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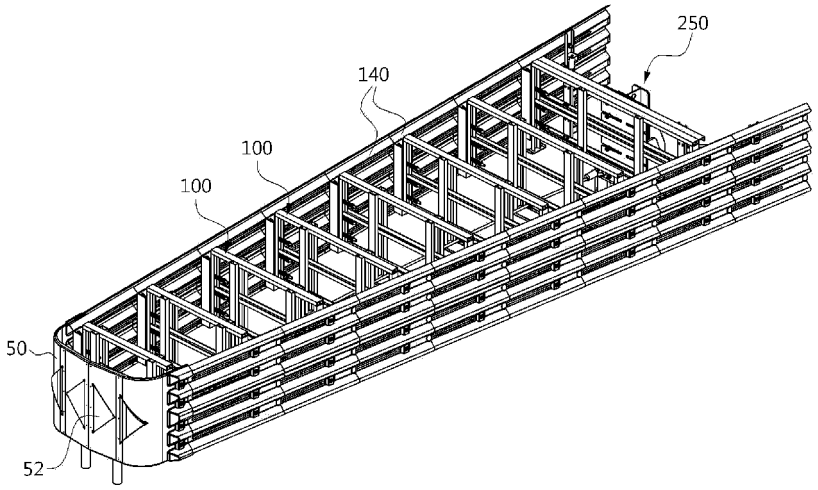
(54) Crash cushion apparatus

(57) Disclosed is a crash cushion apparatus including a front impact absorption portion; a guardrail connection device having support frames, guardrails installed on both sides of the support frames and adapted to move, and connection plates for connecting the support frames and the guardrails; a rear support fixed to the ground and provided with a wire fixing plate for connecting a wire rope; a movable plate installed on one side of the rear support and adapted to move leftwards/rightwards along slots; cushion tanks; and a wire rope. The support frames and the rear support are connected by the wire rope. The crash cushion apparatus can absorb shock energy resulting not only from a front collision, but also from a lateral collision, in a stepwise manner.

FIG.1



EP 2 685 003 A2

Description

BACKGROUND OF THE INVENTION

1. Field of the invention

[0001] The present invention relates to a crash cushion apparatus, and more particularly to a crash cushion apparatus adapted to absorb collision energy, which occurs during a vehicle collision, by means of corresponding friction force so that the vehicle is stopped safely while protecting its occupants.

2. Description of the Prior Art

[0002] Conventional crash cushion apparatuses are adapted to absorb collision energy through plastic deformation (e.g. shearing, drawing) of components, which then cannot be reused, and the external covers, which are made of FRP (Fiber Reinforced Plastics), can generate scattering pieces when broken by a colliding vehicle, posing the possibility of a secondary accident.

[0003] Another type of crash cushion apparatus is known, which uses the tensile force of a tensile material to absorb shocks. This type of apparatus has a problem in that, although the components are reusable, more than a hundred components employed make the structure very complicated and increase the price.

[0004] Korean Registered Patent No. 689528 (registration date: February 23, 2007), the contents of which are incorporated herein by reference, discloses a roadside energy absorption barrier including diaphragms and energy absorption elements arranged between fender panels connected to the diaphragms (i.e. spaced diaphragm arrangement). The construction of the disclosed roadside energy absorption barrier is as follows: among the fender panels, the first fender panel includes slots; a fastener is mounted between the first fender panel of the barrier and a second component; the fastener includes a shank extending through the slot and second components; the shank has extension portions on respective ends; the fastener further includes a spring adapted to respond to one of the extension portions of the shank so that the first fender panel is biased towards the second component while the first fender panel and second components are allowed to remain separated from each other. After a collision, the roadside energy absorption barrier according to the prior art can be easily returned to the original position by pulling the front diaphragm outwards. Furthermore, the spring automatically pulls the fender panels to the originally aligned condition when the barrier is being pulled. This reduces the amount of labor needed to repair the barrier after a collision.

SUMMARY OF THE INVENTION

[0005] Accordingly, the present invention has been made to solve the above-mentioned problems occurring in the prior art, and an object of the present invention is to provide a crash cushion apparatus adapted to absorb collision energy, which occurs during a vehicle collision, by means of corresponding friction force so that the vehicle is stopped safely while protecting its occupants.

[0006] Another object of the present invention is to provide a crash cushion apparatus capable of unfolding and spreading guardrails using simple double-bent connection plates, instead of conventional complicated hinges for guardrail mounting structures.

[0007] Another object of the present invention is to provide a crash cushion apparatus having a cushion tank, which is hollow or contains a buffer member, installed at each stage of the apparatus, considering that collision energy of a vehicle cannot be completely absorbed by friction force of the guardrails alone, thereby further facilitating absorption of collision energy of the vehicle.

[0008] Another object of the present invention is to provide a crash cushion apparatus having a movable plate adapted to move leftwards/rightwards and absorb collision energy, which occurs during a lateral collision of a vehicle, thereby facilitating absorption of collision energy of the vehicle.

[0009] In order to accomplish these objects, there is provided a crash cushion apparatus including a front impact absorption portion; a guardrail connection device having a plurality of support frames, guardrails installed on both sides of the support frames, and connection plates adapted to connect the support frames and the guardrails; a rear support fixed to the ground and adapted to support a support frame of the last stage among the support frames; a movable plate installed to correspond to a front surface of the rear support and adapted to move leftwards/rightwards; a cushion tank comprising an upper cushion tank, a lower cushion tank adapted to be connected to and released from the upper cushion tank, and a fastening member adapted to connect the upper and lower cushion tanks; and a wire rope installed to guide the support frames towards the rear support during an external shock.

[0010] The plurality of support bars are connected by first and second fastening members, the first fastening member is fixed to one side of a guardrail, and the second fastening member is fixed to the support frame.

[0011] The first fastening member includes a bent plate connected to a first connection member, a spacer installed in a position corresponding to the bent plate, and bolts and nuts for fixing the bent plate and the spacer; and the second fastening member includes a bent plate connected to a second connection member and bolts and nuts for fixing the bent plate.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The above and other objects, features and advantages of the present invention will be more apparent from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a perspective view of a crash cushion apparatus according to the present invention;
FIG. 2 is a top view of a crash cushion apparatus according to the present invention;
FIG. 3 is a lateral view of a crash cushion apparatus according to the present invention;
FIG. 4 is an internal lateral view of a crash cushion apparatus according to the present invention, with guardrails removed;
FIG. 5 is a perspective view illustrating the interconnection between a guardrail, a support frame, and connection plates, which are major components of the present invention;
FIG. 6 is a perspective view illustrating the interconnection between guardrails, a support frame, a rear support, and a movable plate, which are major components of the present invention;
FIG. 7 is a top view illustrating the state of a crash cushion apparatus according to the present invention, after a collision;
FIG. 8 is a perspective view of a cushion tank, which is a major component of the present invention;
FIG. 9 is a perspective view of impact absorption members, which are major components of the present invention; and
FIG. 10 is a front view magnifying one of the impact absorption members of FIG. 9.

DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

[0013] Hereinafter, a crash cushion apparatus according to an exemplary embodiment of the present invention will be described in detail with reference to the accompanying drawings.

[0014] A crash cushion apparatus according to the present invention, as illustrated in FIGS. 1 and 2, includes a front impact absorption portion 50, guardrail connection devices 100, a rear support 250, wire ropes 30, and related members (described later).

[0015] The front impact absorption portion 50 has a semicylindrical shape, and is adapted to absorb initial collision energy and provide the front portion of the apparatus with a finish. Reflection sheets 52 are attached to the outer surface of the front impact absorption portion 50 in the shape of "< < > >" to improve nighttime visibility.

[0016] Each guardrail connection device 100 includes, as illustrated in FIGS. 2-4, a support frame 130, guardrails 140, connection plates 150, long bolts 160, long springs 164, spacers 170, bolts 180, and nuts 182. A number of guardrail connection devices 100 are installed at a predetermined interval in such a manner that the length of the width of each support frame 130 increases gradually towards the backside.

[0017] The number of the guardrail connection devices 100 determines the number of bays. The higher the number of bays is, the higher the shock absorption capability becomes. Therefore, the number of bays is determined by the user according to the traveling speed on the road.

[0018] The coupling structure between both sides of a support frame 130 and guardrails 140 will be described with reference to FIG. 5. A guardrail 140 is fixed to one side of the support frame 130, with an interposed double-bent connection plate 150, using spacers 170, bolts 180, and nuts 182 to apply a predetermined torque (fastening force). The other side is fixed using nuts 162 after inserting long springs 164 into the support frame 130 and the long bolts 160.

[0019] The connection plates 150 are installed in the above-mentioned manner for the following reasons: the guardrails 140 are connected with the support frames 130 arranged in the order of length, and the interval between both sides of the guardrails 140 increases gradually, forming inclinations. The lateral surfaces of the support frames 130 are manufactured to form right angles. Therefore, the inclinations of the guardrails 140 and the right-angled surfaces of the support frames 130 need to be connected.

[0020] When the interval between support frames 130 decreases after a vehicle collision, as illustrated in FIG. 7, the distance between guardrails 140, as well as their inclination angle, need to increase as much as the difference of length between front and rear adjacent support frames 130. To the change of interval and angle is added the following effect: while the connection plates 150 are being pulled outwards, compensated, and pulled, the long springs 164 are compressed, and the strong spring tensile force generates large resistance. This absorbs collision energy when the support frames 130 are hit by a vehicle and then moved.

[0021] The rear support 250 is connected to the last support frame among the plurality of support frames 130. The rear support 250 is fixed to the ground by anchor bolts 14 on a base plate 260 and is adapted to withstand the total collision energy, which occurs during a vehicle collision, and prevent the crash cushion apparatus from moving.

[0022] The rear support 250 has a vertical beam 275, which can have various shapes (e.g. H-shape, I-shape), but a H-shaped vertical beam 275 is adopted herein as an example.

[0023] The vertical beam 275 of the rear support 250 is, as illustrated in FIG. 6, installed on a base plate 260. A wire fixing plate 252 is installed on one side of the base plate 260 and is provided with holes 36. A reinforcement member 270 is installed on one side of the wire fixing plate 252 to support the vertical beam 275.

[0024] The base plate 260 has a plurality of through-holes 172 formed on its outer peripheral edge, and anchor bolts 14 are installed in the through-holes 172 to fix the base plate 260 to the ground. An eye bolt 15 is connected to one side of a ring-shaped connection member 34, which is connected to each wire rope 30, and is fixed to the hole 36 on each side of the wire fixing plate 252 by a nut 16. As such, the wire ropes 30 are tensioned

and connected by fastening the nuts 16 tightly.

[0025] A movable plate 280 is installed in front of the rear support 250 and is adapted to move in a lateral direction and alleviate a shock caused by a vehicle colliding with the guardrails 140 laterally.

[0026] A pair of slots 285 is installed at a distance from each other on one side of the movable plate 280, and a plurality of pairs of the slots 285 are installed in the vertical direction at an interval. Bolts 297 are installed on the other side of the movable plate 280 to fit into the corresponding slots 285. The bolts 297 are fitted onto the support frame 330 via the slots 285 by nuts 295.

[0027] Support bars 350 are installed on both sides of the support frame 330, as illustrated in FIG. 2. The support bars 350 are fixed by respective fixing members 570 and 580 via first and second connection members 362 and 372. The fixing members 570 and 580 include bolts and nuts, respectively.

[0028] A first fastening member 360 installed on one side of the support bar 350 is fixed to one side of the guardrail 140, and a second fastening member 370 installed on the other side of the support bar 350 is fixed to the support frame 330. The first fastening member 360 includes a bent plate 364 connected to the first connection member 362, a spacer 366 installed in a position corresponding to the bent plate 364, and a bolt 367 and a nut 368 for fixing the bent plate 364 and the spacer 366. The second fastening member 370 includes a bent plate 374 connected to the second connection member 372 and a bolt 377 and a nut 378 for fixing the bent plate 374.

[0029] The coupling structure between both sides of a support frame 130 and guardrails 140 will be described with reference to FIG. 5. A guardrail 140 is fixed to one side of the support frame 130, with an interposed double-bent connection plate 150, using spacers 170, bolts 180, and nuts 182 to apply a predetermined torque (fastening force). The other side is fixed using nuts 162 after inserting long springs 164 into the support frame 130 and the long bolts 160.

[0030] Meanwhile, on the opposite side of the wire fixing plate 252, as illustrated in FIGS. 2-4, a wire fixing unit 60 is installed on the ground near the front impact absorption portion 50 and is fixed by anchor bolts 14. A pair of wire ropes 30 is connected to the wire fixing unit 60 through a wire clip 70 (described later) seated on a horizontal reinforcement table 132 of each support frame 130.

[0031] Each wire rope 30 has rope rings 34 formed on both ends, respectively, as illustrated in FIGS. 3 and 7. One ring is connected to the wire fixing unit 60 by a shackle 20, and the other ring is connected to the wire fixing plate 252 of the rear support 250 by an eye bolt 15 and a nut 16. The wire ropes 30 are tensioned and connected by fastening the nuts 16 tightly.

[0032] The wire clip 70 includes, as illustrated in FIG. 5, a U bolt 72, nuts 74, and tensile springs 76. The nuts 74 are fastened to pull the U bolt 72 and grasp the wire rope 30. The tensile springs 76 are adapted to exert tensile force corresponding to the pulling force so that the wire rope 30 is grasped by a proper level of force. The wire clip 70, which grasps the wire rope 30, then does not only generate friction force during a movement of the support frame 130 but also prevent it from escaping (i.e. act as a guide). In addition, the wire rope 30 does not only absorb collision energy, which is caused by a lateral collision with a vehicle, by means of its elasticity, but also prevents the support frame 130 and the guardrail 140 from escaping.

[0033] Meanwhile, a cushion tank 450 is used between guiderail connection devices 100, as illustrated in FIG. 8, but can also be omitted if necessary. The cushion tank 450 includes, as illustrated in FIG. 8, an upper cushion tank 462, a lower cushion tank 468 connected to the upper cushion tank 462, and fastening members 474 for coupling the upper and lower cushion tanks 462 and 468.

[0034] The upper and lower cushion tanks 462 and 468 are provided with fastening portions 463 and 469, respectively, which have a plurality of fastening holes 563 and 569 formed at predetermined intervals, respectively. The fastening portions 463 and 469 of the upper and lower cushion tanks 462 and 468 are positioned to face each other so that the fastening holes 563 and 569 communicate with each other, and the fastening members 474 are then fastened and connected. Such separate construction of upper and lower cushion tanks 462 and 468 and assembly of them into a cushion tank 450 using fastening members 474 are advantageous in that, when the cushion tank 450 is partially damaged after a collision, only the corresponding part (either the upper or lower cushion tank) needs to be replaced, without having to replace the entire cushion tank 450 and increase the repair cost.

[0035] An air outlet 454 is formed in a quadrangular shape on the rear surface 452 of the upper cushion tank 462 to discharge air to the outside. The upper cushion tank 462 has an arch-shaped upper surface 480, on which a protrusion 482 is formed. Wire channels 470 are formed beneath the lower cushion tank 468 to guide wire ropes 600.

[0036] The cushion tank 450 is adapted to absorb collision energy by being compressed by a shock applied when a vehicle collides. Particularly, during a vehicle collision, the air inside the cushion tank 450 is compressed so that it acts as an air cushion, and the compressed air is discharged through the air outlet 454, reducing the collision energy.

[0037] The cushion tank 450 is preferably made of metallocene polyethylene resin so that it can restore its original shape when no force presses it any longer.

[0038] The wire channels 470 formed beneath the cushion tank 450 have a depth determined so as to guide the wire ropes 30 and prevent them from escaping. As such, the wire channels 470 serve as passages through which the wire ropes 30 can extend without any interference from the support frames 130.

[0039] The upper surface 480 of the cushion tank 450 has, as illustrated in FIG. 8, a protrusion 482 protruding backwards. The protrusion 482 is adapted to protrude a predetermined length, which corresponds to the width of the support frame 100, so that, when the upper surface of the support frame 100 is covered, the support frame 100 is not exposed to the outside.

[0040] Among the plurality of cushion tanks 450, a predetermined number of them have a plurality of tube-shaped impact absorption members 380 installed therein, while the others are empty, as illustrated in FIG. 4. The reason only the last two of the plurality of cushion tanks 450 have a plurality of impact absorption members 380 installed therein is as follows: when a vehicle collides, the shock against the vehicle can be alleviated gradually if no impact absorption members are installed in the preceding cushion tanks 450.

[0041] Although eighteen impact absorption members 380 are inserted into the last two cushion tanks 450 in the illustrated embodiment, the number of impact absorption members 380 can be varied as needed. The number of cushion tanks 450 containing impact absorption members 380 can also be changed. The cushion tanks 450 are preferably made of a synthetic resin, including polyethylene resin.

[0042] Meanwhile, each of the plurality of impact absorption members 380 includes, as illustrated in FIGS. 9 and 10, a barrier 384 formed at the center; a plurality of first coupling recesses 388 formed on the upper portion; a second coupling recess 398 formed on one side of the lateral surface; a plurality of first coupling protrusions 382 formed on the lower portion; and a second coupling protrusion 392 formed on the other side of the lateral surface. The impact absorption members 380 are made of a soft metal material (e.g. aluminum) so as to absorb shock energy resulting from a shock. However, the material of the impact absorption members 380 is not limited to this, and aluminum or any equivalent thereof can be used.

[0043] When the impact absorption members 380 are to be extended in the longitudinal (horizontal) direction, different impact absorption members 380 are connected in a sliding type using second coupling protrusions 392 and second coupling recesses 398, which are installed on outer peripheral surfaces to face each other, as illustrated in FIGS. 9 and 10. When the impact absorption members 380 are to be extended in the transverse (vertical) direction, different impact absorption members 380 are connected in a sliding type using a pair of first coupling protrusions 382 and a pair of first coupling recesses 388, which are formed on upper and lower portions, respectively.

[0044] The barriers 384 of the impact absorption members 380 are hollow in the longitudinal direction and have a wavy shape. The barriers 384 are adapted to deform together with the impact absorption members 380 and additionally absorb collision energy, and the wavy shape is more favorable to distributing force applied along the compression direction, compared with a straight shape.

[0045] A process of absorbing collision energy, when a vehicle collides, by the crash cushion apparatus according to the present invention, which has the above-mentioned construction, will now be described.

[0046] The process of absorbing collision energy preferably proceeds in the following manner: a small amount of collision energy is initially absorbed, and a gradually increasing amount of collision energy is absorbed so that the velocity of the colliding vehicle decreases at a predetermined rate, i.e. the deceleration does not exceed a threshold.

[0047] When the vehicle initially makes a front collision with the front impact absorption portion 50 of the crash cushion apparatus according to the present invention, as illustrated in FIGS. 2-4, the front impact absorption portion 50 itself undergoes plastic deformation and absorbs a part of the collision energy, thereby reducing the vehicle's velocity. Vehicle collision tests show that, during a vehicle collision, the front impact absorption portion 50 reduces the initial velocity of the vehicle by about 4%. As the vehicle proceeds, the first support frame 130 is moved. At the same time, the first guardrails 140 fixed to both sides of the support frame 130 are moved together and, in this process, friction force occurs with regard to spacers 170 fixed by bolts 180 and nuts 182 of the second support frame 130, additionally absorbing the collision energy. The guardrails 140 can move while being fixed by the bolts 180 and nuts 182 because of the long holes 142 formed on the guardrails 140.

[0048] As the vehicle proceeds further, the first support frame 130 moves and abuts the second support frame 130 until there is no space between them. The first support frame 130 then moves the second support frame 130, and the guardrails 140 move concurrently, generating friction force with regard to spacers 170 of the third support frame 130. When the last support frame 130 abuts the rear support 250 in this manner, strong torque (fastening force) is applied by the bolts 180 and nuts 182, increasing the friction force.

[0049] A plurality of front cushion tanks 450 are hollow, while a plurality of rear cushion tanks 450 contain impact absorption members 380. When the front cushion tanks 450 (which are hollow) are compressed, the internal air is discharged through the air outlets 454 and absorbs collision energy. Due to the air outlets 454, the cushion tanks 450 absorb shocks by themselves during deformation. Since the impact absorption members 380 are installed inside the cushion tanks 450, the impact absorption members 380 do not escape out of the cushion tanks 450 due to shocks, thereby removing the possibility of a secondary accident.

[0050] Considering that all collision energy of a vehicle cannot be absorbed by friction force from the guardrails 140 and the hollow cushion tanks 450 alone, the impact absorption members 380 inside the plurality of rear cushion tanks 450 undergo deformation, as illustrated in FIGS. 2 and 8, and absorb all of the remaining collision energy of the vehicle, which then stops.

[0051] As illustrated in FIG. 3 in connection with the preceding process (process of movement of all support frames 130), the wire ropes 30 are connected to wire clips 70 mounted on all support frames 130 and are pulled towards the ground. Therefore, friction with the ground occurs at parts of the support frames 130 that contact the ground. Friction also occurs between the wire clips 70 and the wire ropes 30. The average weight of the support frames 130 is 150kg, meaning that a considerable amount of energy is absorbed in the process of moving all support frames 130 (energy absorption by inertia). All of the collision energy of the vehicle is absorbed throughout the above-mentioned elements of the process, and the vehicle stops.

[0052] When the vehicle proceeds further until the support frames 130 and the guardrails 140 are pushed to the limit, as illustrated in FIG. 7, the support frames 130 abut each other, and the guardrails 140 are unfolded leftwards /rightwards, so that the overall shape becomes similar to that of a folded fan.

[0053] On the other hand, when the vehicle makes a lateral collision, the movable plate 280 installed on one side of the last support frame 130 so as to correspond to the rear support 250, as illustrated in FIG. 6, is moved and guided by the bolts 297 of the rear support 250 along the slots 285, thereby absorbing the vehicle's collision energy step by step. Particularly, when the vehicle first collides with the guardrails 140 and moves, the movable plate 280 moves in the same direction as the direction of collision and absorbs the generated collision energy. The movable plate 280 is also connected to support bars 350 and moved accordingly so that collision energy can be absorbed more efficiently step by step.

[0054] The support bars 350 are installed between the guardrails 140 and the support frame 330 so that, when the user pushes back the movable plate 280 after the collision, the support bars 350 regain the original conditions in a simple manner.

[0055] The crash cushion apparatus according to the present invention employs hollow cushion tanks 450, cushion tanks 450 containing impact absorption members 380, guardrail connection devices 100, movable plates 280, and support bars 350 to absorb shocks caused not only by front vehicle collisions, but also by lateral vehicle collisions, in a stepwise manner, thereby guaranteeing the safety of drivers and occupants.

[0056] The crash cushion apparatus according to the present invention has the following advantages: road facilities at which crash cushion apparatuses are typically installed, such as entrance ramps, exit ramps, intersections, starting points of median strips, etc. have widths larger than those of conventional straight crash cushion apparatuses, meaning that, when a vehicle makes a lateral collision with the crash cushion apparatus, it may secondarily collide with a part of the road structure. In contrast, the crash cushion apparatus according to the present invention has a rear width large enough to avoid secondary collision.

[0057] In addition, the crash cushion apparatus according to the present invention has a plurality of support bars installed between support frames and guardrails, which are adapted to absorb shocks caused not only by a forward collision, but also by a lateral collision, thereby facilitating absorption of collision energy caused by the collision.

[0058] The crash cushion apparatus according to the present invention can be installed at the junction of a road, at the entrance of a tunnel or an underpass, at a bridge, at a tollgate, etc. The crash cushion apparatus according to the present invention is applicable not only to traffic safety facility fields, but also to other fields related to safety facilities in connection with civil engineering, architecture, construction, harboring, aviation, etc.

[0059] Although an exemplary embodiment of the present invention has been described for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

Claims

1. A crash cushion apparatus comprising:

   a front impact absorption portion (50);
   a guardrail connection device (100) having a plurality of support frames (130), guardrails (140) installed on both sides of the support frames (130), and connection plates (150) adapted to connect the support frames (130) and the guardrails (140);
   a rear support (250) fixed to the ground and adapted to support a support frame of the last stage among the support frames;
   a movable plate (280) installed to correspond to a front surface of the rear support (250) and adapted to move leftwards/rightwards;
   a cushion tank (450) having an upper cushion tank, a lower cushion tank (468) adapted to be connected to and released from the upper cushion tank (462), and a fastening member (474) adapted to connect the upper and lower cushion tanks (462,468); and
   a wire rope (30) installed to guide the support frames (130) towards the rear support (250) during an external shock.

2. The crash cushion apparatus as claimed in claim 1, wherein the front impact absorption portion (50) has a reflection sheet (52) attached to an outer surface to improve nighttime visibility.

3. The crash cushion apparatus as claimed in claim 1, wherein the guardrail connection device (100) has a number of support frames (130) installed at a pre-

determined interval, and the length of width of each support frame (130) increases towards the backside.

4. The crash cushion apparatus as claimed in claim 1, wherein the connection plates (150) of the guardrail connection device (100) have a double-bent shape to interconnect the guardrails (140) and the support frames (130).

5. The crash cushion apparatus as claimed in claim 1, wherein each connection plate (150) of the guardrail connection device (100) is connected to a support frame (130) by a long bolt (160) with an interposed long spring (164) at one side thereof, and is movably connected to a guardrail (140) via a spacer (170) by a bolt (180) and a nut (182) at the other side thereof.

6. The crash cushion apparatus as claimed in claim 1, wherein the movable plate (280) has slots (285,285) formed on both sides at an interval, and fastening members (474) are installed in the slots so that, during a lateral shock, the movable plate (280) moves leftwards/rightwards along the slots with regard to the rear support (250).

7. The crash cushion apparatus as claimed in claim 1, wherein the rear support (250) has wire fixing plates (252) to connect wire rope(30) at both sides of a lower portion thereof.

8. The crash cushion apparatus as claimed in claim 1, further comprising a plurality of support bars (350) installed between the support frame (330) of the last stage and the guardrails (140).

9. A crash cushion apparatus comprising:

a front impact absorption portion (50);
a guardrail connection device (100) having a plurality of support frames (130), guardrails (140) installed on both sides of the support frames (130), and double-bent connection plates (150) adapted to connect the support frames (130) and the guardrails (140);
a rear support (250) adapted to support a support frame (130) of the last stage among the support frames (130);
a movable plate (280) installed to correspond to a front surface of the rear support (250) and adapted to move leftwards/rightwards;
support bars (350) connected and moved to the movable plate (280) and disposed between the support frame (330) of the last stage and the guardrails (140);
cushion tanks (450) installed inside the plurality of support frames (130) and guardrails, impact absorption members (380) being installed in the cushion tanks; and
a wire rope (30) installed to guide the support frames (130) towards the rear support (250) during an external shock.

10. The crash cushion apparatus as claimed in claim 9, wherein the rear support (250) includes a vertical beam (275) installed on a base plate (260), a reinforcement member (270) adapted to support the vertical beam (275), and a fixing plate (252) adapted to fix the wire rope (30).

11. The crash cushion apparatus as claimed in claim 9, wherein the support bars (350) are installed on both sides of the support frame (130) and are fixed by fixing members (570,580) with interposed first and second connection members (362,372).

12. The crash cushion apparatus as claimed in claim 9, wherein each support bar (350) comprises first and second fastening members (360,370); the first fastening member (360) includes a bent plate (364) connected to a first connection member (362), a spacer (366) installed in a predetermined position corresponding to the bent plate (364), and a fixing member adapted to fix the bent plate (364) and the spacer (366); and the second fastening member (370) includes a bent plate (374) connected to a second connection member (372) and a fixing member adapted to fix the bent plate (374).

13. The crash cushion apparatus as claimed in claim 9, wherein each cushion tank includes an upper cushion tank (462), a lower cushion tank (468) adapted to be connected to and released from the upper cushion tank (462), and a fastening member (474) adapted to connect the upper and lower cushion tanks (462,468).

14. The crash cushion apparatus as claimed in claim 13, wherein the upper cushion tank (462) has an air outlet (454) formed on a rear surface (452) to discharge air to the outside, and the lower cushion tank (468) has a wire channel (470) formed on a lower portion to guide the wire rope (30).

FIG.1

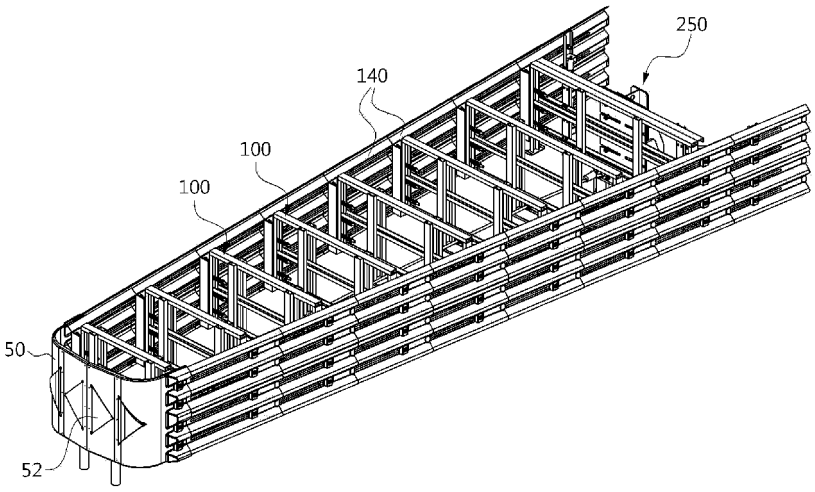

250
140
100
100
50
52

FIG.2

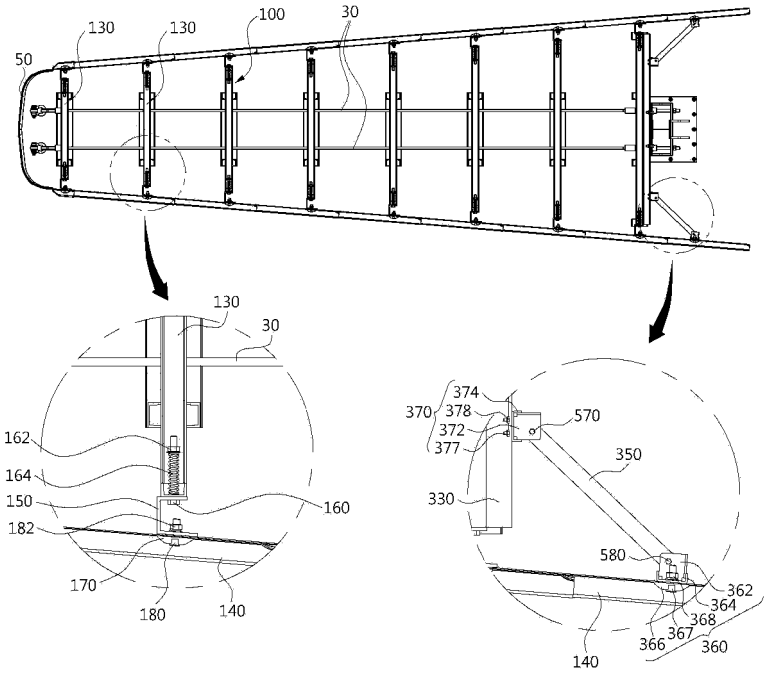

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FIG.3

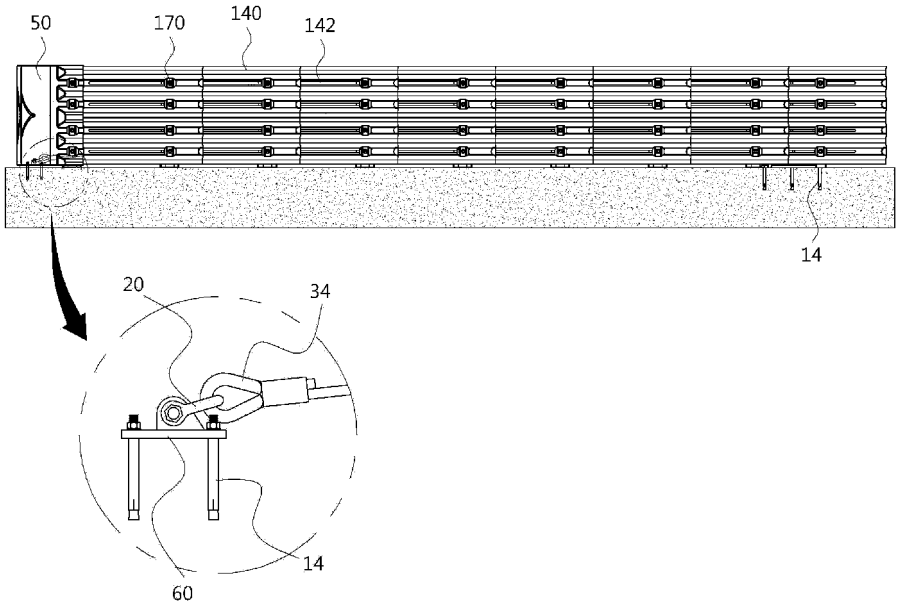


FIG.4

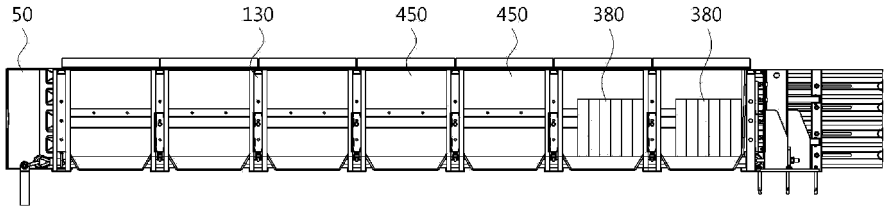


FIG.5

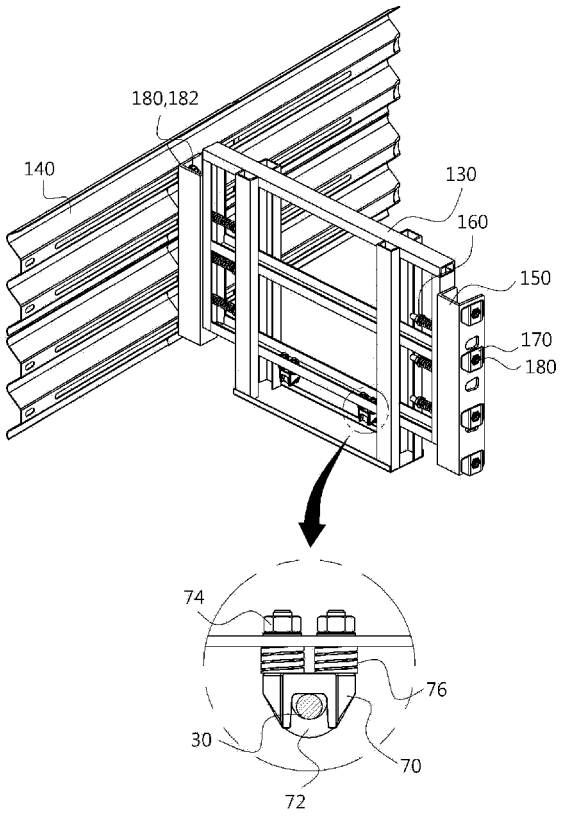
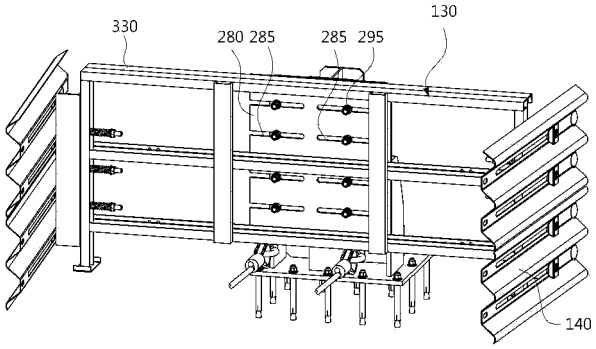


FIG.6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130
140

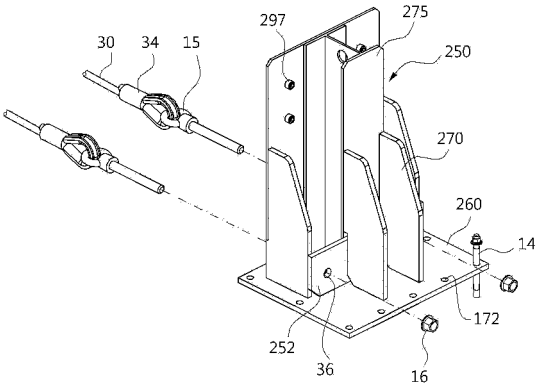
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FIG.7

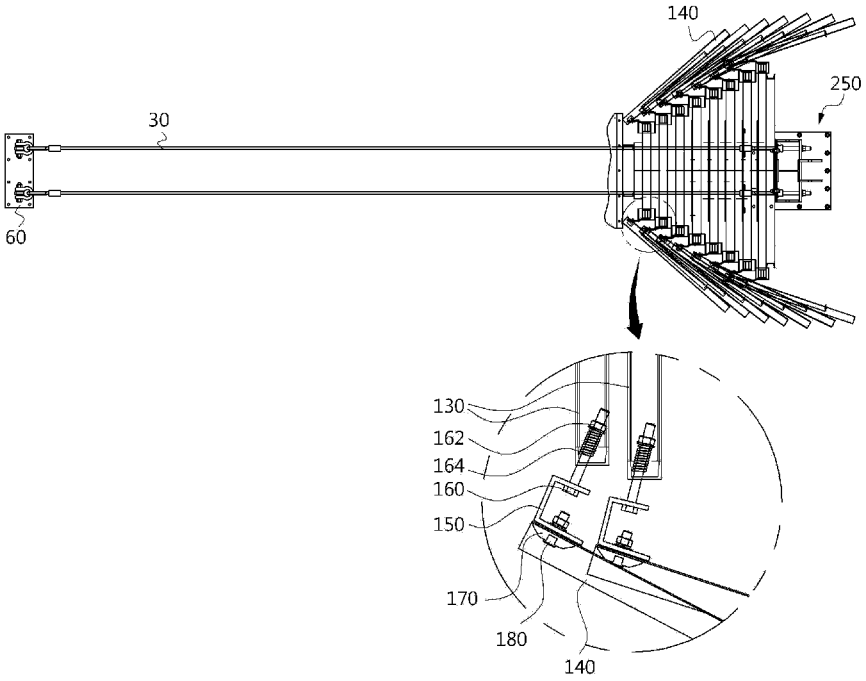

FIG.8

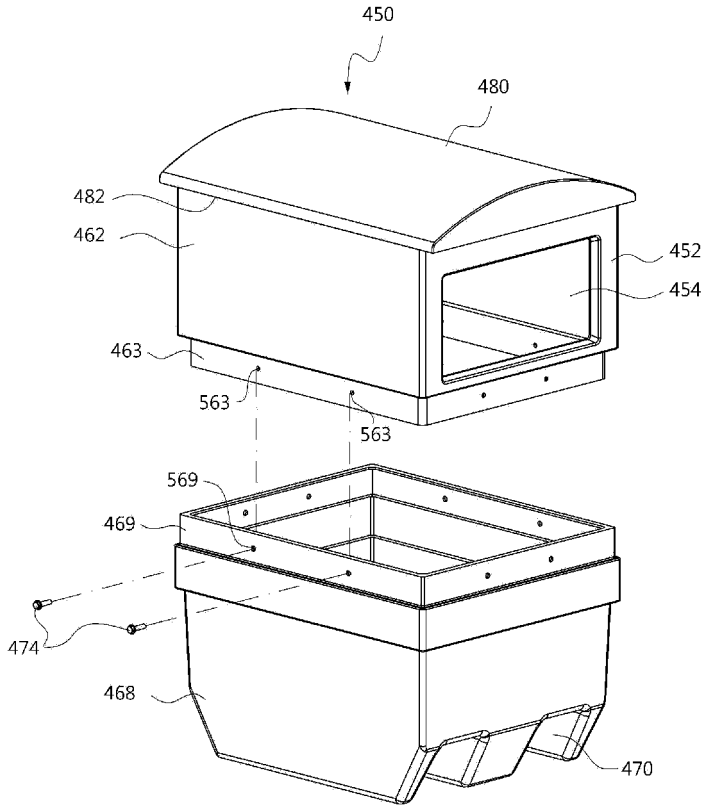
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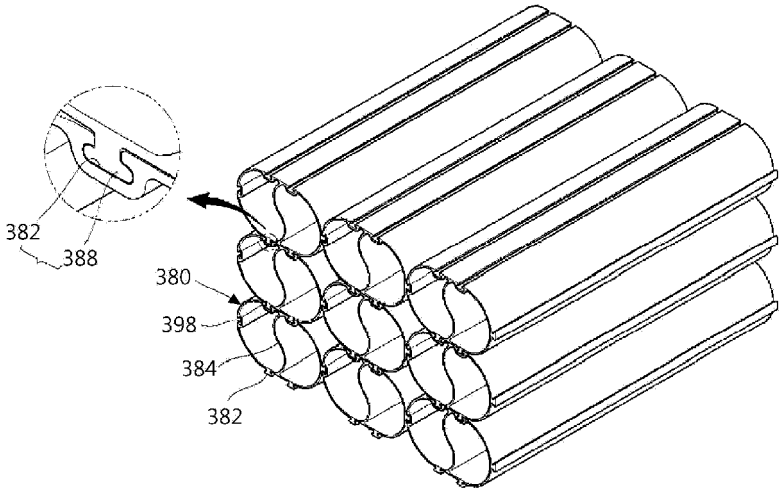
FIG.9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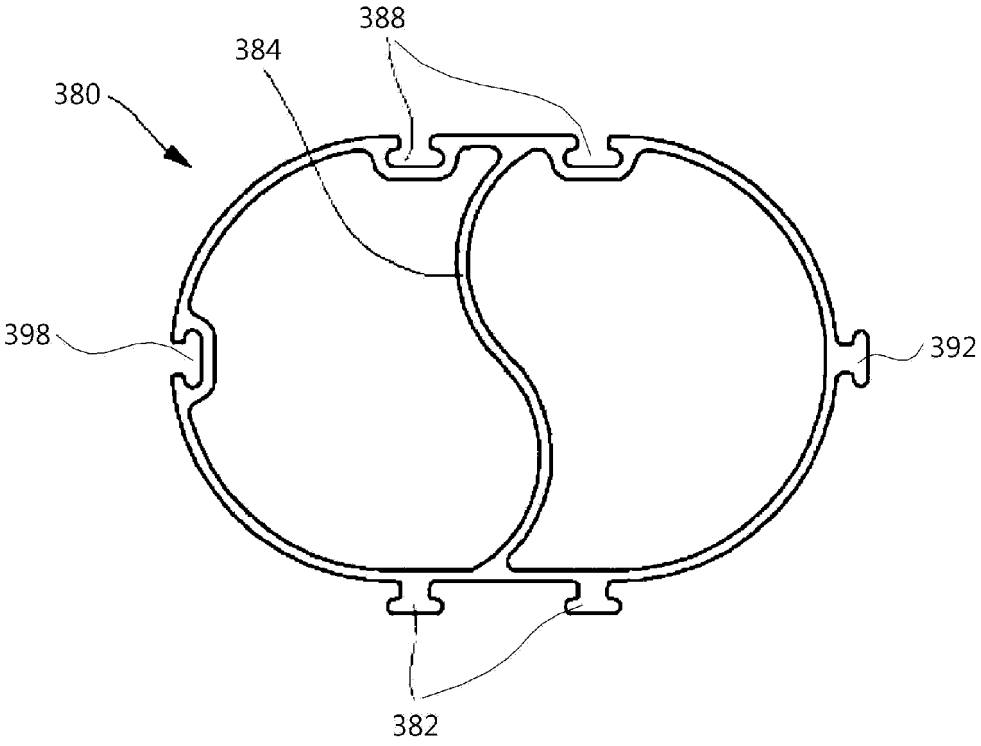
382

FIG.10



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Patent documents cited in the description

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