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(54) **System for protecting work sites subjected to road or highway traffic**

(57) The invention consists of providing for a controlled deceleration and return element (6; 6') for an impacting vehicle, for the protection of the work sites subjected to road traffic; the invention also consists of the easy and quick mounting of such element (6; 6'). In one embodiment, the element (6) is mounted/mountable on the rear of an advancing truck (1) (movable work sites). The truck (1) will thus have a double function, functioning both as a sign and as a containment for impacting vehicles, which

will be decelerated in a controlled manner by the element (6; 6') and sent into the free lane. The element (6; 6') can have innumerable forms, including that of a steel tape for common, already-existing barriers (4). In another possible embodiment of the system (for fixed work sites), the latter is compact and easily transportable in non-use condition, but it has quick connection hooks (11, 11'; 12, 12') for connecting to the existing road barrier (4).

Preferably, the fixed unit (1') is ballasted by means of a tank (14) fillable with water.

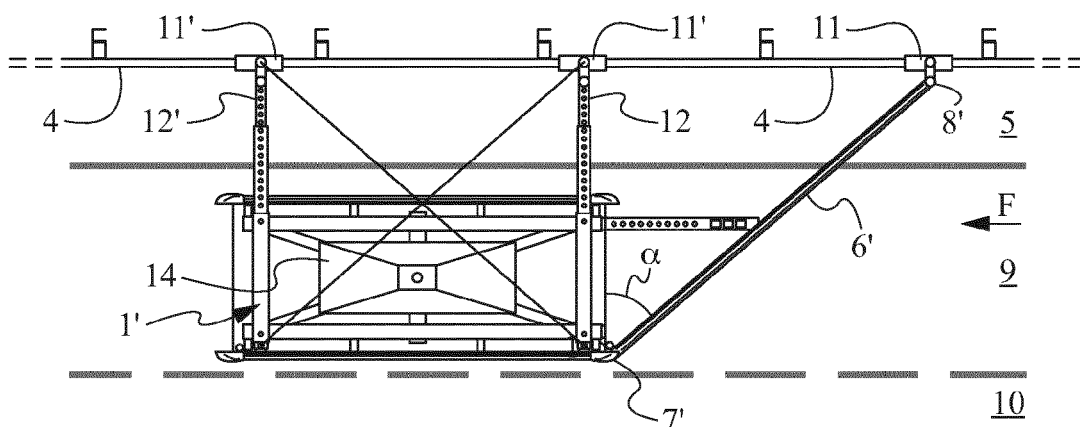


Fig. 2b

Description

Field of the art

[0001] The present invention generally refers to the field of road/highway maintenance and safety, both in urban and extra-urban settings. In particular, it regards a system that protects workers, while they work on a road or highway, from being hit by a motor vehicle, or it protects structures (scaffolds, etc.) from the impact of moving vehicles.

Prior art

[0002] The safety of movable work sites in the presence of traffic directed on extra-urban roads is currently addressed in various modes.

[0003] If the execution times are brief (from 1 to 3 days), or if a daily mounting-dismantling is required, a physical barrier against the possible penetration of circulating motor vehicles into work sites (due to distraction, vehicle breakdown etc.) is not always requested by the managers and/or licensees; in this case, it is often only required that the signage procedures of the new highway code are respected.

[0004] In the case of more long-term work sites, especially if on highways, various systems are in use such as the positioning of heavy concrete barriers (such as Jersey barriers), the parking of a heavy motor vehicle, and the arrangement of piles of inert material.

[0005] In the first case (work sites of brief duration), safety is not ensured except by chance; since the work site is of brief duration, the probability of an accident is low.

[0006] In other cases, total safety is not ensured, since in the case of the concrete barrier - its parts not being connected together - this will be capable of protecting the work site only from the impact of light vehicles. In addition, every component or module of the Jersey barrier protecting the work site will have to be separately positioned with the crane truck, and this requires transportation with several motor vehicles and a considerable installation time.

[0007] On the other hand, the heavy protection truck constitutes a rigid object that puts the safety of the passengers of the impacting vehicle at risk.

[0008] In all cases, the impacting motor vehicle often sustains serious damage, due to the unsuitable form and material of the protection barriers.

[0009] With regard to city streets, no provision is provided for obstacles or work sites, especially on city center streets with light vehicle traffic.

[0010] Therefore, in the art of the field, there remains the need to provide a suitable system for protecting work sites subjected to road and highway traffic, which is such to eliminate, or at least limit, the effects produced by the drawbacks of the prior art.

[0011] The present invention resolves this technical

problem by means of the characteristics contained in the independent claims of the present application.

[0012] Some preferred or specific embodiments of the invention are defined in the dependent claims.

Preferred embodiments of the invention

[0013] Below, the present invention will be illustrated in more detail by referring to several particular embodiments thereof, exemplifying but not limiting, shown in the enclosed figures, in which:

FIGURES 1a and 1b show the system of the invention for protecting work sites in the presence of road traffic, in a first embodiment thereof, on an advancing truck (Fig. 1a truck with sign panel and Fig. 1b truck with luminous sign panel);

FIGURES 2a, 2b and 2c show various preparation steps of a second embodiment (of fixed type) of the system for protecting work sites in the presence of road traffic, according to the present invention;

FIGURES 3a, 3b and 3c show a third embodiment of the invention, relative to a system for protecting work sites in the presence of road traffic, preferably used in an urban setting, and specifically

- the plan view of the system;
- the view of the system in the longitudinal travel direction of the vehicles;
- the side view of the system, in the direction orthogonal to the travel direction (F) of the vehicles.

Detailed description of preferred embodiments of the invention

[0014] In Figure 1a, a truck 1 is shown, like those normally used for the extra-urban highway/road maintenance in order to indicate the presence of work underway. The truck 1 can carry various objects and tools or materials used for the road/highway maintenance, as is known in the field of the art. The truck 1 is therefore equipped with a sign panel 2 and in Fig. 1b such sign panel takes the form of a luminous panel 2', e.g. bearing flashing lights in order to better attract the attention of the drivers. The arrow 3 indicates the need of the drivers to steer (in this case to the left) in order to avoid impact against the danger-indication truck 1. Often, drivers who are careless or inebriated, or due to other causes (motor vehicle breakdown, etc.), impact against the rear part of the conventional sign truck, or they penetrate into the space between the truck and the guardrail 4 (in this case the emergency lane 5). In both cases, the effect is devastating, as the related statistics have widely shown. In the case of impact against the truck, the very strong decelerations acting against the occupants of the impacting vehicle pro-

duce serious or very serious injuries of the same (also by virtue of the considerable rigidity of the rear part of the truck), while if the lane 5 to be protected is penetrated, the road maintenance workers may suffer considerably, as they can be run over by the approaching vehicle.

[0015] In order to overcome such drawbacks, according to the first embodiment of the present invention, a deceleration and return element 6 is mounted on the rear of a truck 1. The deceleration and return element 6 allows minimizing the damage from impact only for light vehicles at low speed, since in reality it lacks a fixed anchorage and is only based on the inertia of the mass identified by the truck (possibly loaded or ballasted). Nevertheless, this embodiment, even with its limited application, allows reducing the consequences of impact for a considerably percentage of collisions.

[0016] In detail, the element 6 could constitute an element entirely similar to the steel tape of a guardrail barrier 4. At the point of connection 7 to the truck 1, the deceleration and return element 6 could be connected in an articulated manner (hinge with vertical axis), so as to allow the rotation thereof in a horizontal plane parallel to the road surface. In substance, in the operative position of the element 6, its free end 8 is arranged further back (considering the advancing direction of the truck 1, or travel direction) than the end 7 connected to the truck 1. In other words, the element 6, in its operative condition, forms an angle with respect to the rear part of the truck 1 (see the angle " α " of the embodiment of Fig. 2b, where the arrow F indicates the travel direction of the vehicular traffic).

[0017] It is observed that the element 6 could also have another form, or it could be made of another functionally equivalent material, and possibly also be anchored in a fixed manner in the point 7 to the advancing truck 1. The element 6 could constitute a movable element whose alpha angle (mentioned above and corresponding to the final operative position) is manually or automatically adjusted (e.g. by the cabin of the truck 1) by means of hydraulic pistons or the like. In addition, between the element 6 and the rear part of the truck, damping elements or the like could be provided. The effect produced by the deceleration and return element 6 is to reduce, through its deformation, the acceleration of the approaching vehicle (not shown) (which would otherwise impact against the rear part of the truck 1), as well as deflect the trajectory of the vehicle itself in order to prevent that it enters into the lane to be protected (in the present case, the emergency lane 5). The effect is therefore rather different from a frontal impact perpendicular to the rear part of the truck, comparable to a rigid barrier (or to an I-beam).

[0018] It is observed that the element 6 could also have a structure extendible in a telescopic manner, or a similar structure (e.g. also in the form of various foldable but interlockable parts), comprising for example various parts of the steel tape 6 mutually slidable on each other.

[0019] Various energy absorption elements can be interposed in the space formed by the abovementioned

alpha angle, between the rear part of the truck 1 and the deceleration and return element 6.

[0020] The system for protecting work sites subjected to road and highway traffic, according to this first embodiment of the invention, attains the following results:

- safety of the work site personnel is ensured, the work site being protected with respect to the systems currently in use;
- great increase of the safety of the moving vehicles with respect to conventional protection systems;
- quick assembly speed;
- low purchase and operating costs.

[0021] Figures 2a to 2c show the second embodiment of the present invention. These are all plan views and once again refer, as a mere example, to the protection of a work site set up in the emergency lane 5 and/or in the normal lane 9, the passing lane 10 in this case remaining the free lane.

[0022] The protection system in this case also comprises a main part 1', which is to be considered fixed in this case, the work site being assumed to be fixed.

[0023] The fixed part or main part 1' is first of all positioned by a crane truck (not shown) close to the forbidden/closed lane, after the mounting of the provided sign (not represented). Then, a lateral steel tape 6' is released from one of its stops, depending on the closed lane, and first made to rotate (the angle α) and then slide in a telescopic manner until it intercepts the adjacent barrier 4. The terminal (free end) 8' of the slidable bar is equipped with a strong eye, where a bayonet device 11 is inserted, which will straddle the existing bar/tape 4 and will then be closed on the lower part by a safety pin.

[0024] Subsequently, the box-like telescopic lateral elements 12' will be extracted from the main part 1', such elements to be constrained to the existing barrier 4, using the same procedure and the same mechanical elements. The mounting of the protection of the work site in this second embodiment of the invention is completed with the rear box structure 13 for reinforcement and double bracing with cable on small hoists. In addition, ballast 14 of the main unit 1' will be filled with clean water.

[0025] The protection system for work sites according to the invention will be equipped with various structures so as to lower the final cost. The most complete system will have a mounting versatility for all road and highway characteristics.

[0026] The system for use on extra-urban roads represented in Figure 2 can be transported (in the rest condition shown Figure 2a which of course also comprises, among other things, the "barrier" 6") by any one truck and even on a simple van.

[0027] Also in this second case, regarding Figures 2a-2c (second embodiment of the invention relative to a fixed extra-urban work site), the same positive results are obtained that were already mentioned for the first embodiment of the invention, i.e. the safety of the work site per-

sonnel, the ease and versatility of mounting, a considerable increase of the safety of the moving vehicles, and finally low purchase and operating costs.

[0028] In the third and final embodiment of the present invention, schematically illustrated in Figures 3a to 3c, the innovative system for protecting work sites subjected to road traffic does not have metal barriers 6 or 6', nor equipment to be extracted 12 and 12', but rather is simply constituted by a steel tank with irregular pyramid 6", with the function of deceleration and return element, which can be transported by any one flatbed van which can be driven with the license B.

[0029] The element 6" is positioned by a crane truck near the sensitive object to be protected (the work site) and then filled with a specific amount of clean water. For the removal, the reverse operation will be carried out.

[0030] This system can have different size in order to optimize the use and minimize the final cost. The results will in this case be the following:

- greater safety of the personnel in the work site present on scaffolds, or supports, or other temporary structures 15 to be protected;
- great increase of the safety of the moving vehicles 20, due to the improved visibility and to the possibility of sending the vehicles back due to the shape of the return element 6";
- quick mounting;
- low purchase and operating costs.

[0031] In substance, the inventive concept consists, for the first of the two embodiments, in positioning at least one ribbed, continuous road barrier tape, with characteristics similar to or greater than those of an existing barrier at the edge of the roadway, to which the tape (or tapes) is (are) constrained, particularly in the case of the second embodiment of the invention.

[0032] In the first embodiment, said tape (or tapes), or an analogous deceleration and return structure 6, is mounted on the rear part of any one truck or van 1.

[0033] For an improved stabilization, the advancing truck or van 1 - or preferably in the case of a fixed work site, the main unit 1' (which is fixed) - can be equipped with ballast 14 obtained with a large tank made of plastic or preferably galvanized steel, which is preferably filled with water upon positioning of the work site protection according to the invention.

[0034] The barrier or return element 6, 6' or 6" is characterized by the maximum level of safety and protection, to the benefit of the operators who perform the maintenance directly on the road or highway. The structure of the return element can be stiffened by a suitable steel reinforcement network.

[0035] Behind the return element 6 or 6', there can be elements which contribute to decelerating the vehicle, e.g. a structure composed of steel honeycomb panels, arranged between the element 6 or 6' and the component 1 (advancing sign truck), or the fixed main unit 1', respec-

tively. Other types of impact absorbers could be equally provided for, like those used in the field of construction of roads/highways for decelerating the vehicles impacting against a fixed structure (traffic divider, etc.).

[0036] The angle " α " of the barrier or protection for work sites subjected to vehicular traffic, thus conceived, whether the barrier is of dynamic type (first embodiment of the invention, Figs. 1a, b) or static type (second embodiment of the invention, Figs. 2a, b, c), in combination with the shape of the barrier itself, with steel tape (tapes) or other material, allows the return of the impacting vehicles in the lane. The element 6, 6', 6", in addition to elastically absorbing the impact, thus minimizes the consequences of the impact itself, and could be designed according to different homologation classes and ASL values, in the same manner as the road/highway lateral barriers (guardrails).

[0037] The mounting of the protection system according to the present invention can be carried out both in the travel lane (with or without emergency lane 5) and in the passing lane.

[0038] In the third embodiment, however, the system protects obstacles and work sites in an urban setting, and is simply constituted by the shaped cover 6" with irregular pyramid shape; such cover has ballast, without the presence of barriers or anchorage. Also such cover, preferably made of steel, is filled with water after its positioning with the crane truck. The return element 6" allows a protection from impact that is not particularly strong but its shape allows the return/sending back of the vehicle, minimizing the consequences of the collision and absorbing (by being deformed) the accidental impact.

[0039] In the third embodiment, moreover, it is observed that the form of the return element 6" (tank) could be "rising", i.e. to allow, like in the case of a common concrete or steel Jersey barrier, the deceleration of the motor vehicle (during its return to the lane) by transforming part of the kinetic energy thereof into potential energy before restoring such energy at a subsequent time. This occurs in order to lessen over time the decelerations that occur during vehicle impact, thus also limiting the damage to the element 6" and to the vehicle 20.

[0040] In general, the shape of the protection according to the present invention allows the vehicle to laterally but not frontally impact, also allowing its return/sending back, ensuring a regulated and elastic impact with energy absorption in a manner so as to limit the damage. In addition, the calculation verifying the various actions allows establishing, with absolute certainty, that the safety limit will not be violated.

[0041] The system according to the present invention, for protecting work sites subjected to road traffic, was designed so that its mounting and/or dismantling on site, and generally its preparation on site, can be obtained in less than ten minutes, in a manner such that its use can be extended to all movable work sites, even those with limited duration.

[0042] Generally, the bars or other types of confinement means (return element 6') will be constrained to the existing barriers 4 of any type (metal or concrete), by means of a "bayonet" coupling system, or by means of other systems (with quick coupling) that are in any case effective for transferring the stresses to the existing barrier 4.

[0043] The protection system according to the present invention is capable of dividing emergency lanes, travel lanes and passing lanes in addition to assisting with road change signage, and can protect scaffolds, supports and any other temporary works that can be affected by accidental impacts.

Claims

1. A system for protecting work sites subjected to road or highway traffic, **characterized in that** it comprises:

- a main unit (1; 1') constituting (a) a vehicle (1) that advances along the roadway, of truck (1), van (1), or similar type, or (b) a fixed unit (1') that is not anchored to the ground;

- a deceleration and return element (6; 6') for an impacting motor vehicle (20);

wherein said deceleration and return element (6; 6') forms a deformable barrier for allowing a controlled deceleration of the impacting motor vehicle (20) and has a first end (7; 7') and a second end (8; 8'), said first end (7; 7') being constrained to the main unit (1; 1') and said second end (8; 8') being free (8) or temporarily connected (8') to a safety barrier (4) or to a traffic divider (4) or the like, by means of first rigid connection means (11);

wherein, moreover, said deceleration and return element (6; 6') has substantially longitudinal, preferably rectilinear form, and is transversely extended approximately over the entire lane (5) to be protected and substantially transversely over the entire width of the main unit (1 or 1'), substantially forming a specific return angle (α) with respect to a *rear* part of the main unit (1 or 1'), considering *the travel direction* (F) of the vehicular traffic (20); and wherein the total mass (M_{tot}) of the protection system is mainly concentrated in the main unit (1; 1').

2. A system according to claim 1, **characterized in that** the main unit (1; 1'), particularly in the case in which it forms a fixed unit (1'), has ballast constituted by a tank (14) preferably made of impact-resistant material, such as steel or the like, such tank (14) being filled with loose material or liquid, preferably water, after its positioning on site.

3. A system according to claim 1 or 2, **characterized in that** the advancing truck (1) or van (1) has a sign panel (2) on the rear side, possibly a luminous sign panel (2').

4. A system according to any one of the preceding claims, **characterized in that** said deceleration and return element (6, 6') of the impacting motor vehicle (20) is of the type that can be longitudinally extended from a rest position up to an operative position, and preferably comprises elements that are longitudinally slidable on each other, e.g. constituted by slidable parts of ribbed tape (6, 6') for steel guardrail barriers.

5. A system according to any one of the preceding claims, **characterized in that** said first end (7; 7') is rigidly connected, for example manually, to said main unit (1; 1').

6. A system according to any one of the preceding claims 1 to 4, **characterized in that** said deceleration and return element (6, 6') is rotatable around a hinge which is situated at a first end thereof (7; 7') and is positionable and lockable, automatically or manually, in its operative position, in accordance with a predetermined angle (α) that can be previously selected.

7. A system according to claim 6, **characterized in that** said deceleration and return element (6, 6') is automatically positionable, and in the case of a main unit constituted by a truck (1) or the like, it is directly positionable by means of a control placed in the cabin of the truck (1) or the like, which for example acts on hydraulic cylinders for positioning the deceleration and return element (6, 6').

8. A system according to claim 1, **characterized in that** said main unit (1; 1') constitutes a fixed unit (1'), laterally anchorable to the lateral barrier (4), to the traffic divider (4), or the like, by means of second rigid connection means (11'; 12, 12').

9. A system according to claim 8, **characterized in that** said second rigid connection means (11'; 12, 12') are extendible in a telescopic manner, from a first retreated rest position, which allows the transport of the fixed unit (1'), up to a second extended position, corresponding to the position of functioning and anchoring of the fixed unit (1') to the lateral barrier (4) or the like.

10. A system according to claim 9, **characterized in that** it comprises a pair (12, 12') of second rigid connection means, spaced from each other, of which one is situated to the front (12') and the other to the rear (12) with respect to the travel direction (F), a double bracing system also being provided for, with cable

on small hoists for stiffening and reinforcing the entire system.

11. A system according to claim 1, **characterized in that** the deceleration and return element (6, 6') comprises one or more ribbed tapes for road barriers. 5
12. A system according to claim 1, **characterized in that** between the main unit (1; 1') and the deceleration and return element (6, 6'), removable or fixed energy absorption elements can be provided, of any known type, for example steel honeycomb panels or another type. 10

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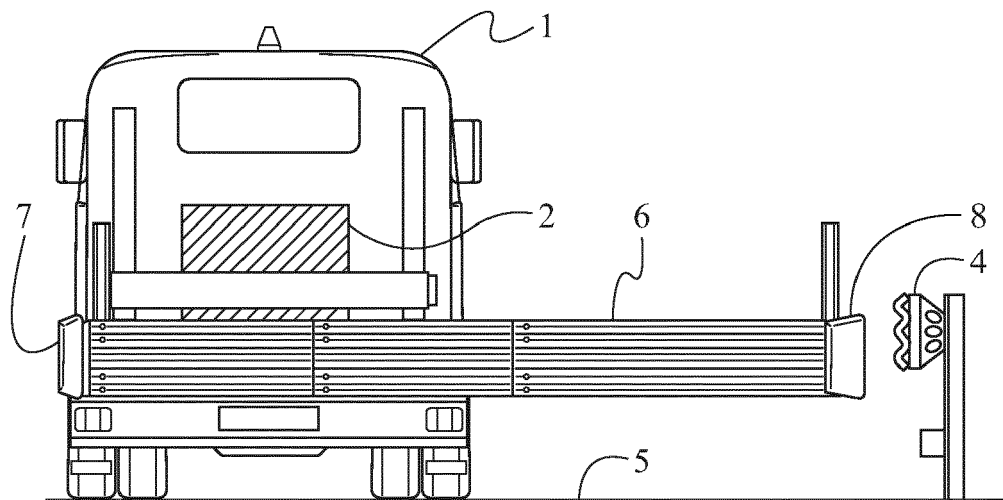


Fig. 1a

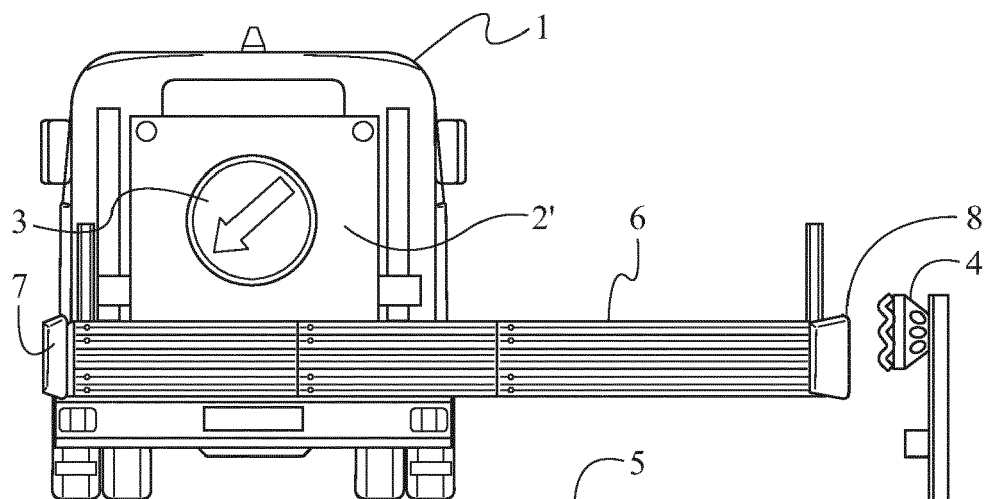


Fig. 1b

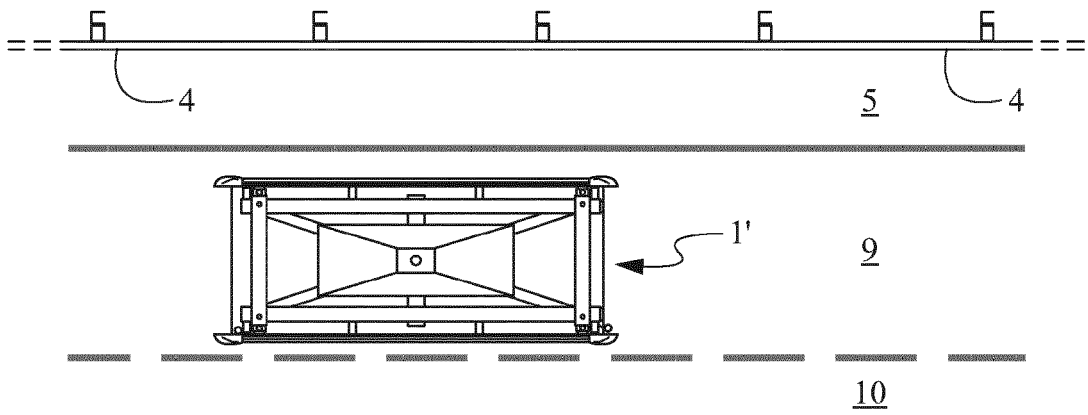


Fig. 2a

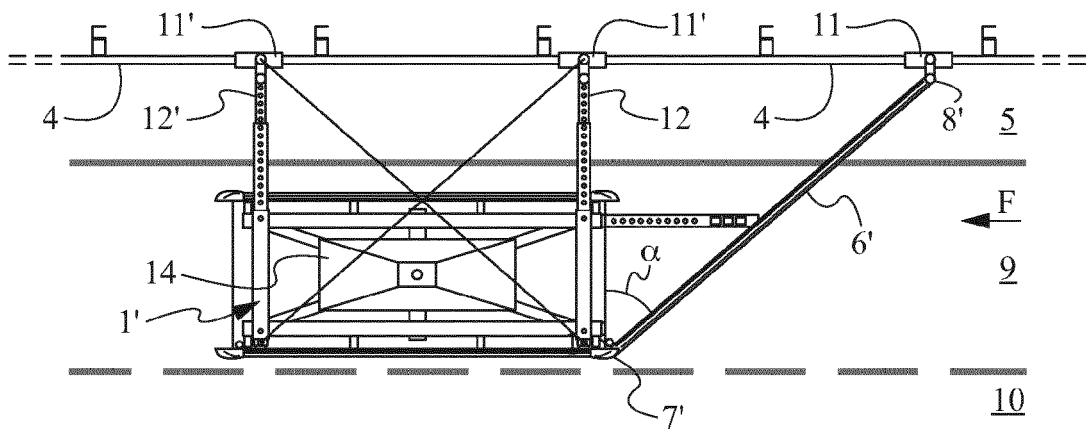


Fig. 2b

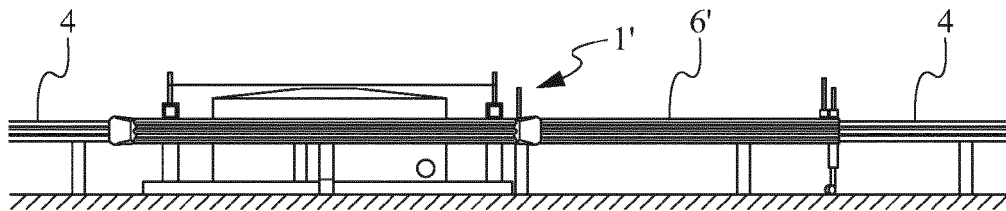


Fig. 2c

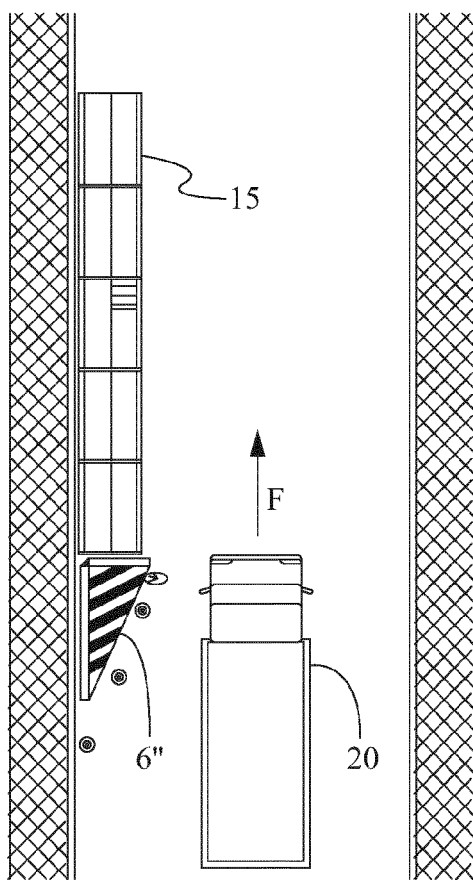


Fig. 3a

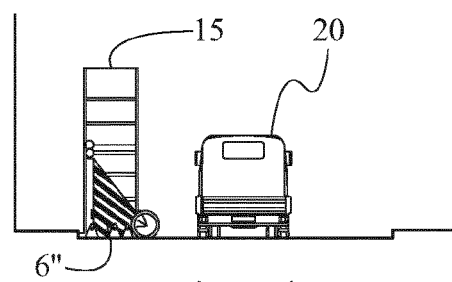


Fig. 3b

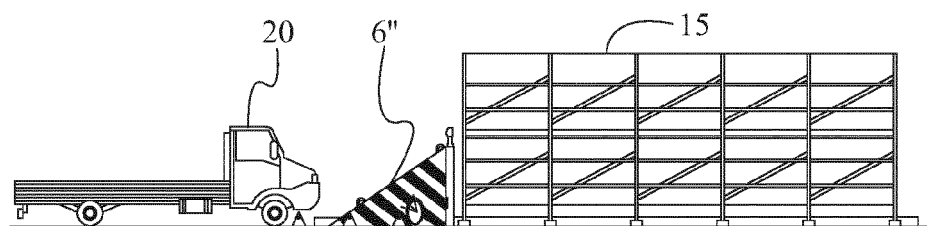


Fig. 3c



EUROPEAN SEARCH REPORT

Application Number
EP 12 15 6242

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Place of search Munich		Date of completion of the search 25 May 2012	Examiner Flores Hokkanen, P
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 12 15 6242

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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