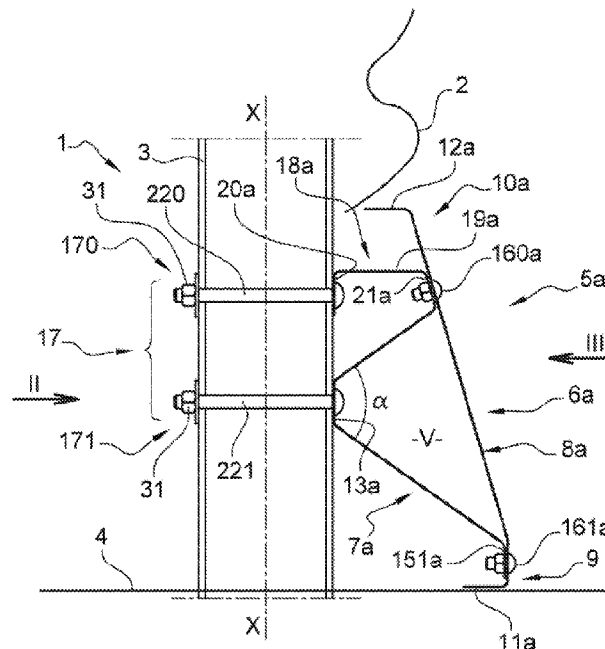




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(54) Title: PROTECTION DEVICE AND ROAD BARRIER FOR MOTORCYCLISTS



(57) Abrégé/Abstract:

The invention relates mainly to a protection device (5a) for motorcyclists, adapted to be secured to a road safety barrier (1) with a plurality of poles (3) regularly spaced out, the protection device (5a) comprising a longitudinal beam (6a) and a spacer (7a) extending longitudinally alongside the rear side of at least one part of said beam (6a) and adapted to be secured to said poles, wherein the beam (6a) and the spacer (7a) are assembled together so as to define, in said part of the beam, a longitudinal damping volume (V) with a closed cross-section.



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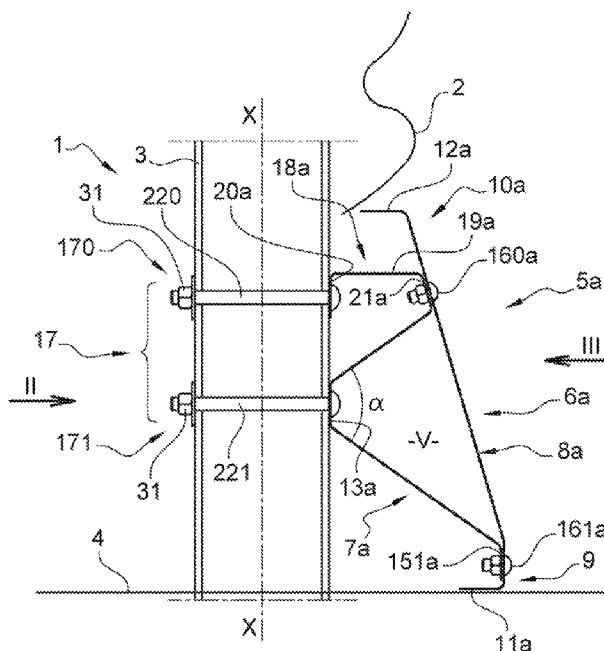


Figure 1

(57) Abstract: The invention relates mainly to a protection device (5a) for motorcyclists, adapted to be secured to a road safety barrier (1) with a plurality of poles (3) regularly spaced out, the protection device (5a) comprising a longitudinal beam (6a) and a spacer (7a) extending longitudinally alongside the rear side of at least one part of said beam (6a) and adapted to be secured to said poles, wherein the beam (6a) and the spacer (7a) are assembled together so as to define, in said part of the beam, a longitudinal damping volume (V) with a closed cross-section.

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PROTECTION DEVICE AND ROAD BARRIER FOR MOTORCYCLISTS

[0001] The invention is in the field of road barriers installed on roadsides and/or
5 highway sides.

[0002] The invention refers more particularly to a protection device for
motorcyclists adapted to be installed on a road barrier, in order to better protect
motorcyclists who would collide with the barrier.

[0003] Road barriers are well known and comprise at least one longitudinal
10 metallic rail, kept at a distance from the ground by a plurality of poles set in
roadsides and spaced out regularly. These barriers form smooth retention devices
which deform themselves in the event of an impact with a vehicle. Part of the
energy from the impact is then absorbed during the deformation of the barrier,
therefore limiting the damage to the vehicle exiting the road.

15 [0004] However, these barriers are only efficient for motor vehicles. Indeed, taking
into account the gap existing between the rail and the ground, motorcyclists who
fall and are projected towards the barrier risk colliding with the poles. Yet, the
significant impact caused by this collision with the poles of the barrier almost
always causes serious injuries to the motorcyclists involved.

20 [0005] The document EP2450489 discloses a protection system for motorcyclists,
adapted to be secured to the road safety barrier. The protection system comprises
a beam extending longitudinally between the rail and the ground to protect the rider
from poles. This beam is kept at a distance from the poles by a plurality of
anchoring means, each anchoring means being secured to a pole and extending in
25 the direction of the pole axis.

[0006] However, the deformation of the protection system in the event of an
impact has such a strong amplitude, that the motorcyclist still risks colliding with
poles of the road safety barrier despite the protection system.

[0007] The invention is to provide a protection device for motorcyclists, adapted to be secured to the road safety barrier, and adapted to protect motorcyclists from the poles of the road barrier at all times while efficiently containing them / slowing them down.

5 [0008] For this purpose, the protection device for motorcyclists is adapted to be secured to a road safety barrier with a plurality of poles regularly spaced out and comprises a longitudinal beam and a spacer extending longitudinally all along the rear side of at least one part of said beam and adapted to be secured to said poles, wherein the beam and the spacer are assembled together so as to define, in said part of the beam, a longitudinal damping volume with a closed cross-section, so as to spread the strain along the device
10 in the event of an impact to limit the transversal deformation of the beam and to maintain it at a distance from the poles of the road barrier. The spacer comprises a central fastening section to said poles from which extend two legs respectively superior and inferior whose open ends are fastened to the beam, the inferior leg and the superior leg being at an angle α comprised between 60° and 100° and the inferior leg and the central
15 fastening section being at an angle β comprised between 105° and 145° .

[0008a] The invention is also to provide a protection device for motorcyclist, adapted to be secured to a road safety barrier with a plurality of poles regularly spaced out, the protection device comprising a longitudinal beam and a spacer extending longitudinally all along the rear side of said beam and adapted to be secured to said poles, wherein the
20 beam and the spacer are assembled together so as to define a longitudinal damping volume (V) with a closed cross-section, wherein the spacer comprises a central fastening section to said poles from which extend two legs respectively superior and inferior whose open ends are fastened to the beam, the inferior leg and the superior leg being at an angle α comprised between 60° and 100° and the inferior leg and the central fastening
25 section being at an angle β comprised between 105° and 145° .

[0009] The protection device for motorcyclists of this invention may also include the following optional characteristics considered individually or according to all possible combination of techniques:

- 5 - The spacer presents such length that it may be secured to at least two adjacent poles of the road barrier
- The longitudinal damping volume is of a polygonal closed cross-section.
- The ratio $S/(H \times W)$ is superior or equal to 0.2, where S is the surface of the transversal cross-section of the damping volume, H the height of the beam and W the width of the beam.
- 10 - The superior leg and the central fastening section are at an angle γ comprised between 105° and 165°.
- Each open end of the two legs comprise a bracket for the beam.

- The longitudinal damping volume is formed by the beam and by the legs and the fastening section to the poles of the spacer.

- The beam comprises a planar central section prolonged by two end parts forming fastening sections to the spacer.

5 - The protection device further comprises at least one stabilising member comprising a central planar section and two end portions adapted to be fixed respectively to one of the poles and to the beam, so as to stabilise the positions of the beam on the barrier.

- The stabilising member is a U-shaped plate.

10 [0010] The invention is to also provide a road safety barrier comprising a longitudinal rail secured to a plurality of poles set in the ground and regularly spaced out, and which is essentially characterised in that it comprises a protection device for motorcyclists as described above.

[0011] The road safety barrier of the invention may also comprise the following
15 optional characteristics considered individually or according to all possible combination of techniques:

- The beam of the protection device comprises a central section that is inclined relative to a pole axis and transversally extends away from said axis as it reaches closer to the ground.

20 - The beam of the protection device comprises two end portions in the prolongation of the inclined section and forming respectively both a superior fastening section and an inferior fastening section to the spacer.

- The inferior fastening section comprises a flap adapted to lay on the ground.

25 - The superior fastening section of the beam forms an angle with the inclined section so that the superior fastening section is parallel to the pole axis.

- The superior fastening section of the beam is located in the same plane as the inclined section so that the superior fastening section is also inclined relative to the pole axis.

- The central section of the beam is inclined relative to the poles axis at an angle of 10° to 25°, preferably 10° to 20°.

- The protection device comprises at least one stabilising member formed by a third profiled sheet comprising a central planar section and two end portions adapted to be fixed respectively to one of the poles and to the beam, so as to stabilise the position of the beam on the barrier.

- The stabilising member is a U-shaped plate.

- At least one end portion of the stabilising member is secured to the beam at the level of the superior fastening section of the beam.

- The protection device is secured to each pole by fastening means.

- The fastening means comprise at least two fastening assemblies respectively superior and inferior, so that the superior assembly encloses the poles while being fixed to the stabilising member, and so that the inferior assembly encloses the pole while being fixed to the spacer.

- Each fastening assembly comprises at least two bolts extending on both side of the pole so the first bolt ends are secured respectively to the stabilising member and to the spacer, and so the respective second bolt ends are secured to superior connecting plates and inferior connecting coming to rest against the back side of the pole opposite to the protection device.

- Each fastening assembly comprises adjusting means for the spacing between the bolts and the poles, said adjusting means being arranged in the connecting plates and respectively in the fastening section to the pole of the spacer and in the first fastening portion of the stabilising member to allow for the bolts to be positioned as close as possible to the edges of the pole during the fastening of the protection device to the poles.

- The superior adjusting means comprise a series of openings arranged in the first fastening portion of the stabilising member, the openings being spaced out regularly and horizontally, and elongated hole arranged in the superior connecting plate and whose major axis extends parallel to the longitudinal axis of the connecting plate.

- The inferior adjusting means comprise a series of openings 281 arranged in the central fastening section 13 of the spacer 7a, 7b, the openings 281 being spaced out regularly and horizontally, and an elongated hole 271 arranged in the inferior connecting plate 241 and whose major axis extends parallel to the longitudinal axis of the connecting plate.

[0012] The invention is to also provide a protection kit for the assembling of a protection device for motorcyclist, adapted to be secured to a road safety barrier with a plurality of poles regularly spaced out, the kit comprising a first profiled sheet forming a longitudinal beam, a second profiled sheet forming a spacer, wherein the beam and the spacer are adapted to be assembled together, with the spacer extending longitudinally all along the rear side of said beam, so as to define a longitudinal damping volume with a closed cross-section, wherein the spacer comprises a central fastening section to said poles from which extend two legs respectively superior and inferior whose open ends are adapted to be fastened to the beam, the inferior leg and the superior leg being at an angle α comprised between 60° and 100° and the inferior leg and the central fastening section being at an angle β comprised between 105° and 145° .

[0013] The kit of the invention may also comprise the following optional characteristics considered individually or according to all possible combination of techniques:

- The kit comprises a plurality of first profiled sheets adapted to be arranged end to end in order to form the longitudinal beam.
- The kit comprises a plurality of elements adapted to be arranged end to end in order to form the spacer.
- The kit comprises a plurality of stabilising members each formed by a third profiled sheet and adapted to stabilise the positions of the beam on the barrier.
- The kit comprises fastening means for fastening the beam and the spacer to the barrier.

[0014] Other characteristics and advantages of the invention will be apparent in the below descriptions, by way of indication and in no way limiting, and referring to the annexed figures among which:

- 5 - Figure 1 is a sectional view of the protection device according to one embodiment secured to a pole of a road barrier,
- Figure 2 is a perspective back view of the barrier from figure 1 according to arrow II, illustrating particularly the damping volume formed by the beam and the spacer,
- Figure 3 is a perspective front view of the barrier from figure 1 according to arrow III, representing specifically the side of the beam opposite to the pole of the road
10 barrier,
- Figure 4 is a sectional view of the protection device according to a first embodiment including a stabilising member,
- Figure 5 is a sectional view of the protection device of figure 4 without the stabilising member,
- 15 - Figure 6 is a sectional view of the protection device according to another embodiment,
- Figure 7 is a perspective back view representing the fastening means of the protection device of figures 1 to 3 to the pole,
- Figure 8 is a longitudinal back view of the protection device from figure 5
20 according to arrow VIII, detailing how the spacing between the bolts of the fastening means can be adapted to the pole.

[0015] First, it is noted that on the figures, the same references designate the same elements regardless of the figure on which they feature and regardless of the form of these elements. Similarly, should elements not be specifically referenced
25 on one of the figures, their references may be easily found by referring oneself to another figure.

[0016] It is also noted that the figures represent mainly two embodiments of the object of the invention but other embodiments which correspond to the definition of the invention may exist.

[0017] It is well known that road barriers include a usually metallic rail extending longitudinally, that is parallel to the ground. This rail is secured to poles set in the ground and regularly spaced out, so that the rail is kept at a distance from the ground.

5 [0018] It is also known to integrate to this type of road barrier a system of protection for motorcyclists, comprising a beam longitudinally extending and secured to the poles of the barrier by means of a plurality of anchoring means, each anchoring means being secured to a pole of the barrier and extending in the direction of the pole axis. Such a protection system presents a deformation of
10 strong amplitude in the event of an impact, which will not always stop the motorcyclist from colliding with the poles of the barrier in the event of a fall. The present invention provides a protection device 5a, 5a', 5b for motorcyclists adapted to be secured to a road barrier, which in the event of an impact presents a deformation of sufficiently low amplitude to remain at a distance from the poles at
15 all times. The motorcyclist who will then hit the protection device 5a, 5a', 5b of the invention following a fall will not collide with the poles of the barrier.

[0019] Referring to figure 1 and as previously indicated, the road barrier 1 comprises a longitudinal metallic rail 2 (partially illustrated), with a W-shaped cross-section for example. The barrier 1 further comprises a plurality of poles 3 set in the
20 ground 4 and regularly spaced out, the poles 3 being all parallel to each other. Each pole 3 thus extends perpendicularly to the rail 2 according to a pole axis X-X. In the rest of this description, the term "vertical" will be used to designate the pole axis and more generally all direction perpendicular to the ground 4, and the term "horizontal" will be used for the elements of barrier 1 which extend longitudinally,
25 that is parallel to ground 4.

[0020] Referring to figures 1 to 4, the road barrier 1 comprises a protection device 5a for motorcyclists according to a first embodiment.

[0021] The protection device 5a comprises a longitudinal beam 6a, thus extending itself horizontally and which is secured to the poles 3 of the barrier 1 by means of a
30 longitudinal spacer 7a. This spacer 7a has the function of maintaining the beam 6a at a distance from the poles 3 at all times, particularly by absorbing more efficiently

the impact energy as will be showed in more details later. Thanks to the longitudinal beam 6a and to the longitudinal spacer 7a, the beam 6a stays sufficiently distant from the poles 3 of the road barrier to protect motorcyclists from these poles 3 at all times while efficiently containing them and/or slowing them
5 down, even in the event of a violent impact caused by a motorcyclist colliding with the beam 6a and generating an important transversal deformation of beam 6a.

[0022] The spacer 7a extends horizontally along one part of the beam 6a, preferably on more than 50% of the beam, more preferably on more than 70% of the beam and even more preferably all along the beam 6a. The spacer 7a extends
10 over the pole 3, preferably extends of at least one meter on both sides of the pole 3.

[0023] The beam 6a and the spacer 7a are formed respectively by first and second profiled metallic sheets, preferably obtained by roll-forming or bending. The steel constituting the first and second sheets presents preferably an average
15 elastic limit of approximately 260 MPa, a great resistance to impacts and an elongation at break of at least 26%. The steel thus also presents a good resistance to corrosion. For this purpose, the steel preferably comprises a Magnelis® type metallic coating produced in a hot-dip galvanising line in a molten bath comprising 2.5-3.5% in magnesium and 3-4% in aluminium.

[0024] The beam 6a comprises a central planar section 8 prolonged by two end parts 9a, 10a, forming fastening sections to the spacer 7a, respectively inferior fastening section 9a and superior fastening section 10a. The central section 8a is inclined relative to the pole axis X-X, at an angle of 10° to 25°, preferably 10° to 20°, more preferably of 16°. The beam 6a transversally extends itself away from
20 the pole axis X-X as it reaches closer to the ground 4. In other words, the inferior section of the beam 6a, corresponding to the inferior fastening section 9a which is the closest to the ground 4, is further away from the poles 3 then the superior section of said beam 6a, forming the superior fastening section 10a located in front of the rail 2. The central section 8 being planar, its deformation during impact is
25 homogeneous in its height and stiffened areas and/or preferential deformations in weak points are avoided. This helps absorbing the energy from the impact. In
30

particular, it doesn't comprise any inwards bend as it would project the motorcyclist in the air towards the longitudinal rail 2 of the road safety barrier.

[0025] The inferior fastening section 9a of the beam 6a further preferably comprises a flap 11a to enable it to lay on the ground 4. Thanks to that, the protection device 5a is more stable. In addition, there are no space between the ground and the beam 6a, preventing a sliding rider from coming into contact with any potential hazard that may be behind the beam 6a. As illustrated in figure 1, the inferior fastening section 9a is bent at an angle of 90° . As the flap 11a is horizontal, the inferior fastening section 9 thus extends itself vertically towards the central inclined section 8a of the beam 6a. The flap 11a is not fastened to the ground so that the deformation during impact is not prevented.

[0026] The superior fastening section 10a also preferably comprises a flap 12a whose open end engages the rail 2. This flap 12a thus ensures continuity between the rail 2 and the protection device 5a. As illustrated in figure 1, the superior fastening section 10a is bent at an obtuse angle. The flap 12a is horizontal and the superior fastening section 10a extends itself beyond the bend towards the central inclined section in the same plane as the latter.

[0027] The spacer 7a is from a sectional view generally V-shaped, and comprises a central section 13a of fastening to the poles 3 from which extend two legs respectively superior 140a and inferior 141a towards and to the inner surface 32a of the beam 6a. The superior leg 140a and the inferior leg 141a are inclined above and below a horizontal axis parallel to the road. Particularly, the inferior leg 141a and the central fastening section 13 are at an angle β of 105° to 145° , preferably of 115° to 135° . Particularly, the superior leg 140a and the central fastening section 13 are at an angle γ of 105° to 165° , preferably of 115° to 135° . Particularly, both legs 140a, 141a, are at an angle α of 60° to 90° , preferably of 70° . The central fastening section 13a ensures the securing of spacer 7a to the poles 3 by fastening means 17 described further below. The central section 13a is thus preferably planar.

[0028] The V-shaped spacer 7a, thanks to the inclination of both inferior 140a and superior 141a legs as defined above and thanks to the value of the angles α , β and

γ , produces a deformation of said legs 140a, 141a in the event of an impact of a motorcyclist against the beam 6a, said deformation leads to an increase of the spacing between the legs 140a, 141a. The deformation not only absorbs the energy from the said impact but also generates a spring effect which pushes back
5 the rider who hit the beam 6a away from the poles 3. In other words, the beam 6a and the spacer 7a work in synergy in case of impact on the protection device 5a to dampen the transversal stresses. In particular, the inferior leg 141a being oriented below the horizontal plane, it doesn't prevent the protection device from absorbing the impact of the motorcyclist sliding along the horizontal plane.

10 [0029] Both the superior leg 140a and the inferior leg 141a of the spacer 7a extend from the central fastening section 13a towards an open end forming respectively the superior bracket 150a and inferior bracket 151a to the beam 6a. More specifically, both the superior bracket 150a and inferior bracket 151a are maintained in contact with the inner surface 32a of the beam 6a respectively at the
15 level of the superior fastening section 10a and of the inferior fastening section 9a of the beam 6a. The superior bracket 150a and inferior bracket 151a are preferably fasten respectively to the superior fastening section 10a and to the inferior fastening section 9a by bolting 160a, 161a. In addition, the bolts 160a, 161a are preferably regularly spaced in the longitudinal direction of the beam 6a, the space
20 between two bolts 160a, 161a, respectively at the level of the superior bracket 150a and at the level of the inferior bracket 151a, being around one meter. Thanks to this value of spacing between two successive bolts 160a, 161a, global stability of the fastening between the beam 6a and the spacer 7a is increased.

25 [0030] As shown in figure 2, the beam 6a and the spacer 7a thus define a damping volume V which extends longitudinally, that is horizontally, along the beam 6a. More specifically, the sides of this damping volume V are defined by the central fastening section 13a and the two legs 140a, 141a of spacer 7a, and by the inclined central section 8a of the beam 6a. In transversal cross-section, the corresponding surface, i.e. defined by the central fastening section 13a and the two
30 legs 140a, 141a of spacer 7a, and by the inclined central section 8a of the beam 6a, is identified as the damping surface S. Thanks to the damping volume V and the corresponding damping surface S, the forces generated by the impact on the

protection device 5a are well distributed along the sides of the damping volume V. As a result, the absorption of the impact energy in the protection device 5a is homogenous and wide, which in turn reduces the amplitude of the transversal deformation of the beam 6a. Particularly, the ratio $S/(H \times W)$ where S is the damping surface, H the height of the beam 6a (measured along the vertical axis) and W the width of the beam 6a (measured along the horizontal axis) is superior or equal to 0.2, more preferably comprised between 0.2 and 0.4. This improves even further the distribution of the forces generated by the impact on the protection device 5a. As a result, the absorption of the impact energy in the protection device 5a is more homogenous and wider.

[0031] In the particular embodiment for which the spacer 7a extends all along the beam 6a, the spacer 7a, in the event of an impact, distributes the forces generated by the impact on the protection device 5a (along the sides of the damping volume V) to a large longitudinal extent. As a result, the absorption of the impact energy in the device 5a is even more homogenous and wider, which in turn reduces the amplitude of the transversal deformation of the beam 6a.

[0032] Referring to figures 1 to 3, the protection device 5a of the first embodiment according to a first particular example preferably comprises at least one stabilising member 18a formed by a third sheet, preferably obtained by roll-forming or bending. The said stabilising member 18a preferably has the same mechanical characteristics than those of the primary and secondary sheets 6a, 7a.

[0033] The stabilising member 18a provides a second fastening point of the beam 6a to the pole 3, thus stabilising the position of the beam 6a in the event of an impact:

- By preventing any rotation of the beam 6a around an axis passing through the fastening points of the beam 6a on the central fastening section 13a of the spacer 7a, and
- By maintaining the spacing from the superior fastening section 10a of the beam 6a to the poles 3, ensuring the continuity between the rail 2 and the beam 6a.

[0034] The stabilising member 18a has a U-shaped transversal cross-section presenting:

- a central planar section 19a extending horizontally between a pole 3 and the inner surface 32a of the beam 6a and
- 5 • two end portions forming respectively the first fastening portion 20a to the pole 3 and the second fastening portion 21a facing the inner surface 32a of the beam 6a at the level of its superior fastening section 10a.

[0035] The second fastening portion 21a preferably faces at the same time the inner surface 32a of the beam 6a at the level of its superior fastening section 10a and the superior bracket 150a of the spacer 7a. The second fastening portion 21a of the stabilising member 18a, the superior bracket 150a of the spacer 7a and the superior fastening section 10a of the beam 6a are thus superimposed and secured together by common securing means, for example a bolt 160a.

[0036] Particularly, the first fastening portion 20a of the stabilising member 18a is secured to pole 3 by fastening means 17.

[0037] The stabilising member 18a is bent at 90° between the central planar section 19a and the first fastening portion 20a, the latter being parallel to the given vertical pole 3, and bent at an obtuse angle between the central planar section 19a and the second fastening portion 21a, the latter being parallel to the inclined central portion 8a of the beam 6a. The second portion of fastening 21a of the stabilising member 18a is thus disposed to rest against the inner surface 32a of the beam 6a at the level of its superior fastening section 10a.

[0038] The U-shaped stabilising member 18a provides an easy installation of the beam 6a on the different types of existing poles 3 of road barriers 1.

[0039] There can be as many stabilising members 18a of the beam 6a as they are poles 3. These stabilising members 18a allow the stabilisation of the protection device 5a, as well as maintaining the flap 12a of the superior fastening section 10a of the beam 6a at a constant distance from the poles 3, particularly when the beam 6a is deformed during an impact.

[0040] According to a second particular example of the first embodiment illustrated on figure 5, spacer 7a et beam 6a are the same than those described above. The damping volume V is thus the same and damping effect is identical. The second particular example does not comprise any stabilising member, which
5 has no effect on damping since said damping effect is provided by the spacer 7 combined with the beam 6a. The device 5a' of this second example is a bit less stable when set to the barrier 1 than the device 5a of the first example of the first embodiment.

[0041] Referring to figure 6, the protection device 5b in a second embodiment is
10 almost identical to the protection device 5a in the first embodiment, excepting for the superior fastening section 10b of the beam 6b which presents a different configuration and for the angle α between the legs 140b, 141b.

[0042] Indeed, the superior fastening section 10b of the beam 6b is now bent at 90° so that the flap 12b is horizontal and superior fastening section 10b extends
15 beyond the bend by a vertical portion 120b. In this embodiment of the invention, the vertical portion 120b and the inclined central portion 8 thus extend themselves into two different planes.

[0043] Thus, the junction line between the superior fastening section 10b and the central part 8b of the beam 6b is closer to the poles 3 in this second embodiment.
20 As a result, the inclination of the central section 8b is more marked. In particular, to compensate for this change in inclination of the beam 6b, the superior leg 140b and inferior leg 141b form an angle α superior to the one of the first embodiment. Particularly, both legs 140b and 141b are at an angle α of 70° to 100°, preferably around 90°. In particular, the angle β between the inferior leg and the central
25 fastening section has the same value than in the first embodiment. Accordingly, the superior leg and the central fastening section form an angle γ inferior to the one of the first embodiment. The ratio $S/(H \times W)$ is still superior or equal to 0.2, more preferably comprised between 0.2 and 0.4.

[0044] The stabilising member 18b of this second embodiment of the device 5b
30 also has a slightly different configuration. Indeed, the stabilising member 18b is bent at 90° between the central planar section 19b and the second fastening

portion 21b to conform to the verticality of the superior fastening section 10b of the beam 6b. The second fastening portion 21b is thus parallel to the given pole 3.

[0045] In this second embodiment of the protection device 5b, owing to the vertical orientation of the superior fastening section 10b of the beam 6b and of the second fastening portion 21b of the stabilising member 18b, the position of the beam 6b on the barrier 1 is better stabilised.

[0046] Regarding figures 4 to 6, it can be assumed that the protection device 5a, 5a', 5b is included in a trapezoidal shape, in which the larger base length is of 180 to 220 mm, preferably of 200 mm, in which the smaller base is of 60 to 100 mm, preferably of 80 mm, and in which the height of such trapezoidal shape is of 400 to 450 mm, preferably of 430 mm.

[0047] The length of the smaller base represents the distance between the pole 3 and the edge of the superior fastening section 10a, 10b which is adjacent to the central section 8a, 8b. The length of the smaller base corresponds to the thickness of the rail 2, so that the superior fastening section 10a, 10b is in the continuity of the rail 2. The length of the larger base represents the distance between a pole 3 and the inferior fastening section 9a, 9b, and is chosen large enough to ensure that a rider will never collide with the pole 3 in case of an accident. Finally, the height of the protection device 5a, 5a', 5b is chosen so that the open end of the flap 12a, 12b engages the rail 2. The flap 12a, 12b thus ensures continuity between the rail 2 and the protection device 5a, 5a', 5b.

[0048] Referring to figures 7 and 8, the fastening means 17 of the protection device 5a, 5b to the barrier 1 comprise for each pole 3 two assemblies respectively superior 170 and inferior 171.

[0049] The superior assembly 170 comprises a superior connecting plate 240 and two superior threaded bolts 220, and the inferior assembly 171 comprises an inferior connecting plate 241 and two inferior threaded bolts 221. The bolts 220, 221 of both assemblies 170, 171 extend on either side of the given pole 3. The superior assembly 240 is adapted to fix the stabilising member 18a to the pole 3 whilst the inferior assembly 221 is adapted to fix the spacer 7 to the same pole 3.

[0050] The bolts 220 of the superior assembly 170 comprise first ends (not represented) passing through openings 280 arranged in the first fastening portion 20a of the considered stabilising member 18a, and second ends 230 passing through openings 260, 270 arranged in the superior connecting plate 240. The superior connecting plate is against the back side 29 of the pole 3, that is the surface 29 opposite to the protection device 5a, 5b. The superior bolts 220, the superior connecting plate 240 and the stabilising member 18a are then bolted together preferably by tightening nuts 31 so that the superior assembly 170 encloses the pole 3.

[0051] Similarly, the first ends (not represented) of the inferior bolts 221 of the inferior assembly 171 pass through openings 281 arranged in the central fastening section 13a, 13b of the spacer 7a, 7b, and the second ends 231 of the bolts 221 pass through openings 261, 271 arranged in the inferior connecting plate 241. The connecting plate 241 of the inferior assembly 171 is also against the back side 29 of the pole 3. The inferior bolts 221, the inferior connecting plate 24 and the spacer 7a, 7b are then bolted together preferably by tightening nuts 31 so that the superior assembly 170 encloses the pole 3.

[0052] Finally, to better adjust the spacing of the bolts 220, 221 to a given pole 3, the fastening means 17 comprise adjusting means 25 of such spacing. Referring to figures 7 and 8, these adjusting means 25 comprise superior and inferior adjusting means, respectively 250 and 251.

[0053] The superior adjusting means 250 comprise:

- a series of openings 280 arranged in the first fastening portion 20a of the stabilising member 18a, 18b, the openings 280 being spaced out regularly and horizontally (and thus perpendicularly to the pole axis X-X), and
- an elongated hole 270 arranged in the superior connecting plate 240 and whose major axis extends parallel to the longitudinal axis of the connecting plate 240.

[0054] The inferior adjusting means 251 comprise :

- a series of openings 281 arranged in the central fastening section 13a, 13b of the spacer 7a, 7b, the openings 281 being spaced out regularly and horizontally (and thus perpendicularly to the pole axis X-X), and
- an elongated hole 271 arranged in the inferior connecting plate 241 and
5 whose major axis extends parallel to the longitudinal axis of the connecting plate 241.

[0055] These adjusting means 25 thus allow to reposition the bolts 220 and 221 as close as possible to the edges of a given pole 3 during the fastening of the protection device 5a, 5b to the poles 3. In addition, this succession of openings
10 280, 281 and these elongated holes 270, 271 allow the fastening of the protection device with adjusting means 25 to any kind of pole 3 or existing barrier. There is thus as many fastening means 17 as there are poles 3 to the road barrier 1.

[0056] Naturally, the adjusting means 25 remain equivalent when they comprise on the one hand elongated holes arranged respectively in the fastening section
15 13a, 13b and the first fastening portion 20a, 20b of the stabilising member 18a, 18b, and on the other hand, a series of holes arranged in the considered connecting plate 240, 241 and regularly spaced out according to a direction parallel to the longitudinal axis of the said connecting plate 240, 241.

[0057] In the particular case of the protection device 5a' without stabilising
20 member 18a, the fastening means 17 of said protection device 5a' to the barrier 1 comprise for each pole 3 only the inferior assembly 171. Consequently, the adjusting means 25 only comprise the inferior adjusting means 251.

[0058] The protection device 5a, 5a' and 5b for motorcyclists according to the invention is therefore formed by at least two sheets (beam 6a, 6b and spacer 7)
25 ensuring the damping and stabilisation of said device 5a, 5b. Preferably, the protection device comprises a stabilising member 18a, 18b. The protection device 5a, 5b is perfectly adapted to be secured by fastening means 17 to a road barrier with a rail 2 to form the road barrier 1 of the invention.

[0059] Virtual testing measures of the head impact criterion, known as the
30 acronym HIC, were performed respectively with the devices 5a and 5b of the invention and with a device without a spacer, using a finite element method.

[0060] The HIC criterion is the parameter measuring the intensity of the impact against the motorcyclist's head. The HIC criterion is determined during crash tests, with mannequins projected against the road barrier 1, from acceleration data gathered by at least one accelerometer integrated at the level of the mannequin's head's gravity centre. Thus, the value reached by the HIC criterion is directly correlated to the gravity of wounds suffered by the motorcyclist colliding with the barrier 1.

[0061] More specifically, the HIC is calculated using the following formula:

$$HIC = \max_{t_1, t_2} \left[(t_2 - t_1) \left(\frac{1}{t_2 - t_1} \int_{t_1}^{t_2} a(t) dt \right)^{2,5} \right]$$

[0062] and evaluates the peak acceleration suffered by the motorcyclist's head during the period of time t_2-t_1 . According to European standard EN 1317-8, concerning criteria to be applied when realizing crash test involving security barrier, it has been established that the HIC criterion reaches a value around 2700 for a road barrier 1 with only the rail 2 and the beam 6a (and thus without the spacer 7), when a 87,5 kilograms dummy hits such a road barrier near a pole, with an angle of 30 degrees relative to the longitudinal rail 2, at a 70 km/h speed. Such a value will trigger the motorcyclist's death in 90% of cases.

[0063] These virtual HIC values of the device of the invention have been obtained by performing four different tests regarding EN 1317-8 standard with a spacer 7a,7b extending all along the beam 6a,6b of the devices 5a and 5b.

[0064] In the first test, a 87,5 kilograms dummy hit the longitudinal beam 6a, 6b of the road barrier 1 near a pole 3, with an angle of 30 degrees relative to the longitudinal rail 2, at a 70 km/h speed. The HIC value measured is 424.

[0065] In the second test, the 87,5 kilograms dummy hit the beam 6a, 6b of road barrier 1 between two poles 3, with an angle of 30 degrees relative to the longitudinal rail 2, at a 70 km/h speed. The distance between two poles is 4 meters. The HIC value measured is 153.

[0066] In the third test, the 87,5 kilograms dummy hit the longitudinal beam 6a, 6b of the road barrier 1 near a pole 3, with an angle of 30 degrees relative to the longitudinal rail 2, at a 60 km/h speed. The HIC value measured is 265.

5 [0067] Finally, in the fourth test, 87,5 kilograms dummy hit the beam 6a, 6b of road barrier 1 between two poles 3, with an angle of 30 degrees relative to the longitudinal rail 2, at a 60 km/h speed. The distance between two poles is 4 meters. The HIC value measured is 96, which is a particularly low value.

[0068] It is thus clear that with the device of the invention and owing to the capacities of spacer 7 to absorb a large part of the impact energy, the values of the
10 HIC criterion decrease dramatically, only causing moderate wounds to the motorcyclist. This is particularly obvious at a 60 km/h speed impact between two poles 3.

[0069] Particularly, computer impact simulations using HIC parameters obtained from the crash tests described above demonstrate that when a motorcyclist
15 collides with the protection device 5a, 5b of the invention, the beam 6a, 6b stays at a distance from the poles 3. Thus, owing to the damping of the impact by the spacer 7a, 7b, the beam 6a, 6b maintains itself efficiently at a distance from the poles 3, which prevents the motorcyclists colliding with the beam 6a, 6b from also hitting the poles 3 of barrier 1.

20 [0070] Thus, as well as efficiently absorbing the impact energy, the spacer maintains the beam at a distance from the poles.

[0071] The invention also relates to a protection kit adapted to be installed on a road security barrier 1. This kit comprises a plurality of profiled elements adapted to be arranged end to end in order to form the longitudinal beam 6a, 6b of the
25 protection device. More precisely, at least one end portion of each profiled element is adapted to overlap the end portion of the adjacent element. The overlapping length is of 150 to 300 mm, preferably of 200 to 250 mm.

[0072] The kit also comprises a plurality of V-shaped profiled elements adapted to be arranged along the beam. When the spacer 7a, 7b is all along the beam 6a, 6b,
30 then the V-shaped profiled elements are adapted to be arranged end to end. More precisely, at least one end portion of each V-shaped profiled element is adapted to

overlap the end portion of the adjacent V-shaped element. The overlapping length is of 150 to 300 mm, preferably of 200 to 250 mm and more preferably of 230 mm.

[0073] In addition, the kit comprises the fastening means 17 described above, in order to allow fastening of the assembled beam 6a, 6b and spacer 7 forming the
5 damping volume V to the barrier 1.

[0074] Finally, the kit may comprise a plurality of stabilising members 18a, 18b described above.

CLAIMS

1. Protection device for motorcyclist, adapted to be secured to a road safety barrier with a plurality of poles regularly spaced out, the protection device comprising a longitudinal beam and a spacer extending longitudinally all along the rear side of said beam and adapted to be secured to said poles, wherein the beam and the spacer are assembled together so as to define a longitudinal damping volume (V) with a closed cross-section, wherein the spacer comprises a central fastening section to said poles from which extend two legs respectively superior and inferior whose open ends are fastened to the beam, the inferior leg and the superior leg being at an angle α comprised between 60° and 100° and the inferior leg and the central fastening section being at an angle β comprised between 105° and 145° .
2. Protection device according to claim 1, wherein the spacer presents such a length that it may be secured to at least two adjacent poles of the road barrier.
3. Protection device according to claim 1 or 2, wherein the longitudinal damping volume (V) is of polygonal closed cross-section.
4. Protection device according to any one of claims 1 to 3, wherein the ratio $S/(H \times W)$ is superior or equal to 0.2, where S is the surface of the transversal cross-section of the damping volume (V), H the height of the beam and W the width of the beam.
5. Protection device according to any one of claims 1 to 4, wherein the superior leg and the central fastening section are at an angle γ comprised between 105° and 165° .
6. Protection device according to any one of claims 1 to 5, wherein each open end of the two legs comprise a bracket for the beam.

7. Protection device according to any one of claims 1 to 6, wherein the longitudinal damping volume (V) is formed by the beam and by the legs and the fastening section to the poles of the spacer.
8. Protection device according to any one of claims 1 to 7, wherein the beam comprises a planar central section prolonged by two end parts forming fastening sections to the spacer.
9. Protection device according to any one of claims 1 to 8, further comprising at least one stabilising member comprising a central planar section and two end portions adapted to be fixed respectively to one of the poles and to the beam, so as to stabilise the positions of the beam on the barrier.
10. Protection device according to claim 9, wherein the stabilising member is a U-shaped plate.
11. Road safety barrier comprising a longitudinal rail secured to a plurality of poles set in the ground and regularly spaced out and a protection device for motorcyclists according to any one of claims 1 to 10.
12. Road safety barrier according to claim 11, wherein the beam of the protection device comprises a central section that is inclined relative to a pole axis and transversally extends away from said axis as it reaches closer to the ground.
13. Road safety barrier according to claim 12, wherein the beam of the protection device comprises two end portions in the prolongation of the inclined section and forming respectively both a superior fastening section and an inferior fastening section to the spacer.
14. Road safety barrier according to claim 13, wherein the inferior fastening section comprises a flap adapted to lay on the ground.
15. Road safety barrier according to claim 13 or 14, wherein the open ends of the spacer of the protection device comprise a bracket for the beam at the level of its end portions.

16. Road safety barrier according to any one of claims 13 to 15, wherein the superior fastening section of the beam forms an angle with the inclined section so that the superior fastening section is parallel to the pole axis.
17. Road safety barrier according to any one of claims 13 to 15, wherein the superior fastening section is in the same plane as the inclined section so that the superior fastening section is also inclined relative to the pole axis.
18. Road safety barrier according to any one of claims 13 to 17, wherein the central section of the beam is inclined relative to the pole axis at an angle of 10° to 25°.
19. Road safety barrier according to any one of claims 13 to 18, wherein the protection device comprises the at least one stabilising member comprising the central planar section and the two end portions adapted to be fixed respectively to one of the poles and to the beam, so as to stabilise the positions of the beam on the barrier.
20. Road safety barrier according to claim 19, wherein at least one end portion of the at least one stabilising member is secured to the superior fastening section of the beam.
21. Road safety barrier according to claim 20, wherein the protection device is secured to each pole by fastening means.
22. Road safety barrier according to claim 21, wherein the fastening means comprise at least two fastening assemblies respectively superior and inferior, so that the superior assembly encloses the poles while being fixed to the stabilising member, and so that the inferior assembly encloses the pole while being fixed to the spacer.
23. Road safety barrier according to claim 22, wherein each fastening assembly comprises at least two bolts extending on both sides of the pole so that the first respective bolt ends are secured respectively to the stabilising member and to the spacer, and so that the second bolt ends are secured to superior connecting plates and inferior connecting plates coming to rest against the back side of the pole opposite to the protection device.

24. Road safety barrier according to claim 23, wherein each fastening assembly comprises adjusting means for the spacing between the bolts and the pole, said adjusting means being arranged in the connecting plate and respectively in a central fastening section to the poles of the spacer and in a first fastening portion of the stabilising member to allow for the bolts to be positioned as close as possible to the edges of the pole during the fastening of the protection device to the poles.

25. Road safety barrier according to claim 24, wherein the superior adjusting means comprise:

- a series of openings arranged in the first fastening portion of the stabilising member, the openings being spaced out regularly and horizontally, and
- an elongated hole arranged in the superior connecting plate and whose major axis extends parallel to the longitudinal axis of the connecting plate.

26. Road safety barrier according to claim 24 or 25, wherein the inferior adjusting means comprise:

- a series of openings arranged in the central fastening section of the spacer, the openings being spaced out regularly and horizontally, and
- an elongated hole arranged in the inferior connecting plate and whose major axis extends parallel to the longitudinal axis of the connecting plate.

27. Kit for the assembling of a protection device for motorcyclist, adapted to be secured to a road safety barrier with a plurality of poles regularly spaced out, the kit comprising a first profiled sheet forming a longitudinal beam, a second profiled sheet forming a spacer, wherein the beam and the spacer are adapted to be assembled together, with the spacer extending all along the rear side of said beam, so as to define a longitudinal damping volume (V) with a closed cross-section, wherein the spacer comprises a central fastening section to said

poles from which extend two legs respectively superior and inferior whose open ends are adapted to be fastened to the beam, the inferior leg and the superior leg being at an angle α comprised between 60° and 100° and the inferior leg and the central fastening section being at an angle β comprised between 105° and 145° .

- 28. Kit according to claim 27, comprising a plurality of first profiled sheets adapted to be arranged end to end in order to form the longitudinal beam.
- 29. Kit according to claim 27 or 28, comprising a plurality of elements adapted to be arranged end to end in order to form the spacer.
- 30. Kit according to any one of claims 27 to 29, comprising a plurality of stabilising members each formed by a third profiled sheet and adapted to stabilise the positions of the beam on the barrier.
- 31. Kit according to any one of claims 27 to 30, comprising fastening means for fastening the beam and the spacer to the barrier.

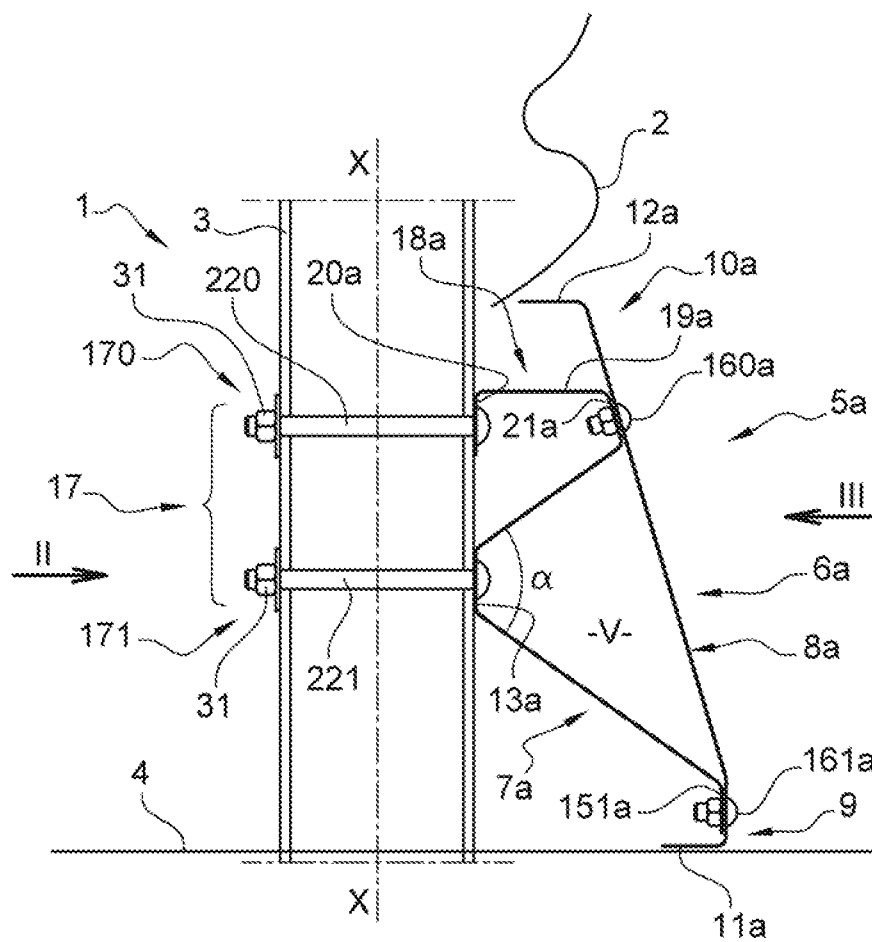


Figure 1

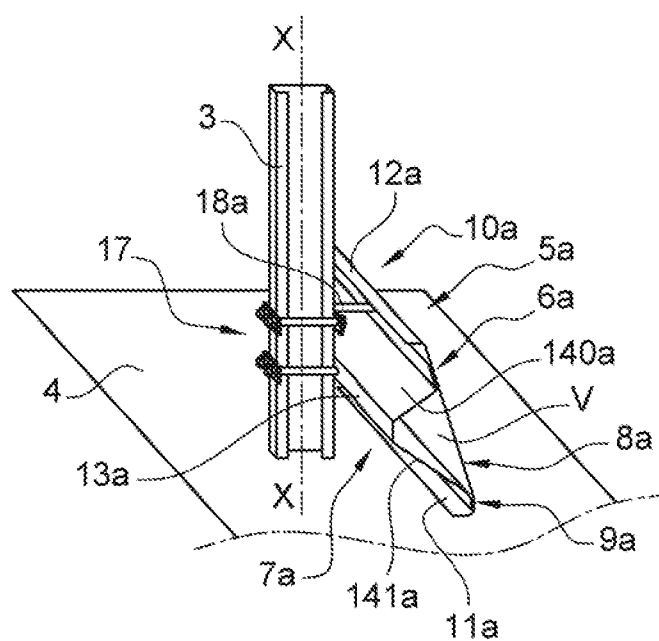


Figure 2

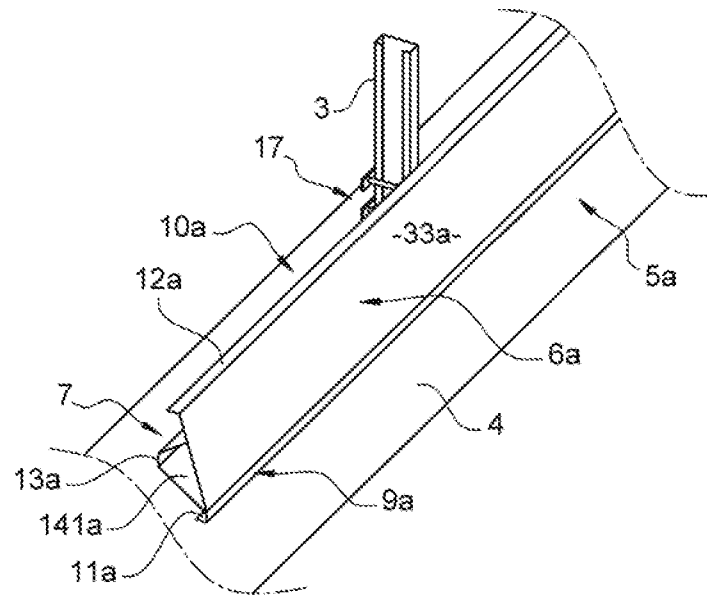


Figure 3

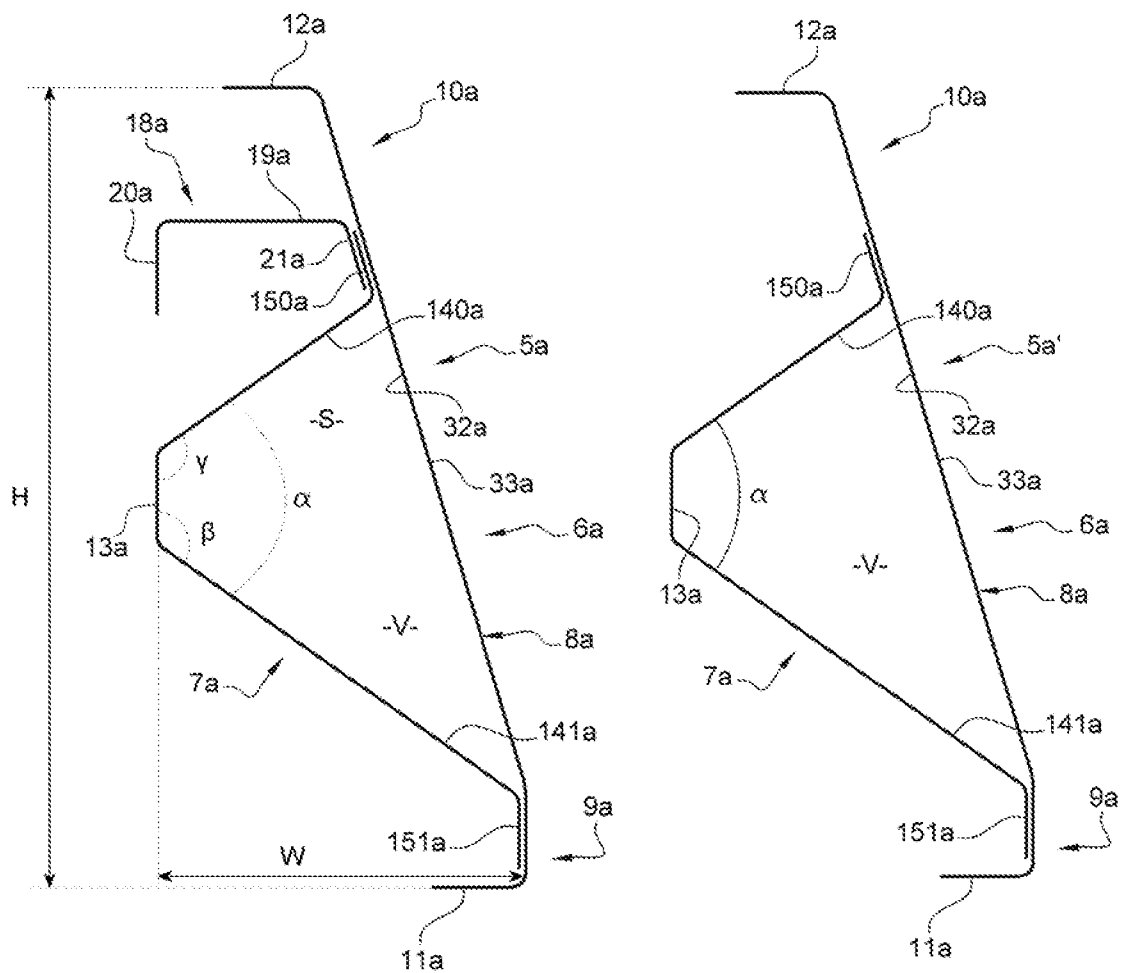


Figure 4

Figure 5

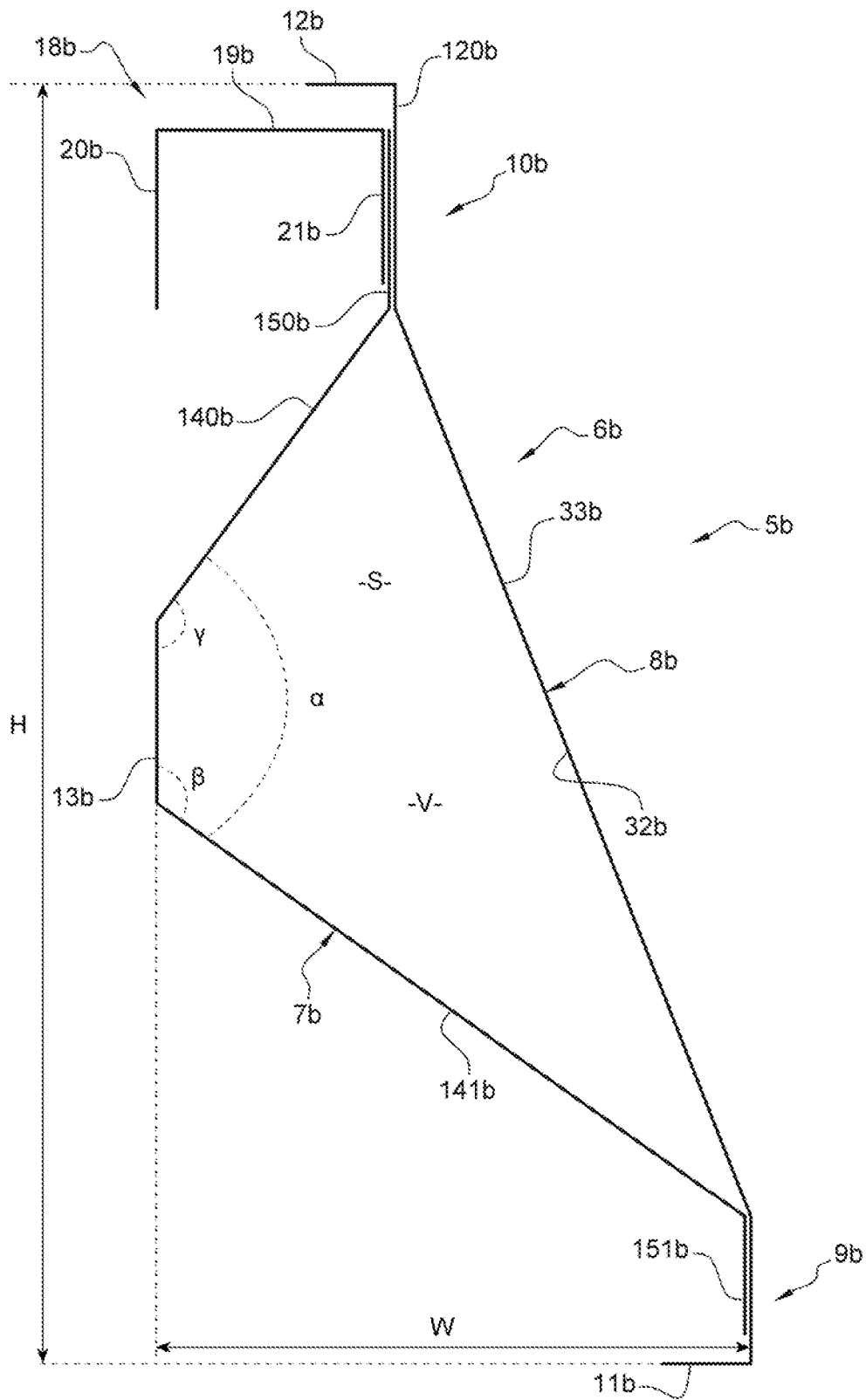


Figure 6

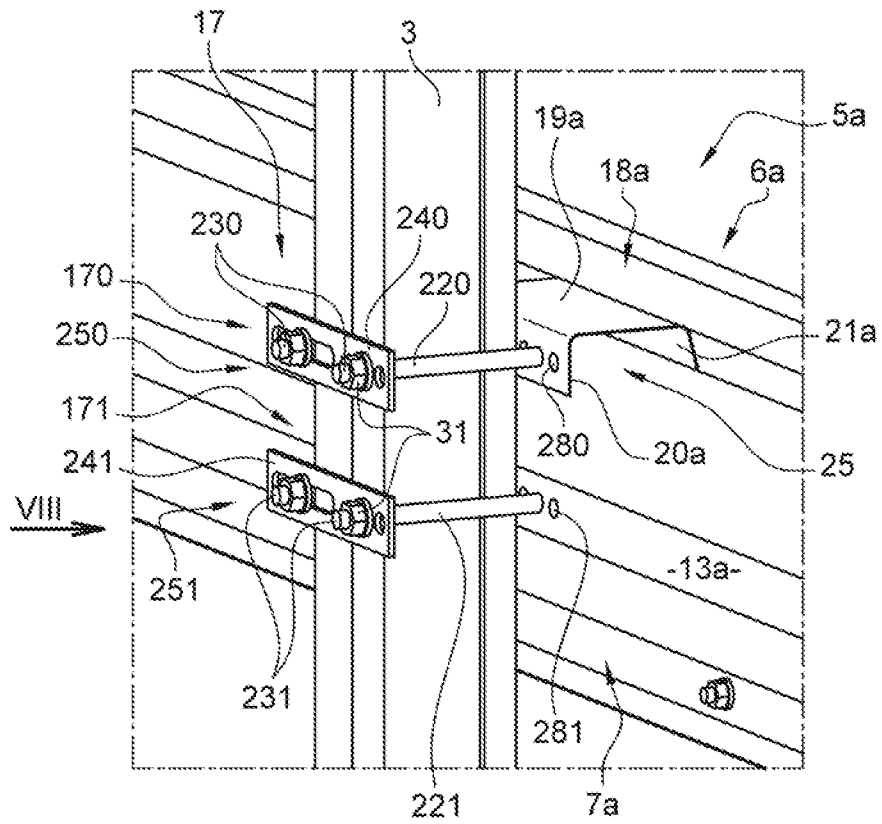


Figure 7

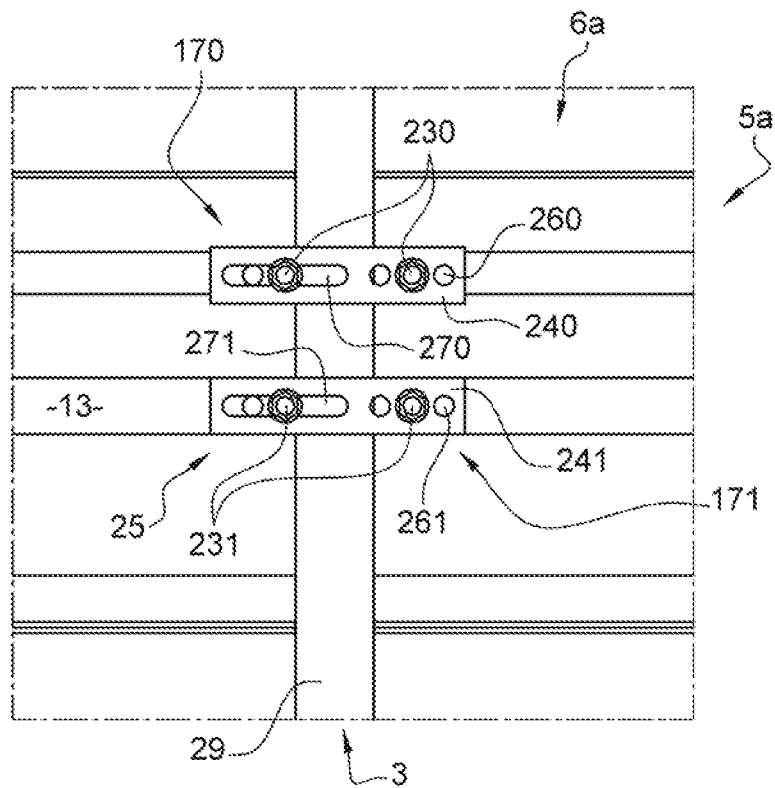


Figure 8

