

(19)



(11)

**EP 2 818 595 B1**

(12)

**EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:  
**20.04.2016 Bulletin 2016/16**

(51) Int Cl.:  
**E01F 15/00 (2006.01)**

(21) Application number: **14181302.2**

(22) Date of filing: **26.02.2010**

(54) **Safety trailer**

Sicherheitsanhänger

Remorque de sécurité

(84) Designated Contracting States:  
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR**

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(30) Priority: **27.02.2009 US 156319 P**

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(43) Date of publication of application:  
**31.12.2014 Bulletin 2015/01**

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(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:  
**10746924.9 / 2 401 436**

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**EP 2 818 595 B1**

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**Description**

**FIELD**

[0001] The present invention relates generally to the field of trailers and other types of barriers used to shield road construction workers from traffic. More specifically, the present invention discloses a safety and construction trailer having a safety wall.

**BACKGROUND**

[0002] Various types of barriers have long been used to protect road construction workers from passing vehicles. For example, cones, barrels and flashing lights have been widely used to warn drivers of construction zones, but provide only limited protection to road construction workers in the event a driver fails to take heed. Some construction projects routinely park a truck or other heavy construction equipment in the lane between the construction zone and on-coming traffic. This reduces the risk of worker injury from traffic in that lane, but does little with regard to errant traffic drifting laterally across lanes into the construction zone. In addition, conventional barriers require significant time and effort to transport to the work site, and expose workers to significant risk of accident while deploying the barrier at the work site. Therefore, a need exists for a safety barrier that can be readily transported to and deployed at the work site. In addition, the safety barrier should protect against lateral incursions by traffic from adjacent lanes, as well as traffic in the same lane.

[0003] US 7125198 discloses a mobile work zone protection device that includes a front carrier, a barrier beam assembly consisting of two sets of telescopic beam structures and rear carrier.

[0004] US 2006/0044816 A1 discloses a safety trailer with 3 interconnectable wall segments.

**SUMMARY**

[0005] These and other needs are addressed by a safety trailer according to claim 1.

[0006] A system is provided that includes first and second platforms comprising at least one set of wheels and a safety wall positionable between the first and second platforms to define an area protected from a vehicular incursion. The system includes first and second platforms, an accordion-like safety wall positioned between, and engaged with the first and second platforms.

[0007] The safety wall includes a plurality of rotatably connected wall segments, each being rotatable, about a vertical axis, with respect to an adjacent wall segment or, as appropriate, an adjacent first or second platform.

[0008] Further preferred embodiments of the invention are defined in the appended dependent claims 2-7.

[0009] The present invention can provide a number of advantages depending on the particular configuration.

By way of example, the safety trailer can have sufficient mass and energy absorption to resist, without substantial displacement, the kinetic energy from the impact. The safety wall itself can be made of any rigid material, such as steel. Lighter weight materials having high strength are typically disfavored as their reduced weight is less able to withstand, without significant displacement, the force of a vehicular collision. Energy absorption can be provided by shocks and inflated wheels. Preferred trailer configurations are not deployed on jack stands, which can minimize energy absorption by these mechanisms.

[0010] The safety wall or barrier (and thus the entire trailer) can be of any selected length or extendable to provide a work area protected from vehicular incursions. This can provide maintenance workers with substantial safety benefits while also providing enhanced driver safety.

[0011] The traffic-incursion side of the safety trailer, including any elongated safety wall, can be substantially planar to avoid hang ups and snags with an impacting vehicle. Hang ups and snags can direct more kinetic impact energy into the wall and/or cause the vehicle to flip over the safety wall.

[0012] The height of the safety wall can be high enough to inhibit entry of an impacting vehicle into the protected work area by climbing, flipping, and careening over the wall.

[0013] End platforms integral to the trailer's design can minimize the need for workers to leave the protected zone and eliminate the need for separate maintenance vehicles by providing onboard hydraulics, compressors, generators and related power, fuel, water, storage and portable restroom facilities. Optional overhead protection can be extended out over the work area for even greater environmental relief (rain or shine).

[0014] The trailer can carry independent directional and safety lighting at both ends and will work with any standard semi tractor. Directional lighting and impact-absorbing features incorporated at each end of the trailer and in the rear platform can combine with the safety wall and improved lighting to provide increased protection for both work crews and the public, especially with ever-increasing amounts of night-time construction. Optionally, an impact-absorbing caboose can be attached at the end of the trailer opposite the tractor to provide additional safety lighting and impact protection.

[0015] The trailer can be designed to eliminate the need for separate lighting trucks or trailers, to reduce glare to traffic, to eliminate the need for separate vehicles pulling portable restroom facilities, to provide better a brighter, more controlled work environment and enhanced safety, and to, among other things, better facilitate 24-hour construction along the nation's roadways.

[0016] The trailer can be designed to provide road maintenance personnel with improved protection from ongoing, oncoming and passing traffic, to reduce the ability of passing traffic to see inside the work area (to mitigate rubber-necking and secondary incidents), and to

provide a fully-contained, mobile, enhanced environment within which the work crews can function day or night, complete with optional power, lighting, ventilation, heating, cooling, and overhead protection including extendable mesh shading for sun protection, or tarp covering for protection from rain, snow or other inclement weather.

[0017] Platforms can be provided at both ends of the trailer for hydraulics, compressors, generators, batteries, water misters, water sprayers, pumps for liquid removal from the protected work area, fans, tool storage, related fuel, water, storage, and restroom facilities and other amenities. The trailer can be fully rigged with direction and safety lighting, as well as lighting for the work area and platforms. Power outlets can be provided in the interior of the work area for use with construction tools and equipment, with minimal need for separate power trailers or extended cords. Both the front and rear platforms can provide areas for fuel, water and storage. Additional fuel, water and miscellaneous storage space can be provided in an optional extended caboose of like but lengthened design.

[0018] Other applications include but are not limited to public safety, portable shielding and shelter, communications and public works. Two or more trailers can be used together to provide a fully enclosed inner area, such as may be necessary in multi-lane freeway environments.

[0019] With significant shifts to night construction and maintenance, the trailer can provide a well-lit, self-contained, and mobile safety enclosure. Cones can still be used to block lanes, and detection systems or personnel can be used to provide notice of an errant driver, but neither offers physical protection or more than split second warning for drivers who may be under the influence of alcohol or intoxicants, or who, for whatever reason, become fixated on the construction/maintenance equipment or lights and veer into or careen along the same.

[0020] The safety trailer can be readily, easily and conveniently deployable. The tractor can, for instance, be able to engage the hitch of the safety trailer from multiple directions, rather than only from one specific orientation. The safety trailer can have an air ride on the rear platform to permit either side or the entirety of the front and/or rear platforms to be raised or lowered.

[0021] The safety trailer can have semi-tractor hookups at both ends and a safety wall that is fixed to one side of the trailer. That side, however, can be changed to the right or left side of the road, depending on the end to which the semi-tractor attaches. A caboose can be attached at the end of the trailer opposite the tractor to provide additional lighting and impact protection. These and other advantages will be apparent from the disclosure of the invention(s) contained herein.

**BRIEF DESCRIPTION OF THE DRAWINGS**

[0022] The accompanying drawings are incorporated into and form a part of the specification to illustrate sev-

eral examples of the present invention(s). These drawings, together with the description, explain the principles of the invention(s). The drawings simply illustrate preferred and alternative examples of how the invention(s) can be made and used and are not to be construed as limiting the invention(s) to only the illustrated and described examples. Further features and advantages will become apparent from the following, more detailed, description of the various embodiments of the invention(s), as illustrated by the drawings referenced below.

Fig. 1 is a side view of an undeployed safety trailer according to the prior art;

Fig. 2 is a side view of a deployed safety trailer according to the prior art of Fig. 1;

Fig. 3 is a plan view of a partially deployed safety wall according to the invention;

Fig. 4 is a plan view of an undeployed safety wall according to the embodiment of Fig. 3;

Fig. 5 is an isometric view of the deployed safety wall according to the embodiment of Fig. 3;

Fig. 6 is a plan view of an undeployed safety wall according to an embodiment;

Fig. 7 is a plan view of a partially deployed safety wall according to the embodiment of Fig. 6;

Fig. 8 is an isometric view of the deployed safety wall according to the embodiment of Fig. 6;

Fig. 9 is a plan view of an undeployed safety wall with an asphalt roller-equipped second platform according to an embodiment;

Fig. 10 is a plan view of an undeployed safety wall with a side dump-equipped second platform according to an embodiment;

**DETAILED DESCRIPTION**

General

[0023] In designing a vehicular impact resistant safety trailer, there are a number of design considerations. For example, the safety trailer should have sufficient mass and energy absorption to resist, without substantial displacement, the kinetic energy from the impact. Energy absorption can be provided by shocks and inflated wheels. Deploying the trailer on jack stands can minimize energy absorption by these mechanisms. If there is insufficient mass and energy absorption, the vehicular impact can displace the safety trailer into the protected work area, with concomitant injuries to maintenance person-

nel. On the oncoming traffic-facing end of the trailer, the safety trailer should have crash attenuation devices to absorb energy from vehicular collisions and lighting and illuminated message boards to provide adequate warnings to drivers. The traffic-incursion side of the safety trailer, including any elongated safety wall, should be substantially planar to avoid hang ups and snags with an impacting vehicle. Hang ups and snags can direct more kinetic impact energy into the wall and/or cause the vehicle to flip over the safety wall. The safety wall, itself, should have sufficient structural strength (e.g., a relatively high tensile and compressive yield strength) and elastic deformation to resist the kinetic energy of vehicular impact. The height of the safety wall should be high enough to inhibit entry of an impacting vehicle into the protected work area by climbing, flipping, and careening over the wall. The safety trailer should have embedded equipment and associated plumbing/wiring to assist workers in the work area. Examples include generators, lighting, compressors, batteries, water misters, water sprayers, pumps for liquid removal from the protected work area, fans, tool storage, and the like. The safety trailer should be readily, easily and conveniently deployable. The tractor should, for instance, be able to engage the hitch of the safety trailer from multiple directions, rather than only from one specific orientation. The safety trailer should have an air ride on the rear platform to permit either side or the entirety of the front and/or rear platforms to be raised or lowered. The various configurations and embodiments disclosed herein have one or more of these features.

#### Rotatable Arm Safety Wall Trailer Designs

**[0024]** According to the prior art, the safety wall rotates to either side of the trailer, by a rotatable arm aligned (in a substantially vertical plane) substantially with the longitudinal axis of the safety trailer. Each of the rotatable arms, when deploying the safety wall, can drop into, or engage, a channel and/or retainer to provide added strength to the safety wall.

**[0025]** Figs. 1-2 depict a safety trailer according to the prior art design. The trailer 100 includes first and second platforms 104 and 108 interconnected by an extendible and retractable safety wall 112. The safety wall 112 includes first and second sections 120 and 124, with the first section 120 telescopically receiving the second section 124. Fig. 1 depicts the safety wall in an undeployed configuration while Fig. 2 depicts the safety wall in a deployed configuration. In the undeployed configuration, the safety wall is retracted while in the deployed configuration the safety wall is extended to define a protected work area for maintenance personnel. The first and/or second platforms 104 and 108 each include a ballast 116, which is positioned on the trailer 100 to offset, at least substantially, the weight of the safety wall 112.

#### Accordion-Like Safety Wall Trailer Designs

**[0026]** In a number of safety trailer embodiments, the safety wall retracts accordion-like and has multiple axes of rotation that are transverse (typically substantially orthogonal) to a longitudinal axis of the trailer.

**[0027]** Referring to Figs. 3-5, a safety trailer 2600 according to an embodiment of this design includes first and second platforms 2604 and 2608 and an accordion-like safety wall 2612 positioned between, and engaged with, the first and second platforms 2604 and 2608. The safety wall 2612 includes a plurality of rotatably connected wall segments 2708 and 2712, each being rotatable, about a vertical axis, with respect to an adjacent wall segment or, as appropriate, an adjacent first or second platform. At each such interface, a hinge-like interconnection is typically employed. When the safety wall 1612 is deployed as in Fig. 5, one or more support members 2700 is used to brace the rotatable interconnection between adjacent wall segments or wall segment and adjacent platform to inhibit rotation of the wall segment in the event of vehicular impact. Brackets 2704 are positioned on either side of the rotatable interconnection to receive the support members 2700.

**[0028]** Referring to Figs. 6-8, a safety trailer 2900 according to another embodiment includes first and second platforms 2604 and 2608 and an accordion-like safety wall 2912 positioned between, and engaged with, the first and second platforms 2604 and 2608. The safety trailer 2900 is similar to the safety trailer 2600 except that it contains more interconnected wall segments 2708 and 2712. As will be appreciated, the number of interconnected wall segments 2708 and 2712 is a function of the desired length of the safety wall (and size of the protected work area). Thus relative to Figs. 3-8, more or fewer wall segments may be employed.

#### Other Features

**[0029]** Fig. 9 depicts a safety trailer 3200 having a heavy roller 3250 on a second (rear) platform 3208. The heavy roller 3250 may be used in lieu of or in addition to rubber tires. In one configuration, the rubber tires (not shown) are elevated above the road surface when the roller 3250 is in use (or in contact with the road surface), and the roller 3250 is elevated above the road surface when the rubber tires are in use (or in contact with the road surface). This may be effected, for example, by a hydraulically actuated mechanism as will be appreciated by those of ordinary skill in the art. The safety wall members 3220, which are interconnected with one another and with the first and second platforms 3204 and 3208 are positioned on the bed defined by the first and second platforms. This safety wall embodiment is discussed in Figs. 3-8 referenced above. When the safety wall is positioned between the first and second platforms 3204 and 3208, the tractor 3280 pulls the safety trailer forward to provide a movable protected work area. The roller 3250

is lowered by engage the road surface in this mode. For asphaltting operations in which hot asphalt decreases substantially the operational life of rubber tires, this configuration is of particular benefit. Additionally, the heavy roller 3250 can eliminate the need for a separate machine to compress the as applied asphalt.

**[0030]** Fig. 10 depicts a safety trailer according to another embodiment. The safety trailer 3300 includes an aggregate director 3350 to direct aggregate materials, such as dirt, gravel, and concrete into the protected work area, when the safety wall is in position. Examples of aggregate directors include hydraulically actuatable front dumps (which dump material forwardly rather than rearwardly or to the side), concrete chutes, concrete mixer, conveyors, and the like. Any of the above trailer configurations and embodiments can have one or both of the platforms configured to include a rear caboose, as disclosed by copending U.S. 7,572,022.

**[0031]** A number of variations and modifications of the invention can be used. It would be possible to provide for some features of the invention without providing others. For example in one alternative embodiment, the features of the above embodiments may be combined with the features of other embodiments disclosed above.

#### Claims

1. A safety trailer (2600, 2900, 3200, 3300) for shielding road construction workers from traffic, comprising:

first and second platforms (2604, 2608), **characterized in that** an accordion-like safety wall (2612, 2912) is positioned between, and engaged with the first and second platforms (2604 and 2608), said safety wall (2612, 2912) includes a plurality of rotatably connected wall segments (2704, 2708, 2712), each being rotatable, about a vertical axis, with respect to an adjacent wall segment or, as appropriate, an adjacent first or second platform, wherein the vertical axis of rotation are transverse, substantially orthogonal, to a longitudinal axis of the trailer.

2. The safety trailer (2600, 2900, 3200, 3300) of claim 1, wherein the plurality of rotatably connected wall segments (2708, 2712) are connected by a hinge-like interconnection.

3. The safety trailer (2600, 2900, 3200, 3300) of claim 1-2, further comprising brackets (2704) and one or more support members (2700) on the rotatably connected wall segments (2708, 2712); wherein the brackets (2704) are positioned on either side of the rotatable interconnection to receive the support members (2700) and to brace the rotatable interconnection between adjacent wall segments or

wall segment and adjacent platform to inhibit rotation of the wall segment in the event of vehicular impact.

4. The safety trailer (2600, 2900, 3200, 3300) of claims 1-3, wherein said accordion like safety wall (2612, 2912) contains interconnected wall segments (2708, 2712, 3220).
5. The safety trailer (2600, 2900, 3200, 3300) of claims 1-4, wherein the second rear platform (3208) is on rubber tires.
6. The safety trailer (2600, 2900, 3200, 3300) of claim 1 wherein a weight of the safety wall (2612, 2912) is at least partially offset by a ballast (116) that is movable, along a fixed path, from one side of the first and/or second platform (2604, 2608) to the other side.
7. The safety trailer (2600, 2900, 3200, 3300) of claim 1 wherein each wall segment (2708, 2712, 3220) has a height of at least 1.21 meters (4 feet) from bottom edge to top edge.

#### Patentansprüche

1. Sicherheitsanhänger (2600, 2900, 3200, 3300) zum Abschirmen von Straßenbauarbeitern vor Verkehr, aufweisend:

erste und zweite Plattformen (2604, 2608), **dadurch gekennzeichnet, dass** eine akkordeonartige Sicherheitswand (2612, 2912) zwischen den ersten und zweiten Plattformen (2604 und 2608) im Eingriff mit diesen angeordnet ist, wobei die Sicherheitswand (2612, 2912) mehrere drehbar verbundene Wandsegmente (2704, 2708, 2712) aufweist, von denen jedes um eine vertikale Achse in Bezug auf ein benachbartes Wandsegment oder soweit zutreffend einer ersten und einer zweiten Plattform drehbar ist,

wobei die vertikale Drehachse quer, im Wesentlichen orthogonal zu einer Längsachse des Anhängers verläuft.

2. Sicherheitsanhänger (2600, 2900, 3200, 3300) nach Anspruch 1, wobei die mehreren drehbar verbundenen Wandsegmente (2708, 2712) durch eine gelenkartige Verbindung verbunden sind.
3. Sicherheitsanhänger (2600, 2900, 3200, 3300) nach Anspruch 1 oder 2, außerdem aufweisend Halterungen (2704) und ein oder mehrere Tragelemente (2700) auf den drehbar verbundenen Wandsegmenten

ten (2708, 2712);  
wobei die Halterungen (2704) auf jeder Seite der drehbaren Verbindung angeordnet sind, um die Tragelemente (2700) aufzunehmen und die drehbare Verbindung zwischen benachbarten Wandsegmenten oder einem Wandsegment und der benachbarten Plattform zur Unterbindung einer Drehung des Wandsegments im Fall eines Fahrzeugaufschlags abzustützen.

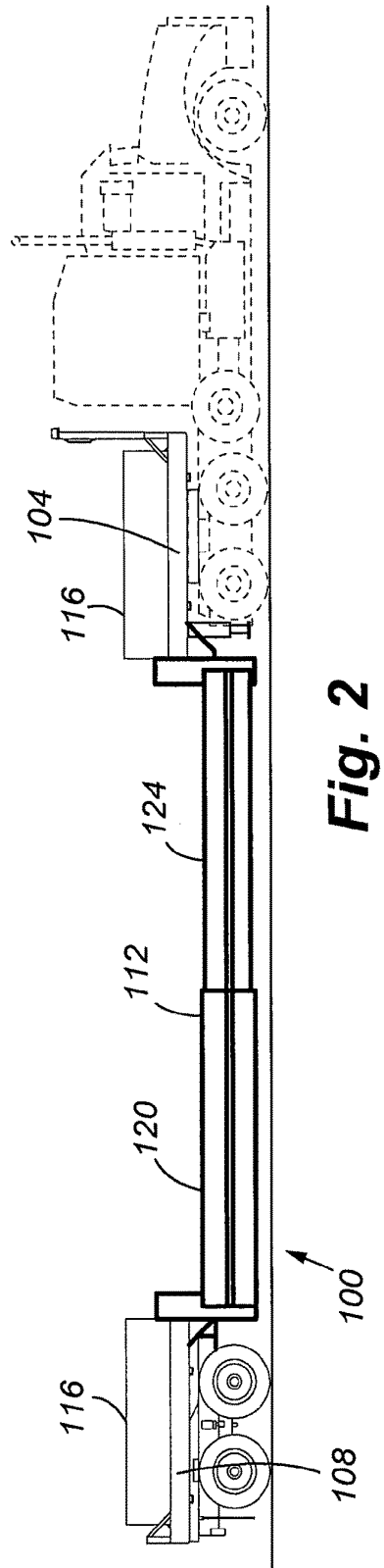
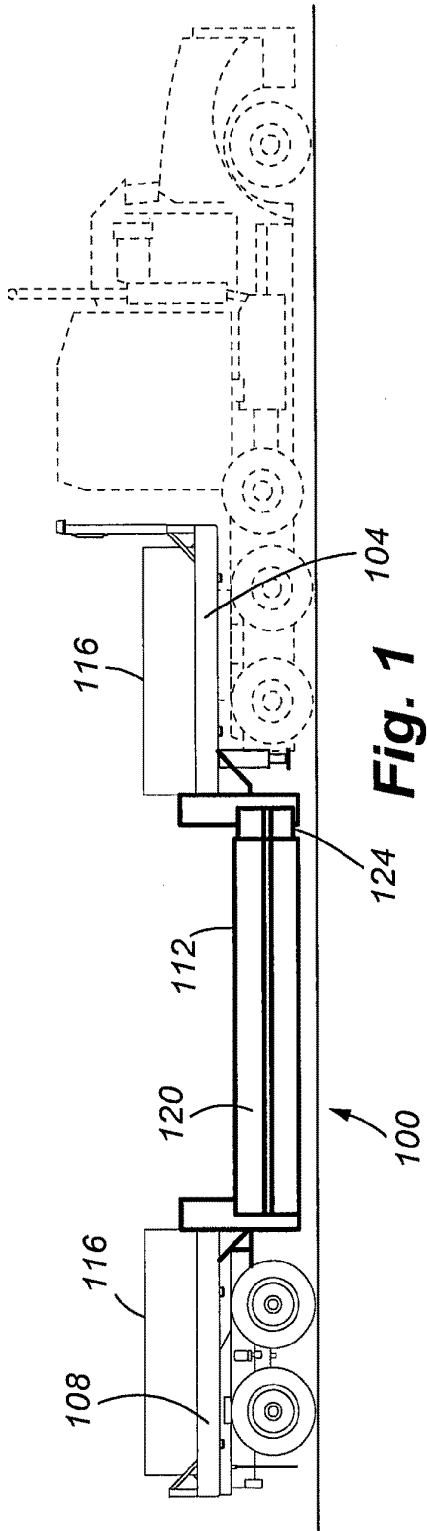
4. Sicherheitsanhänger (2600, 2900, 3200, 3300) nach Anspruch 1-3, wobei die akordeonartige of Sicherheitswand (2612, 2912) miteinander verbundene Wandsegmente (2708, 2712, 3220) enthält.
5. Sicherheitsanhänger (2600, 2900, 3200, 3300) nach Anspruch 1-4, wobei die zweite rückwärtige Plattform (3208) auf Gummireifen vorliegt.
6. Sicherheitsanhänger (2600, 2900, 3200, 3300) nach Anspruch 1, wobei die Masse der Sicherheitswand (2612, 2912) durch einen Ballast (116) zumindest teilweise ausgeglichen wird, der längs eines festgelegten Pfads von der ersten und/oder zweiten Plattform (2604, 2608) zur anderen Seite beweglich ist.
7. Sicherheitsanhänger (2600, 2900, 3200, 3300) nach Anspruch 1, wobei jedes Wandsegment (2708, 2712, 3220) eine Höhe vom zumindest 2,12 Meter (4 Fuß) von der Bodenkante zum oben liegenden Kante aufweist.

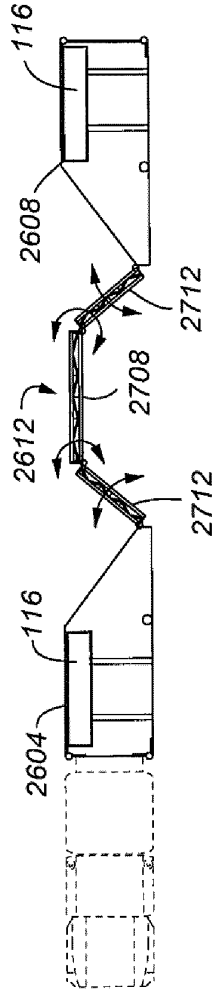
#### Revendications

1. Remorque de sécurité (2600, 2900, 3200, 3300) destinée à protéger des ouvriers de construction routière du trafic, comprenant :
  - des première et seconde plates-formes (2604, 2608),
  - caractérisée en ce qu'**une paroi de sécurité en accordéon (2612, 2912) est positionné entre, et en prise avec, les première et seconde plates-formes (2604 et 2608),
  - ladite paroi de sécurité (2612, 2912) comprend une pluralité de segments de parois reliés de manière rotative (2704, 2708, 2712), chacun pouvant tourner, autour d'un axe vertical, par rapport à un segment de paroi adjacent ou, suivant la situation, par rapport à une première ou seconde plate-forme adjacente,
  - dans laquelle l'axe vertical de rotation est transversal, sensiblement orthogonal, à un axe longitudinal de la remorque.
2. Remorque de sécurité (2600, 2900, 3200, 3300) se-

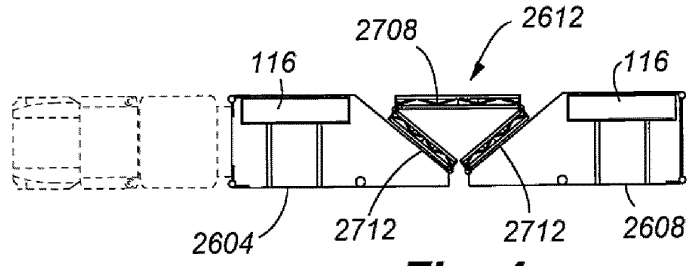
lon la revendication 1, dans laquelle la pluralité de segments de paroi reliés de manière rotative (2708, 2712) est reliée par une interconnexion de type charnière.

3. Remorque de sécurité (2600, 2900, 3200, 3300) selon la revendication 1 à 2, comprenant en outre des étriers (2704) et un ou plusieurs éléments de support (2700) sur les segments de paroi reliés de manière rotative (2708, 2712) ;  
dans laquelle les étriers (2704) sont positionnés de chaque côté de l'interconnexion rotative pour recevoir les éléments de support (2700) et pour renforcer l'interconnexion rotative entre des segments de paroi adjacents ou entre un segment de paroi et la plate-forme adjacente pour empêcher la rotation du segment de paroi en cas d'impact d'un véhicule.
4. Remorque de sécurité (2600, 2900, 3200, 3300) selon les revendications 1 à 3, dans laquelle ladite paroi de sécurité en accordéon (2612, 2912) contient des segments de paroi interconnectés (2708, 2712, 3220).
5. Remorque de sécurité (2600, 2900, 3200, 3300) selon les revendications 1 à 4, dans laquelle la seconde plate-forme arrière (3208) se trouve sur des pneus en caoutchouc.
6. Remorque de sécurité (2600, 2900, 3200, 3300) selon la revendication 1, dans laquelle un poids de la paroi de sécurité (2612, 2912) est au moins partiellement décalé par un lest (116) qui est mobile, le long d'une trajectoire fixe, d'un côté des première et/ou seconde plates-formes (2604, 2608) jusqu'à l'autre côté.
7. Remorque de sécurité (2600, 2900, 3200, 3300) selon la revendication 1, dans laquelle chaque segment de paroi (2708, 2712, 3220) possède une hauteur d'au moins 1,21 mètre (4 pieds) du bord inférieur au bord supérieur.

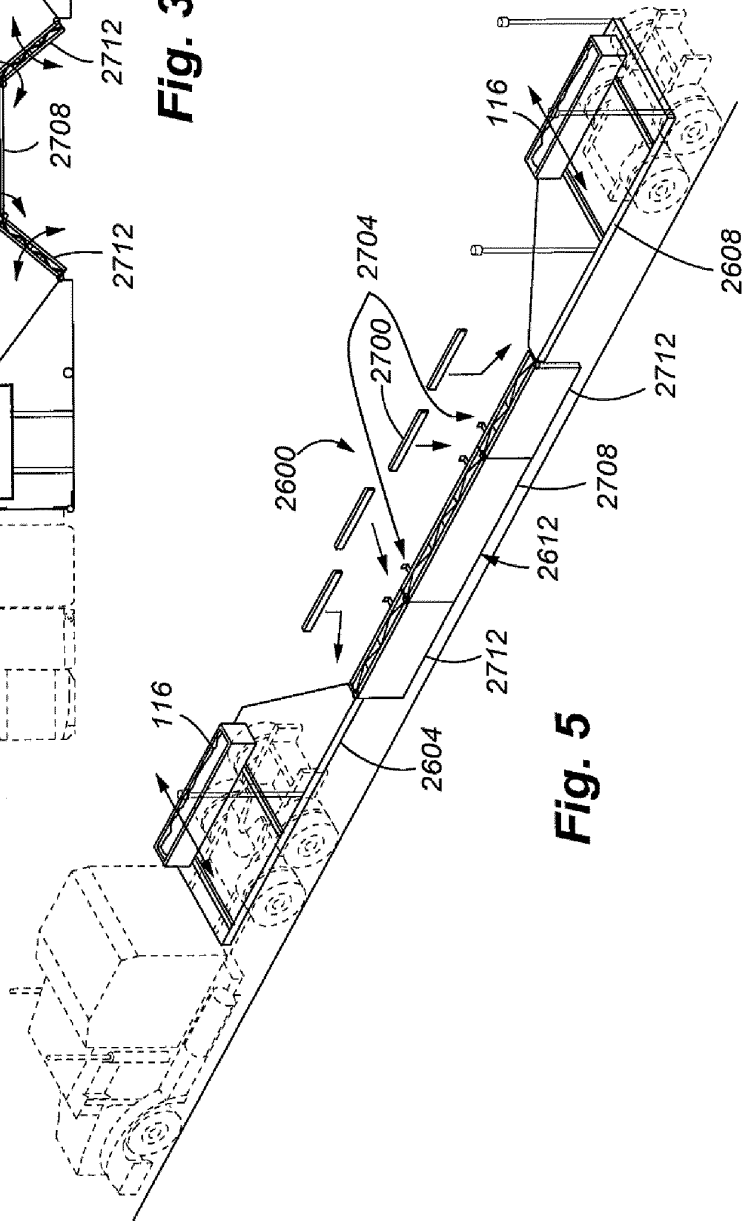




**Fig. 3**

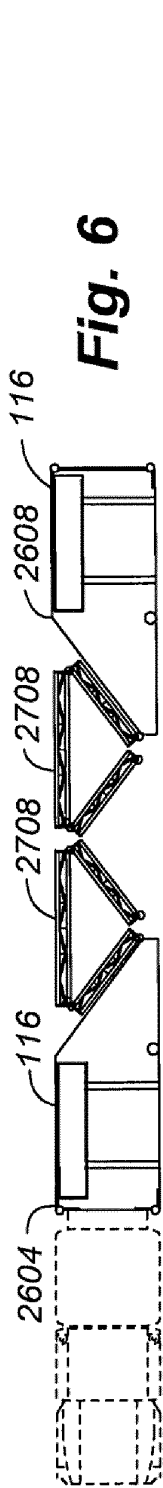


**Fig. 4**

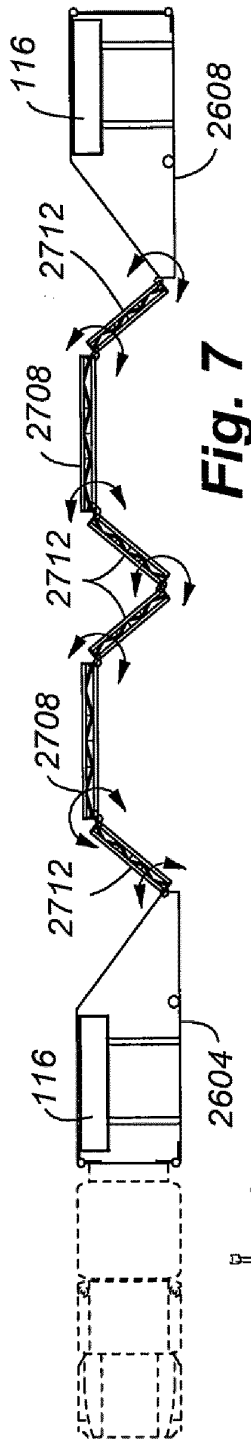


**Fig. 5**

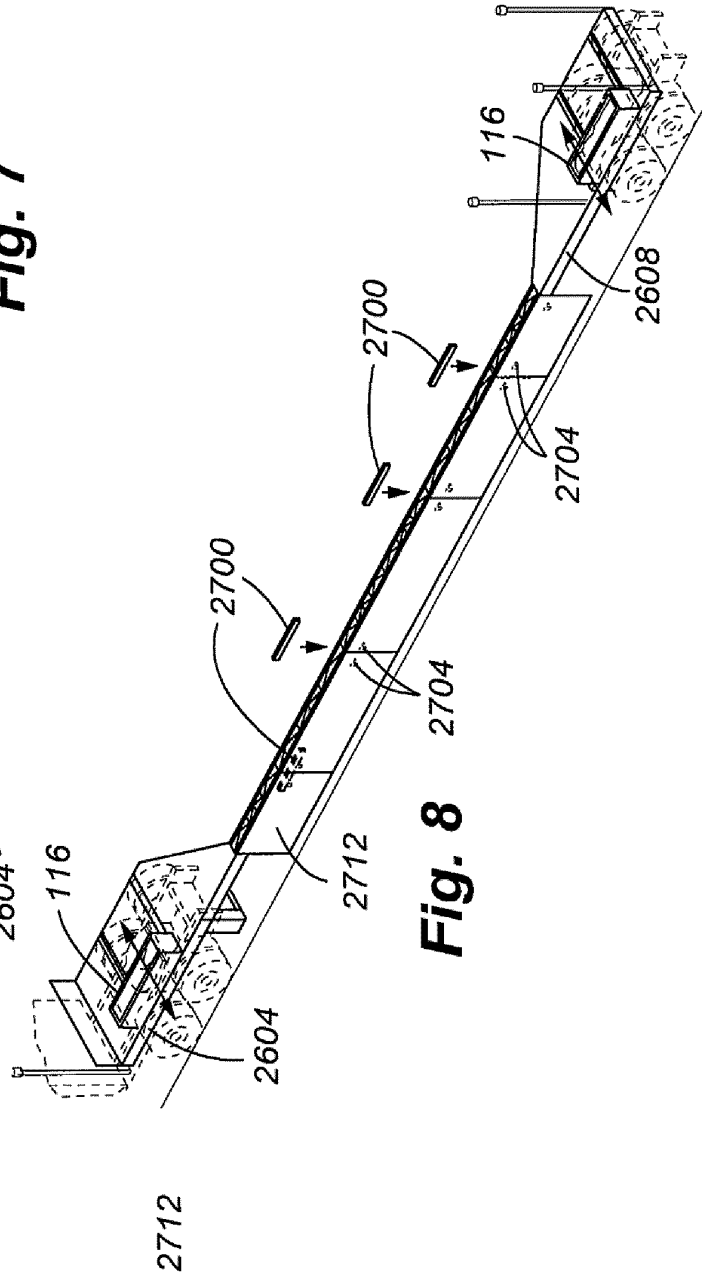




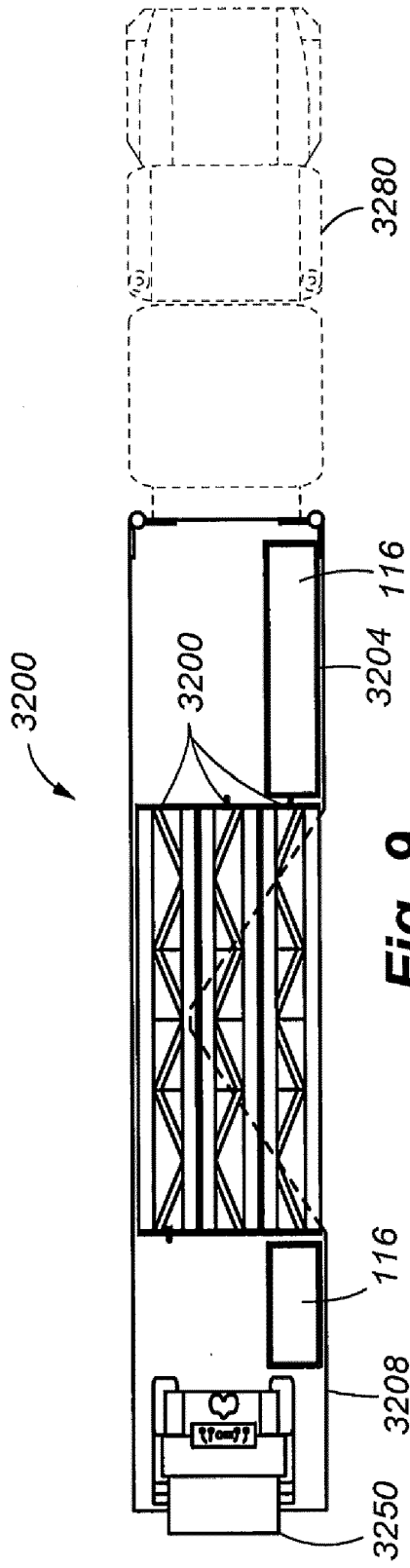
**Fig. 6**



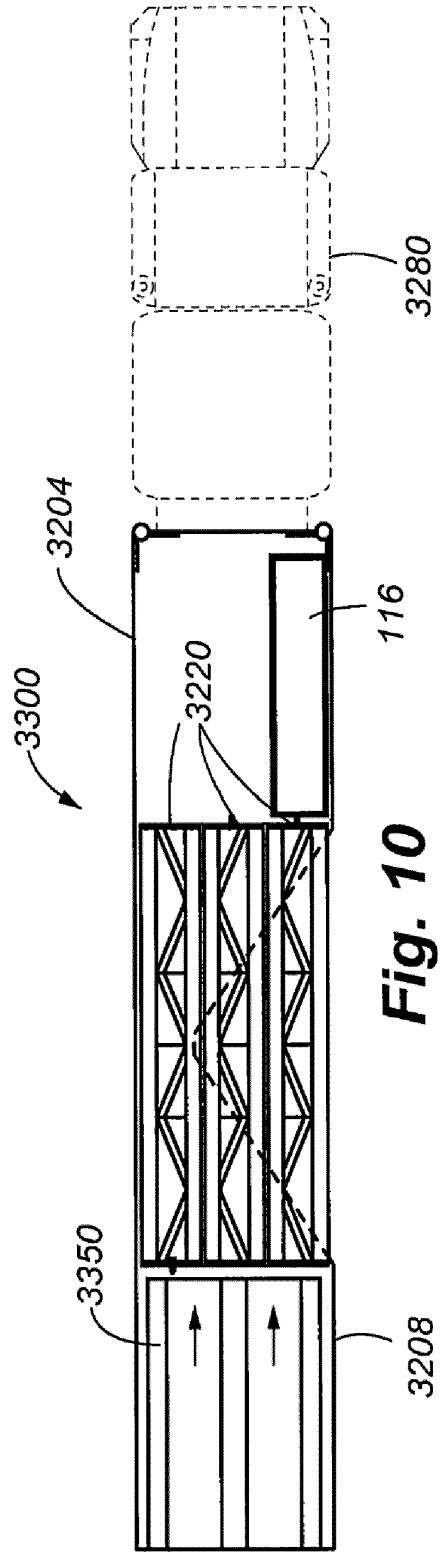
**Fig. 7**



**Fig. 8**



**Fig. 9**



**Fig. 10**

**REFERENCES CITED IN THE DESCRIPTION**

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