



(86) **Date de dépôt PCT/PCT Filing Date:** 2014/07/08
(87) **Date publication PCT/PCT Publication Date:** 2015/01/15
(85) **Entrée phase nationale/National Entry:** 2015/12/17
(86) **N° demande PCT/PCT Application No.:** AU 2014/000707
(87) **N° publication PCT/PCT Publication No.:** 2015/003213
(30) **Priorité/Priority:** 2013/07/10 (AU2013902534)

(51) **Cl.Int./Int.Cl.** *E01F 15/10* (2006.01)
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(54) **Titre : BARRIERE ROUTIERE**
(54) **Title: ROADWAY BARRIER**

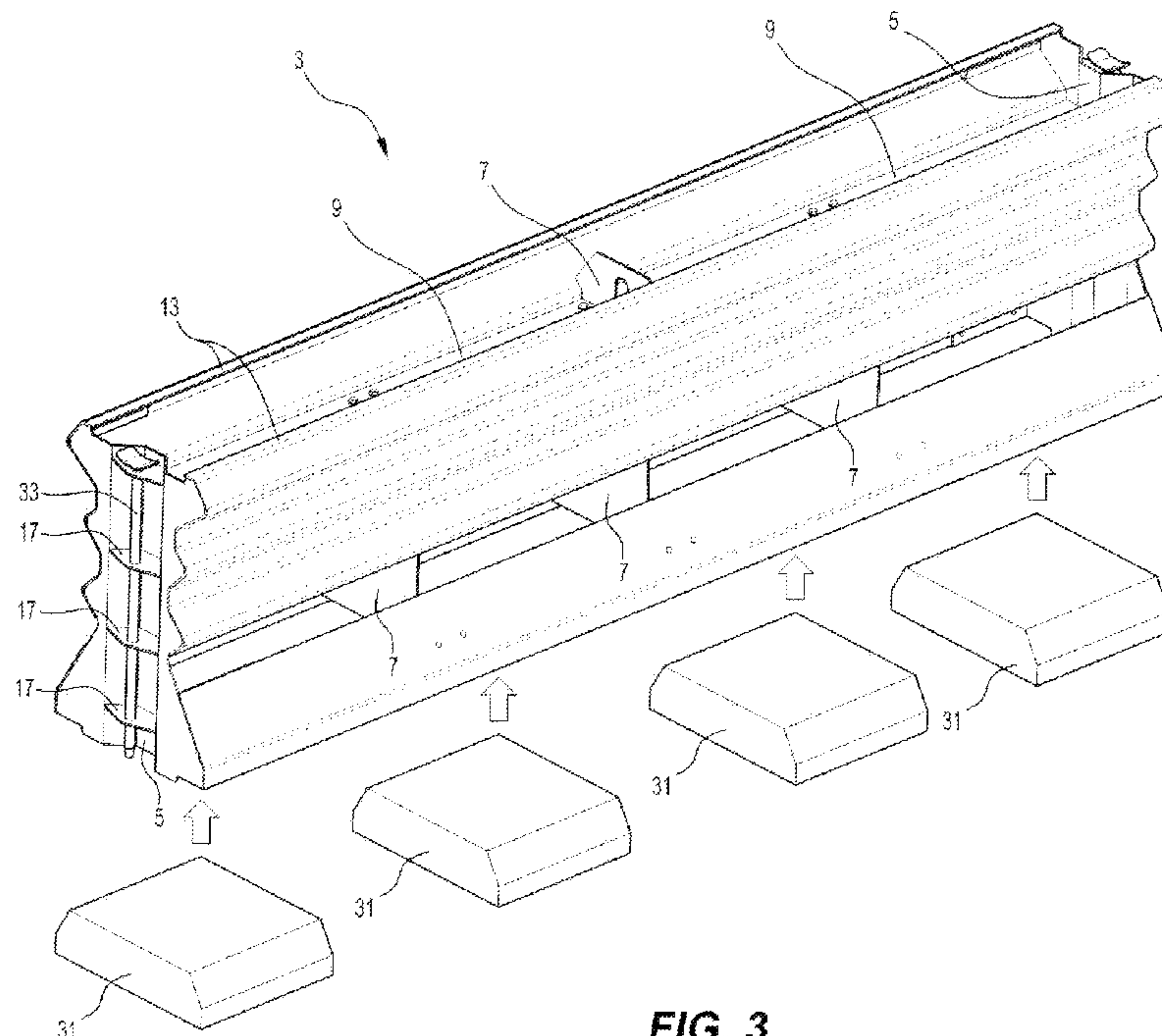
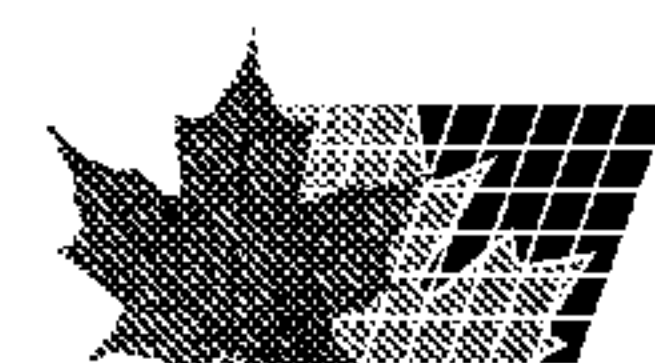


FIG. 3

(57) **Abrégé/Abstract:**

A stand-alone, roadway barrier includes: an internal structural framework (5), (7), (9) which provides the barrier with rigidity for resisting collapse of the barrier in response to impact of a vehicle, panels (13) mounted to opposite sides of the structural framework for deflecting vehicles on impact with the barrier; and ballast (33) in a lower section of the barrier for contributing to the weight of the barrier.



(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau(10) International Publication Number
WO 2015/003213 A1(43) International Publication Date
15 January 2015 (15.01.2015)(51) International Patent Classification:
E01F 15/10 (2006.01)

(21) International Application Number:

PCT/AU2014/000707

(22) International Filing Date:

8 July 2014 (08.07.2014)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

2013902534

10 July 2013 (10.07.2013)

AU

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

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(54) Title: ROADWAY BARRIER

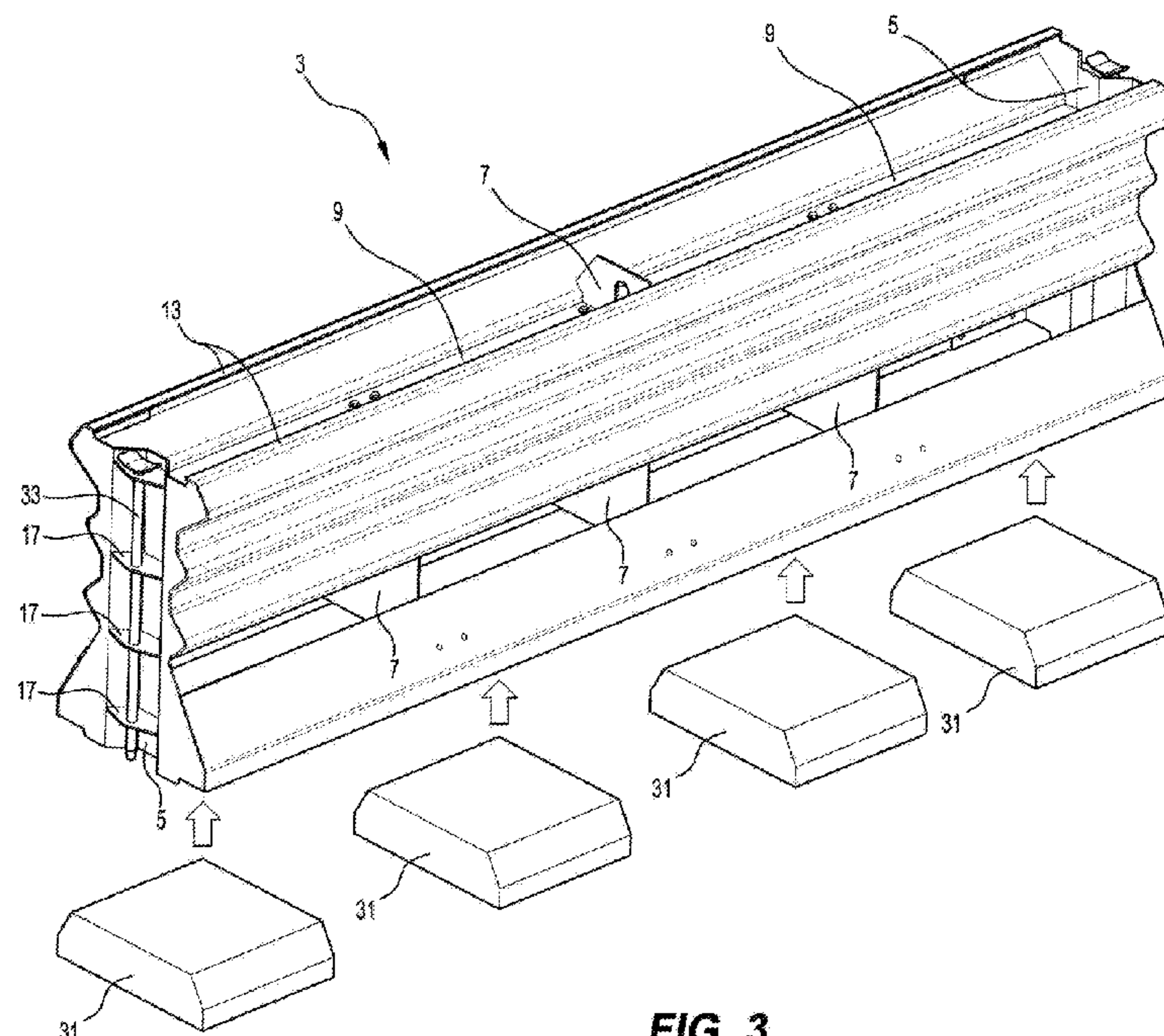


FIG. 3

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WO 2015/003213 A1

WO 2015/003213 A1

Published:

— *with international search report (Art. 21(3))*

(57) Abstract: A stand-alone, roadway barrier includes: an internal structural framework (5), (7), (9) which provides the barrier with rigidity for resisting collapse of the barrier in response to impact of a vehicle, panels (13) mounted to opposite sides of the structural framework for deflecting vehicles on impact with the barrier; and ballast (33) in a lower section of the barrier for contributing to the weight of the barrier.

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ROADWAY BARRIER

The present invention relates to a barrier for roadways.

5

The present invention relates particularly, although by no means exclusively, to a stand-alone, self-supporting, lightweight and readily portable metal (which term includes metal alloy) roadway barrier.

10

Known roadway barriers include:

15

(a) barriers made from concrete that rely on the weight of the concrete to function as barriers and typically weigh 1,000 kg per meter of the length of the barrier;

20

(b) barriers that comprise shells made from plastics materials that are adapted to be filled with water and rely on the weight of the water to function as barriers and typically weigh at least 300 kg per meter of the length of the barrier; and

25

(c) barriers made from steel which also rely on the weight of the barriers to function as barriers and weigh at least 200 kg per meter of the length of the barrier and, in many instances are fixed to the ground.

30

Whilst the above-described barriers function effectively as barriers, principally due to the substantial weights thereof, the substantial weights of the concrete barriers and the steel barriers present significant transportation difficulties, and the need to fill water into and thereafter empty water from the plastics materials shell barriers presents significant handling issues and increases installation times considerably. In addition, concrete barriers and the water-filled barriers tend to crack when impacted by

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vehicles and lose functionality as a consequence and invariably cannot be used as barriers after a vehicle impact. Moreover, the construction of these barriers, particularly the concrete barriers and the steel barriers, means that the barriers have no "give" on impact of a vehicle. A certain amount of resilience of a barrier on vehicle impact is helpful.

There is a need for a lightweight barrier that functions effectively as a barrier and can be readily be lifted into and from required roadway locations and is immediately functional as a barrier when lifted into position.

The above description of prior art barriers is not to be taken as an admission of the common general knowledge in Australia or elsewhere.

The present invention provides a stand-alone, self-supporting, lightweight, portable roadway barrier that includes:

- (a) an internal structural framework which provides the barrier with rigidity for resisting collapse of the barrier in response to impact of a vehicle, the framework including interconnected framework members, the framework members including upright members at opposite ends of the barrier, and at least one longitudinal member extending along the length of the barrier and connected to each of the upright members;
- (b) panels mounted to opposite sides of the structural framework and forming the sides of the barrier for deflecting vehicles on impact with the barrier; and
- (c) ballast in a lower section of the barrier for contributing to the weight of the barrier.

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The purpose of the internal structural framework of the above-described barrier is to provide sufficient rigidity for resisting collapse of the barrier in response to vehicle impact. Specifically, the interconnected
5 arrangement of upright and longitudinal framework members is provided to give the framework sufficient rigidity for resisting direct collapse of the barrier in the regions of vehicle impact and from uncontrolled twisting of the barrier around a longitudinal barrier axis. The upright
10 members of the structural framework also act as supports for the side panels.

Typically, the internal structural framework provides at least 80%, more typically at least 90%, of the
15 rigidity for resisting collapse of the barrier in response to vehicle impact.

The principal purpose of the side panels of the above-described barrier is to deflect a vehicle on impact
20 of the vehicle against the barrier. Accordingly, it is not essential that the side panels make a substantial contribution to the rigidity of the barrier and this makes it possible to minimise the weight of the side panels. Typically, the side panels contribute no more than 30% of
25 the rigidity of the barrier.

The principal purpose of the ballast is to provide weight to resist shunting action on vehicle impact that would move the barrier significantly from a preferred
30 position on the ground.

The structural framework may include at least one upright member between the upright end members, with the longitudinal member being connected to the upright
35 member or members.

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The structural framework may include a central upright member positioned midway between the upright end members.

5 The central upright member may include an opening that can receive a crane hook to facilitate lifting of the barrier.

10 The upright members may be in the form of steel plates.

The upright members may be in the form of steel plates that extend across the width of the barrier.

15 The steel plates may include mounting sections to which the side panels are connected.

20 The longitudinal member or at least one of the longitudinal members may extend along the length of the barrier and be connected at opposite ends to the upright end members and be connected to the or each upright member located between the upright end members.

25 The longitudinal member or the lower longitudinal member when there are two or more longitudinal members may be positioned at a height that is at or higher than 25% of the height of the barrier.

30 The longitudinal member or the lower longitudinal member when there are two or more longitudinal members may be positioned at a height that is at or higher than 50% of the height of the barrier.

35 The longitudinal member or the lower longitudinal member when there are two or more longitudinal members may be positioned at a height that is at or above a centre of gravity of a typical vehicle.

- 5 -

5 The applicant has found that the location of the longitudinal member or the lower longitudinal member when there are two or more longitudinal members as described in the three preceding paragraphs is preferable from the viewpoint of the overall rigidity of the barrier and in terms of minimising the possibility of lengthwise twisting of the barrier in response to vehicle impact.

10 The longitudinal member or at least one of the longitudinal members may be in the form of steel plates.

The side panels may be made from steel.

15 The side panels may be made from steel strip that has been mechanically worked, such as by roll-forming, into a required profile. The required profile may be a profile that facilitates deflecting vehicles on impact.

20 Each side panel may include a series of lengthwise extending corrugations that define panel ribs.

25 The side panels on opposite sides of the barrier may diverge outwardly from each other when viewed from the ends of the barrier.

30 The height of the ballast may be lower than the height of the typical vehicle impact with the barrier. This is an important feature so as to ensure that the structural framework and the side plates of the barrier respond to the vehicle impact by absorbing impact energy and deflecting impact, while the ballast resists shunting movement of the barrier. This arrangement of the
35 components of the barrier provides an effective response to vehicle impact.

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The ballast may be connected to the internal structural framework or to the side panels.

5 The ballast may include a support element for mounting the ballast to the internal structural framework or to the side panels.

10 The ballast may include a body, such as a block of a suitable ballast material, and a support element for mounting the ballast to the internal structural framework or to the side panels.

15 The support element may be in the form of a bracket, such as an angle iron bracket, that is bolted or otherwise fastened to the body of the ballast and is adapted to cooperate with the internal structural framework or to the side panels to mount the ballast to the internal structural framework or to the side panels.

20 The ballast may include a plurality of blocks of a suitable ballast material positioned in spaces separating the upright end members and the upright member or members positioned between the upright end members.

25 The ballast may be made from concrete or any other suitable material.

30 The weight of the ballast may be up to 55% of the total weight of the barrier.

The weight of the ballast may be up to 50% of the total weight of the barrier.

35 The weight of the ballast may be up to 45% of the total weight of the barrier.

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The weight of the barrier may be less than 350 kg per meter of length of the barrier.

5 The weight of the barrier may be less than 300 kg per meter of length of the barrier.

The weight of the barrier may be less than 250 kg per meter of length of the barrier.

10 The weight of the structural framework and the side panels of the barrier may be less than 200 kg per meter of length of the barrier.

15 The weight of the structural framework and the side panels of the barrier may be less than 150 kg per meter of length of the barrier.

20 The barrier further may include a lower side panel on each side of the barrier that prevents vehicle tyres penetrating the barrier and becoming engaged with the barrier.

25 The barrier may include complementary members at the ends of the barriers for allowing a plurality of barriers to be connected together in end-to-end relationship in a line of the barriers.

The barrier may be any suitable length.

30 Typically, the barrier is at least 3 m long.

35 The present invention also provides a barrier assembly including a plurality of the above-described barrier connected together in end-to-end relationship in a line of the barriers.

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The present invention is described further by way of example with reference to the accompanying drawing, of which:

5 Figure 1 is a perspective view of one embodiment of a barrier in accordance with the present invention;

 Figure 2 is a perspective view of the barrier shown in Figure 1 with the side panels and the ballast
10 removed to show the internal structural framework of the barrier;

 Figure 3 is an exploded perspective view of the barrier shown in Figure 1 which shows the blocks of
15 ballast;

 Figures 4 and 5 are respective side and end views of one of the ballast blocks and the brackets for connecting the ballast block to the internal structural
20 framework of the barrier.

The barrier 3 shown in the Figures includes an internal structural framework of:

- 25 (a) upright support plates 5 at opposite ends of the barrier;
- (b) three upright support plates 7 at spaced intervals along the length of the barrier
30 between the end plates 5 and arranged to extend across the width of the barrier; and
- (c) a longitudinal support member 9 (best seen in Figure 2) in the form of a horizontally
35 disposed flat plate connected at opposite ends to the upright end plates 5 and to the internal upright plates 7;

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The structural framework is made from steel. More particularly, the upright support plates 5, 7 and the longitudinal support member 9 are steel plates of any
5 suitable gauge.

The height of the longitudinal support member 9 is selected to be at or higher than 25%, more preferably higher than 50%, more preferably higher than 60%, and
10 typically higher than 75%, of the height of the barrier 3. Typically, the selection is based the height of or greater than the height of a centre of gravity of a typical vehicle.

The barrier 3 further includes side panels 13 that extend along the length of the barrier on opposite sides thereof and are connected to the upright support plates 5, 7 of the structural framework by bolts and or by
15 welding the components together or by any other suitable means.
20

Each side panel 13 is made form steel and is corrugated and includes three parallel crests and two parallel troughs between the crests. It can be
25 appreciated that the side panels 13 may be any suitable profile to facilitate deflecting vehicles on impact with the barrier 3.

The side edges of the upper sections of the upright support plates 5, 7 have a similar corrugated
30 profile to that of the side panels 13. In addition, the side edges of the upright support plates 5, 7 diverge outwardly to form a "christmas tree" formation when viewed from the ends of the barrier. Consequently, the side
35 panels 13, as a consequence of being connected to the upright support plates 5, 7, diverge outwardly.

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Each upright end plate 5 comprises an assembly which enables a plurality of the barriers 3 arranged end-to-end to be hinged together to form a continuous line of the barriers, with the barriers in end-to-end relationship. Each hinge assembly comprises four horizontally disposed and vertically spaced-apart hinge plates 17 having aligned openings 21. The positions of the hinge plates 17 are selected so that the hinge plates 17 at one end of one barrier 3 are above or below the hinge plates at the other end of another barrier 3 when the barriers 3 are positioned end-to-end and the openings of the two sets of hinge plates 17 are aligned. Consequently, a hinge pin 33 (Figure 3) can be inserted through the aligned openings 21 to hinge the two barriers together.

The barrier 3 further includes 4 blocks 31 of ballast (see Figure 3).

The ballast blocks 31 are made from concrete or any other suitable material. The principal function of the ballast blocks 31 is to provide mass to resist shunting action on vehicle impact that would move the barrier significantly from a preferred position on the ground. The ballast blocks 31 make it possible for the barrier 3 to be used as a free-standing, self-supporting unit that can remain substantially in position on vehicle impact.

The ballast blocks 31 are formed to be located in a lower section of the barrier 3. The height of the ballast blocks 31 is selected to be lower than the height of the typical vehicle impact with the barrier so as to ensure that the structural framework 5, 7, 9 and the side panels 13 of the barrier 3 respond to the vehicle impact by absorbing impact energy and deflecting impact, while the ballast resists shunting movement of the barrier 3.

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This arrangement of the components of the barrier 3 provides an effective response to vehicle impact.

The ballast blocks 31 are located in the spaces separating the upright end members 5 and the upright members 7 positioned between the upright end members 5 and are mounted to the side panels 13. With reference to Figures 3 and 4, the ballast blocks 31 include support elements in the form of a pair of forward and rearward angle iron brackets 35 that are bolted to the ballast blocks 31. Figure 4 shows a single bolt 37 used to secure a bracket 35 to a ballast block 31. In other embodiments, 2 or more bolts or other suitable fasteners may be used to secure a bracket 35 to ballast block 31. The brackets 35 have downturned ends that facilitate locating the ballast blocks 31 to the barrier 3, with the bracket ends resting on inwardly-turned sections of corrugations of the side panels 13 and thereby mounted to the side panels 13. With this arrangement, the ballast blocks 31 are not fixed to the side panels 13. The weight of the ballast blocks 31 keeps the blocks in position. It can be appreciated the ballast blocks may be fixed to the side panels 13, for example by bolts or other suitable fasteners (not shown) passing through openings (not shown) in the brackets 35.

In use, the barrier can be conveniently transported from a storage location to a roadside location and then lifted into position as a functional barrier.

Vehicle crash tests have been carried out on the barrier 3 by Crashlab (Registered Trade Mark), a commercial business unit of Roads and Maritime Services, a NSW Government agency and corporation incorporated under section 46 of the Transport Administration Act 1988 (NSW). Crashlab is a NATA accredited laboratory in the field of Mechanical Testing.

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The crash tests were conducted to the recommendations of the US National Cooperative Highway Research Program Report 350, tests 2-11 and 3-11.

5 Two crash tests were carried out, as summarized below:

- 10 • Test 1 impact speed of 100km/hr. 59 barriers 3, each of effective length of 4.155 m length and total weight of 885 kg (including 4 ballast blocks 31 with a total weight of 435 kg, including the weight of the brackets 35), were installed end to end, giving a total installation length of 246 m. The centerline of the test vehicle was aligned with the intersection of barriers 28 and 29 in the line, giving an impact point on the on the middle of barrier 28. Barriers 15 24 to 41 in the line were installed in a straight line but the rest of the barriers were curved and deviated from this line in order to fit the crash site area. The test vehicle (a 1990 GMC Sierra pick-up truck) was propelled and steered using a continuous drive cable and tow skate system, DC drive control and DC motor. The vehicle was released from the tow skate 17 m prior to impact. The impact speed was measured 1 m before impact with the barrier. The 20 vehicle was fitted with tri-axial accelerometers and rate gyros at the vehicle center-of-gravity. The conclusion of the test report is as follows: *"When tested in accordance with the recommendations of the US National Cooperative Highway Research Program Report 350, test 3-11, the Saferoads 'Ironman Hybrid' safety barrier demonstrated compliant levels of structural adequacy, occupant risk and vehicle trajectory with a dynamic barrier deflection of 1.9 m".*
- 25 • Test 2 impact speed of 70km/hr. 29 barriers 3, each of 4 m length and total weight of 885 kg (including 4 ballast blocks 31 with a total weight of 435 kg,
- 30
- 35

- 13 -

including the weight of the brackets 35), were installed end to end, giving a total installation length of 120.5 m. The centerline of the test vehicle was aligned with the intersection of barriers 16 and 17 in the line, giving an impact point on the middle of barrier 16. Barriers 13 to 29 in the line were installed in a straight line but barriers 1 to 12 were curved and deviated from this line in order to fit the crash site area. The test vehicle (a 1998 GMC Sierra pick-up truck) was propelled and steered using a continuous drive cable and tow skate system, DC drive control and DC motor. The vehicle was released from the tow skate 17 m prior to impact. The impact speed was measured 1 m before impact with the barrier. The vehicle was fitted with tri-axial accelerometers and rate gyros at the vehicle center-of-gravity. The conclusion of the test report is as follows: *"When tested in accordance with the recommendations of the US National Cooperative Highway Research Program Report 350, test 2-11, the Saferoads 'Ironman Hybrid' safety barrier demonstrated compliant levels of structural adequacy, occupant risk and vehicle trajectory with a dynamic barrier deflection of 1.25 m"*.

The above-described crash tests indicate that the barrier 3 complies with relevant road safety requirements.

Many modifications may be made to the preferred embodiment of the invention described above without departing from the spirit and scope of the invention.

Whilst the above described embodiment is constructed from steel, it can readily be appreciated that the present invention is not so limited and extends to barriers made from any suitable materials. By way of

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example, the side panels 13 could be made from aluminium or suitable plastic materials. It is envisaged that the internal structural framework be made from metals (including metal alloys).

5

In addition, whilst the ballast blocks 31 are mounted via brackets 35 to the side panels 13, the invention is not limited to this arrangement and extends to any suitable arrangement for mounting the ballast blocks 33 to the other components of the barrier to form a unit assembly. For example, the ballast blocks may be formed to be mounted to the internal structural framework of the barrier.

15

In addition, whilst the support elements for the ballast blocks 31 are in the form of angle iron brackets 35, the invention is not so limited and extends to any suitable support elements. One example of another suitable support element is flat plate straps with down-turned ends.

20

CLAIMS:

1. A stand-alone, self-supporting, lightweight, portable elongate roadway barrier that includes:

- 5 (a) an internal structural framework for resisting collapse of the barrier in response to impact of a vehicle, the framework including interconnected steel framework members, the framework members including (i) upright members
10 at opposite ends of the barrier and at least one upright member positioned between the upright end members, the upright members being in the form of plates extending perpendicular to the length of the barrier across the width of the barrier, the upright members dividing the
15 barrier into spaces between the upright members along the length of the barrier, and (ii) at least one longitudinal member extending along on the length of the barrier and connected to each of the upright members;
20 (b) panels mounted to opposite sides of the structural framework for deflecting vehicles on impact with the barrier; and
(c) ballast in the form of blocks of concrete or
25 other solid material in a lower section of the barrier positioned in the spaces separating the upright members of the structural framework.

2. The barrier defined in claim 1 wherein the
30 internal structural framework provides sufficient rigidity for resisting direct collapse of the barrier in the regions of vehicle impact and from uncontrolled twisting of the barrier around the longitudinal barrier axis.

35 3. The barrier defined in claim 1 or claim 2 wherein the principal function of the side panels is to

deflect a vehicle on impact of the vehicle against the barrier.

4. The barrier defined in any one of the preceding
5 claims wherein the ballast provides mass to resist
shunting action on vehicle impact that would move the
barrier significantly from a preferred position on the
ground.
- 10 5. The barrier defined in any one of the preceding
claims wherein the side panels do not make a substantial
contribution to the rigidity of the barrier.
6. The barrier defined in any one of the preceding
15 claims wherein the longitudinal member or the lower
longitudinal member when there are two or more
longitudinal members is positioned at a height that is at
or higher than 25% of the height of the barrier.
- 20 7. The barrier defined in any one of the preceding
claims wherein the height of the ballast is lower than the
height of the typical vehicle impact with the barrier.
8. The barrier defined in any one of the preceding
25 claims wherein the side panels are made from steel.
9. The barrier defined in any one of the preceding
claims wherein the ballast is connected to the structural
framework or the side panels.
- 30 10. The barrier defined in any one of the preceding
claims wherein the ballast includes a support element for
mounting the ballast to the internal structural framework
or to the side panels.
- 35 11. The barrier defined in claim 10 wherein the
support element is in the form of a bracket, such as an

angle iron bracket, that is bolted or otherwise fastened to the ballast and is adapted to cooperate with the internal structural framework or to the side panels to mount the ballast to the internal structural framework or to the side panels.

12. The barrier defined in any one of the preceding claims wherein the ballast includes a plurality of blocks positioned in spaces separating the upright end members and the upright member or members positioned between the upright end members.

13. The barrier defined in any one of the preceding claims wherein the barrier is at least 3 metres long.

14. The barrier defined in any one of the preceding claims wherein the weight of the ballast is up to 55% of the total weight of the barrier.

15. The barrier defined in any one of the preceding claims wherein the weight of the barrier is less than 350 kg per meter of length of the barrier.

16. The barrier defined in any one of the preceding claims wherein the weight of the structural framework and the side panels is less than 200 kg per meter of length of the barrier.

17. A stand-alone, self-supporting, lightweight, portable elongate roadway barrier that is at least 3 metres long and weighs less than 350 kg per meter of length of the barrier and includes:

(a) an internal structural framework for resisting collapse of the barrier in response to impact of a vehicle, the framework including interconnected framework members, the framework members

- including (i) upright members at opposite ends of the barrier and at least one upright member positioned between the upright end members, the upright members being in the form of plates extending perpendicular to the length of the barrier across the width of the barrier, and (ii) at least one longitudinal member extending along on the length of the barrier and connected to each of the upright members, and wherein the internal structural framework provides sufficient rigidity for resisting direct collapse of the barrier in the regions of vehicle impact and from uncontrolled twisting of the barrier around the longitudinal barrier axis;
- (b) panels mounted to opposite sides of the structural framework for deflecting vehicles on impact with the barrier, wherein the principal function of the side panels is to deflect a vehicle on impact of the vehicle against the barrier, with the weight of the structural framework and the side panels being less than 200 kg per meter of length of the barrier; and
- (c) ballast in a lower section of the barrier, with the ballast including a plurality of blocks of concrete positioned in spaces separating the upright members, with the weight of the ballast being up to 55% of the total weight of the barrier.

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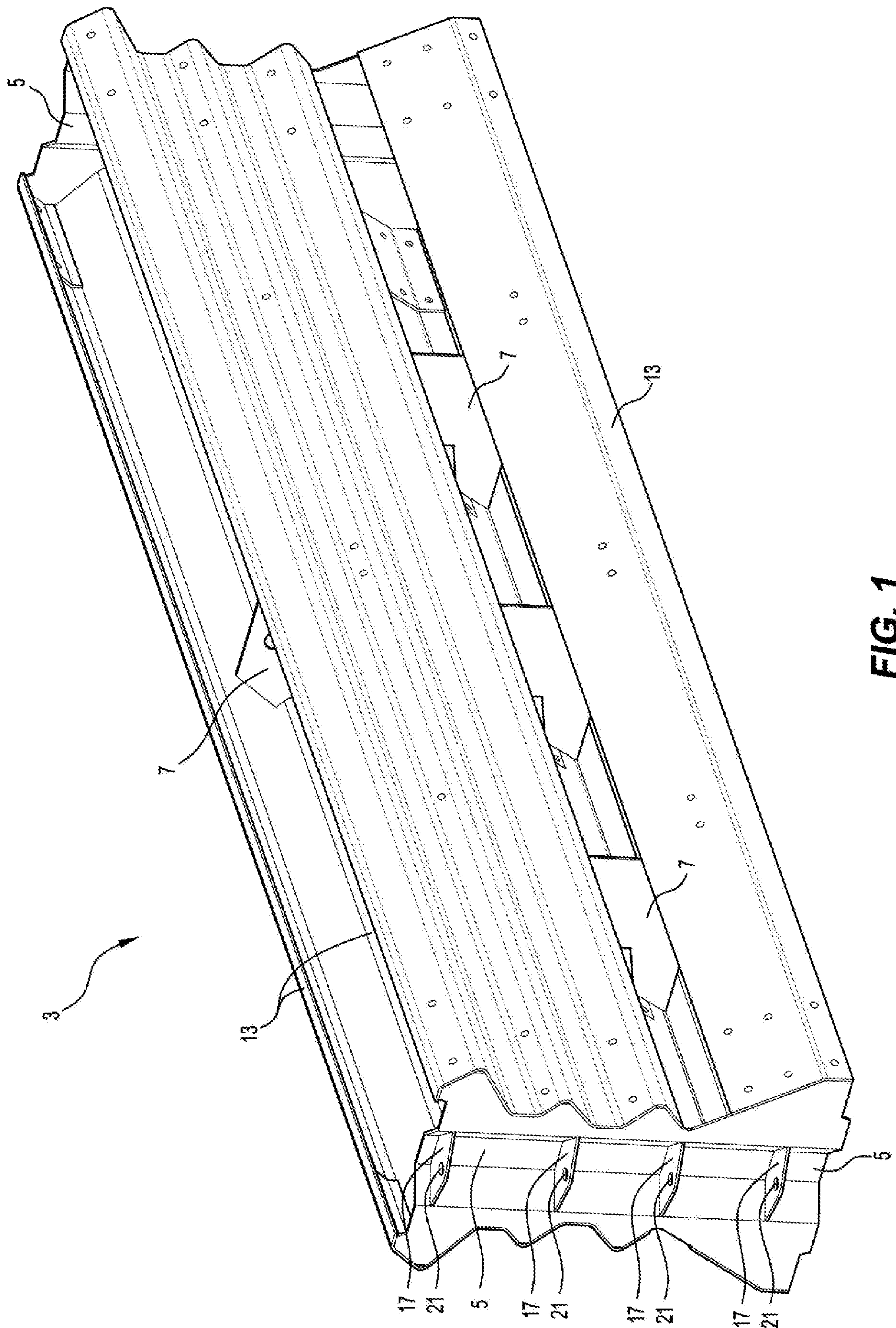


FIG. 1

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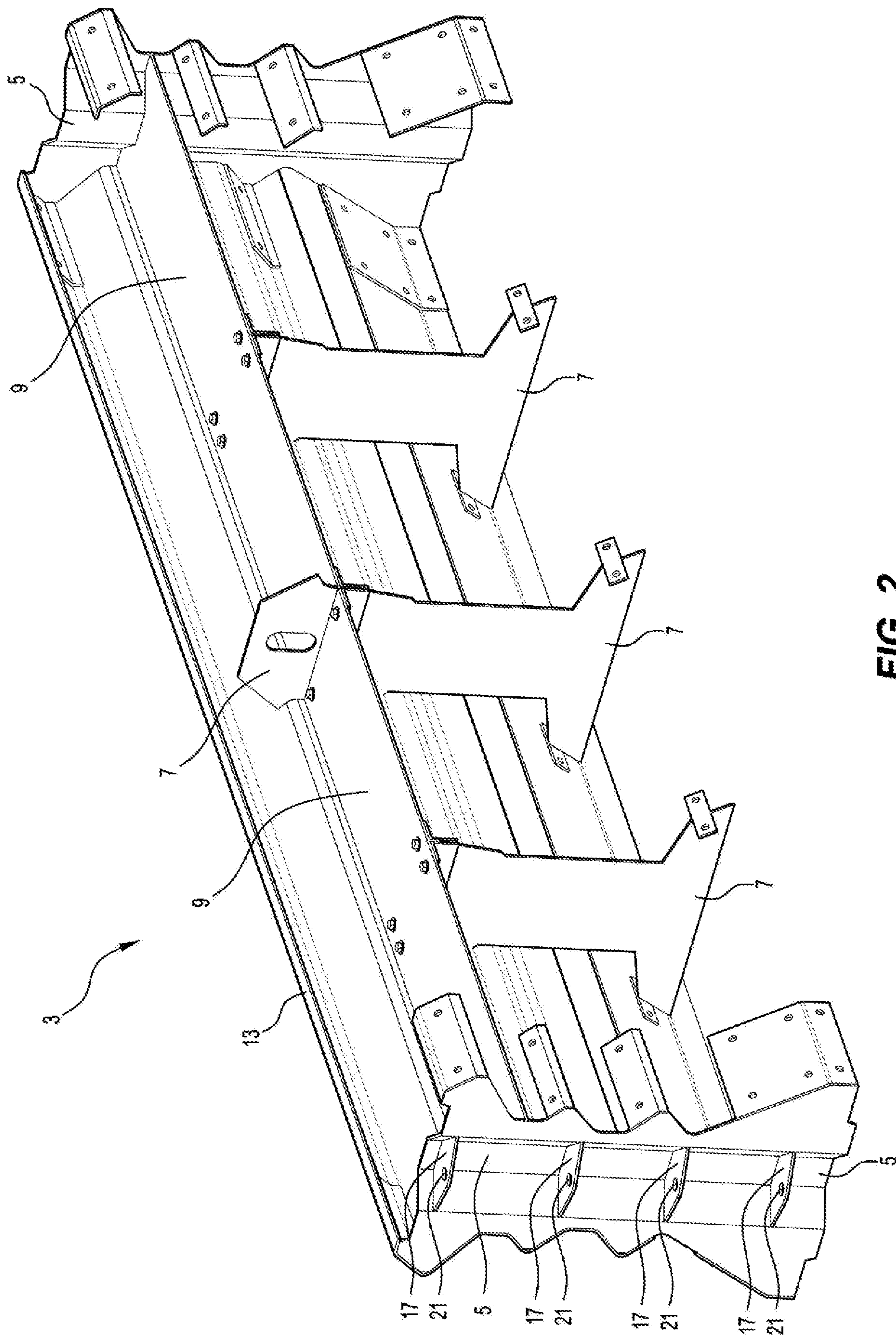
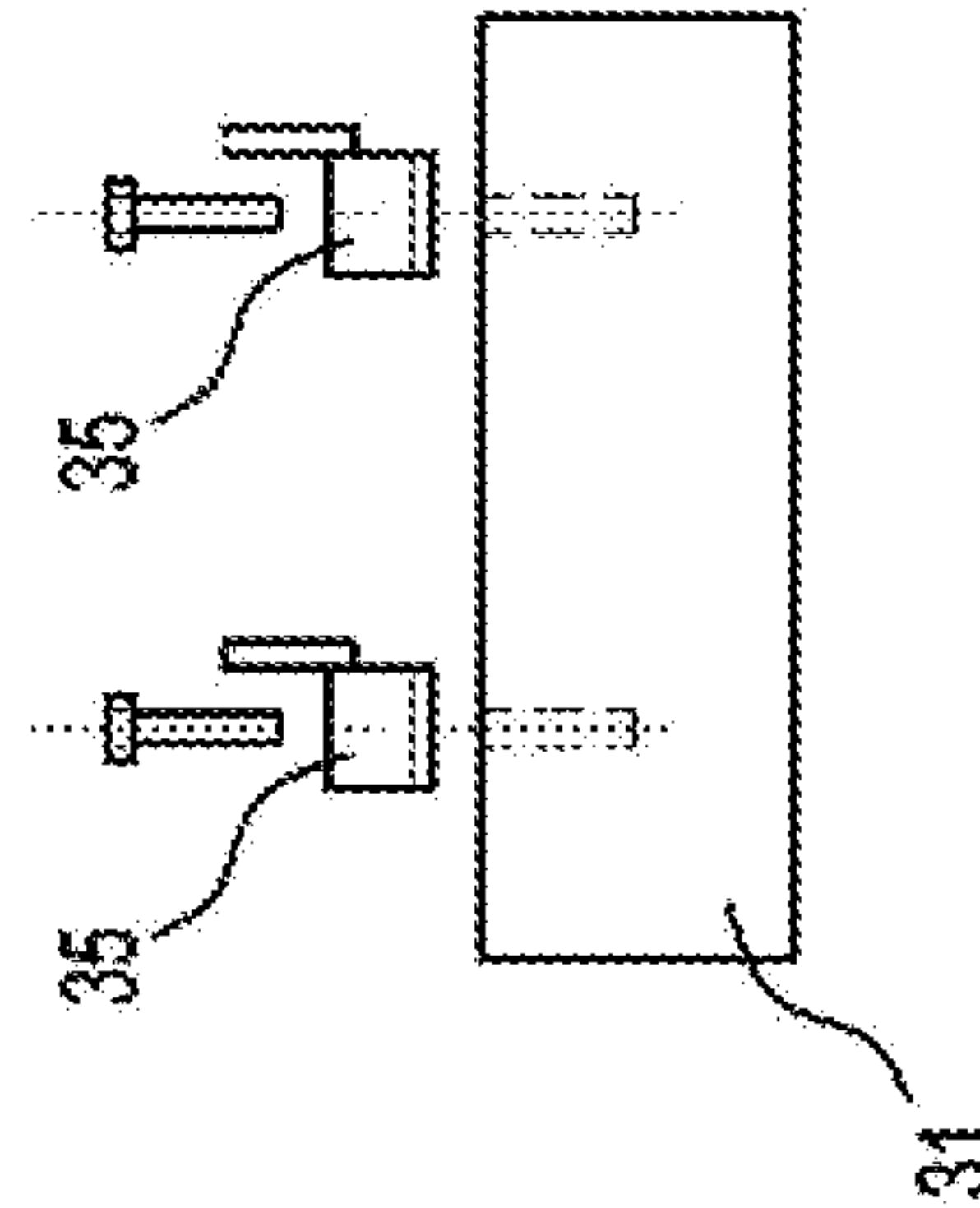
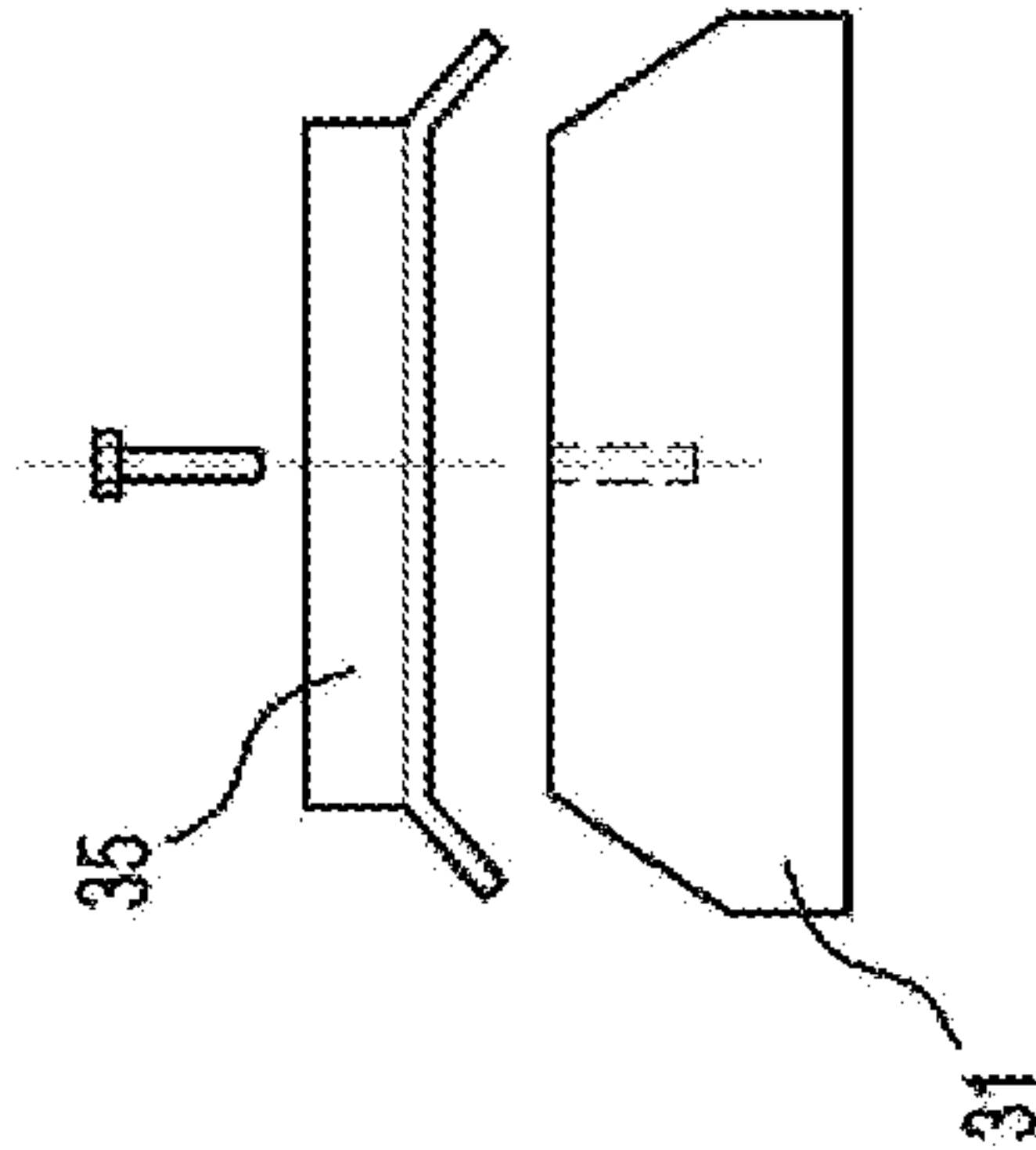
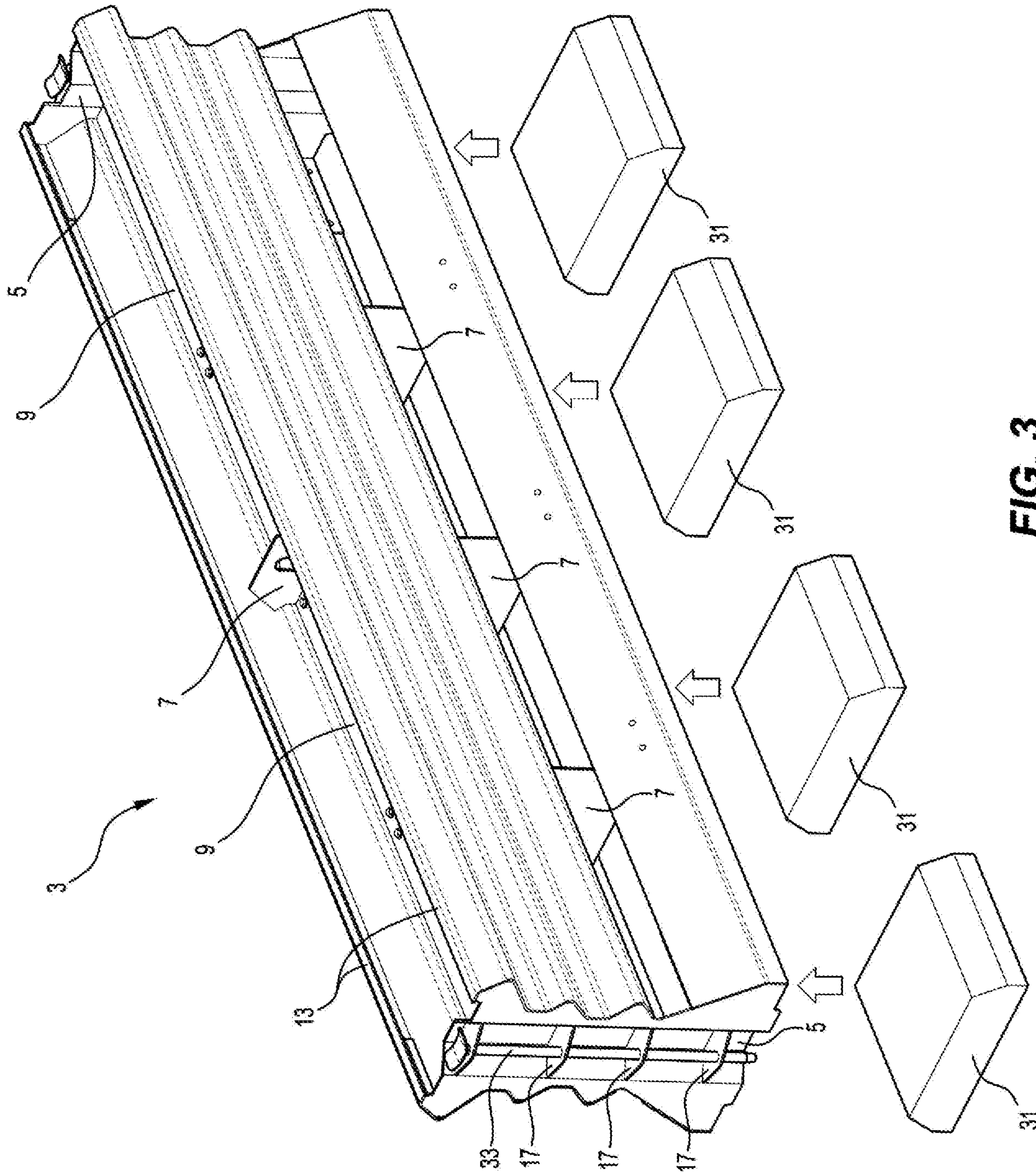


FIG. 2



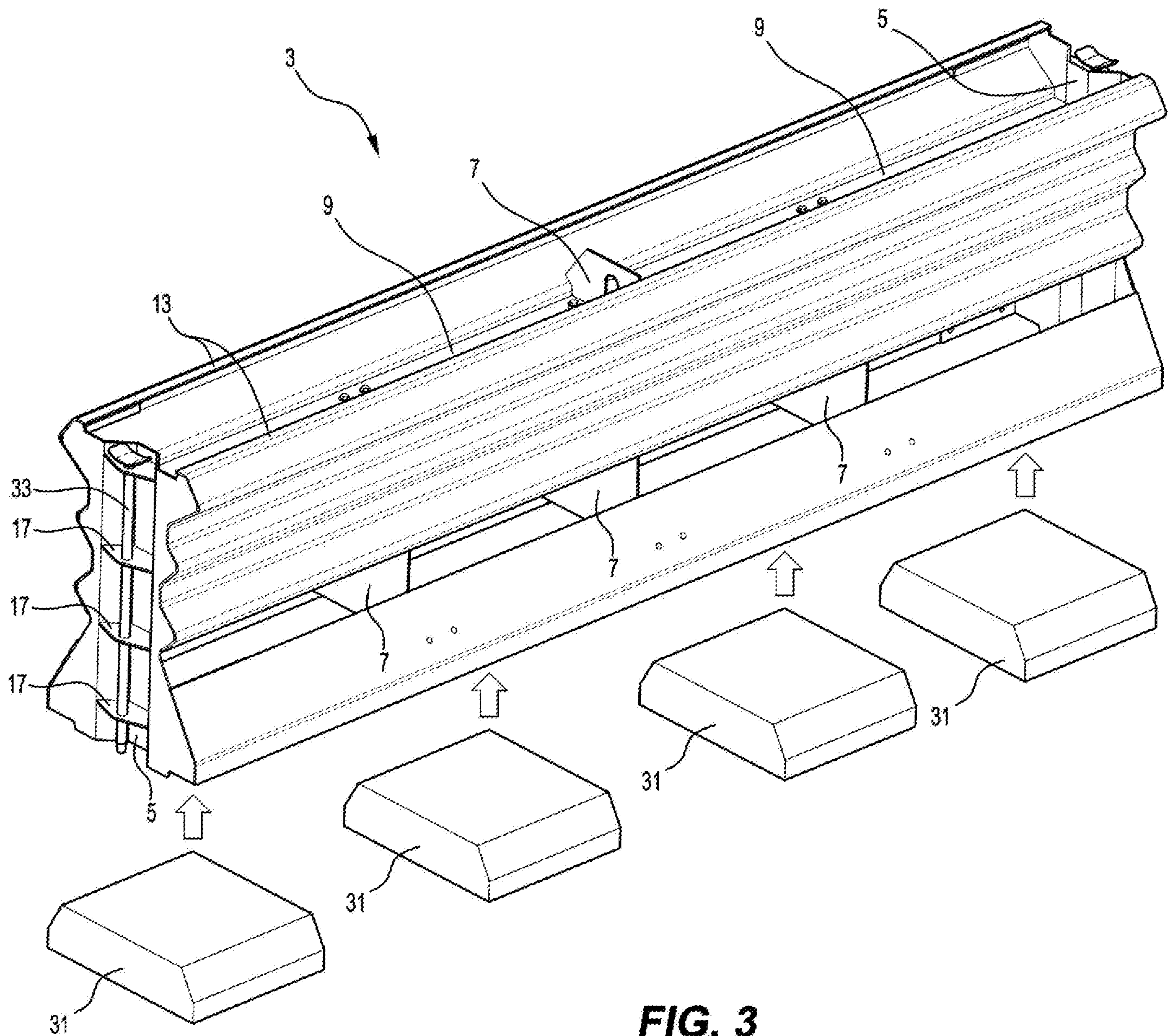


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