

[54] PNEUMATIC SAFETY SYSTEM FOR VEHICLE LADING

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[51] Int. Cl.B60p 7/14, B61d 45/00

[58] Field of Search105/369 BA, 369 D, 369 S;
296/24; 214/10.5; 206/DIG. 30

[56] References Cited

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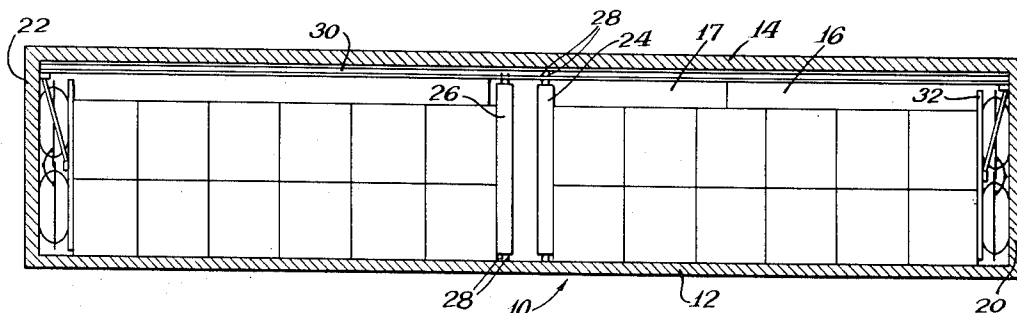
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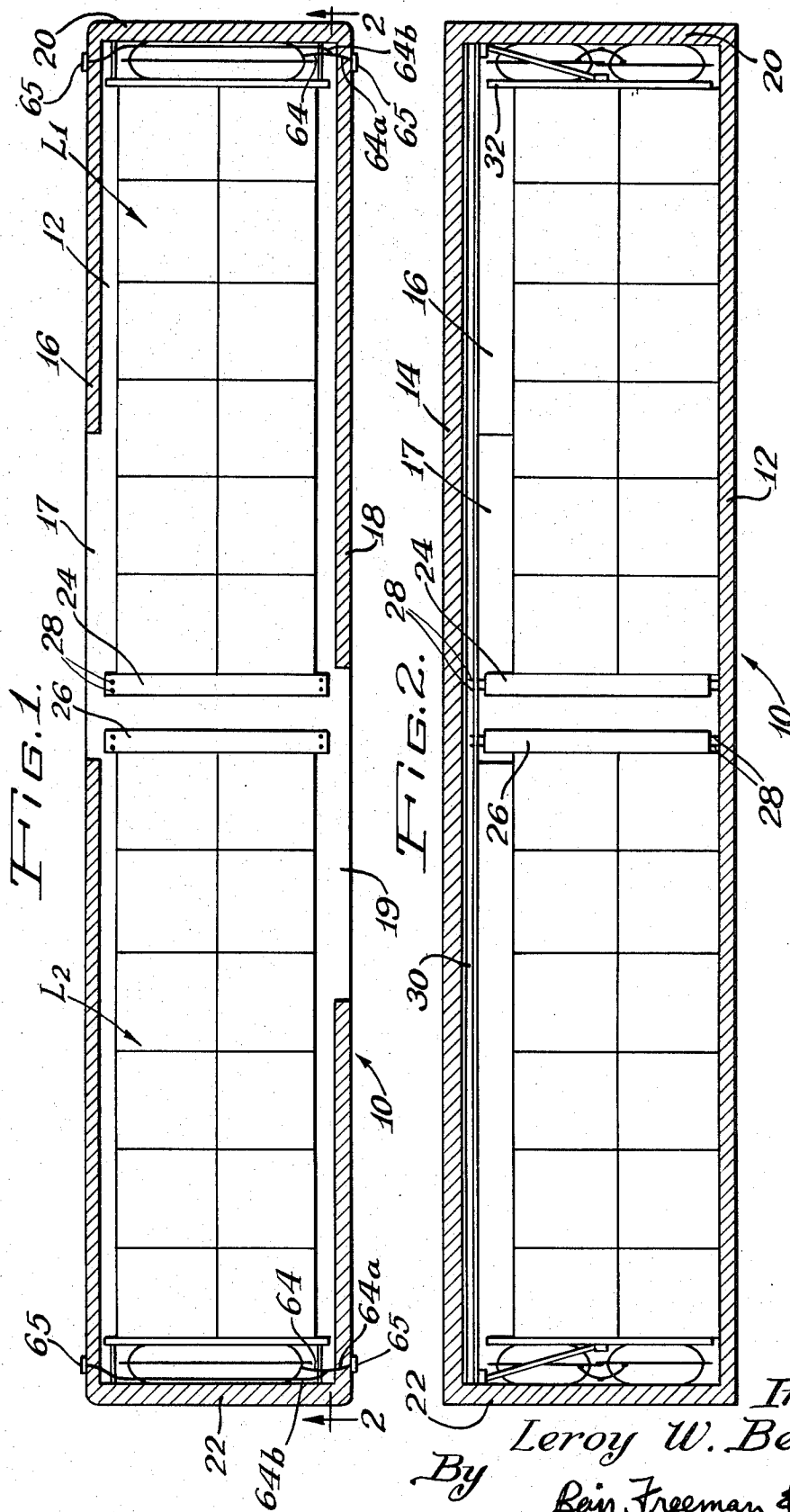
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[57] ABSTRACT

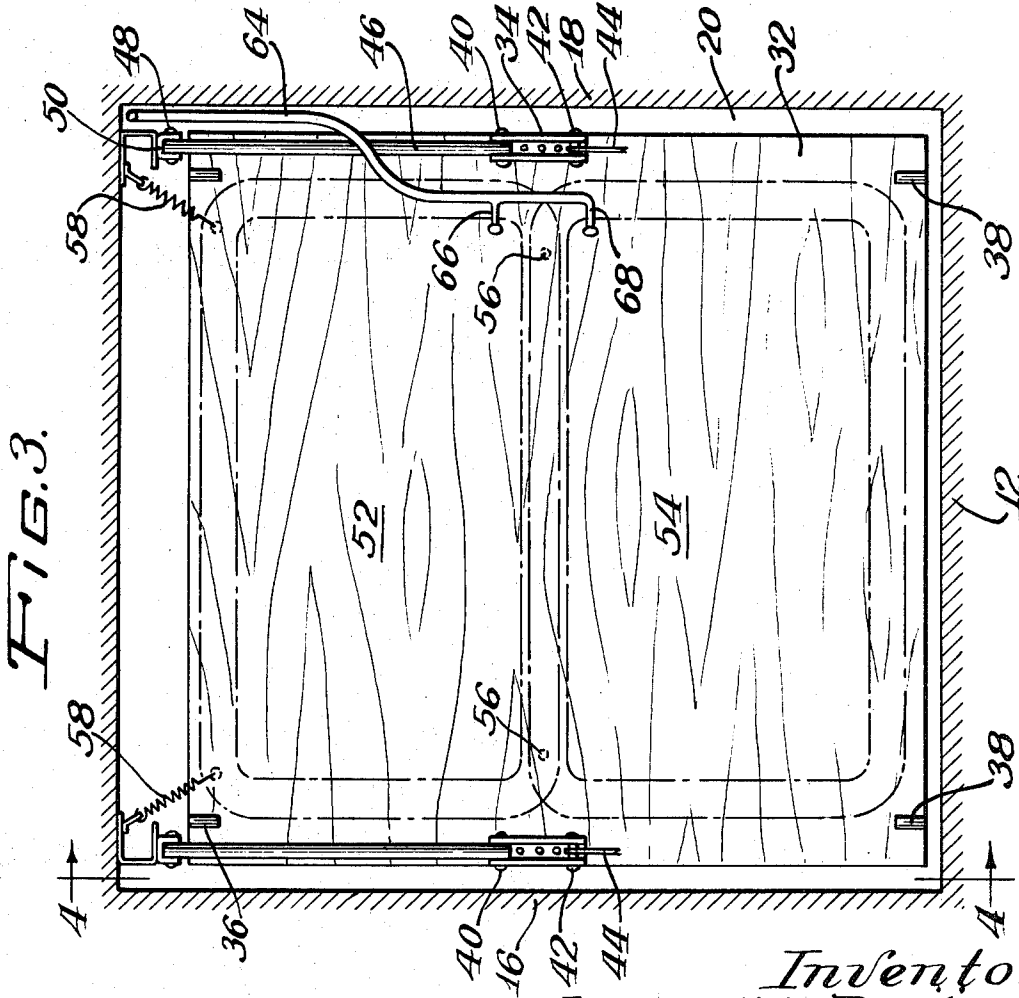
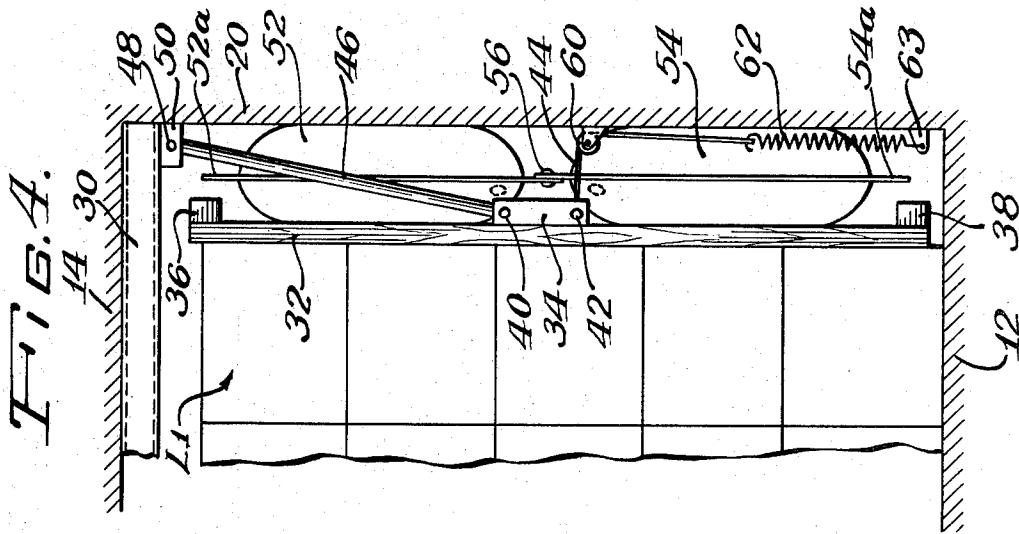
A system for protecting lading against endwise impacting in an ordinary side-loading vehicle body is achieved with movable panels positioned to engage the ends of the lading and with inflatable envelopes positioned to substantially simultaneously move the panels against the ends of the lading. The inflatable envelope means adjacent one end of the lading communicate with the envelope means adjacent the other end of the lading to provide that each envelope means serves as a pressure accumulator for the other envelope means when the lading tends to shift against the first envelope means. The panel is suspended from a fixed support by spaced elongated arms that provide for rocking and skewing of the panel at edge connections located at substantially mid-height of the panel. Bias means are provided which tend to deflate the envelopes and which are arranged to tend to exert oppositely-directed moments upon each panel about its mid-height pivot connections. One arrangement of inflatable envelopes operates to develop greater pressure against the portion of the lading below the mid-height pivot connections for the movable panel.

10 Claims, 9 Drawing Figures





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FIG. 6.

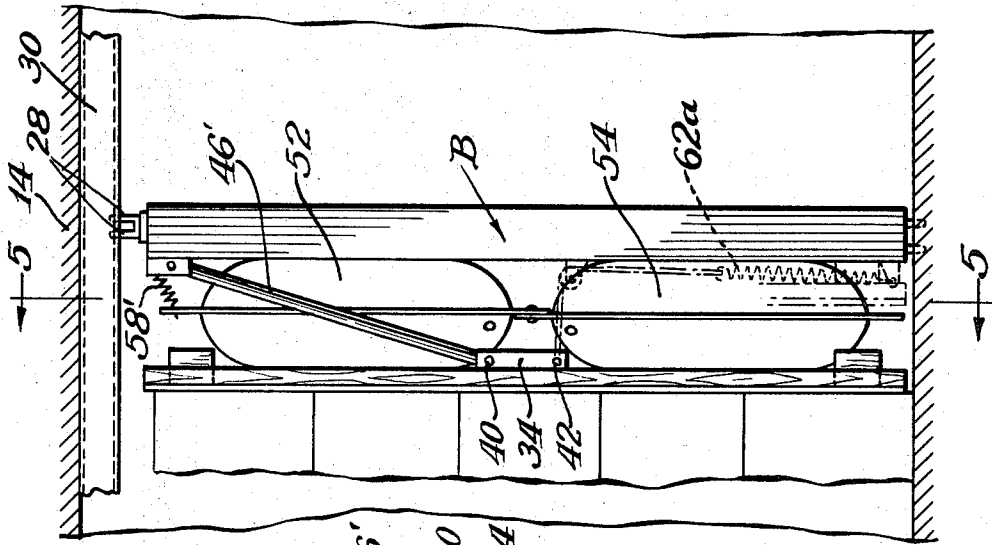
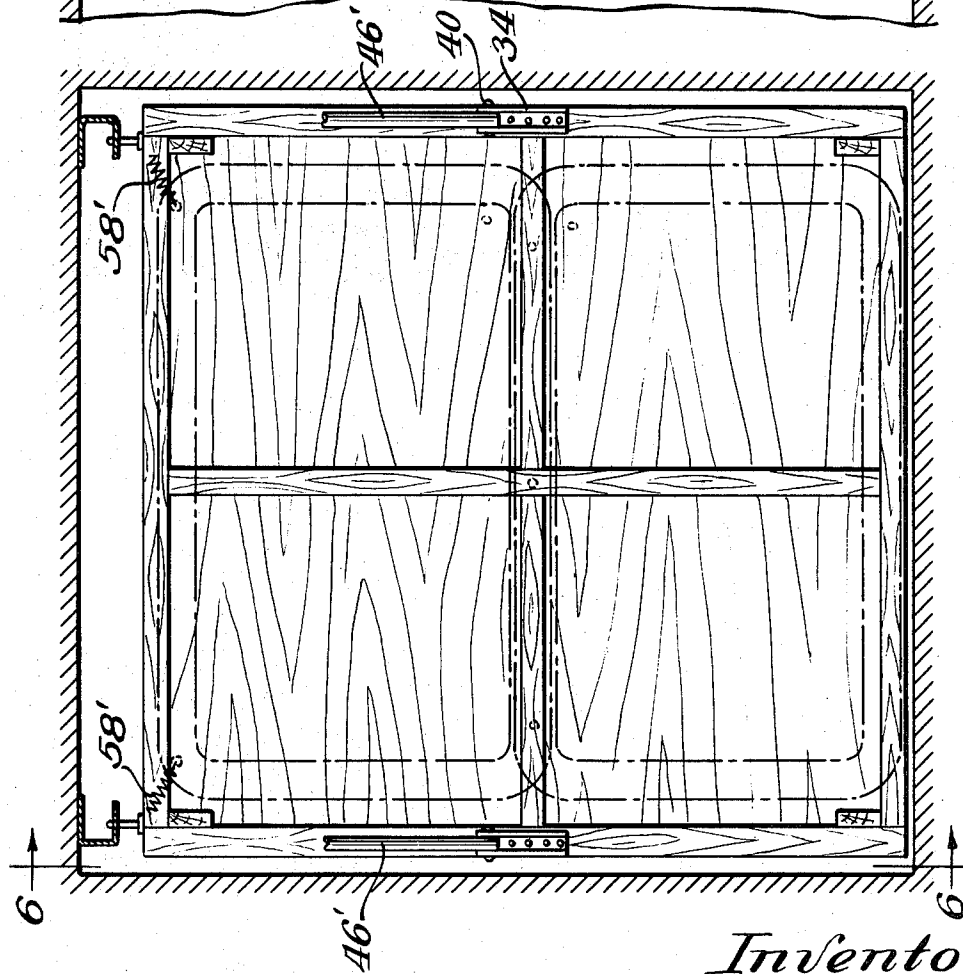


FIG. 5.



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FIG. 7.

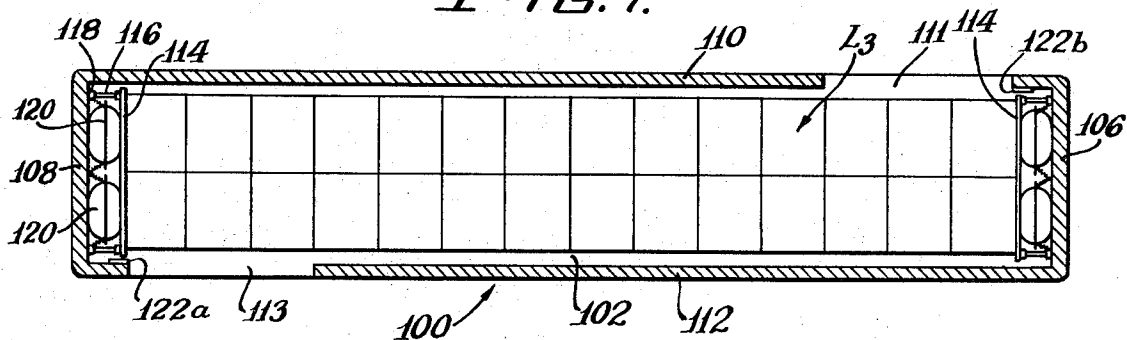


Fig. 8.

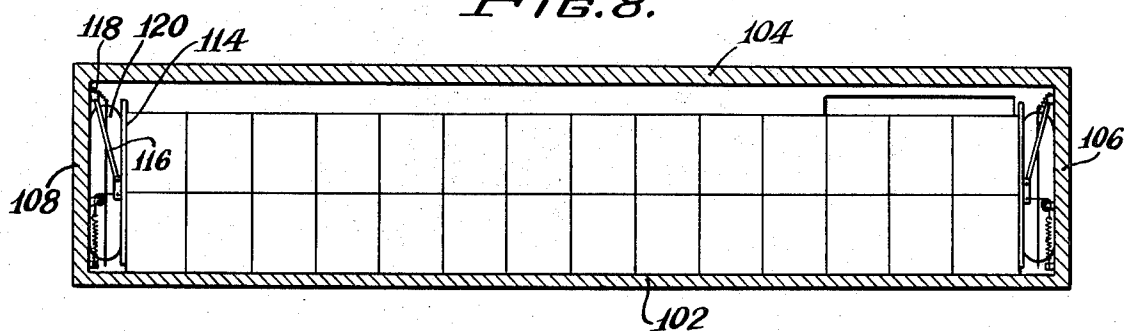
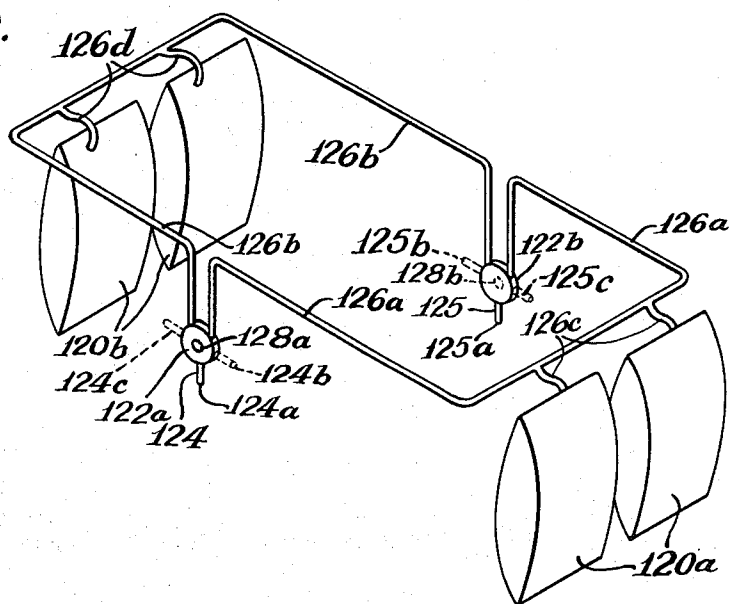


FIG. 9.



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PNEUMATIC SAFETY SYSTEM FOR VEHICLE LADING

BACKGROUND OF THE INVENTION

This invention relates to an improvement in lading protection systems that include inflatable envelopes for absorbing inertia forces developed by lading that is carried by freight-carrying vehicles such as railway cars, trucks and the like.

It has heretofore been proposed to use inflatable devices in freight-carrying vehicles for purposes of absorbing inertia forces of the lading in the vehicles. Brown et al. U.S. Pat. No. 3,427,997 reports some of the early design suggestions using inflatable units and then discloses a variant design in which a bulkhead carries a pair of precisely-parallel freight-engaging panels that are moved by inflatable bags disposed between the bulkhead and panels and where the inflatable bags on opposite sides of the same bulkhead communicate their pressures to each other. Stafford U.S. Pat. No. 3,427,995 discloses use of weight-biased, freely-movable, panels, that are pressured by inflatable bags disposed against end bulkheads of a car, for engaging the ends of lading.

Attempts to provide freight-carrying cars with devices that use inflatable bags has resulted in greater and substantial redesign of the cars and bulkheads themselves, thus making the basic concept, of using inflatable units for absorbing inertia forces, costly and expensive and providing complexity where simplicity is sought and desired.

SUMMARY OF THE INVENTION

The present invention is intended to provide an improved, simple and inexpensive lading protection system and components therefor utilizing inflatable bags, for absorbing inertia forces and for compacting the lading in the vehicle, and utilizing existing designs of freight-carrying vehicles so as to inexpensively adapt existing vehicles with pneumatic cushioning means for the lading carried therein.

Another object of this invention is to provide a lading-protection system with pneumatic cushioning means with improved constructional features that cause the lading-protection system to more readily conform with the physical fact that greater forces are required to be applied against the bottom of a stack of lading than against the top of the stack of lading in order to effect compacting of the lading and to effect proper lading-conforming engagement of the panel with the stacked lading in the vehicle.

Further objects and advantages of this invention will become apparent as the following description proceeds and the features of novelty which characterize this invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

Preferred embodiments of the invention are shown in the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan view of the interior of a typical freight-carrying railway car equipped at its end walls with an improved lading-protection system embodying features of this invention;

FIG. 2 is a side view taken on line 2—2 of FIG. 1;

FIG. 3 is an enlarged view of one end wall of the car in FIGS. 1 and 2 taken looking toward the end wall substantially from the rear face of the panel, and showing the features of arrangement of the inflatable bags, but with the inflatable bags omitted by showing them in broken lines;

FIG. 4 is a view taken on line 4—4 of FIG. 3 and showing the movable panel conforming to an end of the stack of lading in the vehicle;

FIG. 5 is a view somewhat similar to FIG. 3 but taken looking toward the back side of the movable panel in a combination where the panel is adapted for attachment to a movable bulkhead shown in FIG. 6;

FIG. 6 is a view similar to FIG. 4 but is taken on line 6—6 of FIG. 5;

FIG. 7 is a top plan view similar to FIG. 1 but showing another construction of a typical railway car wherein the openings in the side walls of the car are not only offset but are closer to the end walls and wherein the inflatable bags are arranged vertically rather than horizontally as in FIGS. 1—6;

FIG. 8 is a side view similar to FIG. 2 but showing the car and inflatable bag arrangement of FIG. 7; and

FIG. 9 is a schematic view illustrating the inflatable bag arrangement of FIGS. 7 and 8 and the controls therefor.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, FIGS. 1 and 2 illustrate a well known form of railroad freight-carrying car 10 having a floor 12, a roof 14, side walls 16 and 18 and end walls 20 and 22. The side walls have offset door openings 17 and 19 which provide access to the interior of the vehicle. Movable bulkheads 24 and 26 of the type disclosed in Vanderhyde et al. U.S. Pat. No. 3,168,055 are used in the vehicle 10 for abutting engagement and cooperation with one end of sub-divided lading portions L_1 and L_2 . The bulkheads have latch pins 28 for cooperation with upper latch strips 30 and floor-mounted latch strips as disclosed in said Vanderhyde et al. patent.

FIGS. 3 and 4 show the features of construction of the improvement for absorbing inertia forces of the lading in vehicle 10 and for compacting the lading therein, such as lading sub-portion L_1 . Spaced from the upright wall-type member 20 is an upright lading-engaging panel 32 which is lightweight compared to end wall 20 and may be made of lightweight framing and/or plywood. The panel 32 is of lesser width than the spacing of side walls 16 and 18 and of lesser height than the spacing between latch strips 30 and floor 12, but the size of panel 32 is effective to have the panel's outer face engage substantially the full height and width of lading L_1 which is shown in the form of boxed goods resting on floor 12. On the rear face of panel 32 adjacent each upright edge of the panel is an elongated bracket 34 of U-shaped cross-section. Spacer-stops 36 and 38 project rearwardly of panel 32 adjacent the upper and lower edges inwardly of the panel's corners and serve to space panel 32 a minimum distance from wall 20 so as to provide adequate space for the deflated bags therebetween. The upper end of bracket 34 carries a pivot pin 40. The lower end of bracket 34 carries an attachment pin 42 to which a retracting cable 44 attaches.

A pair of elongated support arms 46 connect panel 32 relative to end wall 20. Each arm 46 has its lower end positioned between the spaced legs of the U-shaped bracket 34 and pivoted to pin 40. The upper end of arm 46 is pivotally connected to a pin 48 that is rigidly mounted relative to end wall 20, such as by securement to the legs of bracket 50 that is secured to the underside of a latch strip 30.

The pivot pins 40 are located at a substantially mid-height position relative to the height of panel 32. While pins 40 are aligned to substantially provide a single pivot axis, the length of arms 46 and spacing of pins 40 adjacent opposite edges of panel 32 is such as to permit skewing of panel 32 as it engages the end of lading portion L_1 . This is desirable as it permits panel 32 to conform to minor variations in alignment of lading that are bound to occur in the loading of lading in a vehicle.

Positioned between panel 32 and end wall 20 are two elongated inflatable air-holding bags 52 and 54 arranged so that their longitudinal axes lie substantially parallel to the pivot axis through pivot pins 40 with the greater portion of bag 52 spaced above pivot pins 40 and with all of bag 54 spaced below the axis of pivot pins 40. The length of bags 52 and 54 is less than the spacing of arms 46 so as to fit between said arms without interference. The inflatable bags are of the type having a flat perimeter flange surrounding the inflatable portion of the bag. The perimeter flanges are designated respectively at 52a and 54a. Bags 52 and 54 are joined together by connectors 56 through overlapping flange portions. The uppermost portion of flange 52a is apertured to receive hook ends of retraction coil springs 58 which are arranged to pull outwardly

so that their horizontal spring-force components balance each other and their vertical spring-force components tend to pull the bags upwardly and toward a collapsed position against end wall 20. The upper ends of springs 58 are connected in any desired manner, such as by welding, to the roof 14 or other fixed structure.

The cables 44 connected to pins 42 are each trained over a roller 60 carried on end wall 20 and connect to a vertically disposed tension spring 62 that is anchored by flange 63 to wall 20, and which biases the panel 32 toward wall 20 tending to deflate the envelopes 52 and 54. It will be seen that the arrangement of springs is such as to tend to provide balancing moments about the pivot axis of pins 40, with spring 62 acting through cable tending to provide a counterclockwise moment about axis 40, when viewed in FIG. 4, and the friction between bag 52 and panel 32 under the tension of springs 58 tending to provide a clockwise moment about pin 40 that is spaced from the rear face of panel 32 in the direction toward end wall 20.

The inflatable portions of bags 52 and 54 are connected respectively to branches 66 and 68 of a tubular supply line, or hose, 64 for compressed air or other gas. As illustrated in FIG. 1, the supply line 64 is provided with branches 64a and 64b leading to fittings 65 on the exterior of the opposed side walls 16 and 18 of the car. The fittings 65 are of a type well known in the art and provide for introduction of compressed air or other gas into bags 52 and 54 and may be equipped with valves to effect sealing or opening of the line 64 as desired. It is desired that a greater pressure be developed in lower bag 54 than in upper bag 52. Appropriate valves or constrictions, of a type well known in the art, are included in hose branches 64a and 64b to effect such pressure differences.

In the form of device seen in FIGS. 5 and 6, the construction is substantially identical as in FIGS. 3 and 4 except that instead of having a fixed end wall 20 relative to which the panel 32 moves, there is a movable bulkhead B that panel 32 is attached to and moves relative thereto. The bulkhead B is of the type disclosed in Vander Hyde et al. U.S. Pat. No. 3,168,055 and is designed to receive dynamic forces imparted by longitudinal shift of lading through panel 32, bags 52, and 54, and transmit same forces thereagainst to the vehicle's frame which is designed not only to withstand the static forces of the lading but also the dynamic forces that occur longitudinally of the car when the lading therein tends to shift due to inertia.

Certain structural variations also will be seen in FIGS. 5 and 6. Thus, upper springs 58 are shown connected to the bulkhead B, and the upper ends of panel-supporting arms 46' connect to brackets 50a that are carried on bulkhead B. As an optional alternative construction, the lower springs 62 of FIGS. 3 and 4 are shown in broken lines to indicate that they may be omitted, although if needed they would be mounted on bulkhead B as shown. In FIGS. 5 and 6 similar features are numbered with the same numerals used in FIGS. 3 and 4, but variant elements are identified by the reference numeral primed.

In FIGS. 7 and 8, another configuration of freight-carrying car is shown at 100 as including a floor 102, a roof 104, end walls 106 and 108 and side walls 110 and 112. Door openings 111 and 113 are provided in walls 110 and 112 in longitudinally offset relation to each other with the door openings relatively closely adjacent the end walls. Each end wall has a lading-engaging panel 114 adjacent thereto supported by elongated spaced arms 116 that pivotally connect at their upper ends to brackets 118 on the end wall and pivotally connect at their lower ends at substantially mid-height of the panel 114. A pair of elongated inflatable bags 120 are positioned between panel 114 and the adjacent end walls 110 and 112. In the arrangement of FIGS. 7 and 8 the bags are arranged longitudinally vertically and the entire lading L_3 is disposed between the pair of panels 114.

FIG. 9 illustrates a preferred arrangement of conduits in a rectangular configuration for disposition within the rectangular car of FIGS. 7 and 8 for selectively and remotely pressurizing the inflatable bags or releasing the pressurized air or gas therefrom. One three-position valve designed 122a with a

position selector 124 connects to two conduits 126a and 126b on the near side of the car. The other three-position valve designated 122b with a position selector 125 connects to the same two conduits on the far side and opposite end of the car. Conduit 126a communicates with inflatable bags 120a through conduit branches 126c. Conduit 126b communicates with inflatable bags 120b through conduit branches 126d. The air-entry connectors are designated as 128a and 128b to which a compressed air hose may be connected as is well known in the art. With selectors 124 and 125 in their normal positions shown in full lines at 124a and 124a, the valves are closed and no air passes either into or from valves 122a and 122b. With the air hose attached at 128a and by swinging selector 124 to the right-hand position at 124b, air passes only to the distal bags 120a through conduits 126a and branches 126c. When selector is swung to the left-hand position at 124c, all bags are inflated at the same pressure. After inflation of one set or both sets of bags 120, the selector is returned to the closed position 124a and the air hose is disconnected from the air-entry connector 128a. The pressure in bags 120 is maintained as long as selectors are in closed positions 124a and 125a. With the air hose disconnected, movement of selector 124 to position 124b operates to release the pressure in the distal bags 120a, while movement of selector 124 to position 124c operates to release pressure from all bags 120. The three-position valve 122b on the opposite side of the car performs the same operation as valve 122a with position 125a preventing passage of air either into or from valve 122b, position 125b allowing passage of air either into or from distal bags 120b, and position 125c allowing passage of air either into or from all bags 120.

One valve is provided adjacent the respective entrances 111 and 113 in the opposite side walls, so that an operator may control all pressurizing from only one position on either side of the car.

Considering the operation of the system in FIGS. 7-9, with a car fully loaded with lading L_3 and all bags 120 inflated so as to pressurize the panels 114 against the ends of the lading, when the operator opens the door at opening 113, he turns selector 124 of the adjacent valve 122a to position 124c. This releases the pressurized air from the air bags 120 at both ends of the car, and panels 114 retract from lading L_3 , such as under bias of the spring means as disclosed in FIGS. 3 and 4. It is then possible to unload the lading which preferably is carried on pallets or loading racks. Rack loading is frequently used for shipment of automobile parts. When compacted to eliminate voids between adjacent racks, the entire rack lading, such as L_3 , tends to shift as a unit when the car is impacted. Such rack lading, or palletized lading, is confined to the vertically projected confines of the rack or pallet structures. After the entire lading is removed, the unloaded pallets or empty racks are reinserted into the car and the panels 114 are repressurized to the positions in FIGS. 7 and 8 and the car is ready for safe return shipment.

In loading a car, one starts with the envelopes or bags 120 fully deflated and panels 114 retracted. The selector 125 of valve 122b at the opposite side at the far end of the car is moved to "closed" position at 125a. The loaded racks or pallets are then loaded through the open door tightly against the far panel 114. After loading all racks, a compressed air hose is attached to nipple 128a and selector 124 of the valve 122a adjacent the open door is moved to "far" position at 124b. The bags 120 at the far end of the car then inflate and press the lading toward the left. When the left-hand end of lading L_3 is about 7 inches from the left door post of the car, selector 124 is moved to "both" position at 124c thus also inflating the bags 120 at the near end of the car and so that the inflated bags cause the panels to substantially simultaneously engage the ends of the lading L_3 . When the bags have been inflated to the desired pressure, the selector 124 is moved to "closed" at 124a, and the air hose is disconnected. The car door is closed and the car is then ready for shipment. The conduits serve to communicate the pressurized air or gas in the envelopes at opposite ends of the car, or lading, to each other, so that one set

of envelopes also serve as a pressure-accumulator or reservoir for gas displaced from the other set of envelopes upon occurrence of longitudinal shifting of the load after full pressurization has occurred.

The system of FIGS. 7-9 has the advantages that the car is a standard one requiring no special construction, there are no overhead-supported bulkheads, and thus no rolling parts, carriages, tracks or keepers may become mis-aligned. There is less cost, less added weight, less maintenance, and easy replacement of damaged panels or inflatable bags. The air pressure is equalized at both ends of the car and load is always cushioned at both ends.

In the movable panel arrangements disclosed in FIGS. 3-4 and 5-6, the structures when applied at the ends of lading subportions provide both for endwise pressurizing of lading to apply forces that act to prevent transverse shifting of the lading and also for pneumatically absorbing longitudinal inertial forces caused by impacting the car at excessive speeds. The suspension of the panel provides that it will "float," tending to adjust to unevenness at the end face of the lading. The panel is pivotable or rockable about a horizontal axis at substantially mid-height to adjust for vertical misalignment into a plane or attitude inclined to vertical, and the spaced arms which hold the panel permit some skewing of the panel for adjusting to mis-alignment in a direction transversely of the lading. Preferably the bags are interconnected and pressurized so that the lower bag exerts greater pressure than the upper bag, so as to produce greater force through the movable panel against the lower part of the lading, as is frequently required with dense shipments in cartons such as obtained by canned goods. The variance in pressure is desirable in compacting the lading, but once the lading is compressed the air pressure evens out in the bags to provide a maximum cushioning effect.

While there has been shown and described a particular embodiment of this invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention and, therefore, it is intended in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. An improved system for safely shipping lading in a railway car provided with two spaced end walls and two side walls each with an access opening therein, said system comprising, in combination: a plurality of confined ladings of a size to be entered or removed from the car through the access opening and arranged to abut and engage adjacent confined ladings to provide effectively a continuous palletized car loading with substantially no space between adjacent ladings, each end wall of the car having an associated movable, upright panel adapted to be forced tightly against one free end of the continuous palletized car loading, inflatable envelope means between each panel and its associated end wall, means for pressurizing the inflatable envelope means to cause the oppositely facing movable panels to tend to move toward each other to substantially simultaneously engage the ends of the palletized car loading, conduit means communicating the pressurized gas in the envelope means at opposite ends of the car so that each such envelope means provides a pressure-accumulator, or reservoir, for gas displaced from another envelope means upon occurrence of the event of tendency of the palletized load to shift longitudinally in the car, and the panel

being attached relative to the end wall by a pair of spaced, elongated, support arms each pivotally connected at one end thereof adjacent one upright edge of the panel and providing only two spaced points of pivot connection to the panel that permit the panel to compensatingly skew slightly relative to the end wall and permitting the panel to adjust to unevenness of the end of the lading both vertically and in a direction cross-way of the width of the vehicle.

2. A system as in claim 1 wherein the pivot connection between the support arms and the panel is a horizontal axis located at substantially mid-height of the panel so that the panel may rock about said axis to vertical misalignment at the end to adjust to the lading.

3. A device as in claim 2 including biasing means operatively associated with the lading-engaging panel and inflatable envelope means to exert forces tending to deflate the envelope means and force it against the end wall and arranged so as to apply to the panel oppositely directed moments about the mid-height pivot axis.

4. In a device that uses inflatable envelope means for cushioning the tendency of lading to shift longitudinally of the direction of movement of a lading-carrying vehicle whose frame is designed to withstand the static and dynamic forces developed by the lading therein, the improvement comprising, in combination: an upright wall-type member in the vehicle, serving as a member for receiving and transmitting forces that are applied longitudinally of the vehicle to the vehicle's frame; an upright lading-engaging panel attached to and supported from said wall-type member and arranged to move toward and away from said wall-type member, pressurizing means including a plurality of inflatable envelopes including means to intercommunicate the pressures therewithin and disposed between the wall-type member and said lading-engaging panel, to both provide pressure means for selectively forcing the lading-engaging panel against one end of lading in said vehicle and for absorbing and transmitting forces applied to the lading-engaging panel resulting from tendency of a load to shift longitudinally of the vehicle, and the attachment of the upright panel to the wall-type member including only pivot connections at substantially the mid-height of the panel which permit the panel to incline relative to a vertical plane and to adjust to vertical misalignment at the end face of the lading.

5. A device as in claim 4 wherein the wall-type member is a permanent end wall of the vehicle.

6. A device as in claim 4 wherein the wall-type member is a bulkhead arranged to move longitudinally within the vehicle.

7. A device as in claim 4 wherein two elongated inflatable envelopes are provided between the wall-type member and the lading-engaging panel with the longitudinal axes of the two envelopes spaced one above and the other below said substantially mid-height pivot axis of the panel.

8. A device as in claim 4 wherein the panel is attached to the wall-type member by a pair of elongated support arms, that are spaced apart a distance greater than the width of the inflatable envelope means and said envelope means being located between said support arms.

9. A device as in claim 4 wherein the mounting of the panel includes means that permits skewing of the panel for adjusting of the panel to misalignment of the end face of the lading in a direction transversely of the lading.

10. A device as in claim 4 including means in the intercommunicating means for developing different pressures in different ones of the plurality of inflatable envelopes.

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