(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 310 254 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
24.01.2024 Bulletin 2024/04

(21) Application number: **23186671.6**

(22) Date of filing: **20.07.2023**

(51) International Patent Classification (IPC):
E01F 15/14 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
E01F 15/143; E01F 15/146

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

(30) Priority: **21.07.2022 IT 202200015372**

(71) Applicant: **Obex Systems Ltd.**
Galway City, Co. H91 PD7H
Galway (IE)

(72) Inventors:
- **STEVANATO, Alberto**
  30035 Mirano (VE) (IT)
- **O'REILLY, Patrick**
  R51D803, Co Kildare (IE)
- **PASQUALETTO, Marco**
  30035 Mirano (VE) (IT)

(74) Representative: **Studio Torta S.p.A.**
Viale Appiani, 26
31100 Treviso (IT)

(54) TERMINAL FOR ROAD CRASH BARRIERS

(57) A terminal for road crash barriers (1) comprising: a longitudinal member (2) which is laid on and stably anchored to the ground (P); an interconnecting vertical upright (3), which is integral with, and rises above, said longitudinal member (2), and is adapted to be rigidly fixed to the end of a road crash barrier (100); a row of programmed-deformation modules (5, 6) with oblong tubular structure, which are arranged side-by-side and firmly anchored to one other, and are located in a substantially vertical position above the longitudinal member (2), starting from the interconnecting vertical upright (3), and with the lower end/mouth resting slidingly on the longitudinal member (2), so as to form a deformable fence (4) laterally fixed to the interconnecting vertical upright (3); and one and more contrast members (7), which extend cantilevered from the longitudinal member (2) and engage the lower end/mouth of at least a part of the programmed-deformation modules (5), so as to thwart/restrain the sliding of the same programmed-deformation modules (5) along the longitudinal member (2).

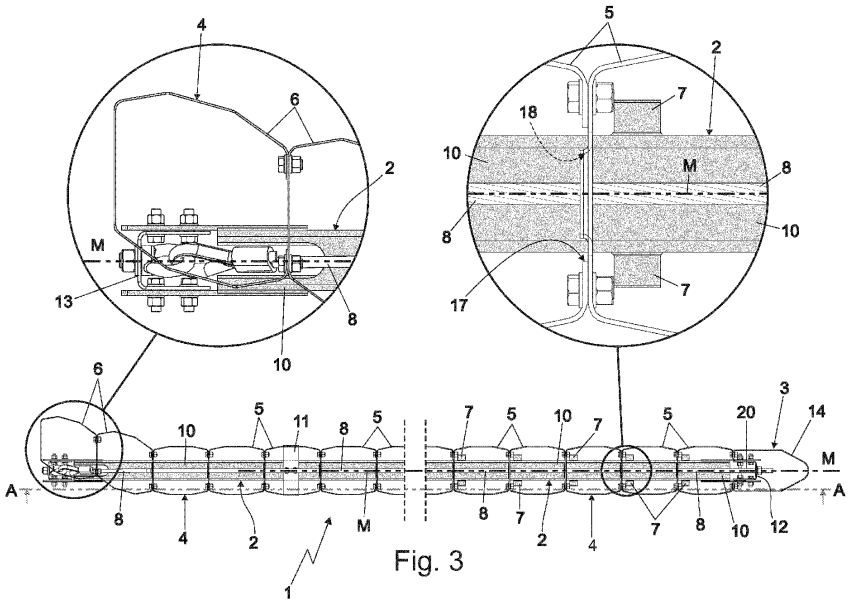


Fig. 3

EP 4 310 254 A1

Description

CROSS-REFERENCE TO RELATED PATENT APPLICATIONS

[0001] This patent application claims priority from Italian patent application no. 102022000015372 filed on July 21, 2022, the entire disclosure of which is incorporated herein by reference.

TECHNICAL FIELD

[0002] The present invention concerns a terminal for road crash barriers.

[0003] In further detail, the present invention concerns a terminal for metal programmed-deformation road crash barriers with double or triple wave cross beams. Use which the following description explicitly refers to without loss of generality.

STATE OF THE ART

[0004] As is known, the metal road crash barriers currently most widely used, traditionally called guard-rails, are made up of a series of supporting posts driven into the ground in a substantially vertical position, spaced side-by-side along the lateral edge of the roadway; and of a series of ribbon-like cross beams with double or triple wave profile, which are fixed on the supporting posts in a horizontal position one after the other, at a predetermined height from the ground, and are moreover butt-fixed to one another by means of through bolts, so as to form a longitudinal metal band that extends uninterruptedly along the lateral edge of the roadway.

[0005] Terminals for road crash barriers are special programmed-deformation metal structures, which are designed to be anchored to the ground at the end of the road crash barrier, with the function of reducing damage to things and injury to persons in the event of impact of a vehicle travelling parallel to the road crash barrier.

[0006] In further detail, the terminals for road crash barriers are designed so as to form an extension of the road crash barrier, and are structured so as to absorb, in the event of impact, a large part of the kinetic energy of the vehicle and simultaneously prevent the double or triple wave cross beams and/or other parts of the road crash barrier from wedging/ penetrating dangerously inside the vehicle, with all ensuing problems for the safety of the persons therein.

[0007] In addition, some models of terminal for road crash barriers are also structured so as to keep the vehicle on the roadway in the event of impact.

[0008] A particular model of terminal for road crash barriers is described in the patent application WO2016/087448 A1.

[0009] This terminal for road crash barriers is basically made up of: a straight longitudinal member, which extends horizontally resting on the ground so as to form an extension of the road crash barrier; a pair of vertical anchoring posts, which are driven into the ground at the two ends of the longitudinal member and are rigidly fixed to the adjacent ends of the longitudinal member so as to anchor the longitudinal member rigidly to the ground; an interconnecting element oblong in shape and with tubular structure, which is firmly fixed to the anchoring post that rises from the proximal end of the longitudinal member, and serves as an anchoring point for the free end of the last cross beam with double or triple wave profile of the road crash barrier; and a row of programmed-deformation modules oblong in shape and with straight tubular structure, which are side-by-side and securely anchored to one another and are arranged in a vertical position above the longitudinal member, partly in slidable abutment on the upper side of the longitudinal member and partly suspended above the same longitudinal member so as to form a deformable fence laterally fixed to the anchoring post which rises from the proximal end of the longitudinal member.

[0010] In addition, the terminal for road crash barriers described in the patent application WO2016/087448 A1 is also provided with a longitudinal cable, which has a first end securely fixed on the distal end of the longitudinal member, extends in a pass-through manner through the majority of the programmed-deformation modules, and finally has the second end rigidly fixed directly to the anchoring post that rises from the proximal end of the longitudinal member, at a predetermined height from the ground.

OBJECT OF THE INVENTION

[0011] Aim of the present invention is to provide a terminal for road crash barriers, which performs better than the one described in the patent application WO2016/087448 A1 and/or which offers the same performance level but is cheaper to produce.

[0012] In accordance with the above aims, according to the present invention there is provided a terminal for road crash barriers as defined in Claim 1 and preferably, though not necessarily, in any one of the claims dependent thereon.

BRIEF DESCRIPTION OF THE FIGURES

[0013] The present invention will now be described with reference to the attached drawings, which illustrate a non-limiting embodiment example, in which:

- figure 1 is a perspective view of a road crash barrier that includes a terminal for road crash barriers produced according to the teachings of the present invention;
- figure 2 is a second perspective view of the terminal illustrated in figure 1, with parts removed for clarity's sake;
- figure 3 is a plan view of the terminal for road crash

barriers illustrated in figure 2, with parts removed for clarity's sake;

- figure 4 is a perspective view of the terminal for road crash barriers illustrated in figure 3, sectioned along the section plane A-A and with parts removed for clarity's sake;
- figure 5 is a perspective view of a programmed-deformation module of the terminal for road crash barriers illustrated in the preceding figures, with parts removed for clarity's sake; whereas
- figure 6 is a plan view of a second embodiment of the terminal for road crash barriers illustrated in the preceding figures, with parts in section and parts removed for clarity's sake.

DETAILED DISCLOSURE OF EMBODIMENTS

[0014] With reference to figures 1 to 4, number 1 denotes as a whole a terminal for road crash barriers, which is preferably adapted to be anchored to the ground at the end of a road crash barrier 100, and is structured so as to reduce damage to things and injury to persons in the event of impact of a vehicle travelling in a direction d substantially parallel to the road crash barrier 100, towards the end of said road crash barrier 100.

[0015] Preferably, the road crash barrier 100 is furthermore a programmed-deformation road crash barrier.

[0016] In further detail, the road crash barrier 100 preferably comprises: a series of supporting posts 101, which are advantageously made of metallic material and are driven into the ground in a substantially vertical position, spaced side-by-side along the lateral edge of the roadway; and a series of ribbon-like cross beams 102 preferably with double or triple wave profile, which are advantageously made of metallic material and are securely fixed to the supporting posts 101 in a substantially horizontal position one after the other, at a predetermined height from the ground.

[0017] In addition, the ribbon-like cross beams 102 are preferably butt-fixed to one another so as to form a longitudinal metal band, which extends along the lateral edge of the roadway at a predetermined height from the ground, advantageously substantially without interruption.

[0018] Clearly, the road crash barrier 100 may have a different structure and/or be made at least partly of concrete, wood, polymeric material, composite material and/or other materials.

[0019] The terminal 1 is preferably adapted to form an extension of the road crash barrier 100, and is therefore adapted to be firmly anchored to the ground P along the lateral edge of the roadway.

[0020] The terminal 1 is furthermore structured so as to deform during impact of the vehicle, absorbing at least a part of the kinetic energy of the latter. In addition, the terminal 1 is preferably also structured so as to prevent, during the impact, parts of the road crash barrier 100 from accidentally penetrating into the vehicle and/or so as to keep the vehicle on the roadway in the event of impact.

[0021] With reference to figures 1 to 4, the terminal 1 comprises: a preferably substantially straight, longitudinal member 2 that extends more or less horizontally resting on the ground P, advantageously along the lateral edge of the roadway so as to form an extension of the road crash barrier 100, and is firmly anchored to the ground P; an interconnecting upright 3, which is integral with and rises above the longitudinal member 2 preferably in a substantially vertical direction, and is adapted to be rigidly fixed to the free end of the road crash barrier 100; and a row of programmed-deformation modules with oblong tubular structure, separate and distinct from one another, which are arranged side-by-side and securely anchored to one another, and are located in a roughly vertical position above the longitudinal member 2, starting from the interconnecting vertical upright 3 and preferably substantially for the entire length of the longitudinal member 2, so as to form a deformable fence 4 laterally integral with the interconnecting vertical upright 3.

[0022] Preferably the single programmed-deformation modules with oblong tubular structure have a monolithic structure.

[0023] In further detail, the interconnecting vertical upright 3 is preferably located at the proximal end of the longitudinal member 2, and preferably serves as an anchoring point for the free end of the last cross beam 102 of the road crash barrier 100.

[0024] The interconnecting vertical upright 3, furthermore, is preferably separate and distinct from the longitudinal member 2, and is preferably rigidly fixed to the longitudinal member 2. The interconnecting vertical upright 3 is preferably arranged astride the vertical mid-plane M of the longitudinal member 2.

[0025] The deformable fence 4 of programmed-deformation modules, on the other hand, includes a plurality of first programmed-deformation modules 5 with oblong tubular structure, which are arranged each with its own lower end/mouth slidingly resting on the longitudinal member 2. Preferably the programmed-deformation modules 5 are therefore separate and distinct from the longitudinal member 2.

[0026] In addition, the programmed-deformation modules 5 are preferably also arranged astride the vertical mid-plane M of the longitudinal member 2.

[0027] In other words, at least a part of the deformable fence 4 is substantially coplanar to the longitudinal member 2, i.e. it lies on the vertical mid-plane of the longitudinal member 2.

[0028] Preferably the first programmed-deformation module 5 of the deformable fence 4, furthermore, is arranged closely juxtaposed and securely anchored to the interconnecting vertical upright 3.

[0029] Preferably the programmed-deformation modules 5 furthermore have a monolithic structure.

[0030] In addition, the deformable fence 4 formed of the programmed-deformation modules preferably also

includes one or more second programmed-deformation modules 6 with oblong tubular structure, which are suspended above the longitudinal member 2, at a predetermined distance from the longitudinal member 2. Preferably also the programmed-deformation modules 6 are therefore separate and distinct from the longitudinal member 2.

[0031] Preferably the programmed-deformation modules 6 furthermore have a monolithic structure.

[0032] In further detail, with reference to figures 1, 2, 3 and 4, the deformable fence 4 preferably has a proximal section and a distal section, advantageously adjoined and complementary to each other.

[0033] The proximal section of deformable fence 4 is adjoined and integral with the interconnecting vertical upright 3, and it preferably includes a plurality of programmed-deformation modules 5 having the lower end/mouth slidingly resting on the longitudinal member 2.

[0034] Preferably the proximal section of deformable fence 4 is moreover substantially coplanar with the longitudinal member 2. In other words, the programmed-deformation modules 5 that make up the proximal section of deformable fence 4 preferably lie on the vertical mid-plane M of the longitudinal member 2.

[0035] The distal section of deformable fence 4, on the other hand, is advantageously adjoined and integral with the proximal section, and is preferably made up of one or more programmed-deformation modules 6 consecutive to one another.

[0036] Preferably, the programmed-deformation modules 6 that make up the distal section of deformable fence 4 are furthermore suspended roughly above the distal end of the longitudinal member 2.

[0037] With particular reference to figure 3, preferably the distal section of deformable fence 4 is furthermore bent/curved outwards from the roadway.

[0038] In other words, at least a part of the programmed-deformation modules 6 forming the distal section of deformable fence 4 is preferably horizontally offset from the vertical mid-plane M of the longitudinal member 2, and the lateral deviation from the vertical mid-plane M increases as the distance of the various programmed-deformation modules 6 from the interconnecting vertical upright 3 increases.

[0039] With reference to figures 2, 3 and 4, in addition the terminal 1 is moreover provided with at least one and more conveniently a plurality of protruding contrast members 7, which extend cantilevered from the longitudinal member 2 and engage the lower ends/mouths of at least a part of the programmed-deformation modules 5, so as to thwart/restrain the sliding of the lower ends/mouths of the various programmed-deformation modules 5 along the longitudinal member 2.

[0040] In further detail, each contrast member 7 is vertically aligned to a respective programmed-deformation module 5, and extends cantilevered from the longitudinal member 2 so as to protrude into the lower end/mouth of said programmed-deformation module 5.

[0041] Preferably the protruding contrast members 7 are furthermore appropriately spaced/distributed along the longitudinal member 2.

[0042] In further detail, the protruding contrast members 7 are preferably spaced/distributed along a segment of the longitudinal member 2 adjacent to and facing the interconnecting vertical upright 3.

[0043] In the example shown, in particular, the protruding contrast members 7 are preferably spaced in a substantially regular manner along the longitudinal member 2, or rather along the segment of the longitudinal member 2 located immediately beneath the proximal section of the deformable fence 4.

[0044] In a different embodiment, however, the spacing between the contrast members 7 may also progressively decrease as the distance from the interconnecting vertical upright 3 decreases.

[0045] With reference to figures 1 to 4, in addition the terminal 1 comprises also a longitudinal cable 8, which has a first end securely fixed on the interconnecting vertical upright 3 at a predetermined height from the ground, extends in a pass-through manner through at least a part of the programmed-deformation modules 5, and lastly has the second end rigidly fixed to the longitudinal member 2 advantageously in proximity of the free end of the deformable fence 4.

[0046] Preferably the longitudinal cable 8 is furthermore tensioned so as to press one or more programmed-deformation modules 5 against the longitudinal member 2, and advantageously also lies on the vertical mid-plane M of the longitudinal member substantially for its entire length.

[0047] The longitudinal cable 8 is adapted to oppose any possible misalignment, twisting and/or detachment of the deformable fence 4 from the longitudinal member 2 beneath.

[0048] With reference to figures 2, 3 and 4, in particular, the longitudinal member 2 is preferably made of metallic material, and preferably has a length greater than 1 m (metre).

[0049] Preferably the longitudinal member 2 moreover has a substantially U- or C-shaped profile. In a different embodiment, however, the longitudinal member 2 may be tubular in shape preferably with rectangular or polygonal section.

[0050] In addition, the longitudinal member 2 preferably also has a modular structure.

[0051] In the example shown, in particular, the longitudinal member 2 has a nominal length preferably ranging from 2 to 6 m (metres), and preferably comprises two or more straight metal section-bars 10 that preferably have a substantially C-shaped profile and are butt-fixed to one another in a rigid manner, advantageously via a series of connecting bolts.

[0052] Clearly in a different embodiment, the longitudinal member 2 may include one single straight metal section-bar 10.

[0053] With reference to figures 2 and 4, preferably the

longitudinal member 2 is moreover also provided with at least one substantially U-shaped, supporting bracket 11, which is adapted to embrace a programmed-deformation module 5 from opposite sides thereof, so as to maintain said programmed-deformation module 5 astride the mid-plane M of the longitudinal member 2.

[0054] In further detail, the supporting bracket 11 preferably has a ribbon-like structure, is preferably made of metallic material, and is preferably arranged above the straight metal section-bar 10, transversally to the longitudinal axis of the latter.

[0055] Preferably the supporting bracket 11 is furthermore rigidly fixed to the straight metal section-bar 10 immediately beneath via one or more connecting bolts.

[0056] With reference to figures 2, 3 and 4, preferably the longitudinal member 2 is furthermore rigidly anchored to the ground P by means of a pair of anchoring posts, advantageously located at the two ends of said longitudinal member 2.

[0057] In further detail, the terminal for road crash barriers 1 preferably also comprises: a first anchoring post 12, separate and distinct from the longitudinal member 2 and advantageously made of metallic material, which is driven into the ground at the proximal end of the longitudinal member 2, and is rigidly fixed to said proximal end of the longitudinal member 2 advantageously by means of one or more connecting bolts; and a second anchoring post 13, separate and distinct from the longitudinal member 2 and advantageously made of metallic material, which is driven into the ground at the distal end of the longitudinal member 2 and is rigidly fixed to the same distal end of the longitudinal member 2 advantageously by means of one or more connecting bolts.

[0058] In the example shown, in particular, the two anchoring posts 12 and 13 preferably consist of as many straight metal section-bars with U-section.

[0059] Clearly in a different embodiment, at least the distal end of the longitudinal member 2 may be securely anchored to the ground P by means of anchor bolts or other mechanical anchoring members.

[0060] With reference to figures 1 to 4, also the interconnecting vertical upright 3 is preferably substantially straight and preferably has a nominal height ranging between 0,5 to 1,5 m (metres).

[0061] Preferably the interconnecting vertical upright 3 is furthermore made of metallic material.

[0062] In addition, the interconnecting vertical upright 3 preferably includes the anchoring post 12, or rather the section/segment of anchoring post 12 that protrudes cantilevered from the ground P and rises upwards advantageously in a substantially vertical direction, to a predetermined height from the ground P.

[0063] In other words, the interconnecting vertical upright 3 preferably includes an anchoring post separate and distinct from the longitudinal member 2, which is partially driven into the ground P advantageously in a substantially vertical position and advantageously at the proximal end of the longitudinal member 2, and is rigidly fixed to the longitudinal member 2 advantageously by means of one or more connecting bolts, so as to fix the longitudinal member 2 firmly to the ground P.

[0064] In further detail, the interconnecting vertical upright 3 preferably comprises: the section/segment of the anchoring post 12 that protrudes cantilevered upwards beyond the longitudinal member 2, or rather beyond the proximal end of the longitudinal member 2; and an outer casing or shell 14 with rigid oblong structure, separate and distinct from the anchoring post 12, which is preferably made of metallic material, and is fitted and/or fixed securely on the anchoring post 12, at least partially covering the latter.

[0065] In further detail, the outer casing 14 is preferably substantially straight, and is preferably dimensioned so as to cover the anchoring post 12, or rather the segment of the anchoring post 12 protruding from the ground P, substantially for the entire height thereof.

[0066] The first programmed-deformation module 5 of deformable fence 4, in turn, is preferably rigidly fixed directly to the side of the interconnecting vertical upright 3, or rather to the side of anchoring post 12 and/or of outer casing or shell 14, by means of a series of connecting bolts.

[0067] With reference to figures 3 and 4, in the example shown, in particular, the outer casing 14 preferably consists of a ribbon-like straight section bar with substantially U- or C-shaped profile, which advantageously has its two longitudinal edges folded inwards, and is arranged in a substantially vertical position, astride the anchoring post 12, so as to embrace said post from both sides.

[0068] Preferably the outer casing or shell 14 is therefore arranged astride the vertical mid-plane M of longitudinal member 2.

[0069] Furthermore the ribbon-like straight section-bar forming the outer casing 14 is preferably made of metallic material, and is preferably rigidly fixed to the anchoring post 12 by means of a series of connecting bolts advantageously located on both sides of the anchoring post 12.

[0070] Preferably the ribbon-like straight section-bar forming the outer casing 14 finally also has a nominal length preferably greater than or equal to the length of the segment of the anchoring post 12 that protrudes cantilevered from the ground P.

[0071] With reference to figures 1 to 5, the programmed-deformation modules 5 and 6 of deformable fence 4, in turn, are separate and independent from each other, and are preferably rigidly fixed to each other by means of connecting bolts.

[0072] In addition, the programmed-deformation modules 5 and 6 are preferably substantially straight and are preferably substantially perpendicular to the longitudinal member 2. Preferably the programmed-deformation modules 5 and/or 6 are furthermore made of metallic material.

[0073] In addition, with particular reference to figures 2, 3, 4 and 5, each programmed-deformation module 5, 6 is preferably substantially prismatic in shape, and is

preferably fixed to the immediately adjacent programmed-deformation modules 5, 6 at two opposite flat faces of the prism.

[0074] In the example shown, in particular, at least one and more conveniently each programmed-deformation module 5 of the deformable fence 4 preferably has a straight tubular structure with roughly octagonal section. Analogously, at least one and more conveniently each programmed-deformation module 6 of the deformable fence 4 preferably has a straight tubular structure with roughly octagonal section.

[0075] Clearly, the programmed-deformation modules 5 and/or 6 may also have a straight tubular structure with substantially rectangular or hexagonal section.

[0076] Preferably one or more of the programmed-deformation modules 5 and/or 6 is/are made of press-folded sheet metal.

[0077] In other words, each programmed deformation module 5 and/or 6 is preferably formed of a ribbon-like metal sheet of suitable thickness, which is bent substantially in the shape of a C so as to form a substantially tubular structure.

[0078] In further detail, with particular reference to figure 5, in the example shown, each programmed-deformation module 5 is preferably formed of a ribbon-like metal sheet 15 of suitable thickness, which is substantially C-bent along eight bending lines parallel to its longitudinal axis, so as to form a substantially tubular structure.

[0079] Preferably the ribbon-like metal sheet 15 is furthermore substantially C-bent so as to arrange the two longitudinal edges/flaps of the ribbon-like metal sheet 15 one side-by-side and substantially coplanar to the other.

[0080] In addition, the two longitudinal edges/flaps of the ribbon-like metal sheet 15 are preferably spaced from each other, so as to form/delimit a longitudinal slit, which extends along the side of the programmed-deformation module 5 substantially for the entire length of the programmed-deformation module 5, and is advantageously also arranged astride the mid-plane of the programmed-deformation module 5.

[0081] Analogously, each programmed deformation module 6 is preferably formed of a ribbon-like metal sheet of suitable thickness, which is substantially C-bent along eight bending lines parallel to its longitudinal axis, so as to form a substantially tubular structure and, preferably, also so as to arrange the two longitudinal edges/flaps of said ribbon-like metal sheet one side-by-side and substantially coplanar to the other.

[0082] Also in the programmed-deformation module 6, the two longitudinal edges/flaps of the ribbon-like metal sheet are furthermore spaced from each other, so as to form/delimit a longitudinal slit that extends along the side of the programmed-deformation module 6, substantially for the entire length of the programmed-deformation module 6, and is advantageously also arranged astride the mid-plane of the programmed-deformation module 6.

[0083] Clearly, in a different embodiment the programmed-deformation modules 5 and/or 6 may lack the longitudinal slit.

[0084] With reference to figures 1 to 5, preferably at least a part of the programmed-deformation modules 5 moreover have their lower end/mouth arranged astride the longitudinal member 2.

[0085] In other words, the lower end/mouth of these programmed-deformation modules 5 is substantially U-shaped, so as to straddle and embrace the longitudinal member 2 on opposite sides thereof.

[0086] In further detail, at least a part of the programmed-deformation modules 5 preferably have, on the rim of their lower end/mouth, at least one coupling notch, or more conveniently a pair of reciprocally opposed coupling notches, which is/are preferably located astride the mid-plane of the programmed-deformation module 5, and is/are shaped so as to be engaged in free slidable manner by the longitudinal member 2.

[0087] The coupling notch(es) present on the rim of the lower end/mouth of the programmed-deformation module 5 allow said end/mouth to be arranged astride the longitudinal member 2.

[0088] In addition, the coupling notch(es) present on the rim of the lower end/mouth of the programmed-deformation module 5 preferably has/have a shape substantially complementary to that of the longitudinal member 2.

[0089] With reference to figures 1, 2 and 4, in the example shown, in particular, the proximal section of deformable fence 4 is preferably divided into two consecutive sectors complementary to each other.

[0090] The first sector is adjoined and integral with the interconnecting vertical upright 3, and is preferably formed of a plurality of programmed deformation modules 5, which are provided with said coupling notches on the rim of their lower end/mouth, and are arranged with their lower end/mouth astride the longitudinal member 2.

[0091] The second sector, on the other hand, preferably borders the distal section of deformable fence 4 and is preferably formed of a plurality of programmed-deformation modules 5, which simply rest on the upper side of the longitudinal member 2, namely they lack said coupling notches on the rim of their lower end/mouth.

[0092] With reference to figures 2, 4 and 5, in the example shown, in particular, the ribbon-like metal sheet 15 with C-shaped profile that forms each programmed-deformation module 5 with the lower end/mouth astride the longitudinal member 2, preferably has, on the edge that contributes to forming the lower end/mouth of the tubular structure, an advantageously substantially U-shaped, recess 16 which is arranged on the opposite side relative to the longitudinal slit 17 laterally delimited by the two longitudinal edges/flaps of said ribbon-like metal sheet 15.

[0093] Preferably the recess 16 furthermore has a shape complementary to that of the longitudinal member 2.

[0094] Preferably the width of longitudinal slit 17, on

the other hand, is slightly greater than the width of the longitudinal member 2, or rather the width of the straight section-bar 10, so as to allow the longitudinal member 2 to also engage the longitudinal slit 17 and thus be able to cross the programmed-deformation module 5 from one side to the other.

[0095] In other words, the recess 16 and the longitudinal slit 17 preferably form the coupling notches of the programmed-deformation module 5.

[0096] With reference to figures 2, 3 and 4, preferably the contrast members 7 extend cantilevered from the longitudinal member 2 so as to protrude with clearance into the lower ends/mouths of the programmed-deformation modules 5 above.

[0097] In further detail, the contrast members 7 extend cantilevered from the longitudinal member 2 preferably so as to protrude into the lower ends/mouths of only the programmed-deformation modules 5 that are arranged astride the longitudinal member 2.

[0098] In addition, the protruding contrast members 7 are preferably also arranged on the longitudinal member 2 so as to remain spaced from the lateral walls of the corresponding programmed-deformation modules 5 until the impact of the vehicle.

[0099] Preferably the protruding contrast members 7 are furthermore arranged in pairs on opposite sides of the vertical mid-plane M of longitudinal member 2, advantageously in a substantially specular position relative to the vertical mid-plane M.

[0100] In further detail, the contrast members 7 preferably consist of rigid bodies advantageously made of metallic material, which are securely fixed along the two lateral sides of the longitudinal member 2, or rather along the two lateral sides of the straight metal section-bar 10, so as to form teeth or shoulders that protrude from the longitudinal member 2 more or less orthogonally to the latter.

[0101] Clearly the protruding contrast members 7, or rather the rigid bodies, may also be fixed/arranged on the upper side of the longitudinal member 2, advantageously astride the vertical mid-plane M of the longitudinal member 2.

[0102] With particular reference to figure 4, in the example shown, each contrast member 7 preferably consists of a small block of metallic material advantageously substantially parallelepipedal in shape, which is rigidly fixed on the side of the longitudinal member 2 advantageously via welding.

[0103] Clearly the block of metallic material may be rigidly fixed to the side of longitudinal member 2 also by means of one or more connecting bolts.

[0104] With reference to figures 1 to 4, finally the longitudinal cable 8 preferably has a multi-strand structure and is preferably made of metallic material.

[0105] In addition, the longitudinal cable 8 preferably has a substantially horizontal starting segment, which extends more or less parallel to the longitudinal member 2 and crosses the programmed-deformation modules 5 of the proximal section of deformable fence 4, engaging pass-through openings 18 made in each programmed-deformation module 5, advantageously astride the mid-plane of the programmed-deformation module 5; and a descending final segment, which extends obliquely underneath the programmed-deformation modules 6 of the distal section of deformable fence 4, and ends on the longitudinal member 2.

[0106] Preferably the first end of longitudinal cable 8 is moreover firmly fixed to the interconnecting vertical upright 3 by the interposition of a screw tensioning device 20 or similar.

[0107] The second end of longitudinal cable 8, on the other hand, is preferably rigidly connected directly to the distal end of the longitudinal member 2.

[0108] Operation of the terminal for road crash barriers 1 is easily inferable from the above description.

[0109] In the event of impact of a vehicle moving in direction d, the programmed-deformation modules 6 of the distal section of deformable fence 4 and the programmed-deformation modules 5 of the proximal section of deformable fence 4 are squashed/ deform, while absorbing at least a part of the kinetic energy of the vehicle.

[0110] The contrast members 7 located along the longitudinal member 2 increase the rigidity to squashing of the programmed-deformation modules 5 nearest to the interconnecting vertical upright 3, thus increasing the amount of energy necessary for the plastic deformation thereof.

[0111] The advantages linked to the particular structure of the terminal for road crash barriers 1 are remarkable.

[0112] The presence of the protruding contrast members 7 along the longitudinal member 2 allows the absorption capacity of the kinetic energy of the vehicle to be significantly increased.

[0113] The presence of the contrast members 7, furthermore, allows to reduce, at equal performances, the thickness of all or some of the programmed-deformation modules that form the deformable fence 4, thus reducing the overall weight of the structure and, therefore, the production costs of the terminal 1.

[0114] Lastly, it is clear that modifications and variations may be made to the terminal for road crash barriers 1 and/or to the road crash barrier 100 described above without departing from the scope of the present invention.

[0115] For example, the protruding contrast members 7, or rather the projecting rigid bodies, may be arranged on the longitudinal member 2 so as to remain permanently in abutment on a lateral wall of the corresponding programmed-deformation module 5.

[0116] In addition, the pass-through openings 18 on the programmed-deformation modules 5 may be arranged at different heights from the longitudinal member 2 so that the starting segment of the longitudinal cable 8 extends above the longitudinal member 2 following a zig-zag path.

[0117] This expedient increases the friction in the con-

tact points between the longitudinal cable 8 and the various programmed-deformation modules 5, thus increasing the capacity of the terminal 1 to absorb the kinetic energy of the vehicle in the event of an impact.

[0118] With reference to figure 6, optionally, along the longitudinal cable 8 there are also arranged clamps 21 that are shaped/ dimensioned so that they cannot pass through the pass-through openings 18 on the programmed-deformation modules 5.

[0119] In the event of impact of a vehicle, the clamps 21 lodge on the walls of the programmed-deformation modules 5 and oppose the squashing of the latter, thus increasing the capacity of the terminal 1 to absorb the kinetic energy of the vehicle in the event of impact.

[0120] Again with reference to figure 6, optionally one or more programmed-deformation modules 5 are also provided with transversal braces 22 preferably made of metallic material and preferably with ribbon-like structure, which extend bridge-like between two opposite lateral walls of the programmed-deformation module 5, more or less perpendicular to the vertical mid-plane M of longitudinal member 2, so as to be stretched during squashing of the programmed-deformation module 5.

[0121] Lastly, in a less sophisticated embodiment, the deformable fence 4 may lack the distal section.

Claims

1. A terminal for road crash barriers (1) comprising: a longitudinal member (2) which is laid on and stably anchored to the ground (P); an interconnecting vertical upright (3), which is integral with, and rises above, said longitudinal member (2), and is adapted to be rigidly fixed to the end of a road crash barrier (100); and a row of programmed-deformation modules (5, 6) with oblong tubular structure, which are arranged side-by-side and firmly anchored to one other, and are located in a substantially vertical position above the longitudinal member (2), starting from the interconnecting vertical upright (3), so as to form a deformable fence (4) laterally fixed to said interconnecting vertical upright (3);

   said deformable fence (4) including a plurality of first programmed-deformation modules (5) each arranged with its lower end/mouth resting slidingly on the longitudinal member (2) ;
   the terminal for road crash barriers (1) being **characterized by** additionally comprising one and more contrast members (7), which extend cantilevered from the longitudinal member (2) and engage the lower end/mouth of at least part of said first programmed-deformation modules (5), so as to thwart /restrain the sliding of the lower ends/mouths of the same programmed-deformation modules (5) along the longitudinal member (2).

2. The terminal for road crash barriers according to Claim 1, wherein the or each contrast member (7) is vertically aligned to a corresponding first programmed-deformation module (5), and extends cantilevered from the longitudinal member (2) so as to protrude within the lower end/mouth of the same first programmed-deformation module (5).

3. The terminal for road crash barriers according to Claim 1 or 2, wherein at least part of said first programmed-deformation modules (5) has its lower end/mouth arranged astride said longitudinal member (2).

4. The terminal for road crash barriers according to Claim 3, wherein the lower end/mouth of said first programmed-deformation modules (5) is substantially U-shaped, so as to straddle and embrace the longitudinal member (2) on opposite sides thereof.

5. The terminal for road crash barriers according to Claim 4, wherein said first programmed-deformation modules (5) have, on the rim of the lower end/mouth thereof, at least one coupling notch (16, 17) shaped so as to be slidingly engaged by said longitudinal member (2).

6. The terminal for road crash barriers according to Claim 5, wherein said at least one coupling notch (16) has a shape substantially complementary to that of the longitudinal member (2) .

7. The terminal for road crash barriers according to any one of the preceding claims, wherein said deformable fence (4) additionally includes one or more second programmed-deformation modules (6) suspended above said longitudinal member (2).

8. The terminal for road crash barriers according to any one of the preceding claims, wherein at least one of said first programmed-deformation modules (5) and/or at least one of said second programmed-deformation modules (6) has a substantially straight tubular structure with an approximately octagonal section.

9. The terminal for road crash barriers according to any one of the preceding claims, wherein at least one of said first programmed-deformation modules (5) and/or at least one of said second programmed-deformation modules (6) is/are made of press-folded sheet metal.

10. The terminal for road crash barriers according to any one of the preceding claims, wherein said contrast members (7) are spaced/distributed along a segment of the longitudinal member (2) adjacent to said interconnecting vertical upright (3).

11. The terminal for road crash barriers according to any one of the preceding claims, wherein said contrast members (7) are located along the sides of the longitudinal member (2), in pairs on opposite sides of the longitudinal member (2).

12. The terminal for road crash barriers according to any one of the preceding claims, wherein said contrast members (7) include rigid bodies that are fixed to the longitudinal member (2) so as to form as many teeth or shoulders that protrude from the longitudinal member (2) nearly orthogonally to the latter.

13. The terminal for road crash barriers according to any one of the preceding claims, wherein the interconnecting vertical upright (3) is located at the proximal end of said longitudinal member (2).

14. The terminal for road crash barriers according to any one of the preceding claims, **characterized by** additionally comprising a longitudinal cable (8) that has a first end fixed to the interconnecting vertical upright (3) at a predetermined height from the ground, extends in pass-through manner across at least a part of said first programmed-deformation modules (5), and finally has the second end rigidly fixed to the longitudinal member (2).

15. The terminal for road crash barriers according to Claim 14, wherein said longitudinal cable (8) has a substantially horizontal starting segment that crosses said first programmed -deformation modules (5) engaging some pass-through openings (18) specifically made in each module, and a descending final segment that ends on the longitudinal member (2).

16. The terminal for road crash barriers according to Claim 14 or 15, wherein the first end of said longitudinal cable (8) is fixed to the interconnecting vertical upright (3) with the interposition of a tensioning device (20) and/or wherein the second end of the longitudinal cable (8) is rigidly connected to the distal end of said longitudinal member (2).

17. The terminal for road crash barriers according to any one of the preceding claims, wherein said deformable fence (4) includes a distal section, which is made up of one or more second programmed-deformation modules (6) suspended above said longitudinal member (2), and which is additionally bent/curved outwards from the roadway.

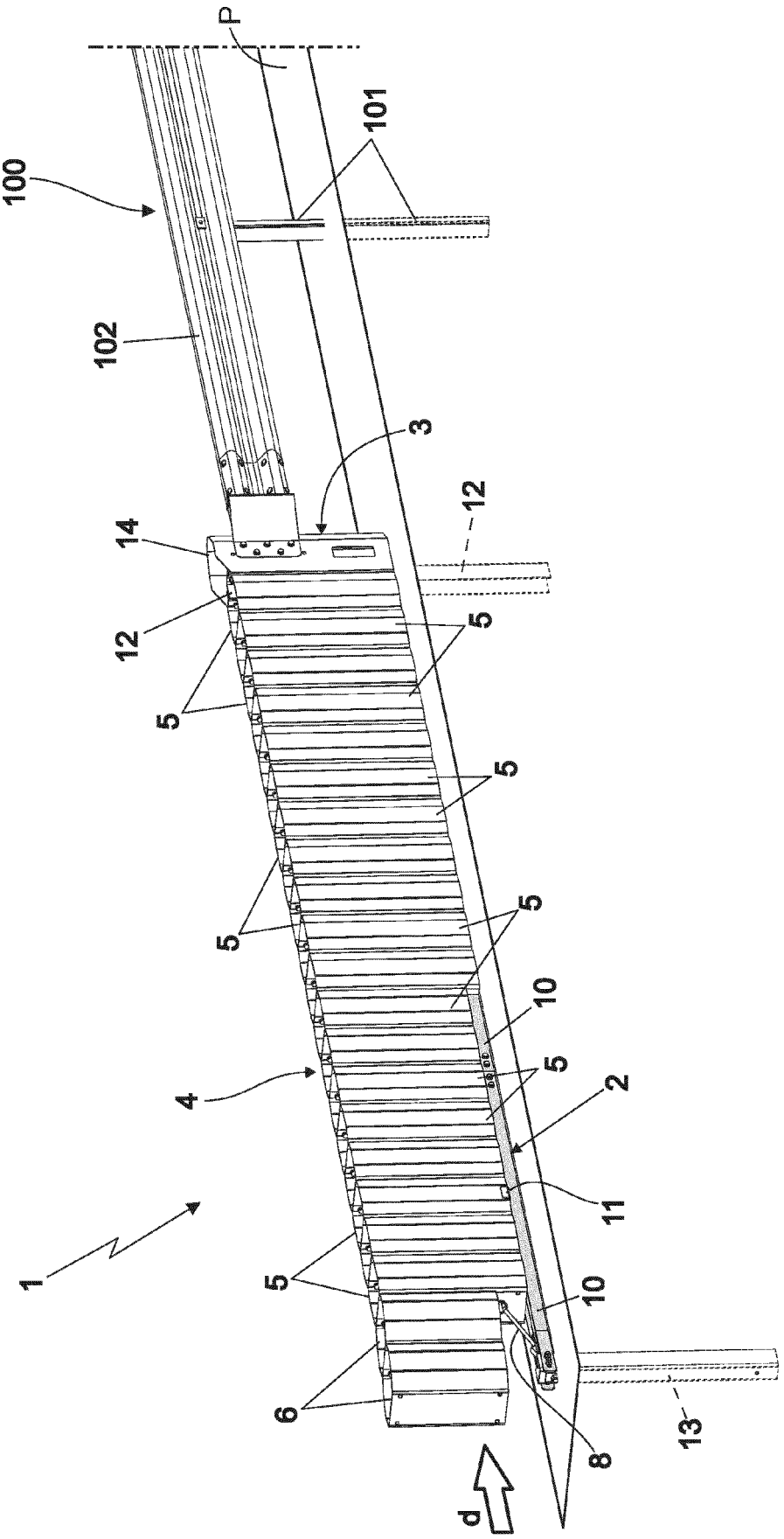
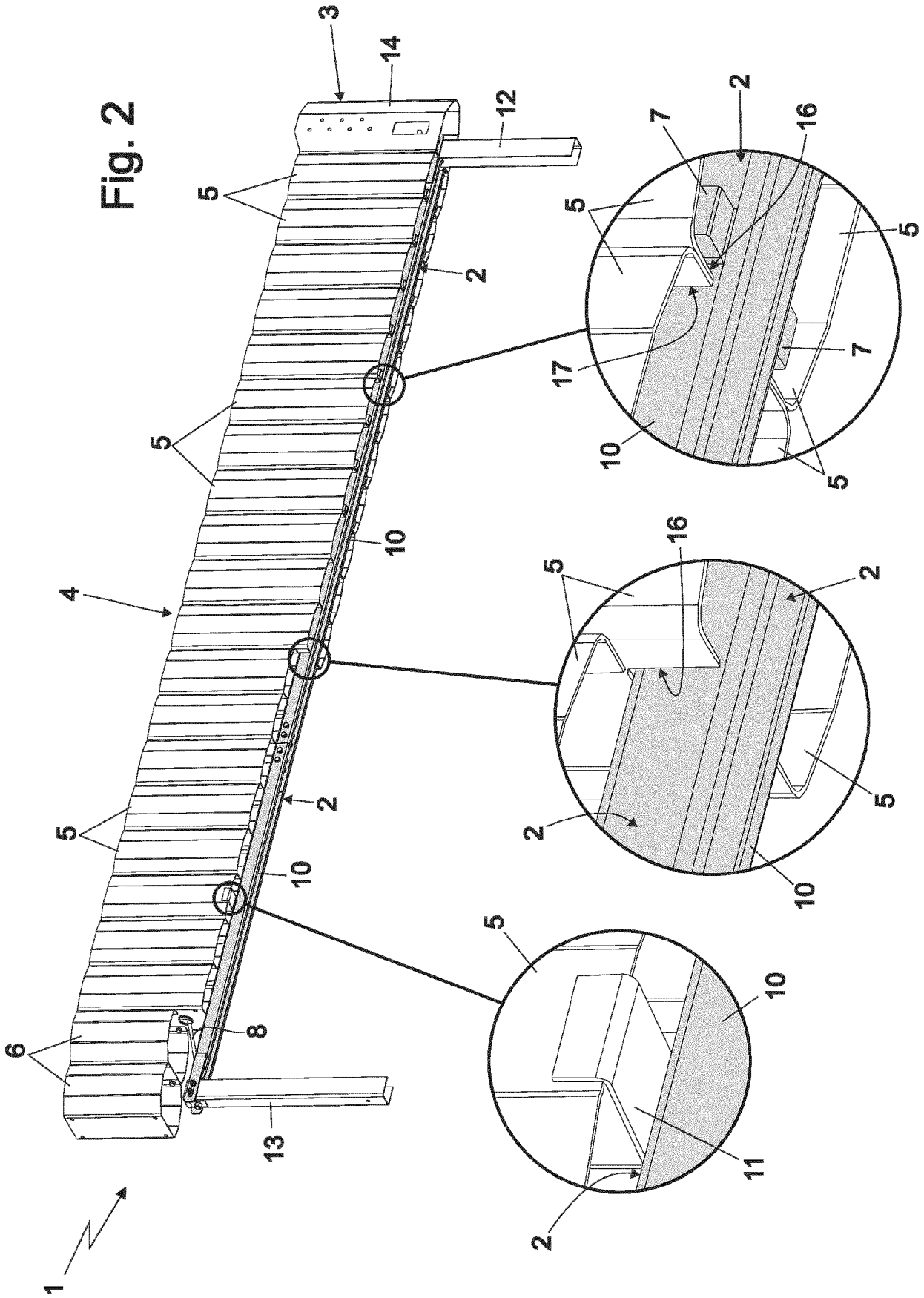


Fig. 1

Fig. 2



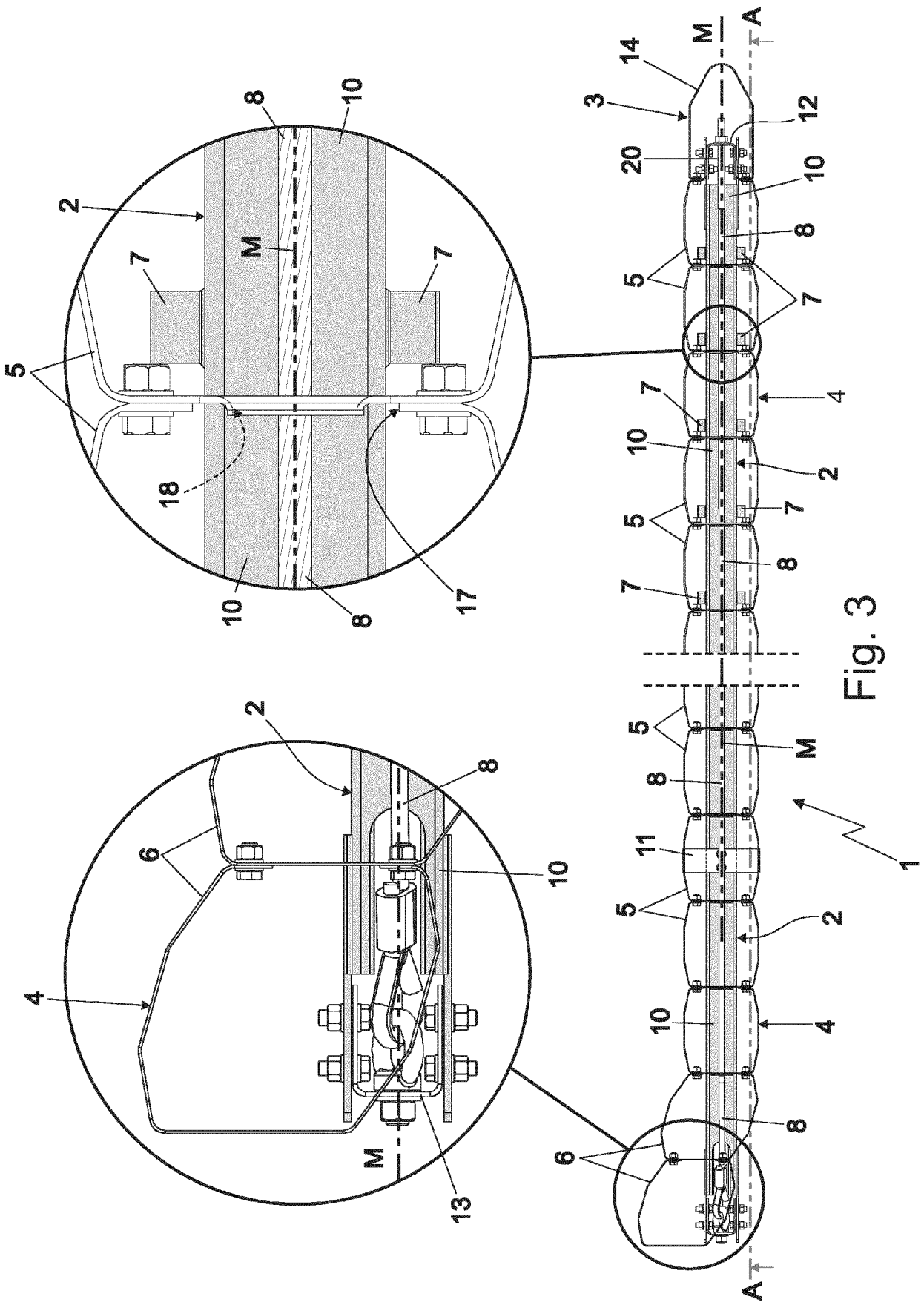
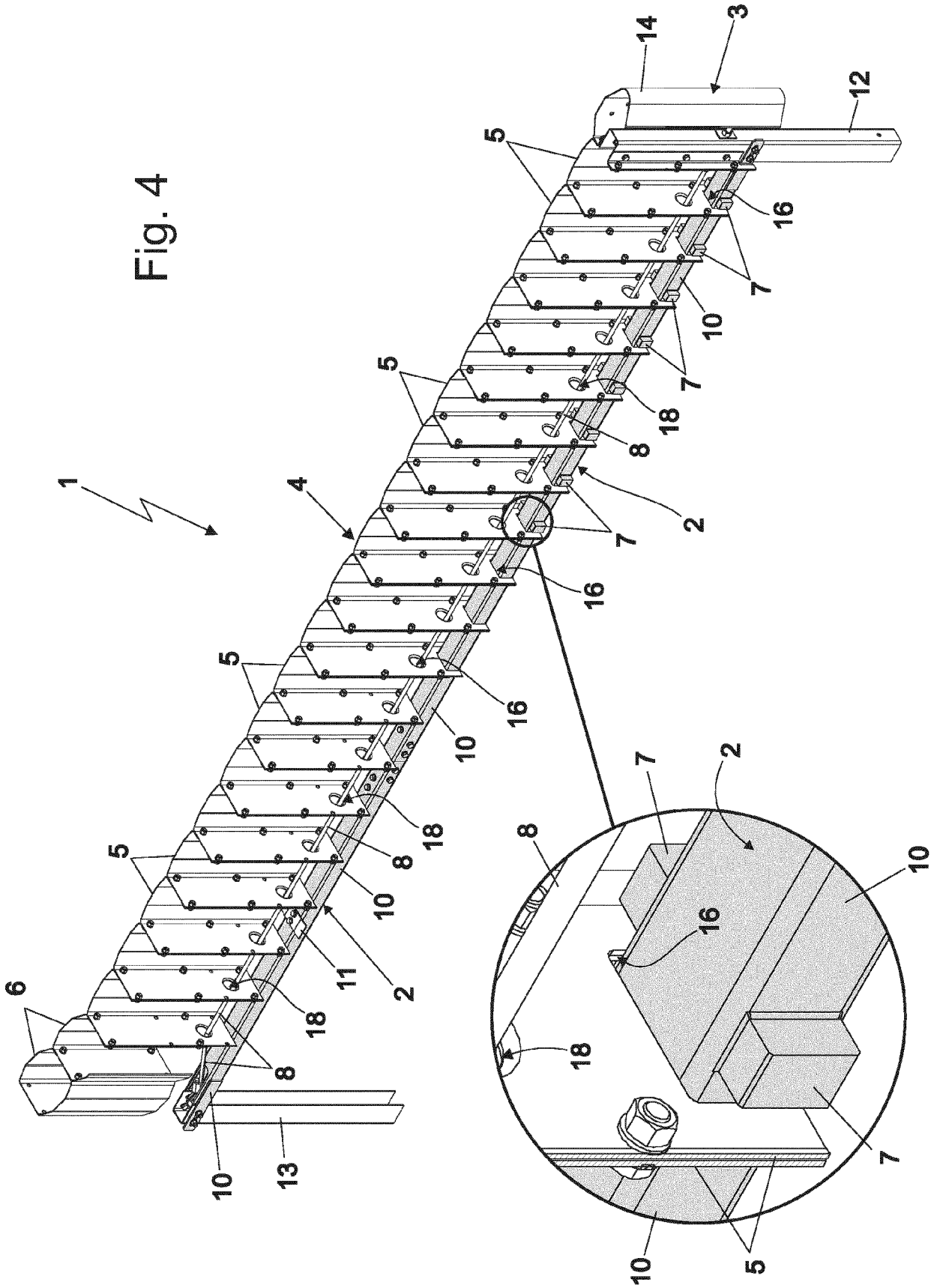


Fig. 3

Fig. 4



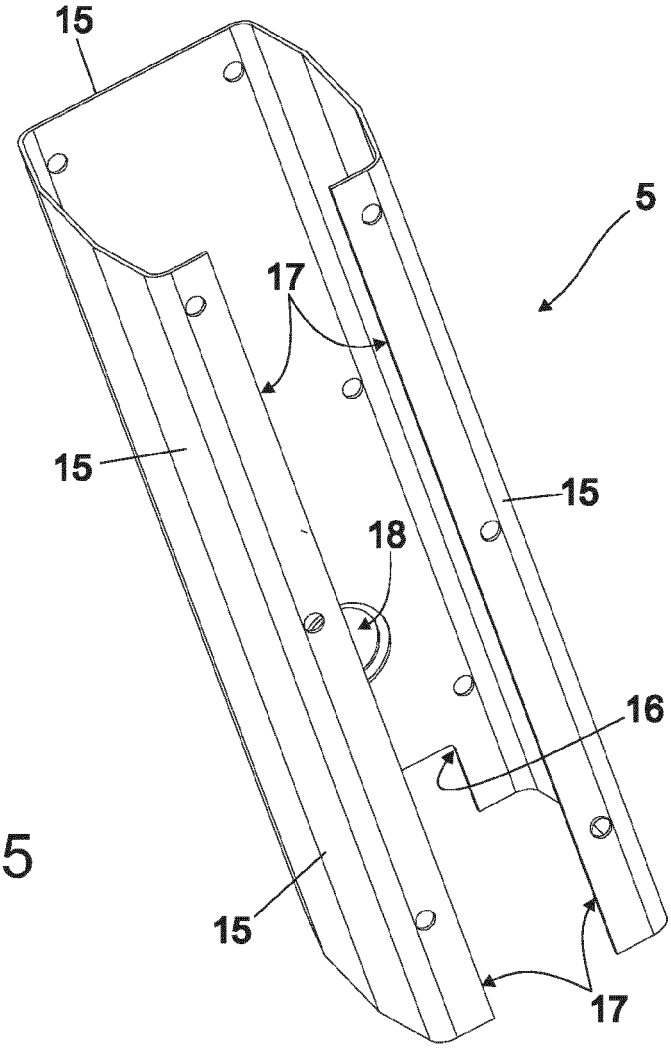

15
5
17
15
15
18
16
15
17

Fig. 5

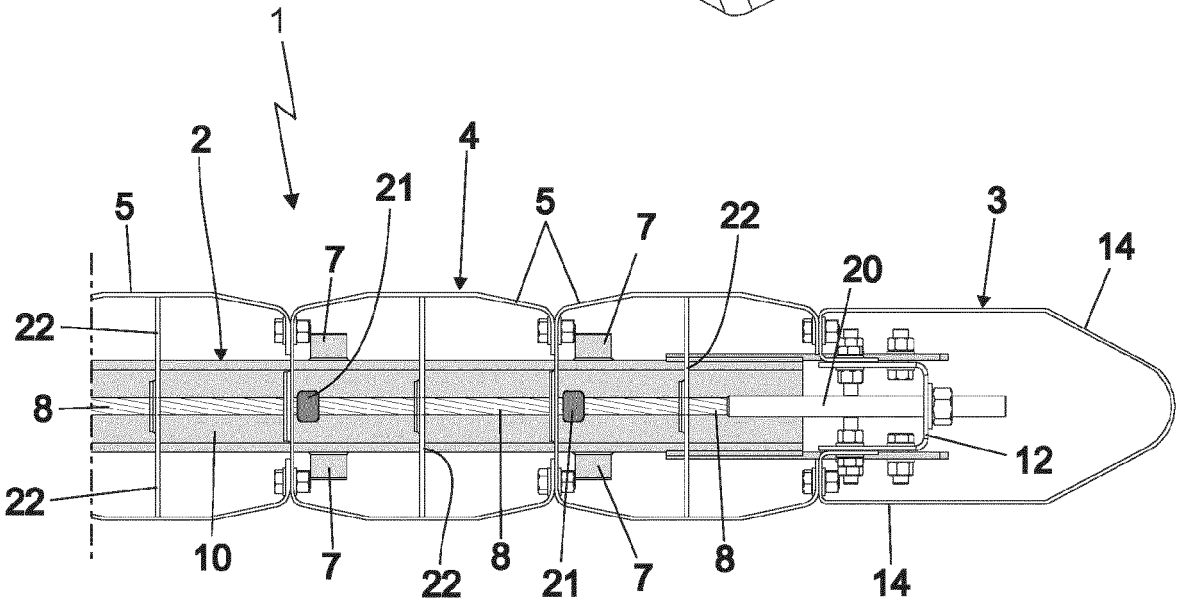

1
2
4
21
5
5
7
22
3
14
7
20
22
8
12
22
10
7
22
8
21
7
8
14

Fig. 6

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 23 18 6671

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y A	KR 2014 0096768 A (KANG SUNG KU [KR]) 6 August 2014 (2014-08-06) * abstract; figures 1-5a *	1-6,9,13 7,8, 14-17 10-12	INV. E01F15/14
Y,D A	WO 2016/087448 A1 (OBEX SYSTEMS LTD [IE]) 9 June 2016 (2016-06-09) * page 1, line 5 - line 8 * * page 7, line 4 - page 15, line 27; figures 1-6 *	7,8, 14-17 10-12	
A	DE 203 17 174 U1 (SPS SCHUTZPLANKEN GMBH [DE]) 8 April 2004 (2004-04-08) * paragraph [0001] * * paragraph [0020] - paragraph [0027]; figures 1-5 *	1-17	
A	DE 20 2005 006224 U1 (SPS SCHUTZPLANKEN GMBH [DE]) 2 March 2006 (2006-03-02) * the whole document *	1-17	

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	28 September 2023	Giannakou, Evangelia

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 23 18 6671

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

28-09-2023

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
KR 20140096768 A	06-08-2014	NONE	
WO 2016087448 A1	09-06-2016	BR 112017011577 A2	27-02-2018
		EP 3230530 A1	18-10-2017
		US 2017362788 A1	21-12-2017
		WO 2016087448 A1	09-06-2016
DE 20317174 U1	08-04-2004	NONE	
DE 202005006224 U1	02-03-2006	NONE	

EPO FORM P0459

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

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- IT 102022000015372 **[0001]**
- WO 2016087448 A1 **[0008] [0010] [0011]**