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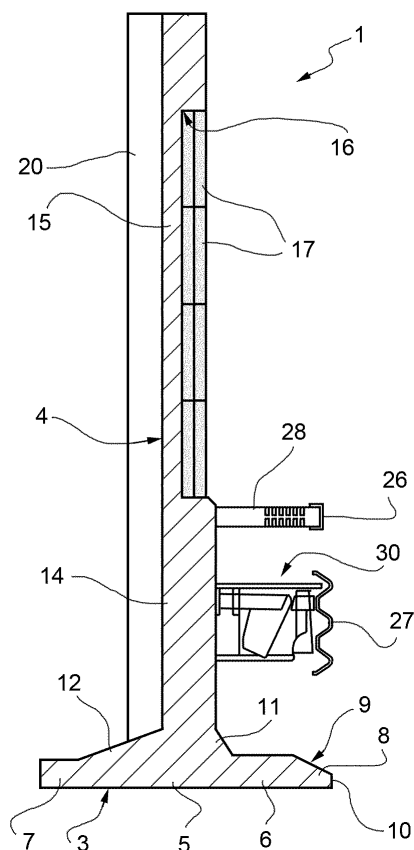
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(54) **Integrated road barrier**

(57) Integrated road barrier (2) comprising a plurality of prefabricated freestanding modules (1; 34) adapted to be positioned aligned one after the other along the edge of a carriageway, and a plurality of connection devices (20) configured so as to connect said modules two by two, each module (1, 34) comprising a monolithic body of reinforced concrete comprising a base (3) adapted to permanently rest on a supporting surface and a vertical wall (4) extending from a longitudinal median area (5) of the base (3). The vertical wall (4) comprises a lower portion (14) having predetermined resistance characteristics and an upper portion (15) supporting sound absorbing (17) and/or sound isolating (35) means in a position facing said carriageway. The barrier (2) furthermore comprises longitudinal metal safety elements (26, 27) fixed to said lower portion (14) of said vertical wall (4).

FIG. 2



Description

[0001] The present invention refers to an integrated road barrier. As is known, at the sides of roads, and in particular of motorways, safety barriers are used to prevent vehicles from veering off the carriageway.

[0002] Ideally, safety barriers should be able to absorb as far as possible the kinetic energy of the impacting vehicle, limiting the effects of the impact on the occupants, the risk of the vehicle straying off the carriageway (particularly serious when the barrier is a central median barrier and straying off the carriageway results in the car crossing over into the carriageway on the other side) and the effect of "rebound" into the original carriageway.

[0003] Safety barriers are known consisting of a plurality of concrete modules resting on the road surface and linked to one another, so that the energy transmitted by the impact onto one of the modules is at least partially transmitted to the adjacent modules, causing an overall chain deformation. A typical production form consists of the so-called "New Jersey" barriers, i.e. blocks with substantially trapezoidal cross section.

[0004] Solutions of this type tend to be effectively used as central barriers on dual carriageways, since they are very effective in preventing vehicles from jumping the carriageway. However, since they are very rigid, their behaviour is less satisfactory in terms of energy absorption.

[0005] For the purposes of kinetic energy absorption, the metal safety barriers commonly known as guardrails are preferable, consisting of a corrugated metal sheet (with two or three corrugations) connected by means of collapsible supports to posts anchored in the ground. However, guardrails are less effective for the purposes of preventing vehicles from jumping the carriageway.

[0006] Road sound barriers are also known. Said barriers have a modular structure. Each module is normally made of concrete, and is configured as a vertical wall element. According to a first known solution, the modules are inserted between uprights appropriately profiled and anchored to the ground. According to another known solution, the modules are freestanding and are provided with an integral base adapted to rest on the road surface.

[0007] On the side facing the road, the sound barriers are normally provided with a coating of sound absorbing material.

[0008] In some situations, in particular on motorway sections located near built-up areas, the need for safety and noise reduction coexists.

[0009] For this purpose, integrated barriers have been proposed. Examples of known solutions are illustrated in the documents EP-A-1528158 and WO01/06063.

[0010] The object of the present invention is the production of an improved integrated road barrier, which has optimal characteristics of safety and sound isolation, and in addition is easy to install and requires inexpensive maintenance operations following vehicle impact.

[0011] The above-mentioned object is achieved by a

barrier according to claim 1.

[0012] For a better understanding of the present invention, two preferred embodiments are described below by way of nonlimiting examples and with reference to the accompanying drawings, in which:

figure 1 is a front elevation view of a module of a first embodiment of integrated barrier according to the present invention;

figure 2 is a section along the line II-II of figure 1;

figure 3 is a perspective view illustrating the connection between adjacent modules;

figure 4 is a front elevation view of a module of a second embodiment of integrated barrier according to the present invention;

figure 5 is a section according to the line V-V of figure 1.

[0013] With reference to figures 1 and 2, 1 indicates as a whole a prefabricated freestanding module for an integrated road barrier 2 produced according to the present invention.

[0014] The module 1 is appropriately made of reinforced concrete, has a monolithic structure and comprises a base 3 adapted to rest on the road surface and a vertical wall 4 extending upwards in an overhanging manner from an intermediate longitudinal area 5 of the base 3. The height of the module 1 is appropriately equal to approximately 4 metres and the width approximately 2.5 metres.

[0015] The base 3 has a front portion 6 extending from the side of the vertical wall 4 adapted to face towards the road, and a rear portion 7 extending from the opposite side of the vertical wall 4.

[0016] The portion 6 has an upwardly tapered terminal area 8, defining a ramp 9 adjacent to a front edge 10 with reduced height. The portion 6 and the portion 7 have respective areas 11, 12 adjacent to the wall 3 with thickness progressively increasing towards the wall, so as to define a greater interlocking section of the vertical wall 4 with respect to the base 3. Appropriately, the area 12 has a greater transverse extension than the area 11.

[0017] The vertical wall 4 has a base portion 14 having predetermined characteristics of mechanical resistance and an upper portion 15 defining a cavity 16 facing the road side and housing sound absorbing panels 17. In the example illustrated, there are twenty square panels arranged in four horizontal rows and five columns.

[0018] The module 1 furthermore comprises a pair of flanges 20 extending all along the vertical edges of the vertical wall 4, on the side opposite the road.

[0019] The flanges 20, in addition to having a stiffening function, serve to connect the modules 1 to one another to form the barrier 2 (fig. 3).

[0020] With particular reference to the enlarged detail illustrated in fig. 3, the connection between two adjacent modules 1 is achieved by means of a connection device 21 adapted to clamp together the flanges 20, positioned

in contact with one another, of the two modules 1. The connection device 21 comprises a rod 22 mounted so as to pass through respective holes (not illustrated) axially facing one another of the flanges 20 and provided with threaded ends 23.

[0021] Said ends 23 are fitted with respective collapsible elements 24 with elasto-plastic behaviour, which are tightly packed together against the respective flanges 20 by pairs of nuts/lock nuts 25. In the example illustrated, the collapsible elements 24 consist of tubular metal sleeves arranged with axis perpendicular to the axis of the rod 22 and to the plane of the vertical wall 4 and provided with cross holes not illustrated for the passage of the rod 22.

[0022] Between each collapsible element 24 and the respective nut/lock nut pair 25, a washer 31 is appropriately positioned.

[0023] In order to avoid interference between the collapsible elements 24 and the vertical wall 4, and to favour screw tightening of the nuts/lock nuts 25, the wall 4 is provided with recesses 32 adjacent to the respective flanges 20.

[0024] According to a further characteristic of the present invention, on the base portion 14 of the modules 1 one or more safety elements 26, 27 are fixed, extending horizontally along the barrier 2.

[0025] In the embodiment illustrated, two elements 26, 27 are provided, upper and lower respectively.

[0026] The upper element 26 consists of a channel, which is fixed to the lower portion 14 by means of a plurality of collapsible tubular elements 28.

[0027] The lower element 27 appropriately consists of a corrugated strip with triple corrugation, which is fixed to the lower portion 14 by means of collapsible supports 30 of known type and not described in detail.

[0028] Figures 4 and 5 illustrate a second embodiment of a module for integrated barriers according to the present invention, described below in the elements that differ from the module 1, using the same reference numbers to indicate parts equal or similar to parts already described.

[0029] The module, indicated overall by the number 34, has an overall height of approximately 6 metres and differs from the module 1 described substantially due to the fact that an upper portion of the vertical wall 4 is slotted and houses a transparent sound absorbing panel 35, for example made of stratified poly(methyl methacrylate) (PMMA) with a thickness of approximately 15 mm.

[0030] The panel 35 is inserted from above between respective sides 36.

[0031] In order to increase resistance to overturning due to the wind, the rear portion 7 of the base 3 has a greater thickness, and the flanges 20 comprise a lower portion 37 having a greater transverse dimension, progressively decreasing from the base 3.

[0032] The connection methods between the panels 35 are analogous to those described previously for the modules 1.

[0033] The barrier 2 formed by the modules 1 or 37 functions as follows.

[0034] In the event of vehicle impact, the kinetic energy of the vehicle is initially partially absorbed by the safety barrier elements 26, 27.

[0035] The fraction of energy not absorbed by said elements causes a movement of the module 1 or 34 receiving the impact and of the modules adjacent and connected to it, said movement being made possible by the sliding of the base 3 on the road surface. Said sliding entails a very high friction and therefore in turn causes the absorption of another fraction of the vehicle impact energy.

[0036] The front edge 10 with reduced height and the ramp 9 of the base 3 favour ascent of the wheels of the impacting vehicle; therefore a part of the weight of the vehicle is added to the weight of the modules and the friction force generated in the sliding of the modules with respect to the road surface is increased.

[0037] The remaining impact energy is absorbed not only by the partial local deformation of the modules 1 or 37 but also by the connection devices 21 and in particular by the elasto-plastic deformation of the collapsible elements 24, which substantially reduce the tractive force on the rod 22 resulting from the impact of a vehicle.

[0038] From an examination of the characteristics of the barrier 2 formed by the modules 1 or 34, the advantages of the present invention are evident.

[0039] The barrier 2, which combines the functions of a sound barrier and safety barrier, is produced with free-standing modules which can be installed very simply and rapidly. The base 3 of the modules, in addition to guaranteeing self-stability, allows maximisation of the friction forces with the road surface in the event of impact, and therefore contributes with the safety elements 26, 27 to mitigating the effects of the impact on the vehicle passengers, and to limiting the damage to the modules following the impact, making it inexpensive to restore the barrier.

[0040] Lastly it is clear that modifications and variations which do not depart from the protective scope of the claims can be made to the barrier 2 described.

[0041] For example, the vertical wall of the modules could be provided with upper lag bolts for any addition of extra upper modules, for example modules provided with photovoltaic panels, sound absorbing panels, transparent panels, etc.

[0042] The base 3 could rest on a supporting surface at ground level for earth embankment roads, so that the barrier 2 can act as a containment for the embankment. Analogously, in the case of open-cut roads, the barrier 2 resting on the road surface can act as a containment for the earth at the sides of the road.

[0043] The connection devices 21 between adjacent modules can be produced in different ways. In particular, the collapsible elements 24 can consist of blocks of open or closed cell metal foam. The rod may not be threaded at one end and may comprise an integral stop element

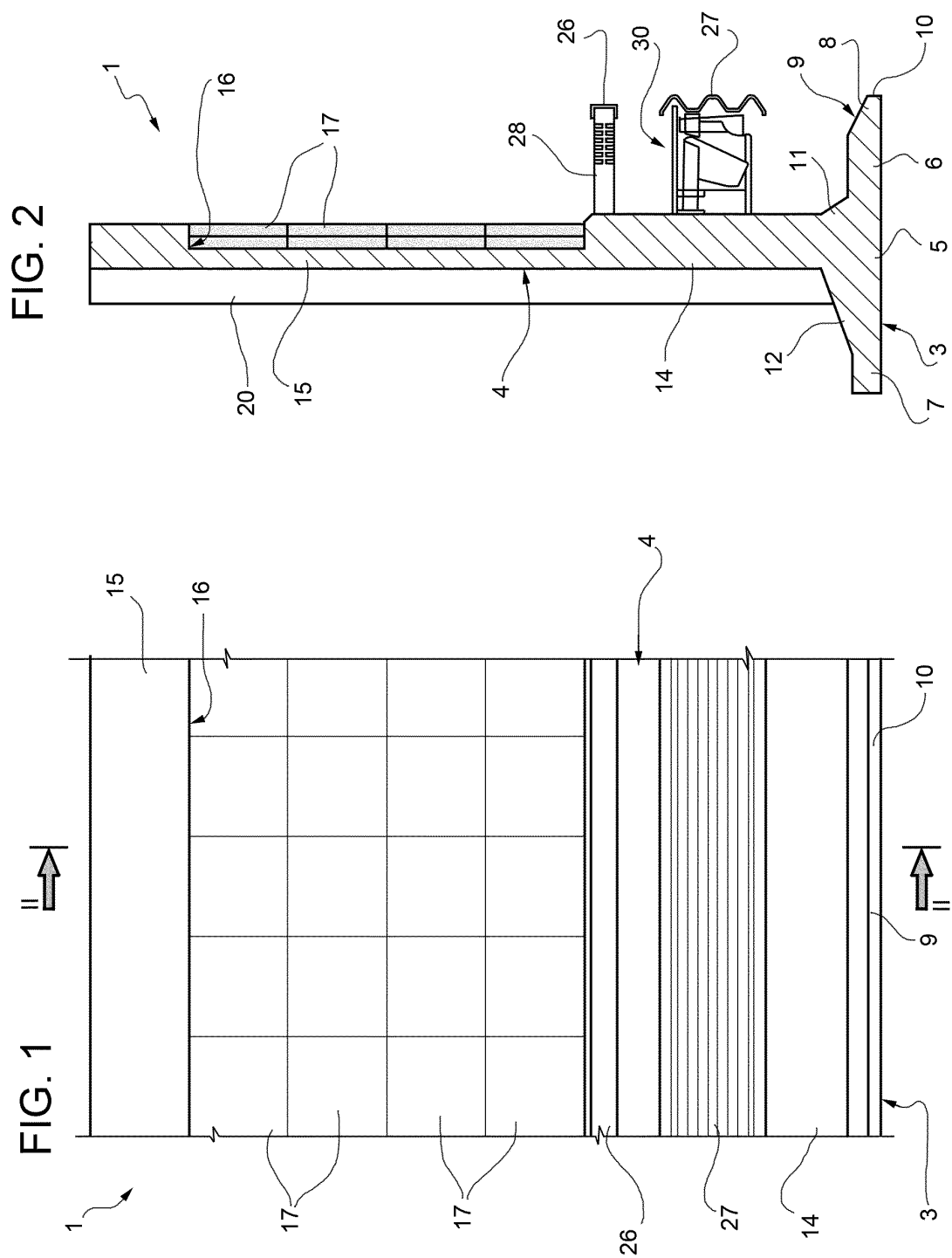
instead of a nut / lock nut pair.

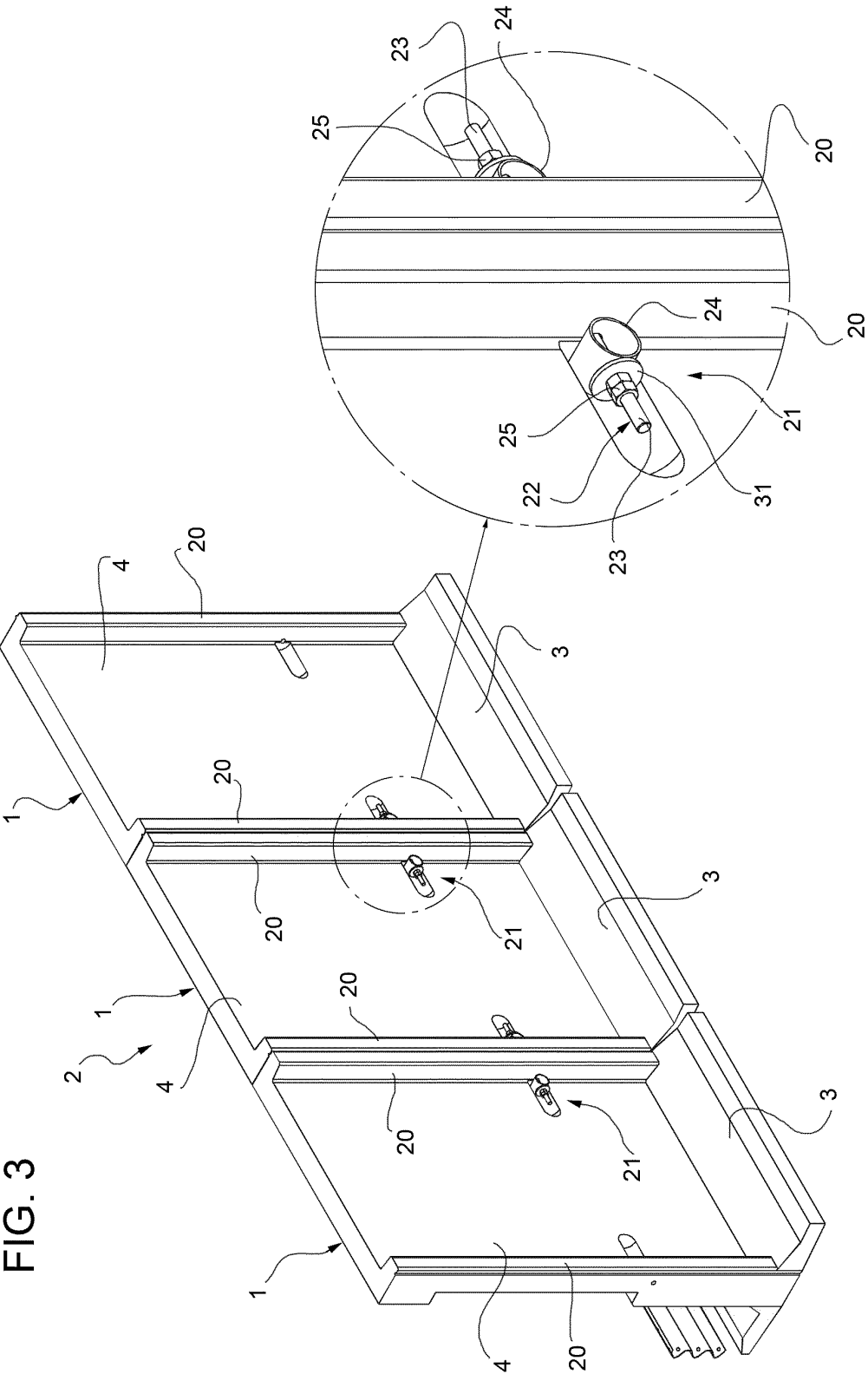
Claims

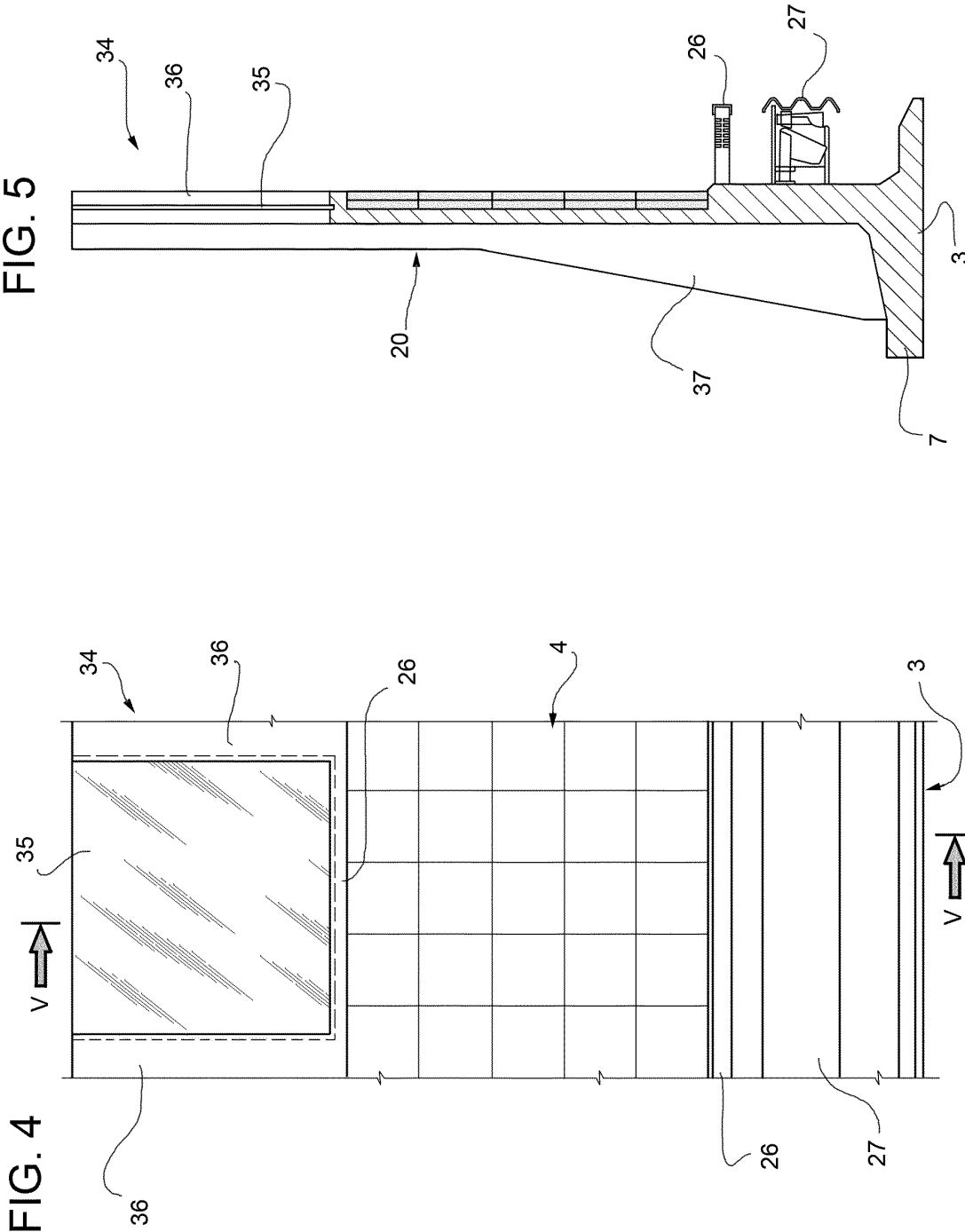
1. An integrated road barrier comprising a plurality of prefabricated freestanding modules (1; 34) adapted to be positioned aligned one after the other along the edge of a carriageway, and a plurality of connecting devices (21) configured so as to connect said modules (1;34) two by two, each module (1;34) comprising a monolithic body of reinforced concrete comprising a base (3) adapted to permanently rest on a supporting surface and a vertical wall (4) extending from a longitudinal median area (5) of the base (3), **characterized in that** the vertical wall (4) comprises a lower portion (14) having predetermined resistance characteristics and an upper portion (15) supporting sound absorbing and/or sound isolating means in a position facing said carriageway, and **in that** it comprises longitudinal metal safety elements (6, 27) fixed to said lower portion (14) of said vertical wall (4), and **in that** said connection devices (21) comprise at least one deformable element (24).
2. The barrier according to claim 1, **characterised in that** said modules (1; 34) comprise a pair of end portions (20) extending along the vertical edges of said vertical wall (4), on the side opposite the road side, and adapted to abut with corresponding end portions (20) of the adjacent modules (1; 34) of the barrier (2).
3. The barrier according to claim 2, **characterised in that** said connection devices (21) are configured to connect to each other respective end portions (20) of two adjacent modules (1; 34).
4. The barrier according to claim 3, **characterised in that** said connection devices (21) comprise a rod (22) housed to pass through respective holes of said adjacent end portions (20), stop means (25) integral with opposite ends (23) of said rod (22) coming out of said end portions (20), the deformable element (24) being positioned between one of said end portions (20) and a stop element (25).
5. The barrier according to claim 4, **characterised in that** said deformable element (24) consists of a metal sleeve (24) provided with a cross hole engaged by said rod (22).
6. The barrier according to claim 4, **characterised in that** said collapsible element consists of a block of metal foam.
7. The barrier according to claim 4, **characterised in that** said rod (22) is threaded and that said stop el-

ements (25) comprise at least one nut screwed onto the rod (22).

8. The barrier according to one of the preceding claims, **characterized in that** said base (3) of said modules (1; 34) has a front portion (6) extending from the vertical wall (4) on the road side and a rear portion (7) extending from the vertical wall (4) on the opposite side, and **in that** the front portion (6) has a front edge (10) which is lowered in order to favour the ascent of at least one vehicle wheel in the event of impact.
9. The barrier according to claim 8, **characterized in that** said front portion (6) of the base comprises an upwardly tapered portion (8) adjacent to said front edge (10) and forming an upper ramp (9).
10. The barrier according to one of the preceding claims, **characterized in that** said longitudinal metal safety elements comprise at least one section bar (26) fixed to said lower portion (14) of said vertical wall (4) by means of a plurality of deformable supports (28).
11. The barrier according to claim 10, **characterized in that** said supports (28) are tubular.
12. The barrier according to one of the preceding claims, **characterized in that** said longitudinal metal safety elements comprise at least one section bar (27) fixed to said lower portion (14) of said vertical wall (4) by means of a plurality of deformable supports (30), said section bar having a cross section with double or triple corrugation.
13. The barrier according to one of the preceding claims, **characterized in that** said sound absorbing and/or sound isolating means comprise a plurality of blocks (17) of sound absorbing material fixed on said upper portion (15) of said vertical wall (4).
14. The barrier according to claim 13, **characterized in that** said upper portion (15) of said vertical wall (4) has a cavity (16) facing toward the road side, said blocks (17) of sound absorbing material being housed in said cavity (16).
15. The barrier according to any one of the preceding claims, **characterized in that** said modules (1; 34) have a slotted upper portion (15) housing a sheet (35) of transparent material.









EUROPEAN SEARCH REPORT

Application Number
EP 13 15 4727

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 22 May 2013	Examiner Kremsler, Stefan
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			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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The members are as contained in the European Patent Office EDP file on
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