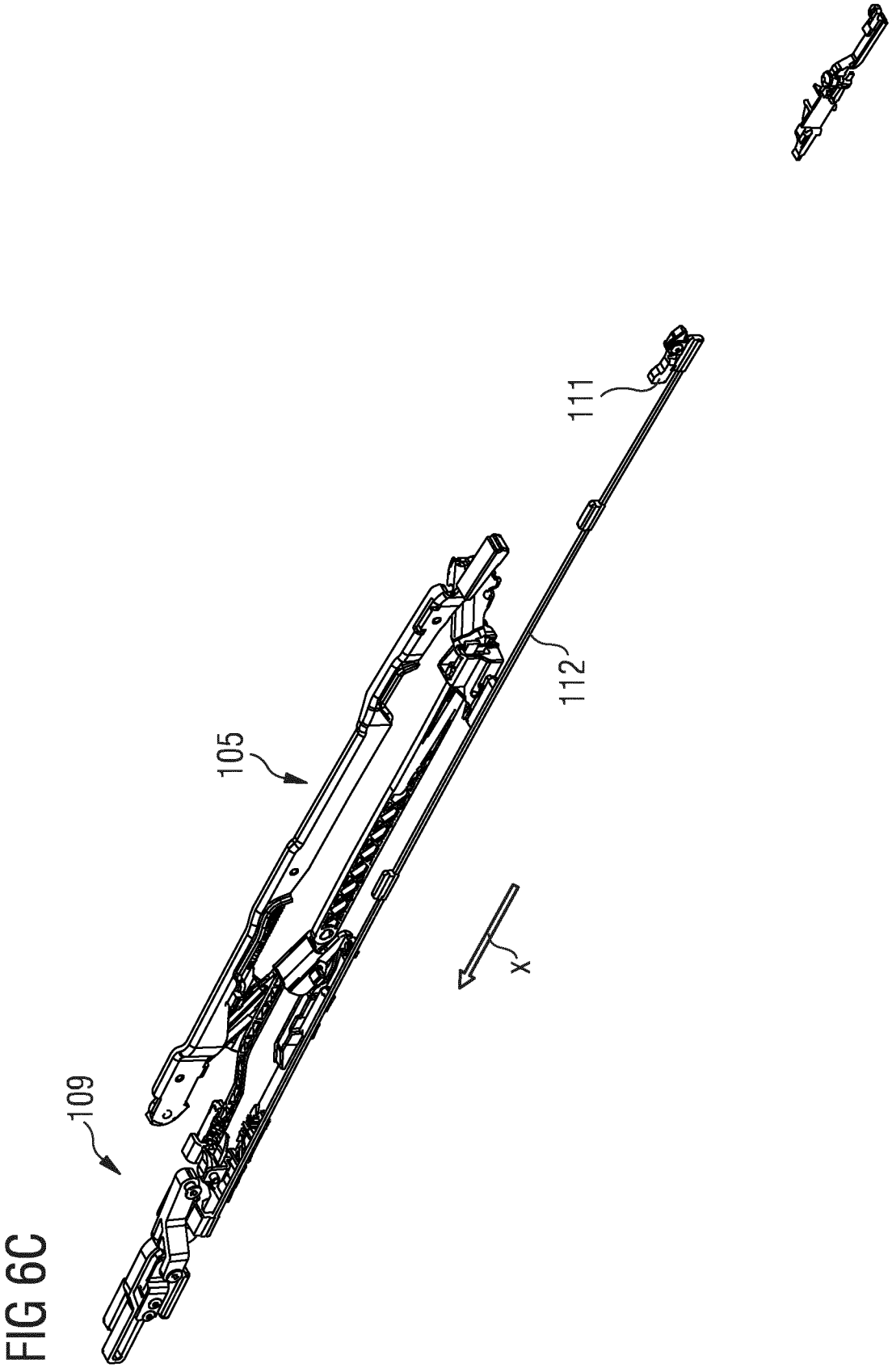


FIG 6C

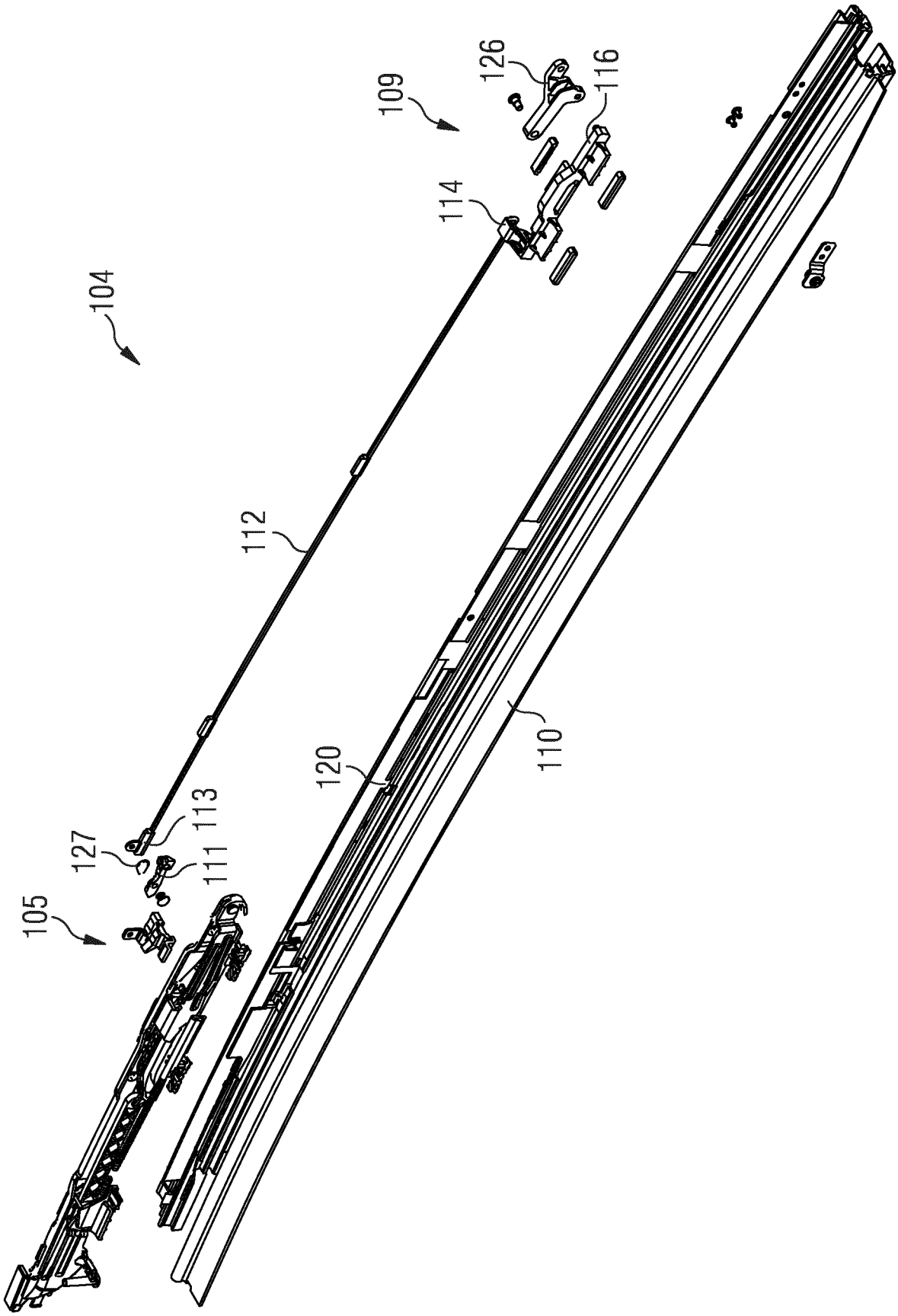
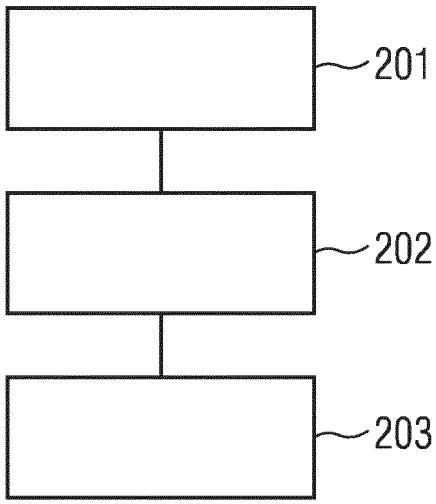


FIG 7

FIG 8



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/053508

A. CLASSIFICATION OF SUBJECT MATTER
INV. B60J7/047
ADD.

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)
B60J

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)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 10 2010 018867 A1 (WEBASTO AG [DE]) 3 November 2011 (2011-11-03) abstract paragraphs [0023] - [0025], [0028] - [0033] figures 1-8	1-8, 10-15

X	DE 10 2013 005217 A1 (WEBASTO SE [DE]) 2 October 2014 (2014-10-02) abstract paragraphs [0041] - [0055] figures 1-5	1-7,11

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
27 October 2016	17/11/2016

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Larangeira, F

2

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/053508

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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X	EP 2 028 031 A2 (YACHIYO IND CO LTD [JP]; HONDA MOTOR CO LTD [JP]) 25 February 2009 (2009-02-25) abstract paragraphs [0018] - [0031], [0049] - [0058], [0076] - [0090], [0115] - [0121] figures 1-15 -----	1-4,11, 12

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2016/053508

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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DE 102013005217 A1	02-10-2014	DE 102013005217 A1	02-10-2014
		WO 2014154383 A2	02-10-2014
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