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(54) **DEVICE FOR OVERCOMING OBSTACLES FOR TRANSPORT MEANS**

(57) Device (1) for overcoming obstacles for transport means (100), such as cars, motorcycles and the like, comprising at least two portions (2, 3, 4, 5) arranged in succession, each of said portions being equipped with a supporting surface (6, 7, 8, 9) for said transport means (100) and with a supporting element adapted to come into contact with the ground (10, 11, 12, 13), wherein a rotatable constraint (14, 15, 16), preferably a hinge, is constrained to each pair of said portions arranged in succession with each other, said device being configured so as to allow a relative rotation between two portions constrained to the same rotatable constraint (14, 15, 16), preferably to all pairs of portions constrained to the same rotatable constraint, higher than 180°, preferably higher than 190°, even more preferably higher than 200°.

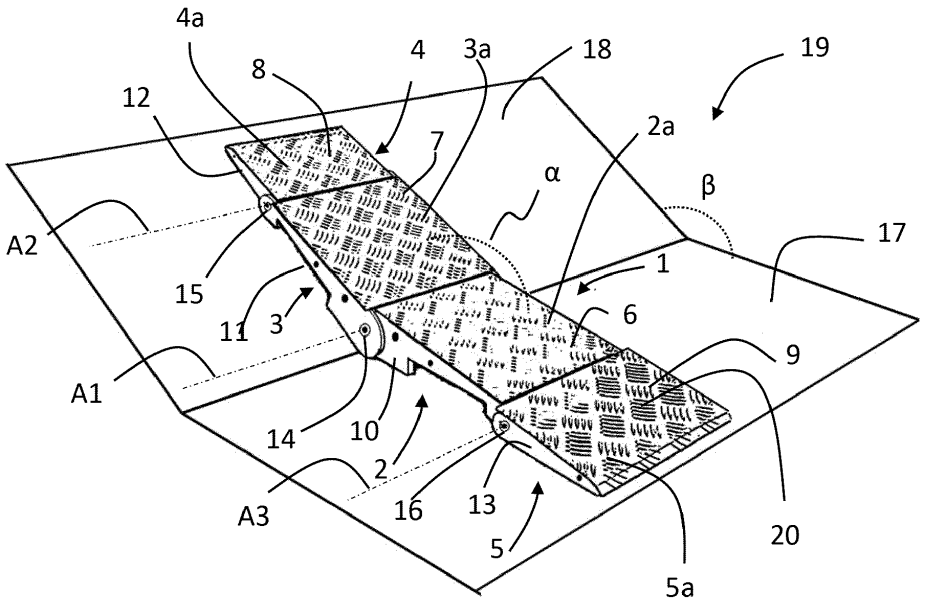

Fig. 2A

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Description

[0001] The present invention relates to the field of overcoming obstacles such as bumps, changes of slopes and the like for transport means, in particular cars.

[0002] In particular, ramps composed of multiple portions hinged to each other are known. These portions are typically lockable so as to form a ramp, i.e. in order to have a portion constrained to the ground and a second portion constrained to an elevated point, while the central part must keep its operating position suspended in the void, so as to allow a transport means to use the same ramp.

[0003] These devices effectively carry out their ramp function but are not adapted to allow a transport means, i.e. typically a vehicle, to overcome a bump or change of slope in the ground or a step.

[0004] Object of the present invention is, therefore, to make a device adapted to allow a transport means, in particular a car, to overcome different types of obstacles, wherein the obstacles comprise at least two points on two planes at heights different from each other.

[0005] Further object of the present invention is to make a device as described above that is simple to manufacture.

[0006] Further object of the present invention is to make a device as described above that can be easily carried.

[0007] These and other objects are achieved by a device, a transport means comprising such device and a respective method of operation according to one or more of the appended claims.

[0008] In particular, object of the present invention are a device, a transport means comprising such device and a respective method of operation according to the appended independent claims. Preferred aspects are instead set forth in the dependent claims. According to an aspect, a device for overcoming obstacles for transport means such as cars, motorcycles and the like, comprises at least two portions arranged in succession and each portion is equipped with a supporting surface for the transport means and a supporting element adapted to come into contact with the ground. A rotatable constraint, preferably a hinge, is interposed between each pair of portions. At least one of the rotatable constraints, preferably all of the rotatable constraints, allow a relative rotation between the two portions to which it is constrained, greater than 180°, preferably greater than 190°, even more preferably greater than 200°.

[0009] The portions of the present device therefore have great freedom of movement, which allows the same device to be used with different types of obstacles.

[0010] It should be noted that "rotatable constraint" means hereinafter a constraint that allows at least one relative rotation between the portions to which it is constrained.

[0011] According to a possible aspect, considering a condition in which the supporting surfaces of the different portions are substantially aligned with each other, for at least one pair of portions which are consecutive and constrained to the same rotatable constraint, preferably for each pair of portions which are consecutive and constrained to the same rotatable constraint, a relative rotation greater than 10°, preferably greater than 20°, is allowed, between the two portions of the pair, in a first direction and greater than 170° in a second direction opposite the first direction.

[0012] This possibility of movement contributes to the versatility of the device.

[0013] According to a possible aspect, the device is configured so that a rotation in the first direction results in a reduction in the angle between the supporting surfaces, and a rotation in the second direction results in an increase in the angle between the supporting surfaces.

[0014] According to a possible aspect, the device comprises a number of portions greater than two.

[0015] According to a possible aspect, the device comprises an even number of portions, preferably four portions.

[0016] According to a possible aspect, the portions comprise a main body comprising multiple parts which can be moved relative to each other, preferably parts that can be translated to each other at least in a direction substantially parallel to at least one axis of rotation of the portions.

[0017] An aspect of the present invention further relates to a device for overcoming obstacles for transport means such as cars, motorcycles and the like, comprising at least two portions arranged in succession, wherein each portion is equipped with a supporting surface for the transport means, and a supporting element adapted to come into contact with the ground. A rotatable constraint, preferably a hinge, is interposed between each pair of portions. For at least one pair of consecutive portions (i.e. constrained to the same rotatable constraint), the angle α between the two supporting surfaces of the portions of the mentioned pair is greater than the angle β between the respective supporting elements and, in particular, between the surfaces of supporting elements intended for contact with the ground.

[0018] An aspect of the present invention further relates to a transport means, preferably a car, comprising at least one device according to one or more of the preceding aspects. An aspect of the present invention also relates to a method for overcoming a change in inclination of the ground by means of a device according to one or more of the preceding aspects, wherein the ground has a first surface angled with respect to a second surface, wherein the device is arranged on the ground, placing one of the rotatable constraints substantially at the meeting point between said angled surfaces and supporting the portions constrained to each other by means of said rotatable constraint on the ground surfaces inclined to each other.

[0019] With reference to the accompanying figures, exemplary and non-limiting embodiments of the present in-

vention are discussed, wherein:

- Figure 1 is a perspective view of a device for overcoming obstacles for transport means such as cars, motorcycles and the like, according to a possible embodiment of the present invention;
- Figure 2 shows a side schematic view of the device of figure 1;
- Figure 2A is a perspective view of the device of figure 1 in the event that this obstacle is a ground with a first surface angled with respect to a second surface.
- Figure 3 is a side view of a device according to the present invention, in an embodiment alternative to that of figures 1 and 2, in which the portions were rotated with each other in the second direction;
- Figure 4 is a top perspective view of the device of figure 3;
- Figure 5 is a schematic view of a device according to claim 3, stored inside a transport means;
- Figure 6 is a bottom schematic view of a device according to the present invention, in which the supporting elements, the lower surface of the supporting surfaces and the contact elements with the ground, can be appreciated;
- Figure 6A is a top view of an alternative embodiment of the present invention;
- Figure 6B is a bottom schematic view of a portion of the device of figure 6A;
- Figure 7 is a side view of a device according to the present invention in a possible application thereof with a bump;
- Figure 8 is a side view of the device of figure 1 in a possible application thereof with a step.

[0020] The device 1 comprises at least two portions 2, 3, 4 and 5 and at least one rotatable constraint 14, 15, 16 which constrains to each other the various portions 2, 3, 4, 5. Each portion comprises a supporting surface 6, 7, 8 and 9 and at least one supporting element 10, 11, 12 and 13, the latter being adapted to support the respective portion and to come into contact with the ground.

[0021] The number of portions of the device 1 may vary in different embodiments. Preferably, the number of these portions is even. Preferred embodiments, such as that shown in the figures, comprise four portions 2, 3, 4, 5.

[0022] In general, the device 1 comprises at least one pair of portions that can be rotated with each other. Preferably, the portions of each pair of portions 2, 3, 4, 5 can therefore be rotated with each other around a respective axis of rotation A1, A2, A3. Preferably, the axes of rotation A1, A2, A3 are substantially parallel to each other. Typically, therefore, considering any pair of axes of rotation A1, A2, A3 selected from those of the portions of the device, those axes have no common points, i.e. they are not tangent, and there is at least one plane that contains both axes A1, A2, A3. It is clear how this condition is the ideal geometric one and that the actual implementations may have a slight deviation from such condition due to the construction tolerances.

[0023] The portions 2, 3, 4 and 5 typically comprise a main body 2a, 3a, 4a, 5a having a dimension smaller than the other two, and preferably substantially bi-dimensional, such as foils or similar elements.

[0024] The main body 2a, 3a, 4a, 5a can be made of different materials; a preferred solution provides that the main body is made of metal. In general, the main body 2a, 3a, 4a, 5a is made so as to be equipped with mechanical and structural characteristics necessary to carry the weight of the transport means 100 during the use of the device 1.

[0025] The supporting surface 6, 7, 8 and 9 is typically one of the surfaces formed by the two dimensions greater than this main body 2a, 3a, 4a, 5a. The supporting surfaces typically have in plan view a substantially trapezoidal, preferably rectangular or square, shape.

[0026] In the event of embodiments having an even number of portions, greater than two, the central portions 2, 3 typically have a supporting surface 6, 7 having an area larger, or at least a length longer, than the area (or length) of the supporting surfaces 8, 9 of the side portions 8, 9. "Length" means a dimension perpendicular to the axis of rotation of the central portions 2, 3.

[0027] According to a possible aspect, at least one of the supporting surfaces 6, 7, 8, 9, preferably all of the supporting surfaces, has a plurality of friction elements 20, i.e. has elements adapted to assist the friction of the device between the supporting surface 6, 7, 8, 9 and the respective transport means 100 (typically, the tyre of the transport means 100) during use, so as to avoid possible slippage of the transport means 100 during its passage. Preferably, these friction elements 20 are shaped as a plurality of projections that protrude from the respective supporting surface 6, 7, 8, 9.

[0028] As discussed, the portions 2, 3, 4, 5 comprise supporting elements 10, 11, 12, 13 adapted to be arranged, during use, in contact with the ground or, in any case, with the surface on which the device 1 is arranged during use.

[0029] According to a preferred aspect, the supporting elements 10, 11, 12, 13 are shaped as projections that protrude from the respective main body 2a, 3a, 4a, 5a in the direction opposite the supporting surface 6, 7, 8, 9. These supporting elements 10, 11, 12, 13 may be made of a single piece with the main body or may be elements external to the main body 2a, 3a, 4a, 5a which are constrained thereto, e.g. by substantially irreversible constraints (such as bonding or welding) or reversible constraints (shape coupling, by using threaded elements, etc.). The supporting elements 10 - 13 are typically configured so that the rotation between two successive portions around the rotatable constraint, which connects such portions, results in a relative rotation between the supporting elements of the same portions. Therefore, the relative rotation between two portions in operating condition results in a relative rotation between the supporting elements of the same portions. In other words, according

to a preferred aspect, considering a pair of successive portions (such as e.g. the portions 2, 3 of figure 2) of the device, it should be considered the angle α between the two supporting surfaces 6, 7 of the portions 2, 3 and the angle β between respective supporting elements 10, 11 and, in particular, between the surfaces 10a, 11a of the supporting elements 10, 11 intended for contact with the ground. A relative rotation between the two portions of the pair results in a variation of both the angle α and the angle β. In particular, the variation between the two angles is the same. It should be noted that the angles α and β are measured so that, considering the condition of use, the arc defined by these angles does not intersect the ground on which the device rests.

[0030] The supporting elements 10, 11, 12, 13 are typically arranged at least at the sides of the main bodies 2a, 3a, 4a, 5a, i.e. at opposite ends of the main body which are arranged distal to a plane perpendicular to the axis of rotation of the portions of which the supporting elements are part.

[0031] According to a possible aspect, the portions 2 - 5 of the device 1 have supporting elements arranged longitudinally of the device 1, at a distance from the sides of the same portions, typically in addition to those arranged longitudinally of the sides of the main bodies 2a - 5a. In other words, in preferred embodiments, each portion has at least three longitudinal supporting elements distinct from each other, wherein a supporting element is arranged between the other two.

[0032] For example, the embodiment of figures 1 and 6 has supporting elements 10, 11, 12, 13 arranged substantially at the longitudinal axis of the device 1.

[0033] The rotatable constraining elements 14 - 16 are typically arranged at the supporting elements.

[0034] In particular, according to a preferred aspect, the supporting elements of at least one pair of successive portions of the device are hinged to each other, i.e. for at least one pair of successive portions of the device, a supporting element of the first portion of the pair is hinged to a supporting element of the second portion of the pair. Typically, this characteristic applies to all pairs of consecutive portions of the device 1.

[0035] The supporting elements 10 - 13 of successive portions of the device 1 that are constrained to each other by a rotatable constraint are generally staggered to each other, so that the two supporting elements can be partially overlapped so as to allow the connection by the respective rotatable constraint.

[0036] The supporting elements 10, 11, 12, 13 are configured so that their surfaces in contact with the ground are not parallel to the supporting surfaces 6, 7, 8, 9. More generally, according to a preferred aspect, for at least one pair of consecutive portions 2, 3 (i.e. constrained to the same rotatable constraint), the angle α between the two supporting surfaces 6, 7 of the portions 2, 3 of the pair is greater than the angle β between the respective supporting elements 10, 11 and, in particular, between the surfaces 10a, 11a of the supporting elements 10, 11, intended for contact with the ground.

[0037] Therefore, if the device is placed on a plane, as shown schematically in figure 2, so that the angle β is substantially equal to 180°, the angle α is greater than 180°. This condition of α greater than β is typically valid for at least one pair of consecutive portions of the device, preferably for all pairs of consecutive portions of the device. The concept of consecutive portions is clear to the person skilled in the art and, as discussed, denotes a pair of portions arranged in series (i.e. with no other portions interposed) and constrained to the same rotatable constraint. For example, with reference to the embodiments shown in the figures, three pairs of consecutive portions can be identified: a first pair of consecutive portions 3, 4 (joined by the rotatable constraint 15), a second pair of consecutive portions 2, 3 (joined by the rotatable constraint 14) and a third pair of consecutive portions 2, 5 (joined by the rotatable constraint 16). Generally, there are typically as many pairs of consecutive portions as there are rotatable constraints in the device.

[0038] The supporting elements 10, 11, 12 and 13 of the different portions of the device are typically arranged so as not to interfere with each other when the device 1 is closed.

[0039] Preferably, the supporting elements comprise contact elements 21 typically made of such material as to assist friction between the supporting elements 10, 11, 12, 13 and the ground, so as to hinder an unwanted movement of the device with respect to the same ground during its use. Typically, these contact elements 21 are made of rubber or similar material.

[0040] The main body 2a, 3a, 4a, 5a of the portions may be made of a single piece or comprise multiple parts. Moreover, main body 21 - 5a and supporting elements 10 - 13 can be immovably or removably constrained to each other.

[0041] In particular, it is possible that main body and supporting elements are, in use, connected by a supporting constraint, so that the second one can easily be removed from the first ones, as in the embodiment of figures 6A and 6B. In this case, the supporting elements typically form a single structure, i.e. even longitudinal supporting elements parallel in use to each other are constrained to each other. The rotatable constraining elements that allow the rotation discussed above between the portions are typically applied to supporting elements. The device therefore comprises a plurality of main bodies 2a - 5a which can be rested on the structure formed by the supporting elements 10 - 13.

[0042] It is also possible that part of the rotation discussed above between the portions is possible only by removing the main bodies from the supporting elements, e.g. to allow the structure of the supporting elements to be folded, in order to reduce its volume in non-operational condition.

[0043] The supporting elements 10 - 13 can be movably connected to each other in a direction parallel to at least one axis of rotation A1, A2, A3 so that the width of

the device can be varied. This may allow the device to be adapted to different types of vehicles having different wheel size. In this case, the structure of the supporting elements 10 - 13 can be coupled to main bodies having sizes different from each other and/or with a different number of main bodies, depending on the width selected for the device, i.e. on the distance between the supporting elements 10 - 13, which is measured in a direction parallel to at least one of the axes of rotation A1 - A3.

[0044] A preferred constraining shape between the supporting elements provides for at least one pair of cranks 31, 32 arranged between two constraining elements, hinged to each other and constrained at their ends by two different constraining elements, with a hinge 33 at one of its ends and a carriage 34 at the opposite end. Moving the carriage 34 allows the angle between the two cranks 31, 32 to be varied, by rotating the hinge 35 which constrains the same cranks to each other and, therefore, the distance between the constraining elements.

[0045] The rotatable constraints 14, 15, 16 are constraints that allow the relative rotation between two consecutive portions 2, 3, 4, 5, i.e. arranged with each other in series, to which the rotatable constraints 14, 15, 16 are constrained. In a preferred embodiment, the rotatable constraints 14, 15, 16 are hinges.

[0046] Each rotatable constraint 14, 15, 16 is therefore constrained to two portions 2, 3, 4, 5. It should be noted that a rotatable constraint 14, 15, 16 coupled to two portions can consist of a single element or multiple elements that allow the relative rotation between two portions 2, 3, 4, 5. For example, with reference to the embodiment of figure 1 and 2, the rotatable constraint 14 that allows the rotation between the portions 2 and 3 comprises three hinges, two placed at the sides of the portions 2 and 3 and one placed centrally with respect to the portions 2 and 3. In the event of more elements forming the same rotatable constraint, the elements are arranged so as to make a single axis of rotation A1, A2, A3 for the two portions to which they are constrained. For example, the hinges that form the constraint 14 between the portions 2 and 3 of the embodiment of figures 1 and 2 are aligned with each other along the same axis of rotation A1, i.e. the axis of rotation of the portions 2, 3. Similarly, in the embodiment of figures 3 and 4, the rotatable constraints 14 and 15 each comprise two hinges arranged at the sides of the respective portions 2, 3, 4, 5.

[0047] The elements that form the rotatable constraint can therefore typically be coupled to the main body 2a, 3a, 4a, 5a and/or the supporting elements 10, 11, 12, 13 of the portions 2, 3, 4, 5 to which they are constrained.

[0048] Generally, the device is configured so that at least one rotatable constraint 14, 15, 16, preferably each rotatable constraint 14, 15, 16, allows a relative rotation greater than 180°, preferably greater than 190°, even more preferably greater than 200°, between the two portions 2, 3, 4, 5 to which it is constrained. In addition to the possibility for the rotatable constraint to perform such rotation, this typically also involves the absence of components of the device which come into contact with each other during the rotation of the portions so as to prevent such an angle of rotation.

[0049] In other words, at least one pair of portions 2, 3, 4, 5 arranged in succession to one another and constrained to the same rotatable constraint 14, 15, 16, has a relative rotation between the two portions of the pair greater than 180° or 190° or 200°.

[0050] In particular, according to a preferred aspect, considering a condition in which two supporting surfaces 2, 3, 4 and 5 arranged consecutively and constrained to the same rotatable constraint are aligned with each other, the device 1 is configured so as to allow a relative rotation in a first direction D1 of at least 10° between the two portions 2, 3, 4 and 5 and at least 170° in a second direction D2, opposite the first one, between the two portions 2, 3, 4 and 5. This condition is preferably valid for at least one pair of portions 2, 3, 4, 5 arranged consecutively and, more preferably, for each pair of portions 2, 3, 4, 5 arranged consecutively.

[0051] In particular, the first direction D1 of rotation (i.e. the one that allows a rotation of at least 10°) is preferably the one that results in a decrease of the angle α between the supporting surfaces 6, 7, 8 and 9. In other words, considering a condition in which the device 1 is placed on the ground, the rotation in the first direction of one of the two portions 2, 3, 4, 5 involves lifting one end of this portion (i.e. the end distal to the rotatable constraint that allows such rotation). Consequently, the relative rotation between two portions 2, 3, 4 and 5 in the second direction D2 by at least 170° results in an increase in the angle between the respective supporting surfaces 6, 7, 8 and 9.

[0052] It should be noted that, in the light of what was discussed above, a condition in which the supporting surfaces 6, 7, 8 and 9 are aligned with each other does not correspond to a condition in which the device rests on a plane.

[0053] In use, the device 1 can be used to overcome different types of obstacles equipped with at least two surfaces that are not coplanar to each other. The portions of the device are appropriately rotated so that at least one pair of consecutive portions of the device is arranged so that a first portion of the pair is arranged on the first surface of the obstacle and a second portion of the pair is arranged on the second surface of the obstacle. The angle α between the supporting surfaces of this pair of portions is typically lower than 180° in use.

[0054] According to a possible aspect, in use, the device 1 can be used for overcoming a ground with a change of inclination 19.

[0055] A ground with a change of inclination 19 is characterised by a first surface 17 inclined with respect to a second surface 18, as shown in Figure 2.

[0056] By appropriately rotating the portions of the device 1, e.g. from a folded condition in which it was stored inside the transport means 100, at least one first portion can be rested on the first surface 17 and at least one second portion on the surface 18 of the ground.

[0057] Typically, the device comprises an even number of portions 2, 3, 4, 5. In this case, the same number of portions may be rested on each of the two surfaces 17, 18 of the ground. In this case, it is therefore preferable to arrange the central rotatable constraint at the meeting point between the two surfaces 17, 18 of the ground.

[0058] As discussed, according to a preferred aspect, this allows an angle α between the portions greater than the angle β to be formed between the supporting elements 10 - 13 of the portions, which in this case substantially matches the angle between the surfaces 17, 18 of the ground.

[0059] According to a further possible aspect, in use, the device 1 can be used to allow a transport means 100 to overcome a bump. A bump is characterised by a protrusion adapted to protrude vertically with respect to the ground and, in particular, with respect to the portions of the ground that are arranged downstream and upstream of said bump. Preferably, this device 1 may be placed downstream of the bump. The positioning of the device 1 downstream of the bump allows the transport means 100 to overcome the bump by passing the tyre on the supporting surfaces 6, 7, 8 and 9 and to avoid possible unwanted contacts between the transport means and the ground downstream of the bump, as exemplified in figure 7.

[0060] In use, according to a further possible aspect, the device 1 may be used to allow a transport means 100 to overcome a step 30. A step is characterised by a surface 22 substantially parallel to a surface 23 such that the surfaces 22, 23 are positioned on two planes substantially at different heights.

[0061] In particular, according to a preferred aspect, during use, for at least one pair of consecutive portions (typically, the two central consecutive portions, in the event of even numbers of portions), a first portion is arranged on the ground so that its supporting element (or the whole formed by its supporting elements) is in contact with the ground. Preferably, this first portion of the pair is entirely arranged on the ground, i.e. it is arranged so that all of its supporting elements define the maximum possible supporting area with the ground (i.e. the one equal to the situation in which the device 1 is entirely arranged on level ground, such as e.g. in the situation of figure 2). Preferably, the second portion is rotated so that the angle β between the respective supporting elements 10, 11 is lower than 180°.

[0062] Considering e.g. figure 7 and the pair of portions 2, 3 of the device, it should be noted how the portion 3 is arranged on the ground so that its supporting element is entirely (i.e. with the maximum possible supporting area) in contact with the ground. In particular, the portion 3 is arranged on the ground in the same condition as it would be if the device were fully rested on a plane (i.e. it is arranged as in figure 2). The portion 2, on the other hand, is rotated so that the angle β formed between the supporting elements of the portions 2 and 3 is less than 180°.

[0063] Similarly, in figure 8, the portion 2 is entirely rested on the ground, while the portion 3 is rotated so as to define an angle β less than 180° between the supporting elements of the two portions.

[0064] By appropriately rotating the portions of the device 1, e.g. from a folded condition in which it was stored inside the transport means 100, it is possible to appropriately rotate the portions of the device in the second direction D2 so that they rest on the two surfaces 22, 23 of the step. A possible variant, exemplified in figure 8, provides for using a supporting element 24 which may be arranged at the step, in such a way as to define a step with a lower height than the step present on the ground. In other words, a new obstacle is formed which consists of a surface 22 of the original step and the upper surface of the supporting element 24. Thereby, even in the present condition, a first portion 2 of the device is arranged on the first surface 22 of the obstacle, while a second portion 3 of the device 1 is arranged on the second surface of the obstacle.

[0065] It should be noted that depending on the type and size of transport means 100, as well as the device 1, a single device 1 can be used (e.g., in the event that the transport means is two-wheeled or, e.g., in the event that the transport device is large enough to allow both front wheels of a car to step onto on the device at the same time), or a plurality of devices 1, e.g., two devices 1 placed at a distance corresponding to the distance between the front wheels of a car).

Claims

1. Device (1) for overcoming obstacles for transport means (100) such as cars, motorcycles and the like, comprising at least two portions (2, 3, 4, 5) arranged in succession, each of said portions being equipped with a supporting surface (6, 7, 8, 9) for said transport means (100) and with a supporting element adapted to come into contact with the ground (10, 11, 12, 13), wherein a rotatable constraint (14, 15, 16), preferably a hinge, is constrained to each pair of said portions arranged in succession with each other, said device being configured so as to allow a relative rotation between two portions constrained to the same rotatable constraint (14, 15, 16), preferably to all pairs of portions constrained to the same rotatable constraint, greater than 180°, preferably greater than 190°, even more preferably greater than 200°.

2. Device according to claim 1, configured so that, considering a condition in which the supporting surfaces (6, 7, 8, 9) of the different portions (2, 3, 4, 5) are substantially aligned with each other, for at least one pair of portions (2, 3, 4, 5) which are consecutive and constrained to the same rotatable constraint, preferably for each pair of portions (2, 3, 4, 5) which are

consecutive and constrained to the same rotatable constraint, a relative rotation greater than 10°, preferably greater than 20°, is allowed, between the two portions (2, 3, 4, 5) of the pair, in a first direction and greater than 170° in a second direction opposite the first direction.

3. Device according to claim 2, wherein said device is configured so that a rotation in said first direction results in a reduction in the angle between said supporting surfaces (6, 7, 8, 9) and a rotation in said second direction results in an increase in the angle between said supporting surfaces (6, 7, 8, 9).

4. Device according to one of the preceding claims, wherein the rotatable constraining elements are arranged at the supporting elements.

5. Device according to claim 3, wherein supporting elements (10 - 13) of successive portions of the device 1 that are constrained to each other by a rotatable constraint are staggered to each other, so that said supporting elements can be partially overlapped so as to allow the connection by the respective rotatable constraint.

6. Device according to one of the preceding claims, wherein for at least one pair of successive portions of the device, a supporting element of the first portion of said pair of successive portions is hinged to a supporting element of the second portion of said pair of successive portions.

7. Device according to one of the preceding claims, which is configured so that a relative rotation between the two portions of a pair of consecutive portions of the device results in a variation of both an angle α and an angle β, wherein the angle α is the angle between the supporting surfaces of the two portions of the pair of consecutive portions and the angle β is the angle between the supporting elements 10, 11 of the two portions of the pair of consecutive portions.

8. Device according to one of preceding claims, comprising an even number of portions, preferably a number of portions (2, 3, 4, 5) higher than two, preferably four portions.

9. Device according to one of the preceding claims, configured so that, for at least one pair of consecutive portions, preferably for each pair of consecutive portions, the angle (α) between the two supporting surfaces of the portions of the cited pair is greater than the angle (β) between the respective supporting elements.

10. Device according to one of the preceding claims, wherein at least part of the supporting elements are movably connected with each other in a direction parallel to at least one axis of rotation (A1, A2, A3), so as to be able to vary the width of the device.

11. Device (1) for overcoming obstacles for transport means (100) such as cars, motorcycles and the like, comprising at least two portions (2, 3, 4, 5) arranged in succession, each of said portions being equipped with a supporting surface (6, 7, 8, 9) for said transport means (100) and with a supporting element adapted to come into contact with the ground (10, 11, 12, 13), wherein a rotatable constraint (14, 15, 16), preferably a hinge, is constrained to each pair of said portions arranged in succession with each other, said device being configured so that, for at least one pair of consecutive portions, preferably for each pair of consecutive portions, the angle (α) between the two supporting surfaces of the portions of the cited pair, is greater than the angle (β) between the respective supporting elements.

12. Transport means (100), preferably a car, comprising at least one device according to one or more of the preceding claims.

13. Method for overcoming an obstacle (19; 30; 40) by means of a device (1) according to one or more of preceding claims 1 to 11, wherein said obstacle has at least two surfaces (17, 18; 22, 23; 41, 42) which are not coplanar with each other, wherein at least two consecutive portions of the device 1 are arranged so that a first portion of the pair rests (4) on said first surface (17; 22; 41) of said obstacle and the second portion of said pair rests on said second surface (18; 23; 42) of said obstacle, preferably in such a way that the angle (α) between the supporting surfaces of the portions of said pair is smaller than 180°.

14. Method for overcoming an obstacle according to claim 13, wherein said obstacle comprises a change of inclination of the ground (19), wherein said ground has a first surface (17) angled with respect to a second surface (18), wherein the device (1) is arranged on the ground (19) by placing one of said rotatable constraints (14, 15, 16) substantially at the meeting point between said angled surfaces (17, 18) and by resting the portions (2, 3, 4, 5) constrained to each other by means of said rotatable constraint (14, 15, 16) on said surfaces (17, 18) of the ground (19) that are inclined to each other.

15. Method for overcoming an obstacle according to claim 13 or 14, wherein, for at least one pair of consecutive portions, a first portion is arranged entirely in contact with the ground and, preferably, the second portion is rotated so that the angle β between

the supporting elements of the first and second portions of said pair of consecutive portions is lower than 180°.

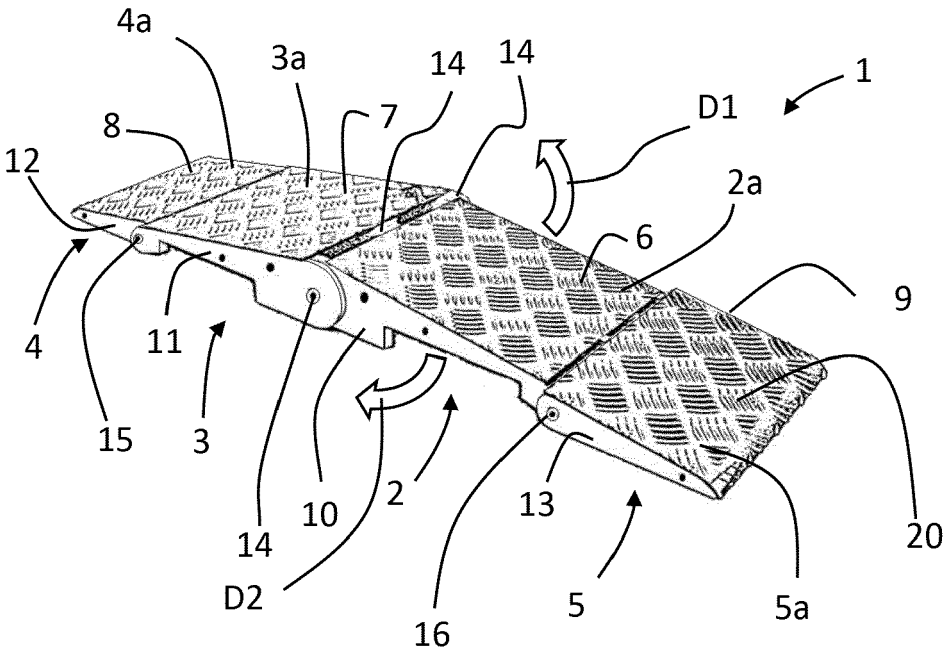
4a
3a
14
14
1
8
7
D1
12
2a
6
9
4
11
3
15
10
2
13
20
14
D2
16
5
5a

Fig. 1

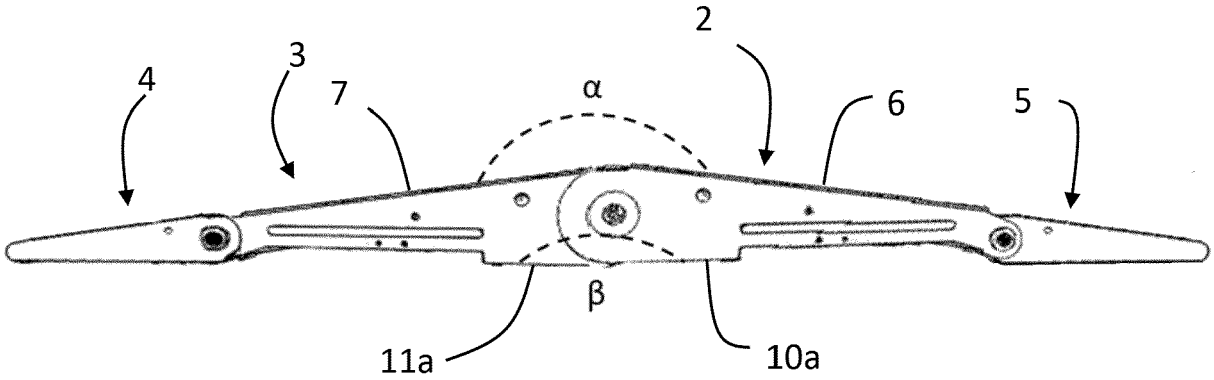
2
4
3
7
α
6
5
β
11a
10a

Fig. 2

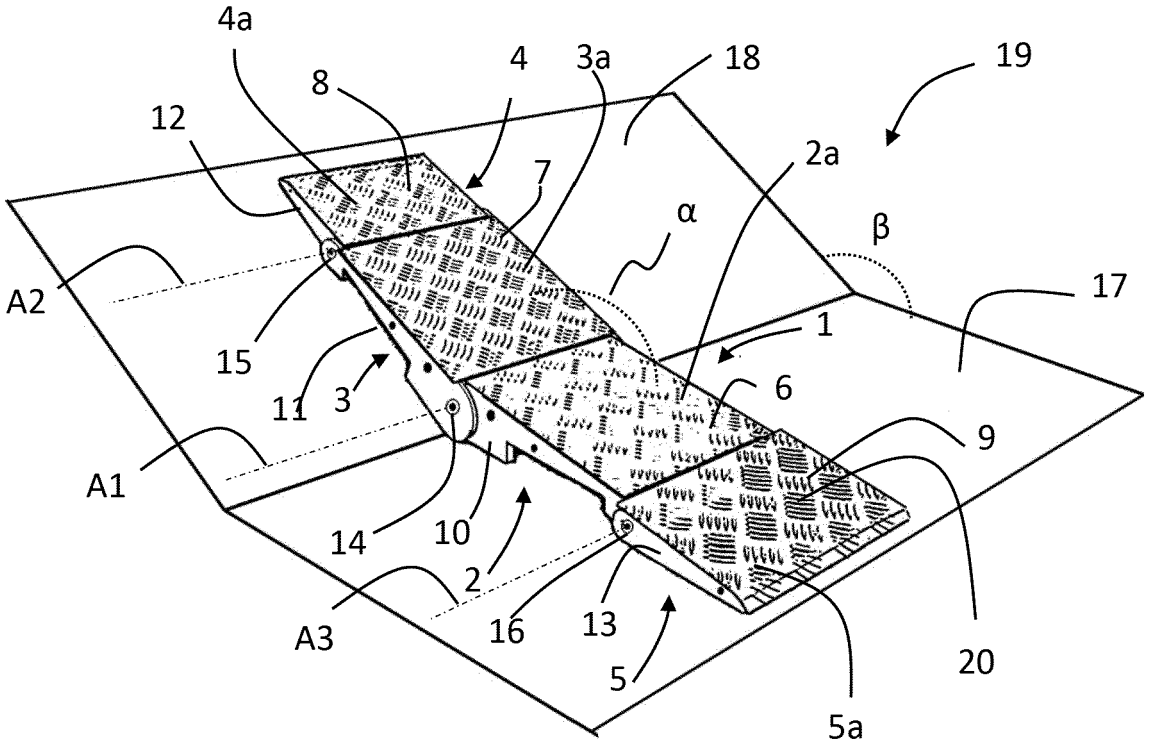

Fig. 2A

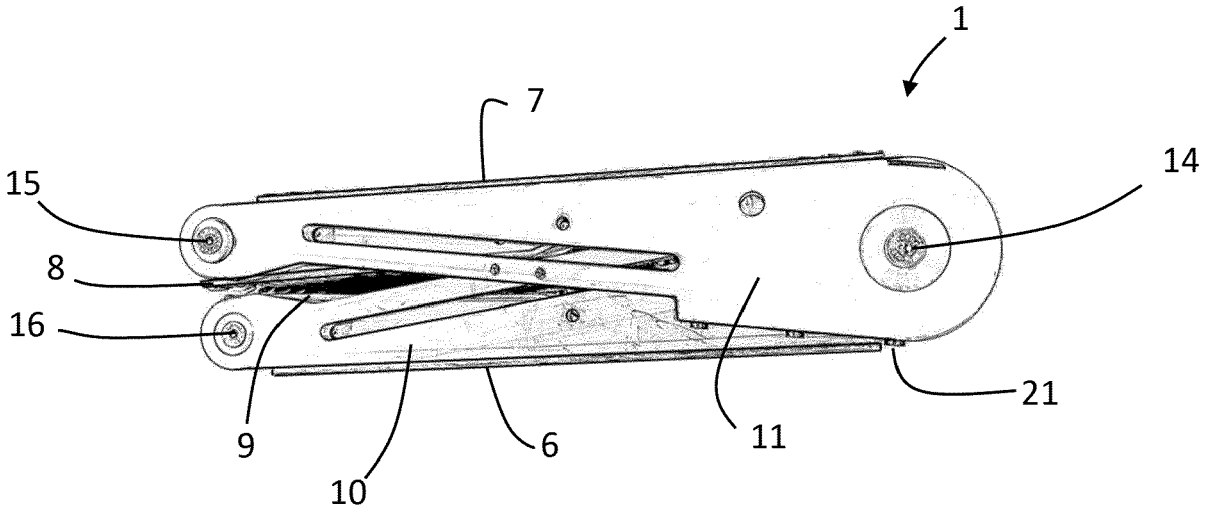

Fig. 3

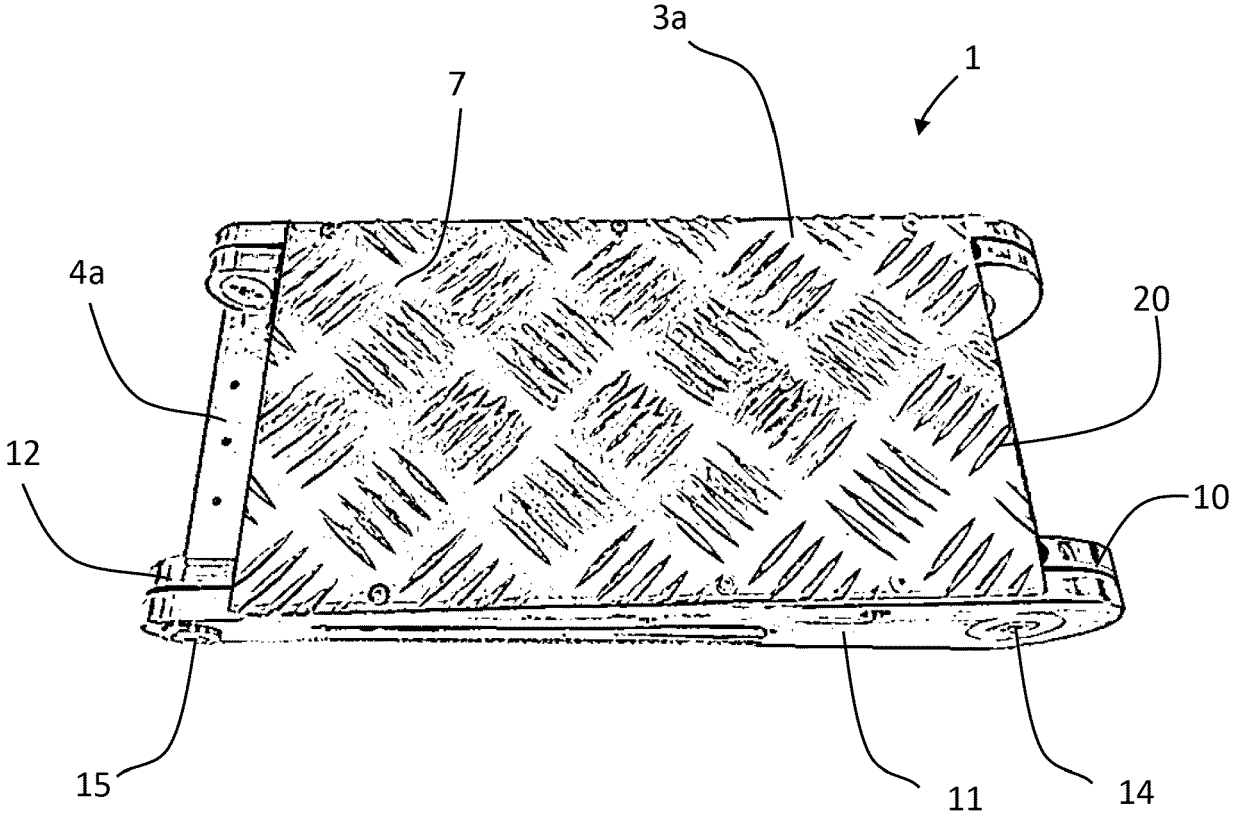

Fig. 4

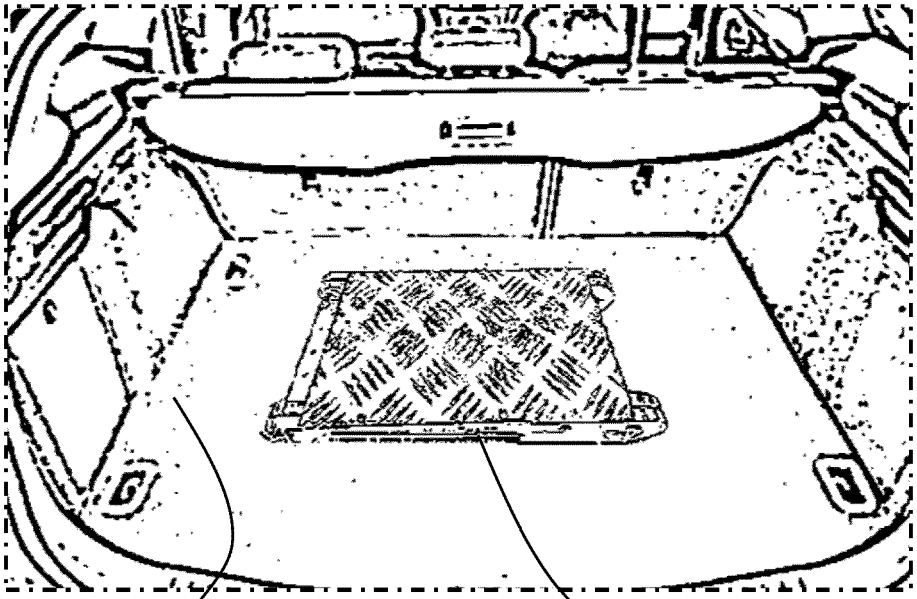

Fig. 5

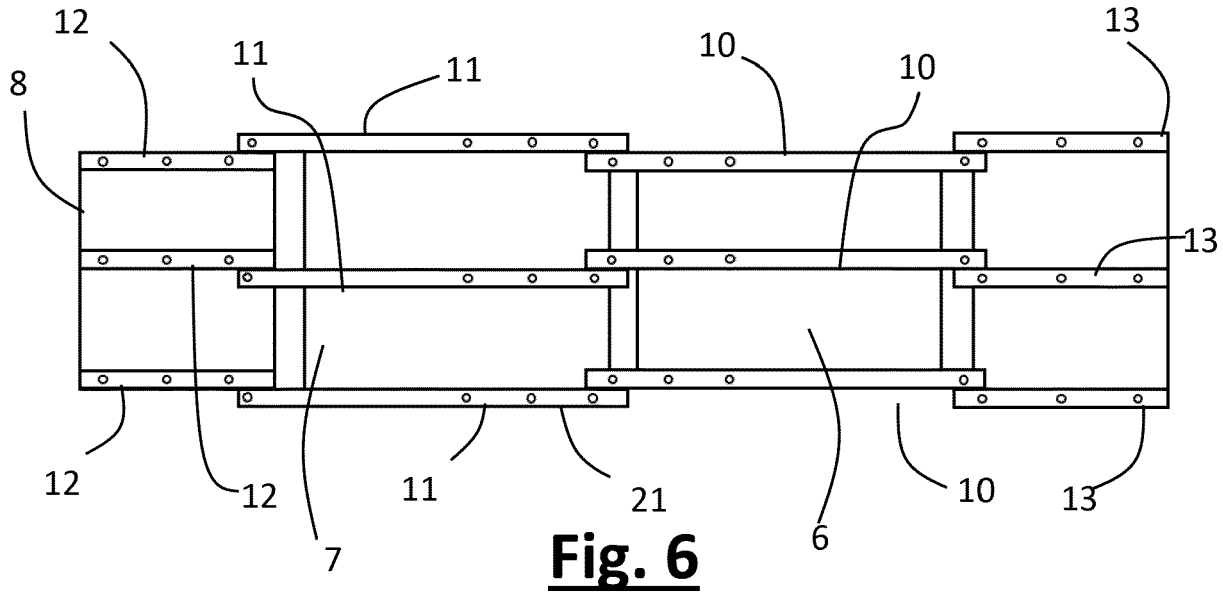

Fig. 6

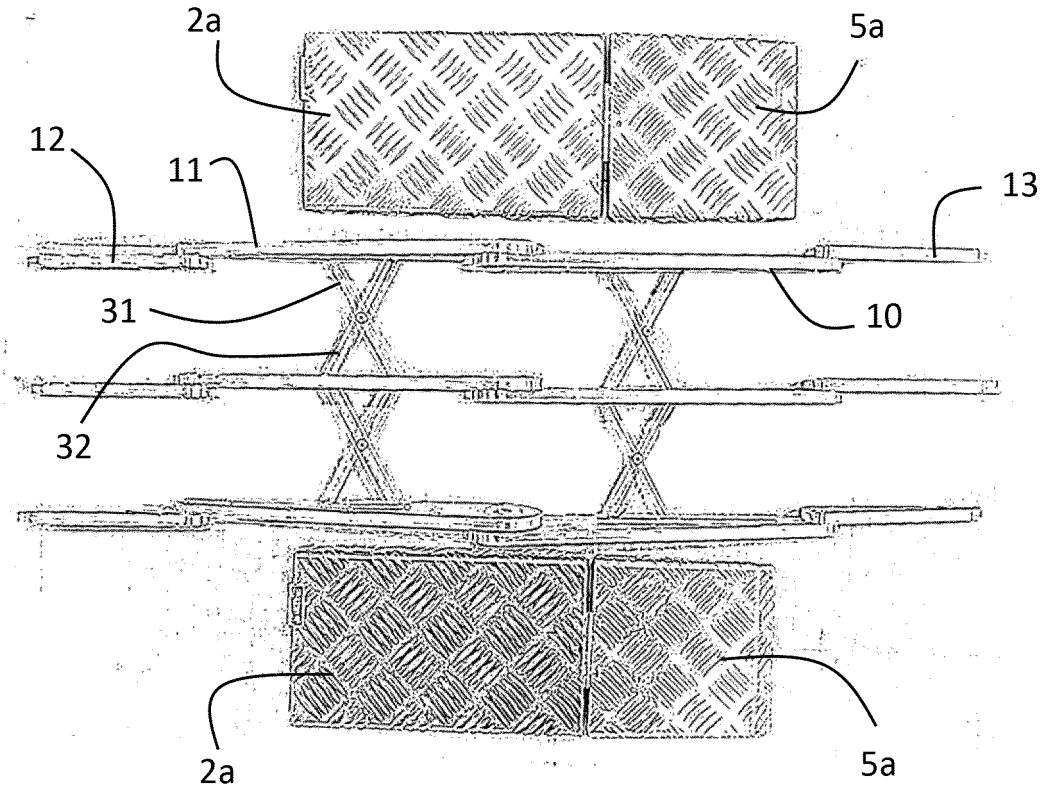

Fig. 6A

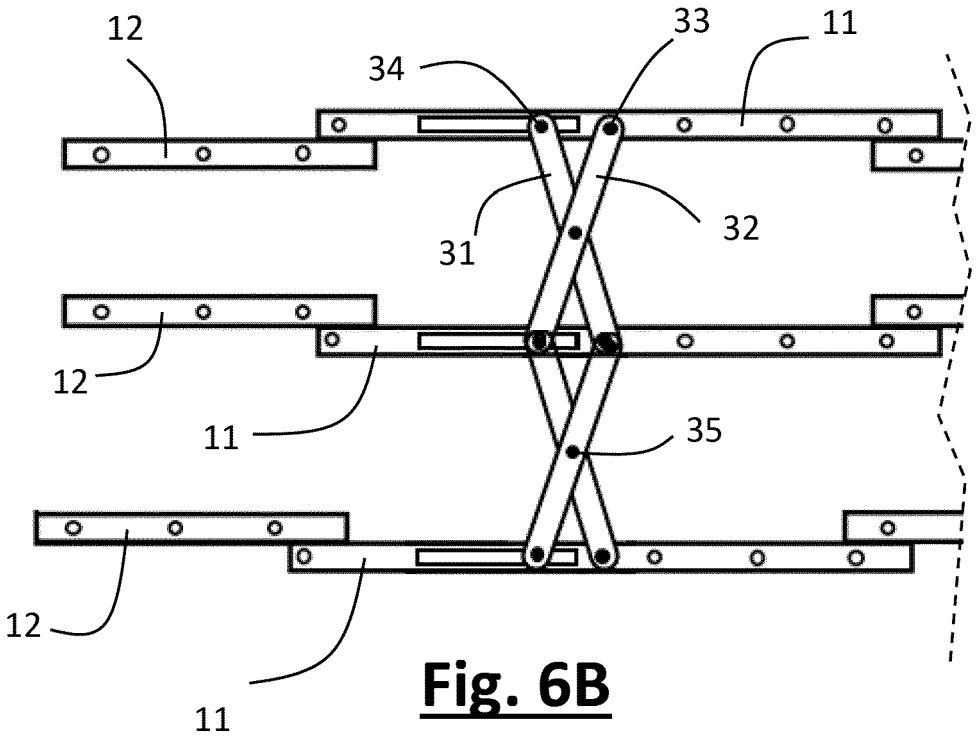

Fig. 6B

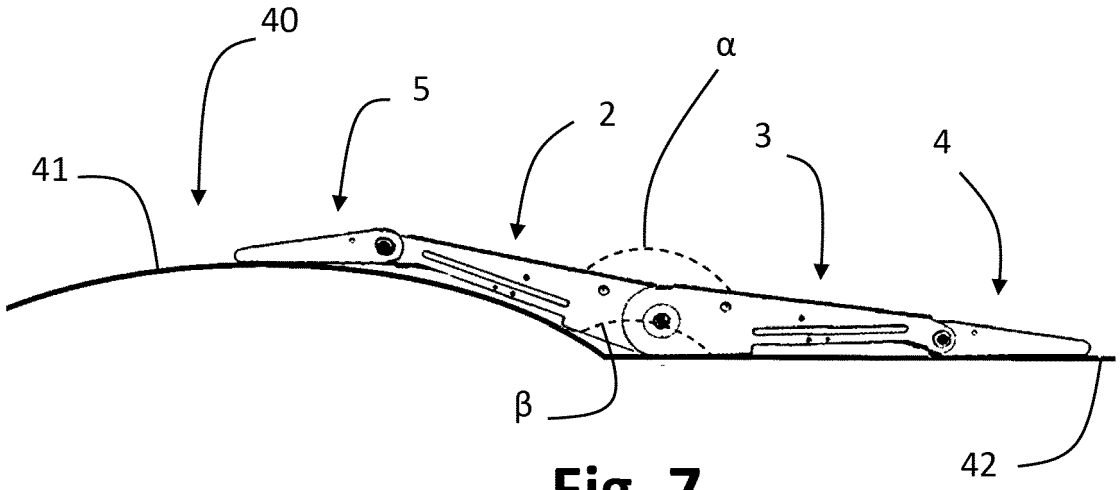

Fig. 7

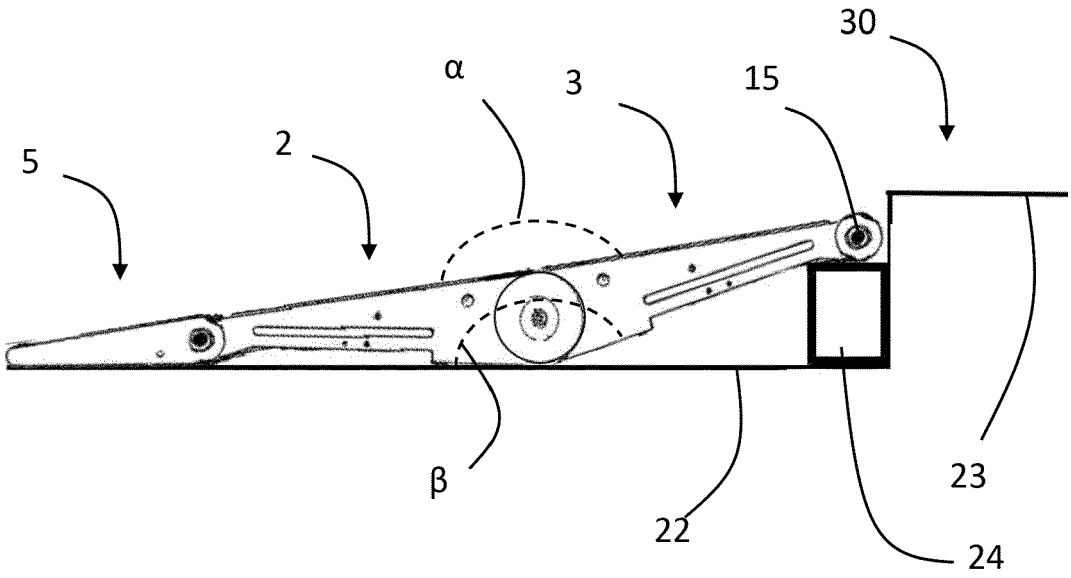

Fig. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 23 15 3303

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 Y	US 9 279 221 B1 (ORONA MICHAEL CARDONA [US] ET AL) 8 March 2016 (2016-03-08) * column 2, line 34 - column 3, line 25; figures 1-9 *	1-11,15 12	INV. B66F7/24 B66F7/28 E01D15/12
X Y	US 8 448 278 B1 (BEILSTEIN RICHARD R [US]) 28 May 2013 (2013-05-28) * figures 1-4 *	1-6, 8-11, 13-15 12	
Y	US 10 633 808 B2 (EAGLE TECH LLC [US]) 28 April 2020 (2020-04-28) * figures 6A-6F *	12	

TECHNICAL FIELDS SEARCHED (IPC)

B66F
E01D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	24 April 2023	Delval, Stéphane

CATEGORY OF CITED DOCUMENTS

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L : document cited for other reasons

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24-04-2023

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US 8448278 B1	28-05-2013	NONE	
US 10633808 B2	28-04-2020	EP 3628777 A1	01-04-2020
		US 2020102709 A1	02-04-2020

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82