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(71) Applicant: **Anas S.p.A.**
00185 Rome (IT)

(72) Inventor: **GRECCO, Raffaella**
00185 Roma (IT)

(74) Representative: **Colombo, Stefano Paolo et al**
Marchi & Partners S.r.l.
Via Vittor Pisani, 13
20124 Milano (IT)

(54) **ROAD BARRIER WITH MOTORCYCLIST PROTECTION DEVICE, AND PROTECTION DEVICE**

(57) Road barrier (1) comprising: a series of support posts (2) which are adapted to be firmly fixed to the ground (P) in a substantially vertical position, arranged spaced next to each other along the lateral edge of the roadway; a series of horizontal crossbars (3), which are firmly fixed to the support posts (2) in a substantially horizontal position one after the other, so as to form a first longitudinal containment rail (4) extending along the lateral edge of the roadway at a predetermined height from the ground (P); and a series of additional oblong sections (10), which are made of an elastomer-based composite material and are firmly fixed to the support posts (2) in a substantially horizontal position one after the other, so as to form a second longitudinal containment rail (11) extending along the lateral edge of the roadway, below said first longitudinal containment rail (4).

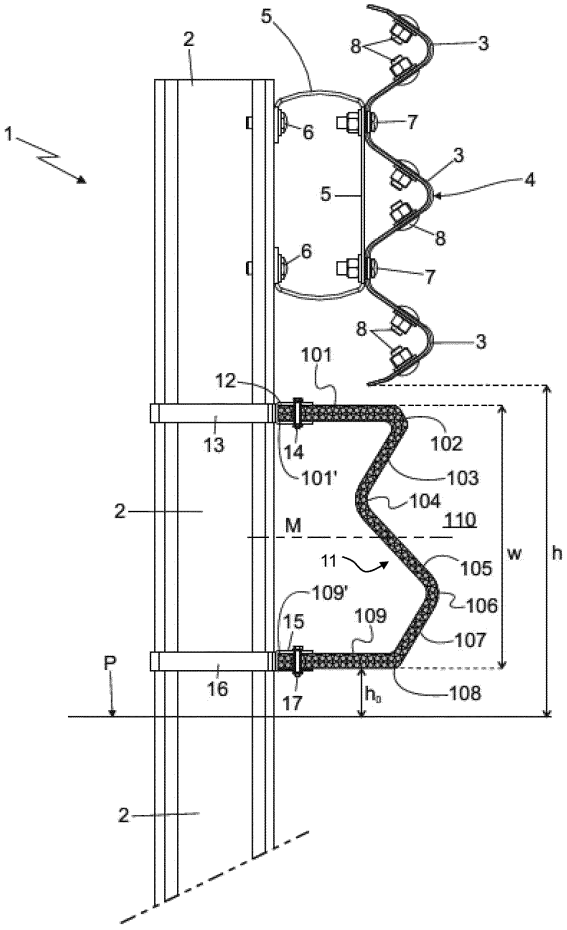

Fig. 2

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Description

TECHNICAL SECTOR

[0001] The present invention relates to the sector of road barriers and in particular relates to a road barrier with a motorcyclist protection device. The present invention also relates to a motorcyclist protection device to be associated with a road barrier.

[0002] In greater detail, the present invention relates to a programmed-deformation road barrier of the discontinuous type with a motorcyclist protection device. The description below will make specific reference to such an application without thereby losing its general character.

PRIOR ART

[0003] The currently most widely used road barriers of the discontinuous type, which are conventionally called "guard-rails", comprise a series of vertical support posts which are typically made of metallic material and are embedded in the ground in a substantially vertical position, arranged spaced next to each other along the lateral edge of the roadway. The road barriers also comprise a series of strip-shaped metal sections with a double or triple wave profile. These metal sections are fixed to the support posts in a horizontal position one after another at a predetermined height above the ground. In this way they form a longitudinal containment rail which extends continuously along the lateral edge of the roadway.

[0004] Clearly, the support posts and the strip-shaped metal sections with a double or triple wave profile are specifically designed with a structure and dimensions suitable for retaining, within the roadway, a car or other vehicle transporting medium-to-large size objects and/or persons which might accidentally hit the road barrier in the event of an accident. However, although they fulfil their purpose in an excellent manner, the structure of discontinuous road barriers may constitute an extremely dangerous obstacle for a motorcyclist who, in the event of a fall, accidentally hits the road barrier.

[0005] In fact, it happens that the motorcyclist, following the fall, continues to slide along the road surface until he/she hits one of the support posts of the road barrier which is located on the lateral edge of the road. The motorcyclist risks particularly serious traumatic injuries even in the case of impact at low speed.

[0006] In addition, the support posts and the double or triple wave oblong sections sometimes have "sharp" corner edges which unfortunately may be lethal for the motorcyclist hitting them at high speed.

[0007] In order to overcome this problem, some roadway barrier manufacturers have developed road barriers of the discontinuous type provided with an additional protection structure which prevents the motorcyclist from hitting the support posts of the road barrier.

[0008] The patent application EP2108741 A2, for example, describes a road barrier with motorcyclist protection, which comprises, in addition to the conventional horizontal metal sections with a double or triple wave profile, also a series of horizontal crossbars which are made of profiled metal and are arranged in a horizontal position spaced underneath the longitudinal containment rail formed by the horizontal metal sections with a double or triple wave profile and which are fixed to the support posts of the road barrier by means of brackets with a programmed-deformation structure which deform in the event of their being hit by the motorcyclist.

[0009] The patent application EP2088247 A2, instead, describes a road barrier which, in addition to the horizontal metal sections with a double or triple wave profile, also comprises a series of metal sections with an omega profile, which are arranged in a horizontal position one after another, spaced below the longitudinal containment rail formed by the horizontal metal sections with double or triple wave profile, and are directly fixed against the support posts of the road barrier by means of metal locking clamps.

[0010] Finally, road barriers are known where, in addition to the traditional horizontal metal sections with double or triple wave profile, there is also a series of strip-like crossbars with an S-shaped profile which are arranged in a horizontal position one after another, immediately below the longitudinal containment rail formed by the horizontal metal sections with double or triple wave profile, and which are connected to the bottom edge of the longitudinal containment rail so as to form a downwards extension of the said longitudinal containment rail.

[0011] In greater detail, the top longitudinal edge of the strip-shaped crossbars with S-shaped profile is firmly fixed to the bottom edge of the longitudinal containment rail by means of through-bolts, while the bottom longitudinal edge of the strip-shaped crossbars with S-shaped profile is firmly fixed to the various support posts of the road barrier by means of U-shaped brackets.

[0012] The installation of the road barriers described above along bends and road sections with relatively small radii of curvature is somewhat problematic and costly. In fact, the crossbars, prior to installation, must be calendered so as to be adapted to the curvature of the road section. This operation requires special machinery and is practically impossible to perform on-site, with all the machining and transport problems involved.

[0013] In addition numerous experimental tests have shown that the motorcyclist who hits the road barriers described

above is often in any case subject to relatively high decelerations, with all the physical problems which this involves.

[0014] FR 2460365 A1 and WO 2007/036593 A1 describe a road barrier with motorcyclist protection system.

SUMMARY OF THE INVENTION

[0015] The Applicant has noted that the motorcyclist protection system described in FR 2460365 has a number of drawbacks. In particular, the part made of elastomeric material is associated with a metal core. This has the effect of making the elastomer material part substantially rigid and therefore substantially unsuitable for absorbing impacts with a motorcyclist. The form of the motorcyclist protection system does not allow deformation thereof. The installation of the motorcyclist protection system is long, costly and subject to maintenance, at least as regards the metal parts which tend to rust. Furthermore, the solution described in FR 2460365 cannot be easily adapted to bends of varying radius since the metal core must be curved according to needs. Finally, in the event of impact, the motorcyclist protection system may not be used again since the metal core is subject to permanent deformation.

[0016] The Applicant has noted that the motorcyclist protection system described in WO 2007/036593 also has a number of drawbacks. This solution also involves a metal reinforcement in direct contact with the elongated rail against which a motorcyclist collides during a fall. All the drawbacks described above in connection with FR 2460365 are also applicable to WO 2007/036593. WO 2007/036593 also envisages an additional cushioning device and this represents an additional cost and additional complication during assembly.

[0017] The object of the present invention is to provide a road barrier of the discontinuous type which offers improved protection for motorcyclists in the event of an accident.

[0018] According to the present invention a road barrier with a motorcyclist protection device comprising an elongated member, but advantageously a series of elongated members, is provided. The elongated members are made of an elastomer-based composite material. The elongated members are firmly fixed to the support posts in a substantially horizontal position one after another, so as to form a second longitudinal containment rail. The front part of the elongated members does not have any reinforcing core, for example, in particular, does not have a metallic core.

[0019] The elongated members also comprise, in addition to the front part, two side walls which create a suitable (non zero) distance between the front part and the posts of the barrier. In this way, in the event of an impact, the second longitudinal containment rail may be deformed.

[0020] According to a first aspect of the invention a road barrier with a motorcyclist protection device is provided, said barrier comprising: a series of support posts, which are adapted to be firmly fixed to the ground in a substantially vertical position, being arranged spaced next to each other along the lateral edge of the roadway, and a series of horizontal crossbars, which are firmly fixed to the support posts in a substantially horizontal position one after the other, so as to form a first longitudinal containment rail extending along the lateral edge of the roadway at a predetermined height above the ground;

wherein the motorcyclist protection device comprises a series of elongated members, which are made of an elastomer-based composite material and are firmly fixed to the support posts in a substantially horizontal position one after the other, so as to form a second longitudinal containment rail extending along the lateral edge of the roadway, below said first longitudinal containment rail, and are substantially strip-shaped and have a profile substantially in the form of an open broken line.

[0021] According to embodiments, the elongated members are made of a solid and compact agglomerate which comprises mainly granules and/or powders of natural and/or synthetic rubber embedded in a thermoplastic polymer binder matrix.

[0022] According to embodiments, at least some of the granules and/or powders of natural and/or synthetic rubber which form said agglomerate are made of vulcanized rubber.

[0023] According to embodiments, at least some of the granules and/or powders of vulcanized rubber are obtained from the recycling of discarded tires.

[0024] According to embodiments, the percentage of granules and/or powders of natural and/or synthetic rubber present in said agglomerate is greater than 60% and preferably also greater than 80% of the total weight of the material.

[0025] According to embodiments, the elongated members have a substantially M or Σ (sigma) shaped profile.

[0026] According to embodiments, the elongated members have a thickness ranging between 1 cm and 3 cm.

[0027] According to embodiments, the elongated members have a nominal width ranging between 20 and 50 cm and/or a nominal length greater than 1 m.

[0028] According to embodiments, the elongated members are fixed end-to-end by means of a male-female joint and/or have a sectional modular structure.

[0029] According to another aspect, the present invention provides a motorcyclist protection device configured to be associated with a road barrier, comprising at least one elongated member made of an elastomer-based composite material and configured to be firmly fixed to support posts in a substantially horizontal position, wherein said at least one elongated member is substantially strip-shaped and has a profile substantially in the form of an open broken line.

[0030] According to embodiments, the elongated members are made of a solid and compact agglomerate which comprises mainly granules and/or powders of natural and/or synthetic rubber embedded in a thermoplastic polymer binder matrix.

[0031] According to embodiments, at least some of the granules and/or powders of natural and/or synthetic rubber which form said agglomerate are made of vulcanized rubber.

[0032] According to embodiments, at least some of the granules and/or powders of vulcanized rubber are obtained from the recycling of discarded tires.

[0033] According to embodiments, the percentage of granules and/or powders of natural and/or synthetic rubber present in said agglomerate is greater than 60% and preferably also greater than 80% of the total weight of the material.

[0034] According to embodiments, the elongated members comprise a substantially Σ (sigma) shaped profile.

BRIEF DESCRIPTION OF THE FIGURES

[0035] The present invention will now be described, by way of a non-limiting example, with reference to the attached drawings, in which:

- Fig. 1 is a perspective view of a road barrier made according to the present invention, with parts removed for greater clarity;
- Fig. 2 is a side view of the road barrier according to Fig. 1, with parts cross-sectioned and parts removed for greater clarity;
- Figs. 3a and 3b are simulation images of an initial impact against the motorcyclist protection device showing the deformation of the protection device following impact with the helmet; and
- Figs. 4a and 4b are simulation images following the initial impact.

DETAILED DESCRIPTION

[0036] With reference to Figures 1 and 2, the number 1 denotes overall a road barrier suitable for being installed along the lateral edge of the roadway, with the function of retaining, inside the roadway, a car or other vehicle for transporting medium-to-large size objects and/or persons, which in the event of an accident accidentally hits the said road barrier 1.

[0037] The road barrier 1 is designed to be firmly secured to the ground P along the lateral edge of the roadway and comprises a plurality of vertical support posts 2 and a plurality of horizontal crossbars 3.

[0038] The vertical posts 2 are, for example, made of metallic material and are fixed/configured to be firmly fixed to the ground P in a substantially vertical position, being arranged spaced next to each other along the lateral edge of the roadway.

[0039] The horizontal crossbars 3 are, for example, made of metallic material and are firmly fixed to the support posts 2 in a substantially horizontal position one after the other at a predetermined height above the ground, so as to form a longitudinal containment rail 4 extending along the lateral edge of the roadway substantially parallel to the ground P.

[0040] The support posts 2 are preferably substantially rectilinear and are preferably embedded in the ground in a substantially vertical position.

[0041] Clearly the road barrier 1 could also be a road barrier bordering a bridge or the like. In this case, the support posts 2 could be fixed directly onto a kerb of reinforced cement, advantageously by means of plates and anchor bolts.

[0042] The horizontal crossbars 3 are instead preferably fixed projecting onto the lateral flank of the support posts 2, for example by means of spacing members 5 which are arranged in between and which have a programmed deformation structure and preferably are also made of metallic material.

[0043] In other words, the spacing members 5 are preferably fixed projecting onto the lateral flank of the support posts 2 at a predetermined height above the ground, advantageously by means of at least one and more - conveniently a plurality - of connecting through-bolts 6, and the horizontal crossbars 3 are fixed directly onto the spacing members 5 advantageously by means of at least one or more - conveniently a plurality - of connecting through-bolts 7.

[0044] In addition, the horizontal crossbars 3 are preferably fixed end-to-end to one another so as to form a longitudinal containment rail 4 extending continuously along the lateral edge of the roadway.

[0045] In greater detail, the horizontal crossbars 3 have preferably an elongated form and are preferably fixed end-to-end by means of one - and more conveniently a plurality - of connecting through-bolts 8.

[0046] In the example shown, the support posts 2 have an overall length preferably of between 1 and 2 m (meters) and are preferably made of steel. In greater detail, the support posts 2 preferably consist of straight metal sections advantageously with a substantially U-shaped or C-shaped profile.

[0047] According to embodiments, the support posts 2 are also embedded in the ground so that the projecting part has a total length ranging between 80 and 90 cm (centimeters), for example equal to about 85 cm.

[0048] The horizontal crossbars 3 have, instead, a total length preferably of between 2 and 6 m (meters), for example

about 5 m (meters), and are for example made of steel.

[0049] According to embodiments, each horizontal crossbar 3 preferably comprises an elongated metal section, advantageously with a double or triple wave profile.

[0050] According to embodiments, the horizontal crossbars 3 have a nominal width ranging between 45 and 55 cm (centimeters), for example equal to about 50 cm.

[0051] The horizontal crossbars 3 may be positioned at a minimum height h above the ground ranging between about 40 and 50 cm (centimeters), for example equal to about 47 cm.

[0052] Consequently, the longitudinal containment rail 4 is located at a minimum height h above the ground preferably ranging between 40 and 50 cm (centimeters), for example equal to about 47 cm.

[0053] According to embodiments, the spacing members 5, instead, are preferably formed by strip-shaped battens which are made of metallic material and folded in a substantially U or C shape and are advantageously arranged with their two ends bearing against the lateral flank of the support post 2. According to embodiments, the strip-shaped battens are preferably made of steel.

[0054] According to the present invention, with reference to Figures 1 and 2, the road barrier 1 also comprises a motorcyclist protection device.

[0055] The motorcyclist protection device comprises an elongated member 10. According to embodiments, the motorcyclist protection device comprises a plurality of elongated members 10. The elongated members may comprise an elastomer-based composite material.

[0056] The elongated members 10 may be firmly fixed to the support posts 2 in a substantially horizontal position one after the other, at a predetermined height above the ground P, so as to form a second longitudinal containment rail 11. The second longitudinal containment rail 11, during use, extends along the lateral edge of the roadway, underneath the longitudinal containment rail 4 and substantially parallel to the ground P.

[0057] In addition, in a similar manner to the horizontal crossbars 3, the elongated members 10 are preferably fixed end-to-end so as to form the second longitudinal containment rail 11 extending continuously along the lateral edge of the roadway.

[0058] According to embodiments, the elongated member 10 is preferably made, at least partially, of a solid and compact agglomerate which comprises mainly granules and/or powders of natural and/or synthetic rubber embedded in a thermoplastic polymer binder matrix.

[0059] According to embodiments, the elongated member 10 may be made by means of molding. According to embodiments, the elongated element 10 may be formed by means drawing.

[0060] According to embodiments, at least some of the granules and/or powders of natural and/or synthetic rubber are made of vulcanized rubber.

[0061] According to embodiments, at least some of the granules and/or powders of rubber are obtained from the recycling of discarded or "end-of-life" tires (ELTs). In other words, at least some of the granules and/or powders of natural and/or synthetic rubber contained in the agglomerate are made of recycled vulcanized rubber.

[0062] According to embodiments, the percentage of granules and/or powders of natural and/or synthetic rubber is preferably greater than 60% and optionally also greater than 80% of the total weight of the material.

[0063] According to embodiments, the binder matrix comprises one more polymers, advantageously of the elastomer type and/or belonging to the family of polyolefins (PO), such as polypropylene (PP), polyethylene (PE) or the like, advantageously obtained from recycling. In addition or alternatively, the binder matrix may also comprise ethylene vinyl acetate or other similar copolymers.

[0064] According to embodiments, the solid and compact agglomerate has a nominal density preferably ranging between 1 and 2 g/cm^3 (grammes/cubic centimeter) and/or a surface hardness preferably ranging between 70 and 85 Shore A.

[0065] According to embodiments, with reference to Figures 1 and 2, the elongated members 10 are preferably fixed/can be fixed end-to-end, for example by means of a male-female joint. In other words, the two opposite ends of the elongated members 10 are preferably structured so that they can be joined together by means of a male-female joint.

[0066] According to embodiments, the elongated members 10 have a sectional modular structure.

[0067] In greater detail, the elongated members 10 may be substantially strip-shaped. The elongated members 10, according to embodiments, have a (cross-sectional) profile substantially in the form of an open broken line and are preferably firmly fixed to the support posts 2 along their top longitudinal edge and/or their bottom longitudinal edge.

[0068] According to embodiments, the two axial ends of the elongated members 10 are also structured so as to be able to be joined/engaged together, for example by means of a mortise and tenon joint.

[0069] According to embodiments, each elongated member 10 has a nominal thickness preferably of between about 1 and 3 cm (centimeters). According to embodiments, the upper side wall 101 and the lower side wall 109 have a thickness greater than that of the front walls which are directly exposed to the impact. For example, the side walls may have a thickness of about 20 mm and the front walls may have a thickness of about 15 mm. According to embodiments, each elongated member 10 has preferably a substantially M, S or Σ (sigma) shaped profile.

[0070] As shown in Fig. 2, each elongated member 10 comprises an upper side wall 101 and a lower side wall 109. The side walls 101 and 109 are substantially flat and parallel to each other. The side walls 101 and 109 are positioned spaced from each other, with respect to a longitudinal mid-plane M.

[0071] The upper side wall 101 comprises a free end 101' for fixing to the road barrier 1. According to embodiments, the free end 101' may be fixed to the barrier by means of a longitudinal guide 12, which is for example C-shaped.

[0072] The opposite end 101' forms a first elbow 102 with a first upper front wall 103. The first upper front wall 101 and the upper front wall 103 form an angle of about 60°. The first upper front wall 103 is inwardly inclined and forms a gulley 110 with a second upper front wall 105 which is instead outwardly inclined. The two upper front walls 103 and 105 are inclined to form an angle 104 of about 110°. The bottom of the gulley 110 is at a distance of about 10-25 cm from the barrier post.

[0073] Continuing downwards, the second upper front wall 105 forms a third elbow 106 with a lower front wall 107. The lower front wall 107 is inwardly inclined. The inclination may be the same as that of the first upper front wall 103. Finally, the lower front wall 105 forms a fourth elbow 108 with the lower side wall 109.

[0074] In a similar manner to the upper side wall 101, the lower side wall 109 has a free end 109' for fixing to the road barrier 1. According to embodiments, the free end 109' may be fixed to the barrier by means of a longitudinal guide 15, which is for example C-shaped.

[0075] The side walls 101 and 109 are substantially parallel to the longitudinal mid-plane M.

[0076] As will become clearer below, in the event of an impact between a motorcyclist and the bottom longitudinal containment rail 11, the motorcyclist's helmet will strike and be channeled into the gulley 110. The motorcyclist's shoulder will strike the lower front wall 107 and will then be channeled into the gulley 110. The front walls (and in some cases the side walls, but to a lesser extent) may be deformed since a sufficient empty space is provided between the front walls of the bottom longitudinal containment rail 11 and the posts of the barrier. The bottom longitudinal containment rail 11 does not have a metal core. According to the invention, the bottom longitudinal containment rail 11 acts as an energy cushion, without the need for an additional cushion. This is made possible owing to the perfect calibration between material, form and space between the bottom longitudinal containment rail 11 and the posts.

[0077] The first upper front wall, the second upper front wall and the lower front wall have, overall, an S-shaped profile which is continuously connected to the two side walls 101 and 109.

[0078] The elongated members 10 have a nominal width w preferably ranging between 20 and 50 cm (centimeters) and more preferably between 30 and 40 cm.

[0079] In addition, the elongated members 10 have a nominal length preferably greater than 1 m (meter) and preferably smaller than 8 m (meters).

[0080] In greater detail, the elongated members 10 have a nominal length preferably ranging between 1.5 and 3.5 m (meters).

[0081] In the example shown, in particular, the elongated members 10 have a nominal width w preferably equal to about 35 cm (centimeters) and/or a nominal length preferably equal to about 2 m (meters).

[0082] As mentioned above, with reference to Figures 1 and 2, the upper longitudinal edge of the elongated members 10 is preferably fixed rigidly onto a longitudinal support guide 12 which is preferably substantially straight and/or made of metallic material and which is firmly fixed on the side of the support posts 2 in a substantially horizontal position, at a predetermined height above the ground P.

[0083] In greater detail, the longitudinal support guide 12 may have a substantially U-shaped profile and may be firmly fixed in abutment against the side of the support posts 2 by means of U-shaped brackets 13 which are for example made of a metallic material and which embrace the support posts 2 and are secured on the rear of the longitudinal guide 12 advantageously by means of one or more connecting through-bolts.

[0084] The top longitudinal edge 101' of the elongated members 10, in turn, is preferably inserted and firmly clamped inside the longitudinal guide 12, for example by means of a series of connecting through-bolts 14 which are spaced in a substantially uniform manner preferably along the entire length of the elongated members 10.

[0085] Similarly the bottom longitudinal edge 109' of the elongated members 10 is preferably firmly fixed onto a second longitudinal support guide 15, which is for example substantially straight and/or made of metallic material and which is rigidly fixed onto the lateral flank of the support posts 2 in a substantially horizontal position, spaced below the longitudinal guide 12 and at a predetermined height above the ground P.

[0086] According to embodiments, the longitudinal guide 15 has preferably a substantially U-shaped profile and is preferably firmly fixed in abutment against the lateral flank of the support posts 2 by means of the U-shaped brackets 16, which are for example made of metallic material and embrace the support uprights 2 and are secured onto the rear of the longitudinal guide 15 advantageously by means of one or more connecting through-bolts.

[0087] The bottom longitudinal edge 109' of the elongated members 10, in turn, is preferably inserted and firmly clamped inside the longitudinal guide 15, for example by means of a series of connecting through-bolts 17 which are spaced in a substantially uniform manner preferably along the entire length of the additional strip-shaped section 10.

[0088] In other words, the top and/or bottom longitudinal edge of the elongated members 10 is preferably fixed rigidly

onto a longitudinal support guide 12, 15 which is preferably substantially straight and/or made of metallic material and which is firmly fixed on the lateral flank of the support posts 2 in a substantially horizontal position, at a predetermined height above the ground P.

[0089] With particular reference to Figure 2, finally, the elongated members 10 are preferably positioned on the support posts 2 at a minimum height h0 above the ground P less than or equal to 10 cm (centimeters) and more conveniently equal to about 5 cm.

[0090] Consequently, the bottom longitudinal containment rail 11 is located at a minimum height above the ground preferably less than 10 cm (centimeters), and more conveniently equal to about 5 cm.

[0091] The operating principle of the road barrier 1 may be easily deduced from that described above.

[0092] The longitudinal containment rail 11 formed by the elongated members 10 is located at a height from the ground such that it may be reached by the motorcyclist who, following a fall, slides along the road surface until he/she hits the road barrier 1.

[0093] Consequently, the kinetic energy of the motorcyclist is transmitted directly onto the elongated members 10 which are elastically and gradually deformed reducing the impact decelerations to which the motorcyclist is subject.

[0094] In the event of an impact, moreover, the kinetic energy of the motorcyclist is substantially entirely cushioned by the elongated members 10 alone, without metal parts being involved.

[0095] In other words, the longitudinal guides 12 and 15, the brackets 13 and 16 and the through-bolts 14 and 17 have only the function of providing support and connection to the vertical posts 2.

[0096] The advantages associated with the particular structure of the bottom longitudinal containment rail 11 of the road barrier 1 are significant.

[0097] Experimental tests carried out in the field in accordance with the UNI ISO 17025 standard and UNI CENT TS 17342 standard have shown that, in the event of impact with the bottom longitudinal containment rail 11, the dummy fitted with instrumentation and reproducing the vital parts of the motorcyclist's body is subject to low biomechanical index values with a resultant lower degree of physical damage. The tests stipulated by the standards have two different configurations. In the first - more stringent - test configuration (TEST A), the dummy is directed against the bottom longitudinal containment rail at the point where the post is situated, with an impact angle of 30°. In the second - less stringent - test configuration (TEST B), the dummy fitted with instrumentation is directed against the bottom longitudinal containment rail where there are two posts, with an impact angle of 30°. The results of the two tests, expressed in biomechanical indices, must lie within the level I threshold values (very safe values for motorcyclists with no injuries following impact) and the level II threshold values (safe values for motorcyclists with slight injuries following impact).

[0098] Table 1 shows the standard threshold values and the results achieved by the device according to the present during two tests (A and B).

Table 1

DSM performance	HIC	Fz.trac. [N]	Fz comp. [N]	Fx [N]	My flex. [N]	My ext. [Nm]	Mx [Nm]
Level II threshold	1000	3300	4000	3100	190	57	134
Level I threshold	650	2700	3200	1900	190	42	134
TEST A invention ANAS	292	1486	2867	880	66	41	83
TEST B Invention ANAS	79	455	1170	539	59	20	31

[0099] The first two rows in Table 1 show the standard threshold values, Level I and Level II, while the last two rows in the table show the values resulting from the two tests carried out on the device according to the present invention, both tests falling within the Level I standard values corresponding to the maximum safety for the motorcyclist. HIC corresponds to the head injury criterion and is a measurement of the probability of injuries to the head resulting from an impact.

[0100] The indices which represent the risk of neck injury are as follows:

anterior-posterior cutting force (Fx);
lateral cutting force (Fy);
pressing/compressive force (Fz);
lateral bending moment calculated on the occipital condyle (Mocx);
extension/bending movement calculated on the occipital condyle (Mocy);
twisting moment (Mz).

[0101] It is clear that the HIC of the device according to the present invention is significantly lower than the threshold

values stipulated by the standard. The same is true for the indices which represent the risk of neck injury.

[0102] Simulations have also been carried out using a known program with finite elements for simulating the impact between a motorcyclist and a protection device according to the present invention. Some images are shown in Figures 3a, 3b, 4a and 4b. In particular, Figures 3 show the instant of the initial impact, while Figures 4 shows the following moment.

[0103] Since they are made of at least partially elastic and flexible material, the elongated members 10 which form the bottom longitudinal rail 11 return into the initial position after the impact with the motorcyclist, minimizing the costs for maintenance and/or repair of the road barrier 1.

[0104] In addition, since they have an elastic and flexible structure, the elongated members 10 which form the bottom longitudinal containment rail 11 may be easily adapted on-site to the curvature of the road section, greatly simplifying the installation of the road barrier 1.

[0105] Owing to this flexibility which allows easy adaptability to the form of the road section, moreover, the elongated members 10 may also have a length equal to or greater than 6 m (meters).

[0106] Last but not least, the outer surface of the elongated members 10 is particularly resistant to abrasive friction and therefore does not require further surface treatment. During the manufacture of the elongated members 10, in fact, the polymer particles of the binder matrix migrate towards the outer surface of the part, forming a smoother and more compact surface.

[0107] Clearly, the elongated members 10 which form the motorcyclist protection device, or rather the bottom longitudinal containment rail 11, may be mounted/incorporated also in other types of road barriers which do not or may not have the longitudinal containment rail 4, such as masonry road barriers or reinforced concrete road barriers (Jersey barriers) or the like, with similar results. In this case also, obviously, the longitudinal containment rail 11 is nevertheless mounted/fixed on the vertical flank of the road barrier at a height from the ground such that it may be reached by a motorcyclist sliding on the road surface.

[0108] Finally it is clear that the road barrier 1 described above may be subject to modification and variations without thereby departing from the scope of the present invention.

[0109] For example, in a more sophisticated embodiment (not shown), the top ends of the vertical support posts 2 may be connected together by means of horizontal longitudinal members which are preferably made of metallic material.

Claims

1. A road barrier (1) with a motorcyclist protection device comprising: a series of support posts (2), which are adapted to be firmly fixed to the ground (P) in a substantially vertical position, arranged spaced next to each other along the lateral edge of the roadway; and a series of horizontal crossbars (3), which are firmly fixed to the support posts (2) in a substantially horizontal position one after the other, so as to form a first longitudinal containment rail (4) extending along the lateral edge of the roadway at a predetermined height above the ground (P);
said road barrier (1) being **characterized in that** the motorcyclist protection device comprises a series of elongated members (10), which are made of an elastomer-based composite material and are firmly fixed to the support posts (2) in a substantially horizontal position one after the other, so as to form a second longitudinal containment rail (11) extending along the lateral edge of the roadway, below said first longitudinal containment rail (4), and are substantially strip-shaped and have a profile substantially in the form of an open broken line.

2. The road barrier according to Claim 1, wherein the elongated members (10) are made of a solid and compact agglomerate which mainly comprises granules and/or powders of natural and/or synthetic rubber embedded in a thermoplastic polymer binder matrix.

3. The road barrier according to Claim 2, wherein at least some of the granules and/or powders of natural and/or synthetic rubber forming said agglomerate are made of vulcanized rubber.

4. The road barrier according to Claim 3, wherein at least some of the granules and/or powders of vulcanized rubber are obtained from the recycling of discarded tires.

5. The road barrier according to Claim 2, 3 or 4, wherein the percentage of granules and/or powders of natural and/or synthetic rubber present in said agglomerate is greater than 60% and preferably also greater than 80% of the total weight of the material.

6. The road barrier according to Claim 1, wherein the elongated members (10) have a substantially M or Σ (sigma) shaped profile.

7. The road barrier according to Claim 1, wherein the elongated members (10) have a thickness ranging between 1 and 3 cm.

8. The road barrier according to Claim 1, wherein the elongated members (10) have a nominal width (w) ranging between 20 and 50 cm and/or a nominal length greater than 1 m.

9. The road barrier according to any one of the preceding claims, wherein the elongated members (10) are fixed end-to-end by means of a male-female joint and/or have a sectional modular structure.

10. A motorcyclist protection device configured to be associated with a road barrier comprising at least one elongated member (10) made of an elastomer-based composite material and configured to be firmly fixed to support posts (2) in a substantially horizontal position, wherein said at least one elongated member (10) is substantially strip-shaped and has a profile substantially in the form of an open broken line.

11. The motorcyclist protection device according to Claim 10, wherein the elongated members (10) are made of a solid and compact agglomerate which mainly comprises granules and/or powders of natural and/or synthetic rubber embedded in a thermoplastic polymer binder matrix.

12. The motorcyclist protection device according to Claim 11, wherein at least some of the granules and/or powders of natural and/or synthetic rubber which form said agglomerate are made of vulcanized rubber.

13. The motorcyclist protection device according to Claim 12, wherein at least some of the granules and/or powders of vulcanized rubber are obtained from the recycling of discarded tires.

14. The motorcyclist protection device according to Claim 11, 12 or 13, wherein the percentage of granules and/or powders of natural and/or synthetic rubber present in said agglomerate is greater than 60% and preferably also greater than 80% of the total weight of the material.

15. The motorcyclist protection device according to Claim 10, wherein the elongated members (10) comprise a substantially sigma (Σ) shaped profile.

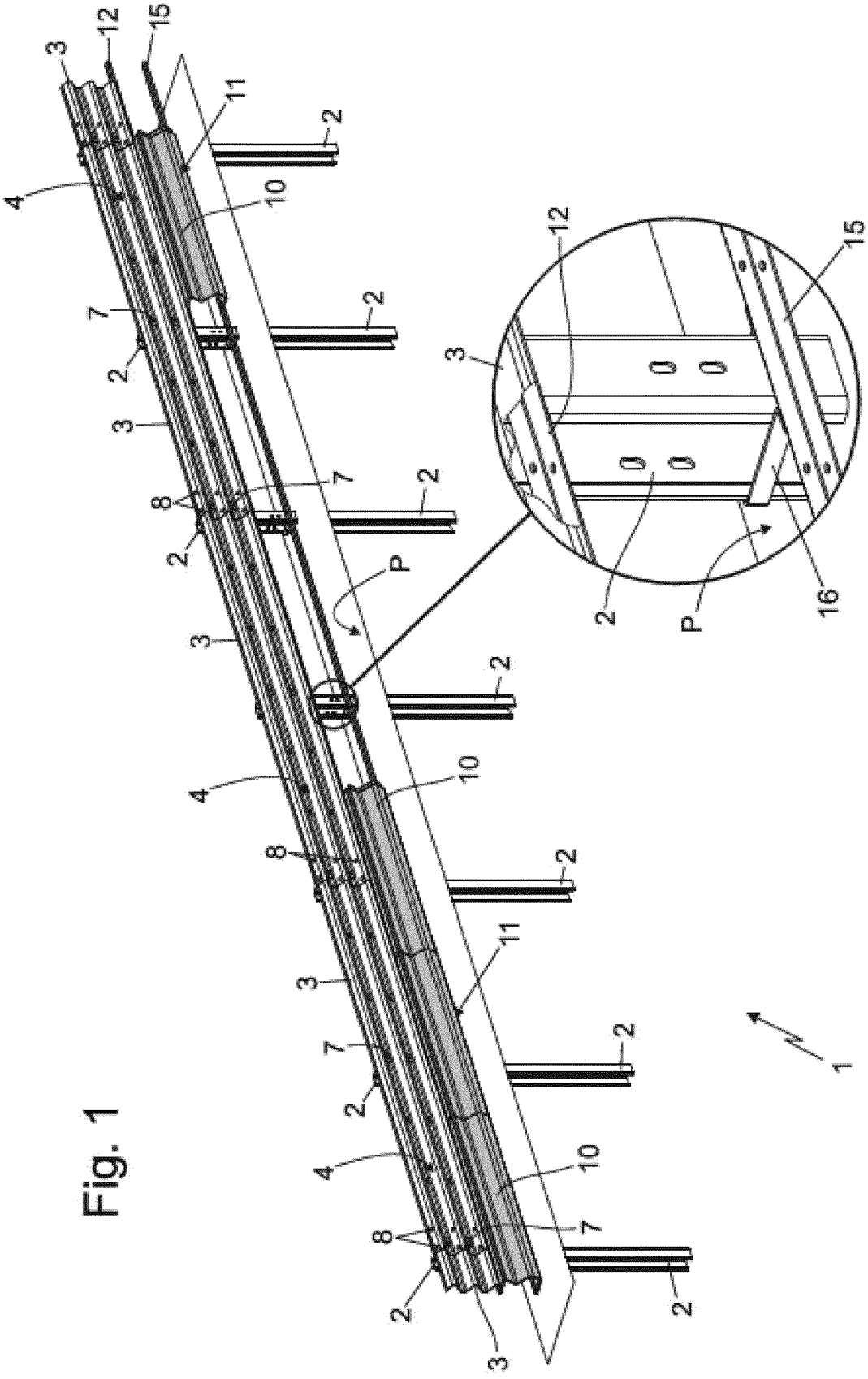

Fig. 1

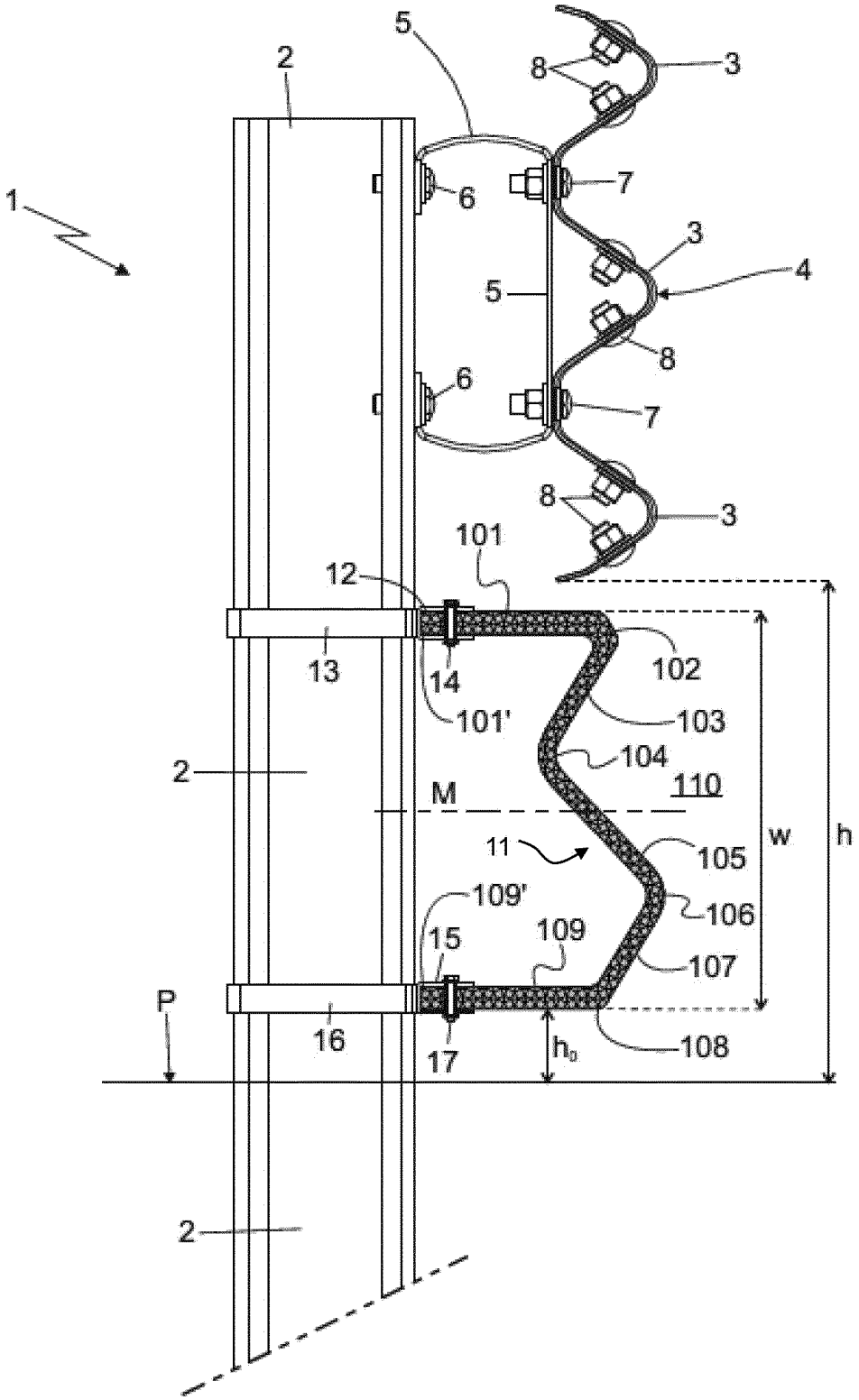
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Fig. 2

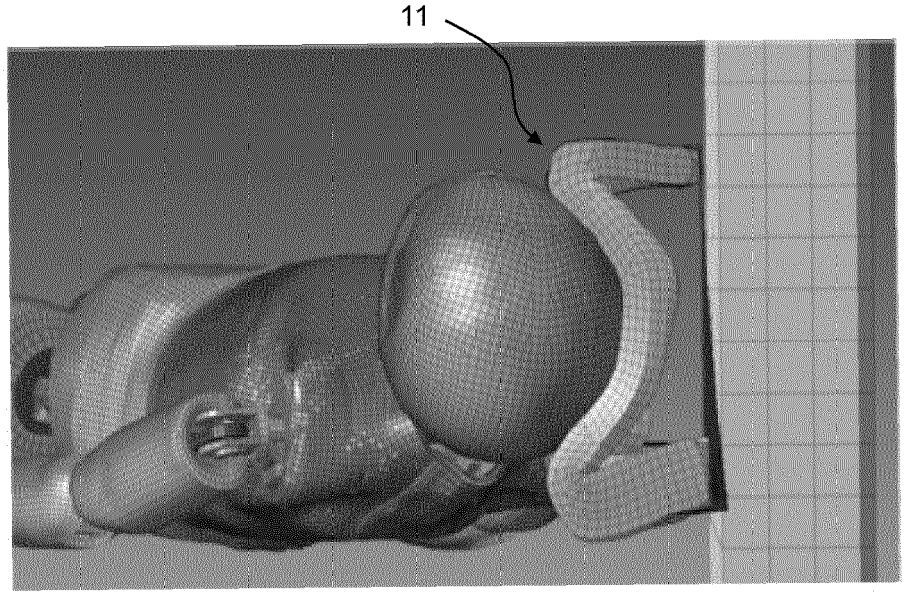

Fig. 3A

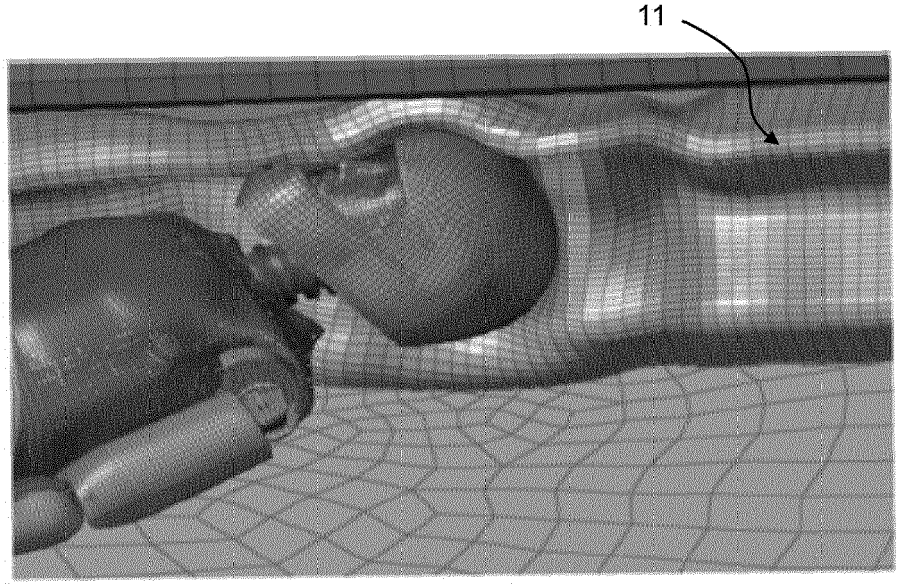

Fig. 3B

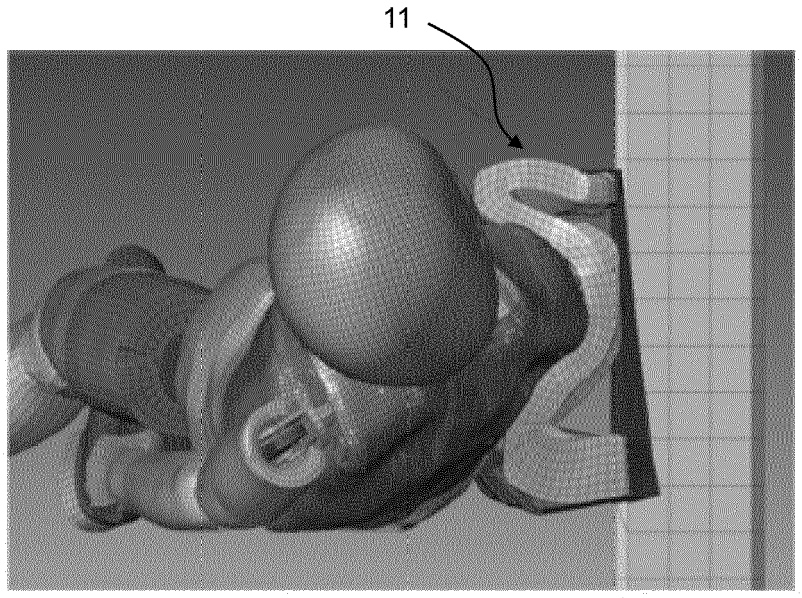

Fig. 4A

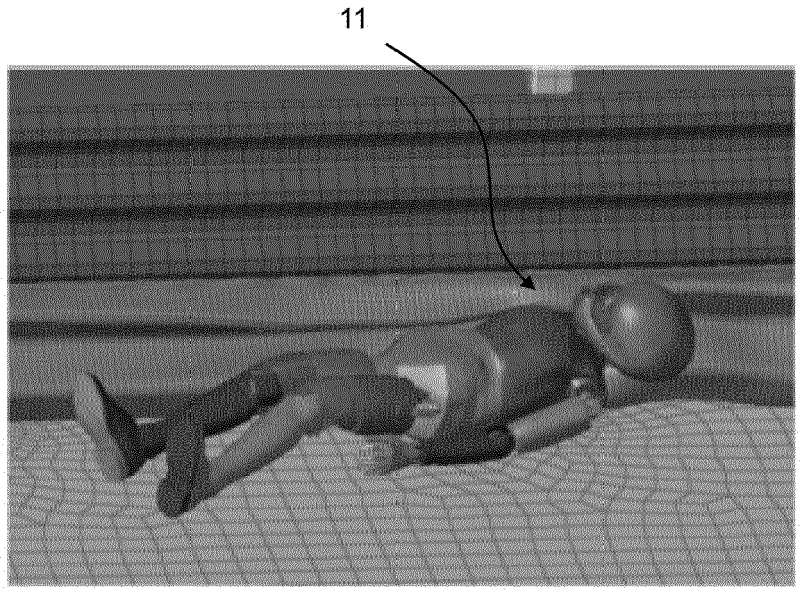

Fig. 4B

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EUROPEAN SEARCH REPORT

Application Number
EP 23 19 8825

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A	WO 2007/036593 A1 (RAYON CARLOS [ES]) 5 April 2007 (2007-04-05) * pages 2,3; figures *	1-15	

TECHNICAL FIELDS SEARCHED (IPC)

E01F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	15 January 2024	Movadat, Robin

CATEGORY OF CITED DOCUMENTS

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15-01-2024

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