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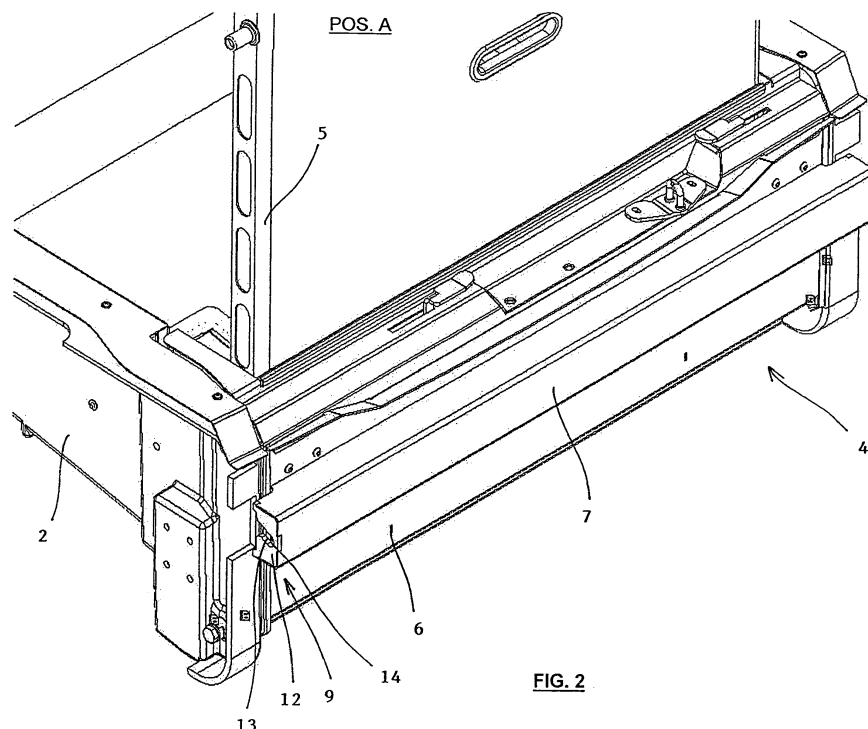
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(54) **DEVICE ABSORBING IMPACT ON THE REAR PART OF A VEHICLE EQUIPPED WITH A FOLDABLE RAMP**

(57) A vehicle (1) with a foldable ramp (4) has its central part of the bumper replaced with a horizontal brace (7) in the bottom part of the foldable ramp (4). The device under this invention allows to connect ends of the brace (7) with the main bearers (3,3') of the vehicle body by means of interlocking modules. The interlocking module consist of a fixed interlocking element (8) connected

with the main bearer (3, 3'), advantageously by means of a bracket (15), and of a moving interlocking element (9) connected with the brace (7). When the interlocking elements (8, 9) snap in a firm connection is created between the main bearers (3, 3') and the brace (7) in the lengthwise and transverse directions.

**FIG. 2****EP 3 400 922 A1**

Description

Field of the invention

[0001] The invention concerns a device absorbing impact on the rear part of a vehicle equipped with a foldable ramp designed particularly to move manual and electric wheelchairs into and out of a vehicle through the rear door.

Background of the invention

[0002] There are many devices facilitating movement into and out of vehicles, as well as for transport, of persons bound to a wheelchair and they can be also used for electric scooters and similar equipment provided with travel wheels. The devices differ depending on the purpose and type of the vehicle. At present, an important portion of vehicles are those operated in the so-called combined operation. This means that vehicles are used alternately for transport of healthy persons or regular loads and also for transport of disabled persons, persons with health-related limitations or physical disability who need to use wheelchairs. In practical terms, they include vehicles used by e.g. taxi services, hotels, travel agencies, as well as family cars used intermittently for regular daily transport for private and business purposes, as well as for transport of a person in a wheelchair.

[0003] It is therefore desirable that the foldable ramp takes up as little space inside the vehicle as possible and that normal operation of the vehicle is possible when the ramp is folded. It is also necessary to make the control of folding of the ramp in and out simple, safe and physically undemanding even for persons who are not physically strong or who may have certain limitations due to their health condition or age.

[0004] Such requirements are ideally met by foldable ramps pivotally attached in the rear part of the vehicle's lowered floor and described in the patent files GB 2275030, WO 97/02171, EP 0390431, WO 03059685 and US 5137413. The entry platform of the ramp is in the entry position folded out of the vehicle from the rear door towards the ground and in the transport position it is vertically lifted between the wheelchair and the rear door.

[0005] An improved solution of a foldable entry ramp has been described in the published patent application WO 0009060. The entry platform is attached to the edge of the floor well by means of a pivotal hinge. If the platform is made of one part, after the wheelchair drives into the vehicle, the platform is lifted to a vertical transport position between the wheelchair and the door and it is locked with a safety latch. After the wheelchair moves out of the vehicle, the platform is folded into the vehicle, while the pivotal hinge is moved into another height configuration, and the platform covers the floor well. In this position there is a luggage room created in the rear part of the vehicle corresponding to common vehicles, with no limitation of access. If the platform is made of two parts there

is no need to change the height configuration of the pivotal hinge. In the entry position and in the transport position both parts are in an interlocking position. After the wheelchair moves out of the vehicle the lock is released and the second part of the platform is folded on the floor well, while the first part creates the rear face.

[0006] Finally, there is a solution of a foldable entry ramp under EP 2293755. According to this solution in the rear part of the vehicle there are two tiltable side parts arranged on the opposite sides, pivotally attached to the bottom edge of the floor well, with the moving entry platform between them. Tiltable side parts turn on the hinges from the vertical position to the entry position and vice versa. In the vertical position they are secured with side latches. The moving fit of the entry platform in the tiltable side parts makes it possible, with the tiltable side parts in the vertical position, to fold the entry platform inside the vehicle at its floor level into the so-called passive position. For this purpose, the entry platform is provided with metal sheet carriers on its sides that perform rotationally translational movement in respect to the tiltable side parts. The trajectory of this movement is defined by guiding grooves created in the tiltable side parts and in the carriers and by pins that engage into the guiding grooves. The vertical position of the entry platform is called the transport position. The rear door in this position is closed and the wheelchair with the transported person is located and secured in front of the entry platform arrested in the transport position.

[0007] The problem with installation of foldable ramps in the rear part of the vehicle consists in the fact that it is necessary to remove a central part of the rear bumper which would otherwise prevent the ramp from folding out into the entry position. On the lengthwise main bearers of the self-supporting body there are only the left part and the right part of the rear bumper. Between them there is the bottom part of the foldable ramp provided with a transverse brace that replaces the missing central part of the bumper. Although vehicles redesigned in this way meet the requirements for approval, crash tests have shown that in case of an impact from the back on the rear door and on the bottom part of the foldable ramp or its transverse brace the impact force is not sufficiently transferred to the lengthwise main bearers that are for this purpose provided with deformation elements. Consequently, the deformation is directed inside the rear part of the vehicle, i.e. where the passenger is sitting in the wheelchair and the passenger is only protected with the rear door and the entry platform of the foldable ramp in the vertical transport position. However, this is not sufficient from the viewpoint of safety of the transported persons. Moreover, even small impacts may deform the rear part of the vehicle and make it wider from the center to the sides, which means that a relatively small impact may cause a damage requiring an extensive repair of the rear part.

[0008] This invention seeks to eliminate the shortcomings described above and to create a device for efficient absorption of impacts on the rear part of vehicles provid-

ed with a foldable ramp.

Summary of the invention

[0009] This task has been resolved by the device under this invention.

[0010] The device consists of two interlocking modules. Each interlocking module is situated between the end of the horizontal brace of the bottom part of the foldable ramp and the adjoining main bearer. Each interlocking module consists of a fixed interlocking element connected with the main bearer and a moving interlocking element connected with the brace and moving with it, while in the transport position the bottom parts of the interlocking elements mutually snap in. The interlocking module thus forms a firm connection between the main bearers and the brace, horizontally in the driving direction of the vehicle and also in the direction perpendicular to it. The force of an impact on the rear side is transferred via the interlocking modules to the main bearers in the driving direction and, at the same time, the interlocking modules prevent deformation of the body in the direction perpendicular to the driving direction, i.e. from the center to the sides.

[0011] In one advantageous embodiment of the invention the fixed interlocking element is not connected directly to the main bearer but to a bracket connected with the main bearer. The bracket may also have an additional function as we will describe below.

[0012] In another advantageous embodiment of the invention the fixed interlocking element consists of a dowel pin linked with a retainer and the movable interlocking element consists of the side wall of the brace provided with a groove and a stop, while in the transport position the dowel pin engages in the groove and rests on the stop and the retainer falls behind the side wall inside the brace.

[0013] In another advantageous embodiment of the invention the brace is made out of a hollow steel U-shaped section with its open side towards the bottom part of the foldable ramp.

[0014] The vertical retainer is L-shaped, its one arm forming the retainer and the other arm is attached to the bracket connected to the main bearer.

[0015] Another advantageous design of the bracket has the base attachable to the end of the main bearer and its arm is perpendicular to the base in the extended direction of the main bearer towards the end of the brace, while the fixed interlocking element is attached to the arm of the bracket.

[0016] Another advantageous design of the bracket arm is provided with a front hitch with openings, arranged in parallel with the base, and with an upper hitch with openings, arranged perpendicularly to the base, with a deformation element between the front hitch and the base, which is attached to the hitches with screws placed in the openings.

[0017] Advantages of the device under this invention

consist in the fact that even if the impact hits the center of the rear part of the vehicle the force will be transferred to the lengthwise main bearers with deformation elements and an extensive deformation of the vehicle in the driving direction will be prevented. At the same time, the device under this invention prevents deformation of the rear part also in the transversal direction from the center to the sides.

Brief description of drawings

[0018] The invention will be explained in detail by means of the drawings.

- 15 Fig. 1 view of a rear part of a vehicle with a foldable ramp in transport position A,
- Fig. 2 perspective view of a lowered floor well with a foldable ramp in transport position A,
- Fig. 3 perspective section of a vehicle's side with the main bearer and a bracket with a fixed interlocking element,
- 20 Fig. 4 perspective view of a bracket with a fixed interlocking element,
- Fig. 5 perspective section of a vehicle's side with the main bearer, a bracket with a fixed interlocking element and a deformation element,
- 25 Fig. 6 side view of a foldable ramp in entry position B,
- Fig. 7 side view of a foldable ramp in the upright transport position A,
- 30 Fig. 8 view of a cutout of the vehicle's side and a foldable ramp in the position before locking of the interlocking module,
- Fig. 9 view of a cutout the vehicle's side and of a foldable ramp when the interlocking module is in transport position A.
- 35

Preferred embodiments of the invention

[0019] It is understood that the below described and depicted particular cases of embodiment of the invention are presented for illustration and not to limit the invention to such examples. Those skilled in the art will find or will be able to provide, based on routine experimenting, one or more equivalents of the embodiments of the invention disclosed herein. Such equivalents shall be included into the scope of the following patent claims.

[0020] The vehicle 1 is in its rear part, i.e. in the luggage compartment, provided with a lowered floor well 2 which is embedded in the floor between two main bearers 3, 3' arranged lengthwise under the sides of the vehicle 1 and under the rear wheel houses. Ends of the main bearers 3, 3' are linked with deformation elements 20 that carry a left segment of the bumper 23 and a right segment of the bumper 23'.

[0021] A platform-like bottom part 6 of the foldable ramp 4 is pivotally attached on hinges to the rear edge of the lowered floor well 2. The bottom part 6 has tiltable side parts revolving on hinges and thus the bottom part

6 moves from the transport position A to the entry position B and vice versa. The tiltable side parts are provided with moving carriers connected with the entry platform 5. When the bottom part 6 is in the transport position A the carriers can be used to fold the platform 5 into the vehicle on edges of the lowered floor well 2, into the so-called passive position not shown in Figures 1 - 9. The foldable ramp 4 is also provided with a system of pulleys that conduct ropes attached to springs to ensure smooth movement of the foldable ramp 4 between the individual working positions.

[0022] The bottom part 6 of the foldable ramp 4 is provided with a horizontal brace 7. The brace 7 is supposed to retain an impact on the rear part of the vehicle 1 and it consists of a steel "U" section with its open side towards the bottom part 6 of the foldable ramp 4 and it stretches all along its length. However, the brace 7 can have a number of other possible embodiments.

[0023] At the ends of the brace 7 there are interlocking modules that arrest the brace 7 in relation to the main bearers 3, 3' in the transport position A and create a firm connection between them that prevents displacement of the brace 7 and the whole bottom part 6 inside towards the front part of the vehicle 1 during impact from the back. The connection is also firm in the perpendicular direction to the vehicle's driving direction 1 and thus it also prevents transverse deformation in the direction from the center to the sides.

[0024] Each interlocking module consists of a fixed interlocking element 8 attached to the main bearer 3, 3' and from a moving interlocking element 9 attached to the brace 7. The movable interlocking element 9 moves on a trajectory in the shape of a part of a circle, jointly with the brace 7 and the bottom part 6 of the foldable ramp 4. In the transport position A the movable interlocking element 9 snaps in with the fixed interlocking element 8 and the firm connection is created in the mentioned directions.

[0025] Figures 1 through 9 illustrate an example of embodiment in which the fixed interlocking element 8 consists of a dowel pin 10 and a related retainer 11. The dowel pin 10 is arranged horizontally and the retainer 11 is a flat slab formation arranged vertically. The dowel pin 10 and the retainer 11 form an integral steel weldment. The movable interlocking element 9 is integrated in the brace 7 so that the side wall 12 that closes both ends of the hollow brace 7 has an arched groove 13 that engages the dowel pin 10. At the end of the groove 13 there is radius forming the stop 14 on which rests the dowel pin 10 in the transport position A and in case of an impact it prevents displacement of the brace 7 to the front. The dowel pin 10 passes through the groove 13 inside the brace 7, along with the retainer 11, which is at the end of the dowel pin 10. In case of an impact from the back on the brace 7 the retainer 11 rests from the inside on the side wall 12 of the brace 7 and prevents the fixed interlocking element 8 from shifting from the end of the brace 7. As the fixed interlocking element 8 is connected

with the main bearers 3, 3', it prevents deformation of the vehicle 1 in the transverse direction perpendicular to the driving direction. Another specific embodiment of the fixed interlocking element 8 and moving interlocking element 9 may feature signs of inverse kinematics or it may be resolved by another method obvious to persons skilled in the art.

[0026] Despite the fact that Figures 1 through 9 show only one interlocking module, specifically at the left main bearer 3, the other interlocking module at the right main bearer 3' is designed identically, only as the mirror image. The connection of the interlocking element 8 with the main bearers 3, 3' is implemented with a bracket 15. The bracket 15 is a die stamping with a flat base 16 attached to the end of the main bearer 3, 3'. The base 16 forms the right angle with the flat arm 17 that runs toward the back in the extended direction of the main bearer 3, 3'. The fixed interlocking element 8 made of an L-section with the retainer 11 and the dowel pin 10 is welded to the arm 17. In parallel with the base 16, at the end of the arm 17, there is a front hitch 18 with openings 19. Lengthwise with the arm 18, 21 and the base 16 there is the existing deformation element 20, attached with screws in the openings 19, 22. The deformation element 20 continues with the left segment of the bumper 23 on one side of the vehicle 1 and the right segment of the bumper 23' on the other side of the vehicle 1.

[0027] The bracket 15 is not indispensable but it is advantageous, among other things, also for placement of the deformation element 20. The fixed interlocking element 8 may be attached to the main bearer 3, 3' directly or indirectly via a simple arm or strut.

[0028] The device under this invention may be used in vehicles equipped with a rear foldable ramp.

Reference numbers in the drawings

[0029]

- | | | |
|----|----|----------------------------------|
| 40 | 1 | vehicle |
| | 2 | lowered floor well |
| | 3 | main bearer |
| | 3' | main bearer |
| | 4 | foldable ramp |
| 45 | 5 | entry platform |
| | 6 | bottom part of the foldable ramp |
| | 7 | brace |
| | 8 | fixed interlocking element |
| | 9 | moving interlocking element |
| 50 | 10 | dowel pin |
| | 11 | retainer |
| | 12 | side wall brace |
| | 13 | groove |
| | 14 | stop |
| 55 | 15 | bracket |
| | 16 | bracket base |
| | 17 | bracket arm |
| | 18 | front hitch |

- 19 opening in the front hitch
- 20 deformation element
- 21 upper hitch
- 22 opening in the upper hitch
- 23 left segment of the bumper
- 24 right segment of the bumper

- A transport position of the foldable ramp
- B entry position of the foldable ramp

Claims

1. Device absorbing impact on the rear part of a vehicle (1) provided with a lowered floor well (2), arranged between two main bearers (3, 3') and with a foldable ramp (4) consisting of an entry platform (5) and a bottom part (6) carrying the entry platform (5), where the bottom part (6) is pivotally attached to the edge of the lowered floor well (2) and it can move between the transport position (A), when it is set vertically inside the vehicle (1), and the entry position (B), when it is folded out from the vehicle (1), while the bottom part (6) is provided with at least one horizontal brace (7), **characterized in that** it consists of two interlocking modules, each of the interlocking modules is arranged between the end of the horizontal brace (7) and the adjoining main bearer (3, 3'), each interlocking module consists of a fixed interlocking element (8) connected to the main bearer (3, 3') and of a moving interlocking element (9) connected to the brace (7) which moves along with the brace, while in the transport position (A) the bottom parts (6) of the interlocking elements (8, 9) mutually snap in and the interlocking module forms a firm connection of the main bearers (3, 3') with the brace (7), horizontally in the driving direction of the vehicle (1) and in the direction perpendicular to the driving direction of the vehicle (1).
2. Device under the claim 1 **characterized in that** the fixed interlocking element (8) is attached to the bracket (15) connected with the main bearer (3, 3').
3. Device under the claim 1 **characterized in that** the fixed interlocking element (8) has a dowel pin (10) with a retainer (11), the movable interlocking element (9) has a side wall (12) of the brace (7) provided with a groove (13) and a stop (14), while in the transport position (A) the dowel pin (10) engages in the groove (13) and rests on the stop (14) and the retainer (11) falls behind the side wall (12) inside the brace (7).
4. Device under any of the claims 1 through 3 **characterized in that** the brace (7) is made up of a hollow U-shaped steel section with its open side towards the bottom part (6) of the foldable ramp (4).

5. Device under the claim 3 **characterized in that** the vertical retainer (11) is L-shaped, its one arm forms the retainer (11) and the other arm is fixed to the bracket (15) connected with the main bearer (3, 3').

6. Device under the claim 2 or 5 **characterized in that** the bracket (15) has a base (16) that can be attached to the end of the main bearer (3, 3') and an arm (17) perpendicular to the base (16) in the extended direction of the main bearer (3, 3') towards the end of the brace (7), while the fixed interlocking element (8) is attached to the arm (17).

7. Device under the claim 6 **characterized in that** the arm (17) is provided with a front hitch (18) with openings (19), arranged in parallel with the base (16), an upper hitch (21) with openings (22), arranged perpendicularly to the base (16), and between the front hitch (18) and the base (18) there is a deformation element (20) attached to the hitches (18, 21) with screws in the openings (19, 22).

POS. A

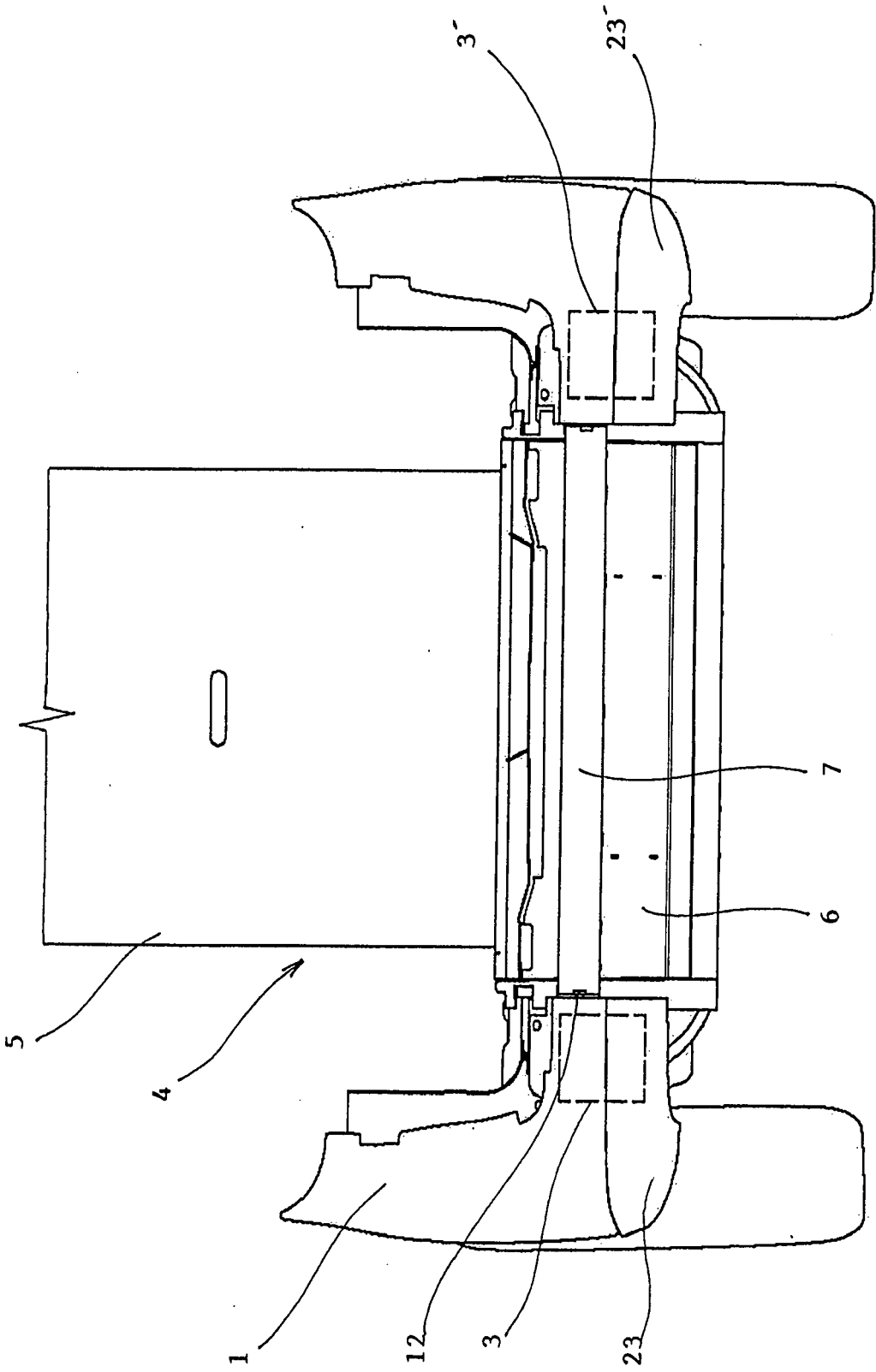
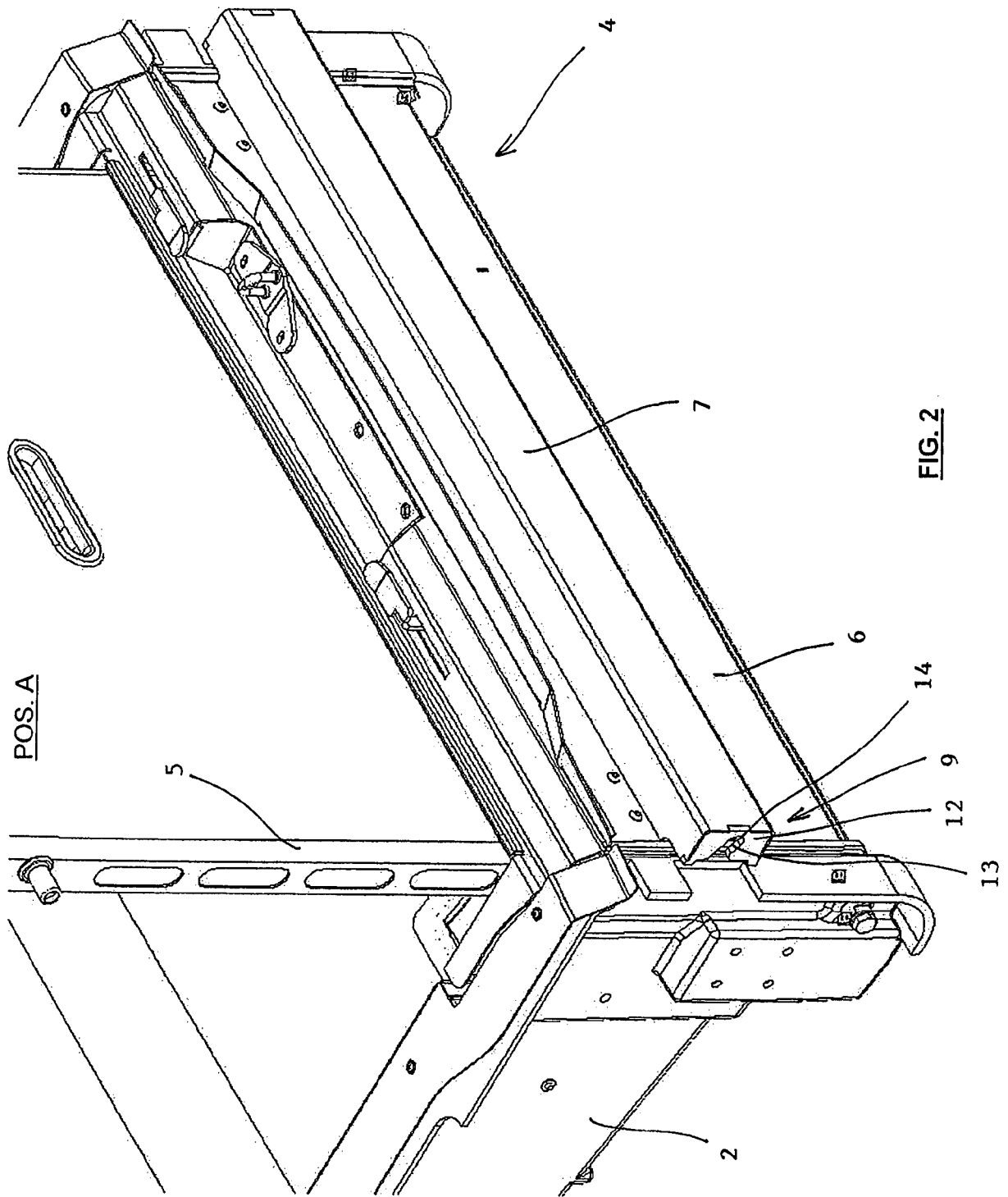
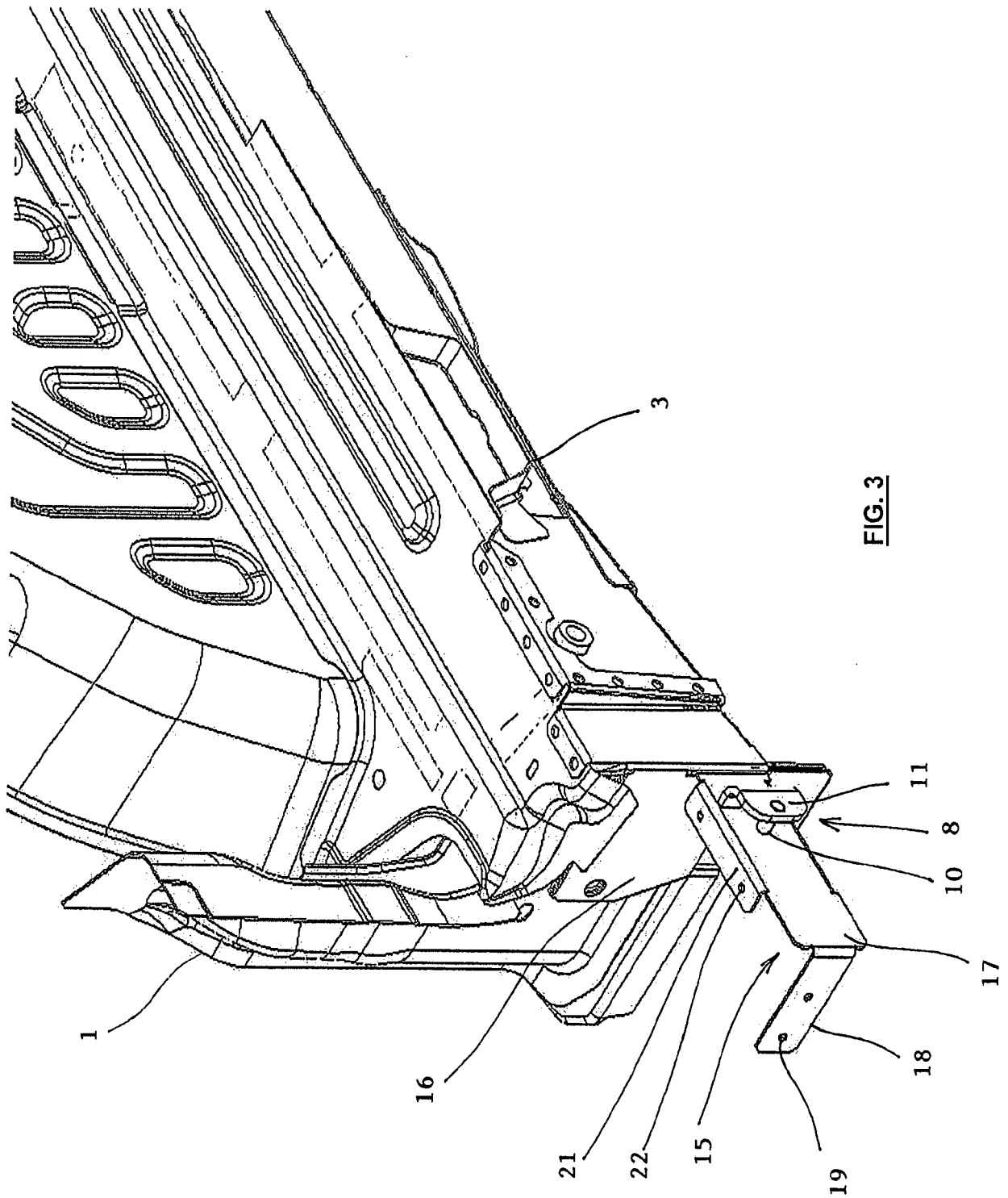


FIG. 1





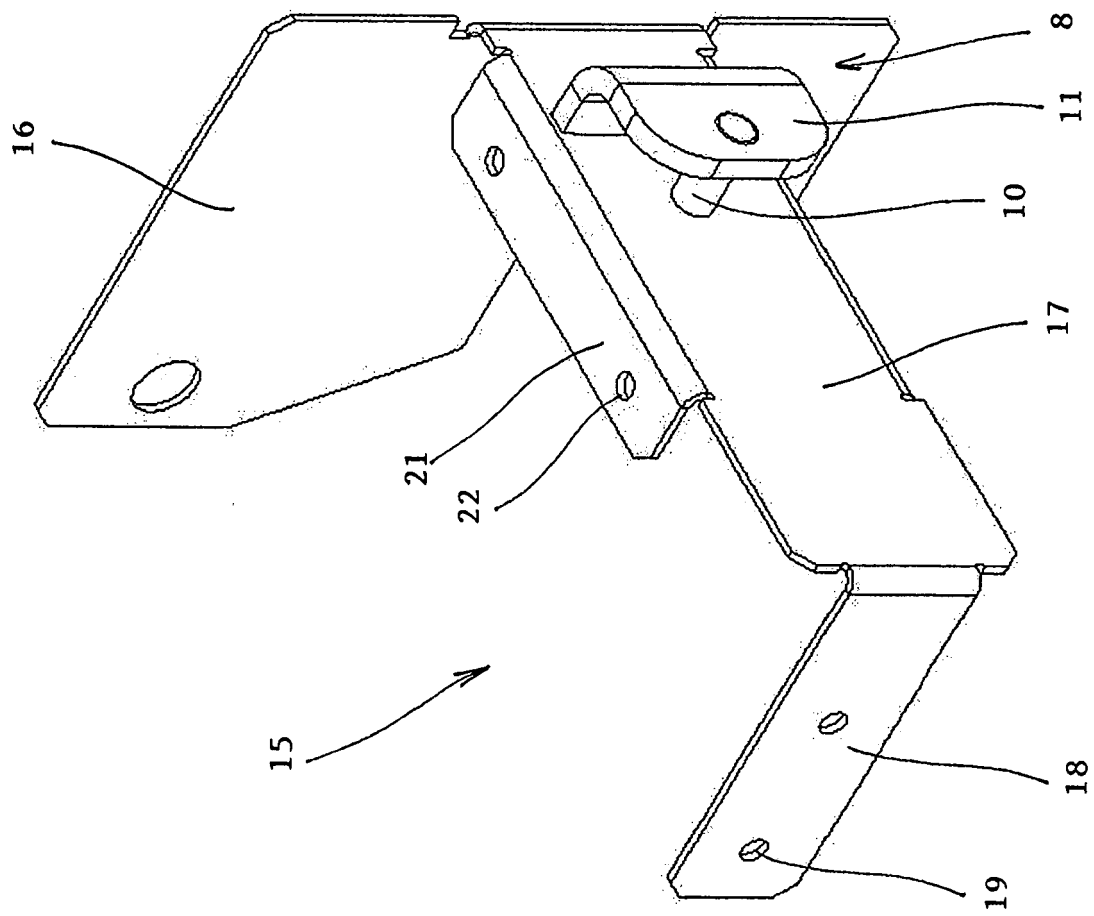
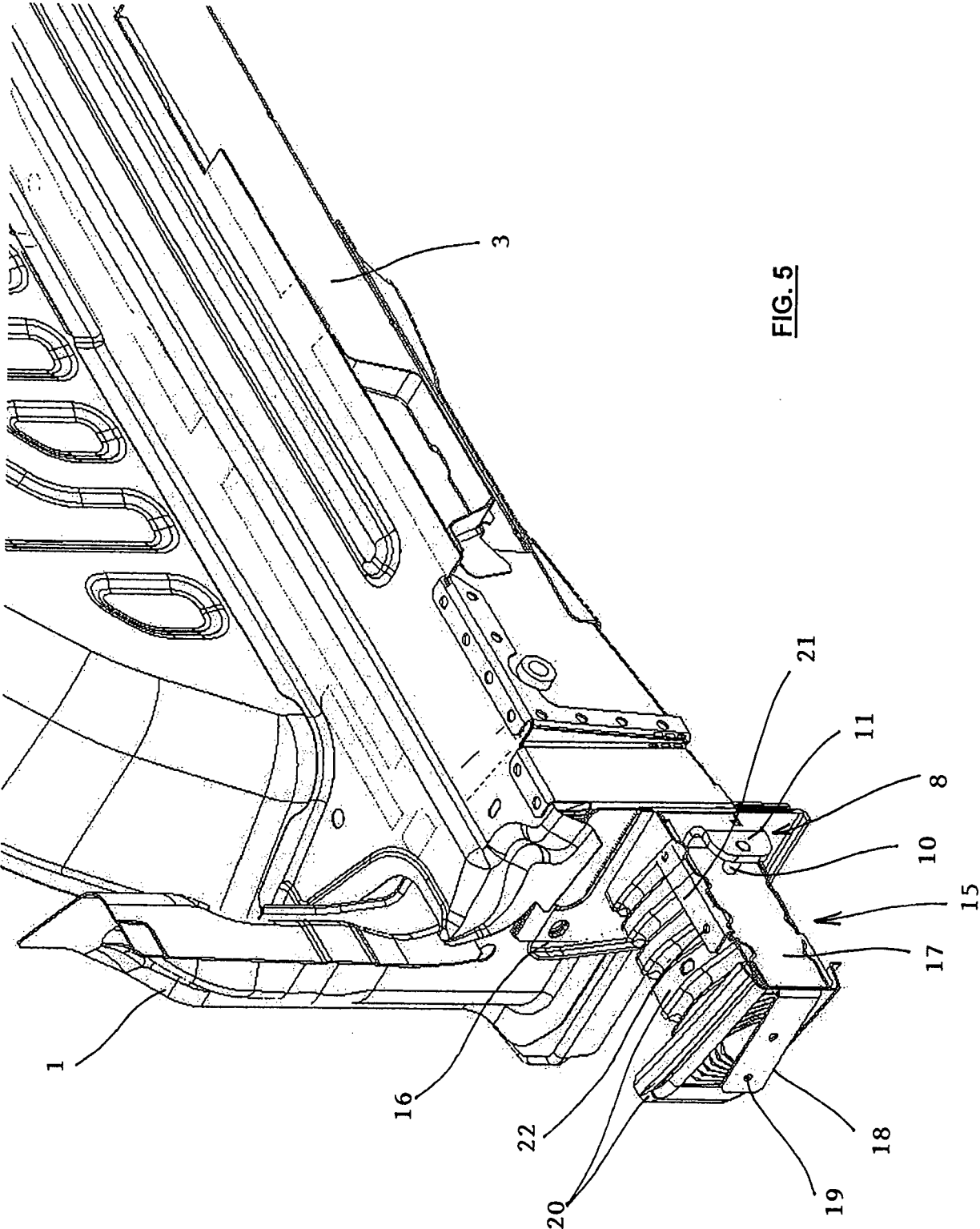
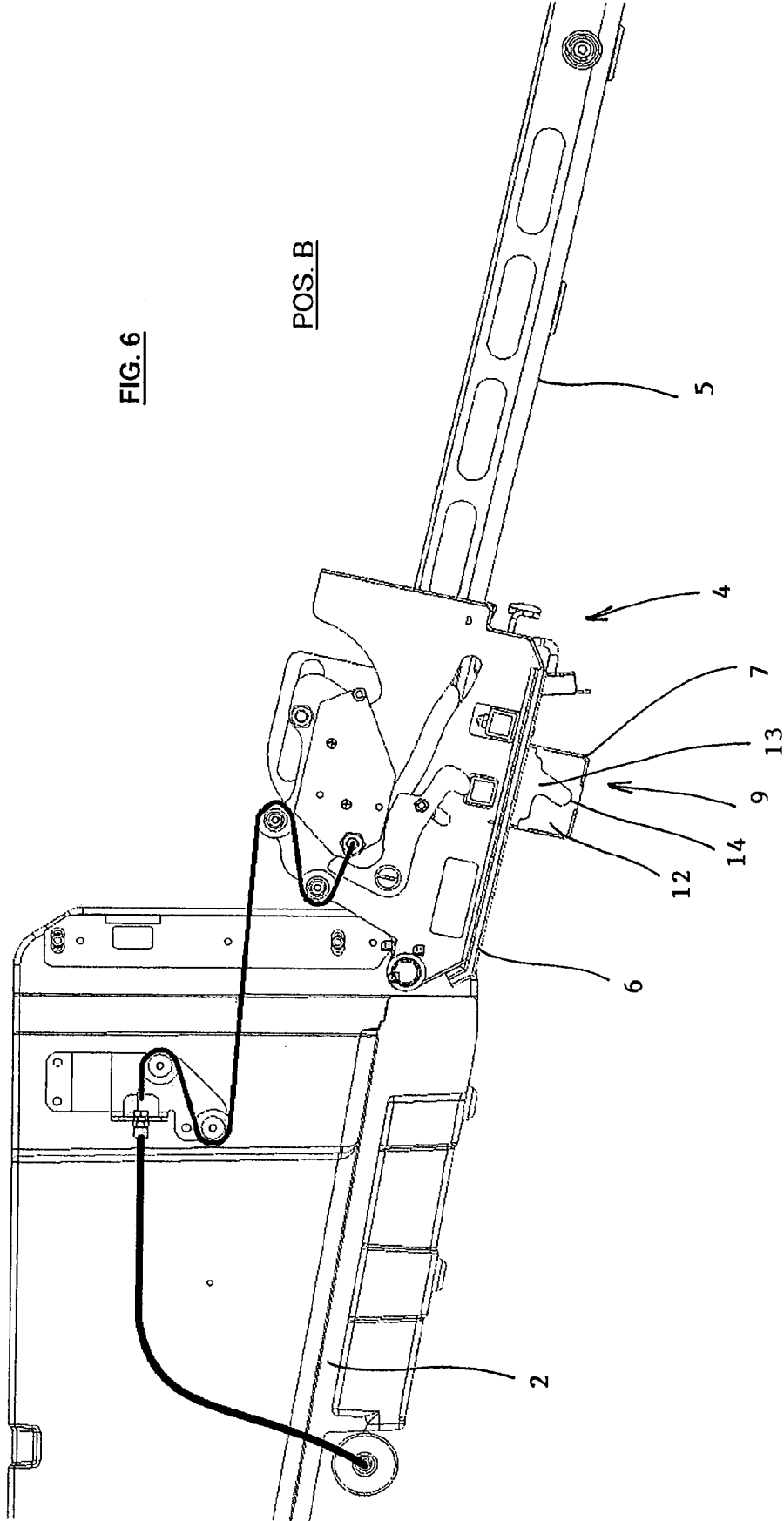
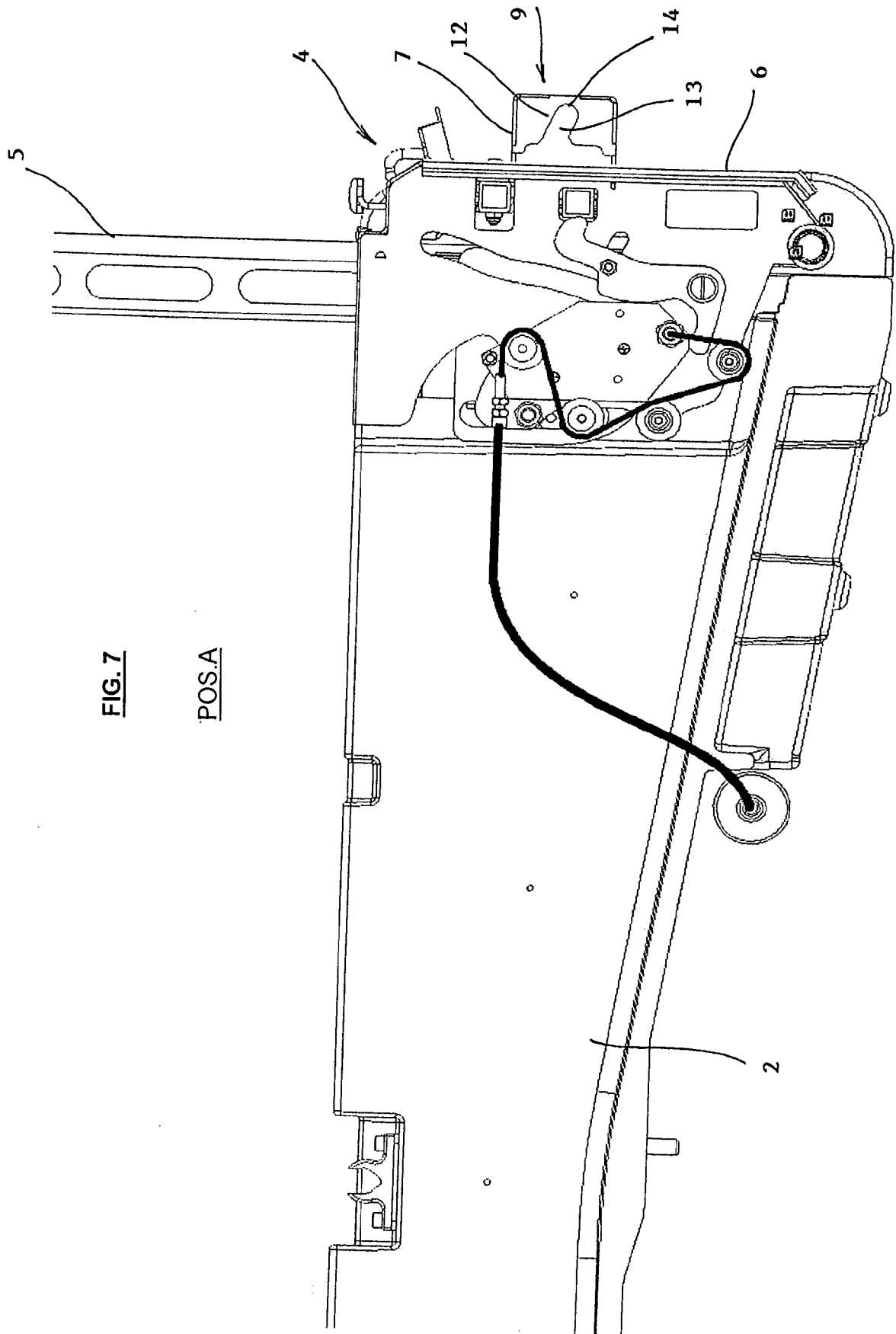


FIG. 4







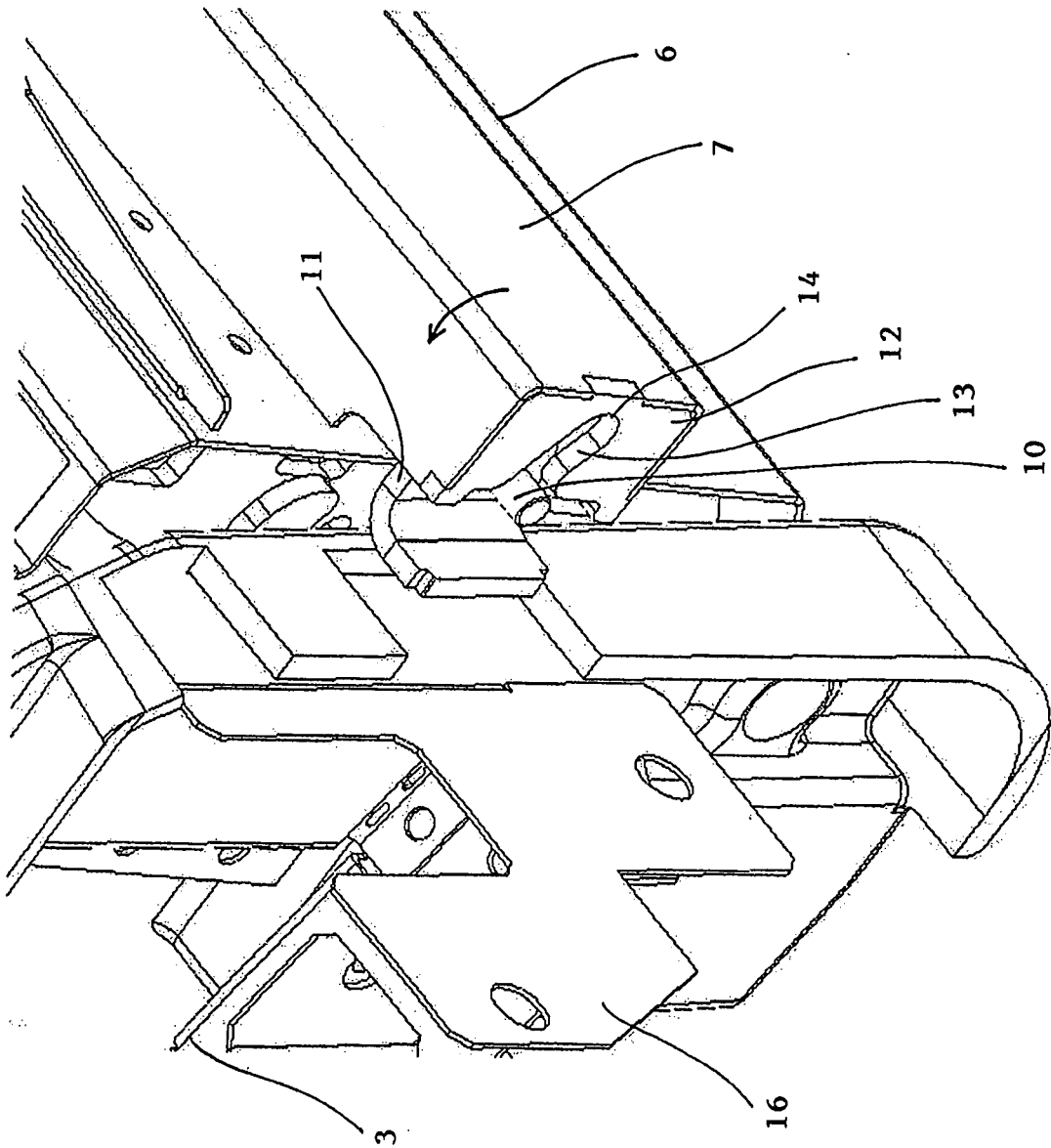


FIG. 8

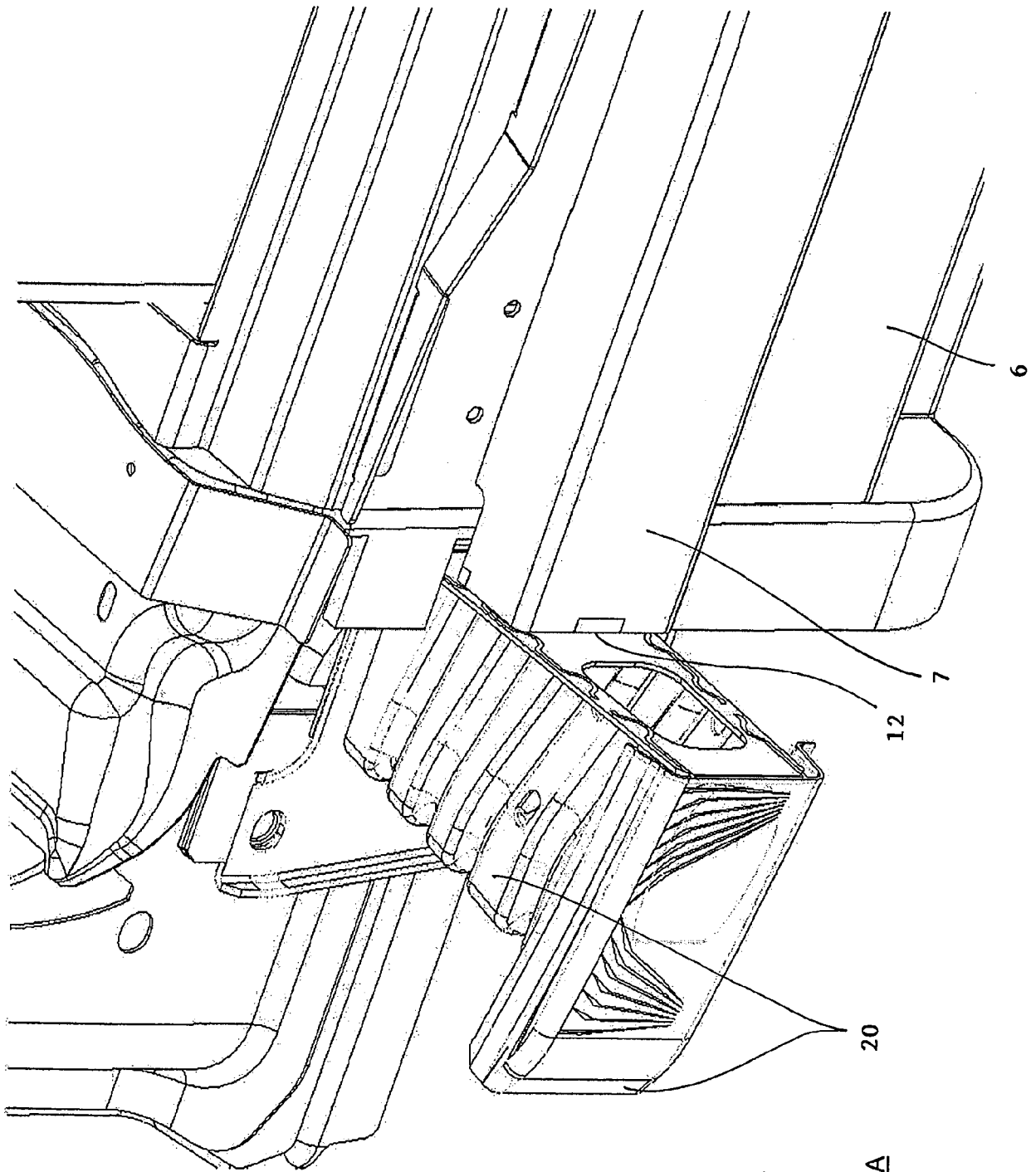


FIG. 9

POS.A



EUROPEAN SEARCH REPORT

Application Number
EP 17 00 0795

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2014/255138 A1 (BRUNS GERIT [DE]) 11 September 2014 (2014-09-11) * paragraphs [0039] - [0042]; figures 2,4 *	1-7	INV. A61G3/06
X	----- WO 2010/003387 A1 (API CZ S R O [CZ]; BARTOS MIROSLAV [US]) 14 January 2010 (2010-01-14) * page 6, paragraph 2 - page 7, column 1; figures 3-5,8 * -----	1-5	
			TECHNICAL FIELDS SEARCHED (IPC)
			A61G
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 8 November 2017	Examiner Kroeders, Marleen
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ON EUROPEAN PATENT APPLICATION NO.**

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08-11-2017

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2014255138 A1	11-09-2014	DE 202013002152 U1	11-06-2014
		EP 2774810 A2	10-09-2014
		US 2014255138 A1	11-09-2014

WO 2010003387 A1	14-01-2010	AT 533455 T	15-12-2011
		CZ 18846 U1	10-09-2008
		EP 2293755 A1	16-03-2011
		ES 2377866 T3	02-04-2012
		WO 2010003387 A1	14-01-2010

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- GB 2275030 A [0004]
- WO 9702171 A [0004]
- EP 0390431 A [0004]
- WO 03059685 A [0004]
- US 5137413 A [0004]
- WO 0009060 A [0005]
- EP 2293755 A [0006]