Aug. 4, 1964 K. J. AUSTGEN 3,143,082

DECKLESS LONG TRAVEL CUSHION CAR FOR FREIGHT CONTAINERS

Original Filed Feb. 16, 1960 9 Sheets-Sheet 1

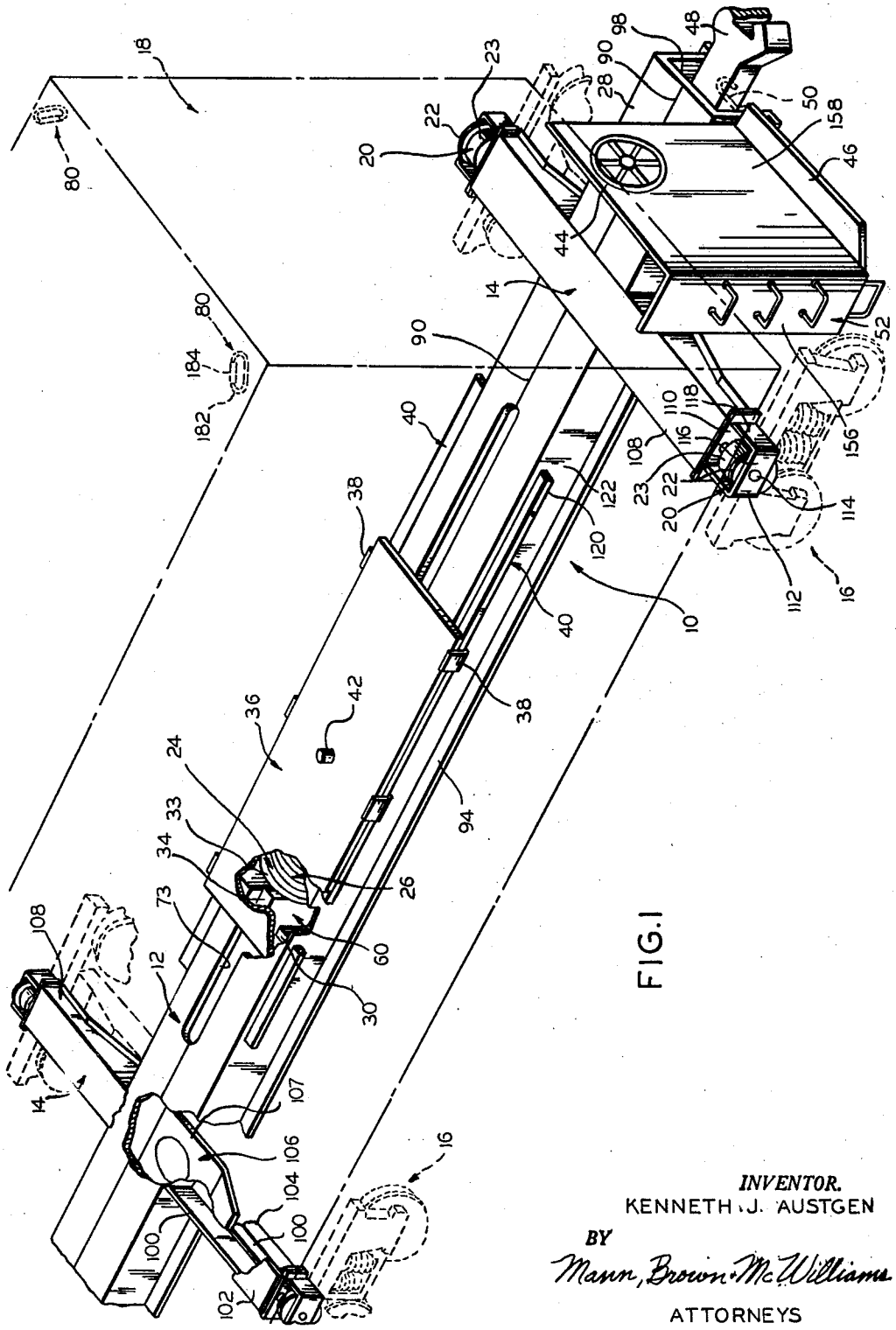


FIG. 1

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Original Filed Feb. 16, 1960 9 Sheets-Sheet 2

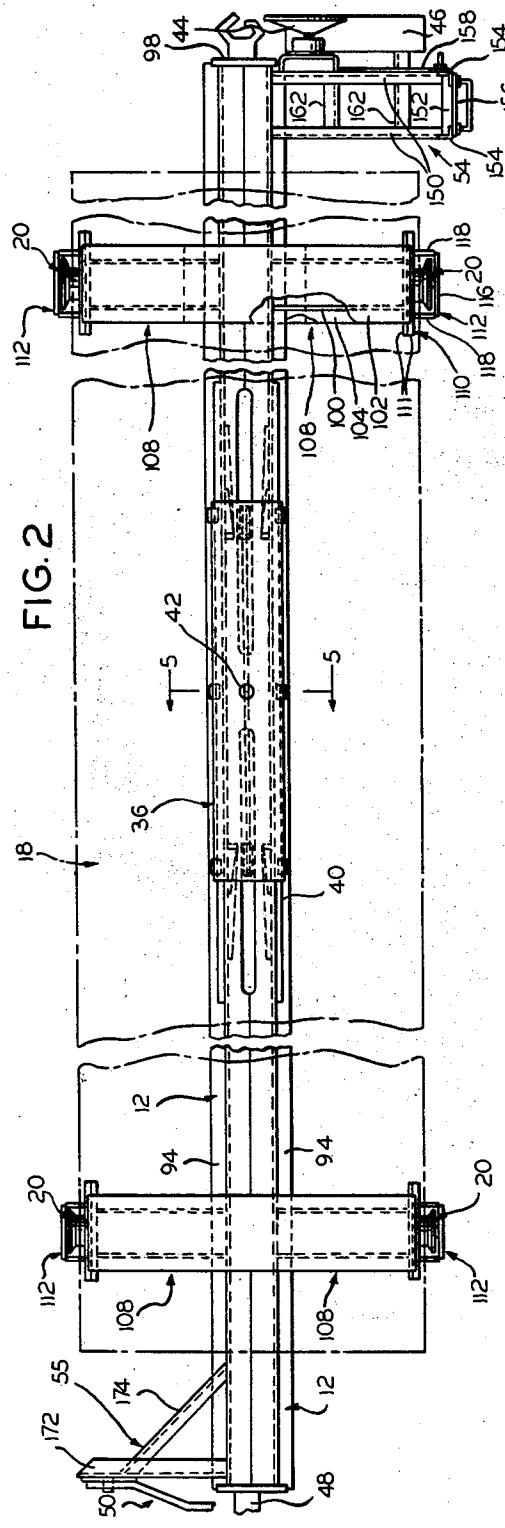


FIG. 2

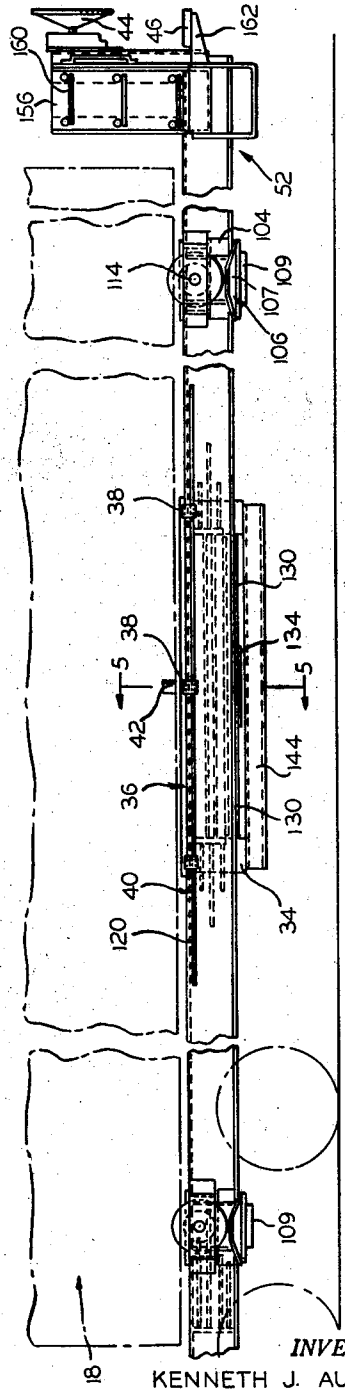


FIG. 3

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Original Filed Feb. 16, 1960 9 Sheets-Sheet 3

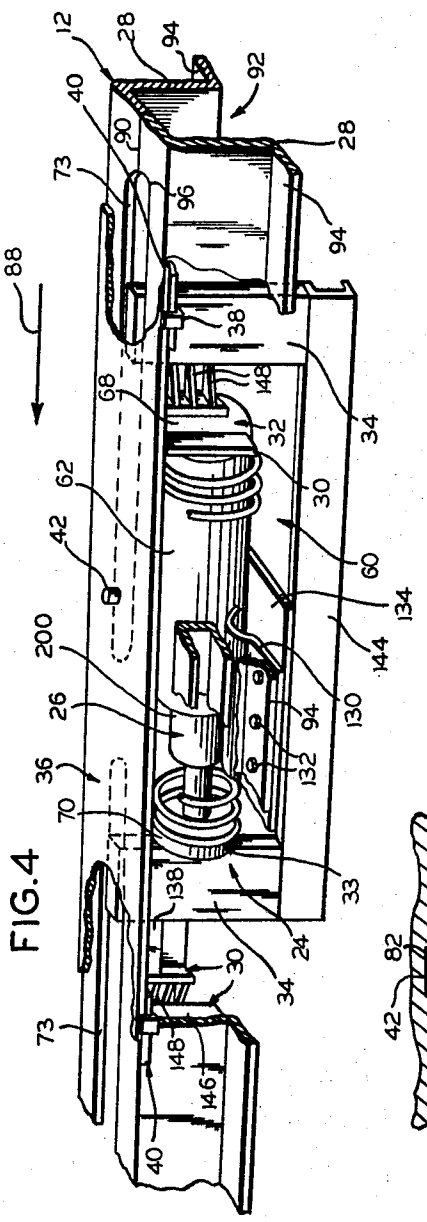


FIG. 4

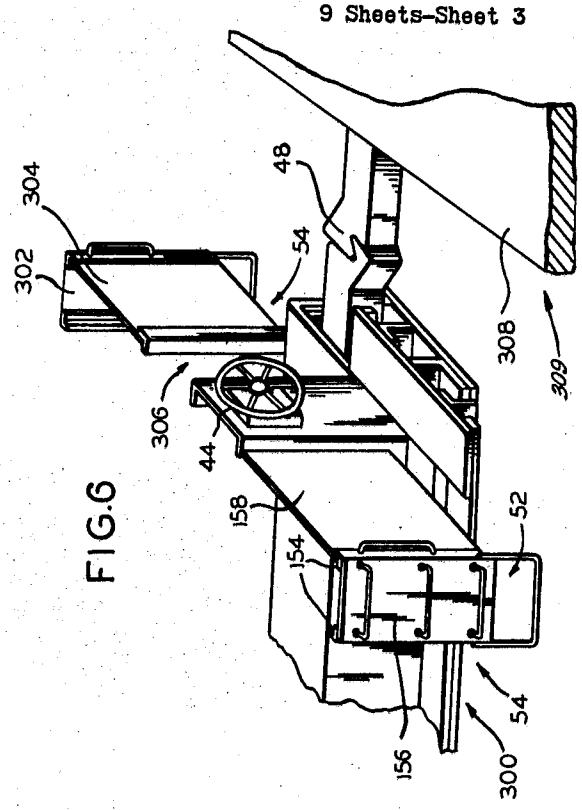


FIG. 6

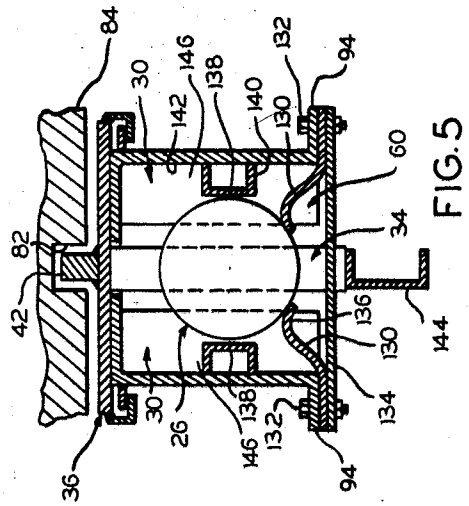


FIG. 5

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Aug. 4, 1964 K. J. AUSTGEN 3,143,082

DECKLESS LONG TRAVEL CUSHION CAR FOR FREIGHT CONTAINERS

Original Filed Feb. 16, 1960 9 Sheets-Sheet 4

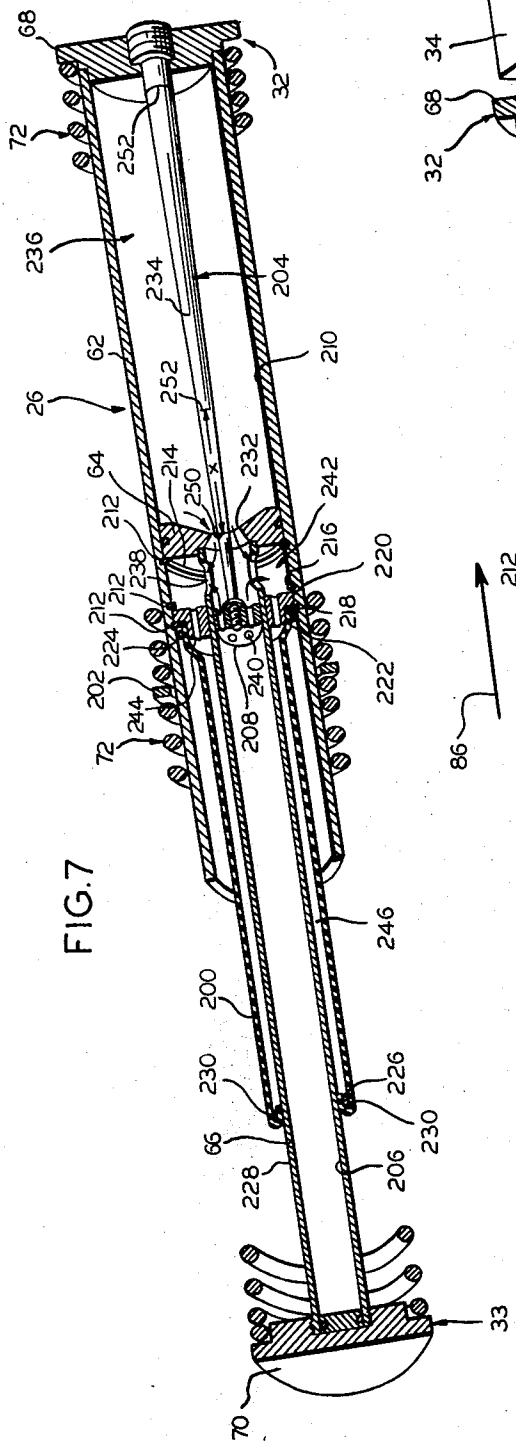


FIG. 7

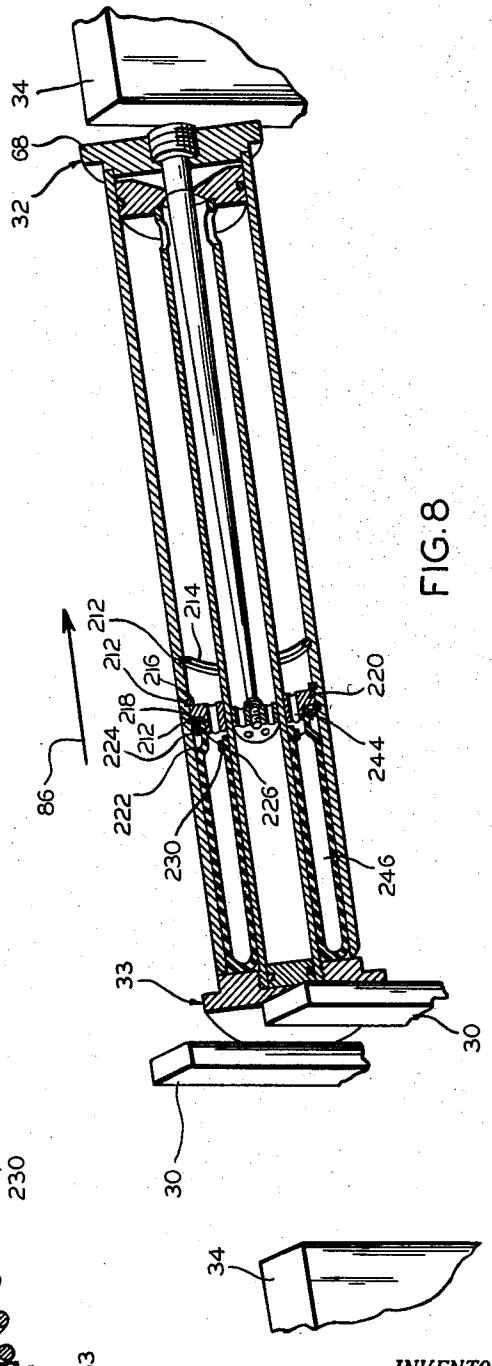


FIG. 8

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Aug. 4, 1964 K. J. AUSTGEN 3,143,082

DECKLESS LONG TRAVEL CUSHION CAR FOR FREIGHT CONTAINERS

Original Filed Feb. 16, 1960 9 Sheets-Sheet 5

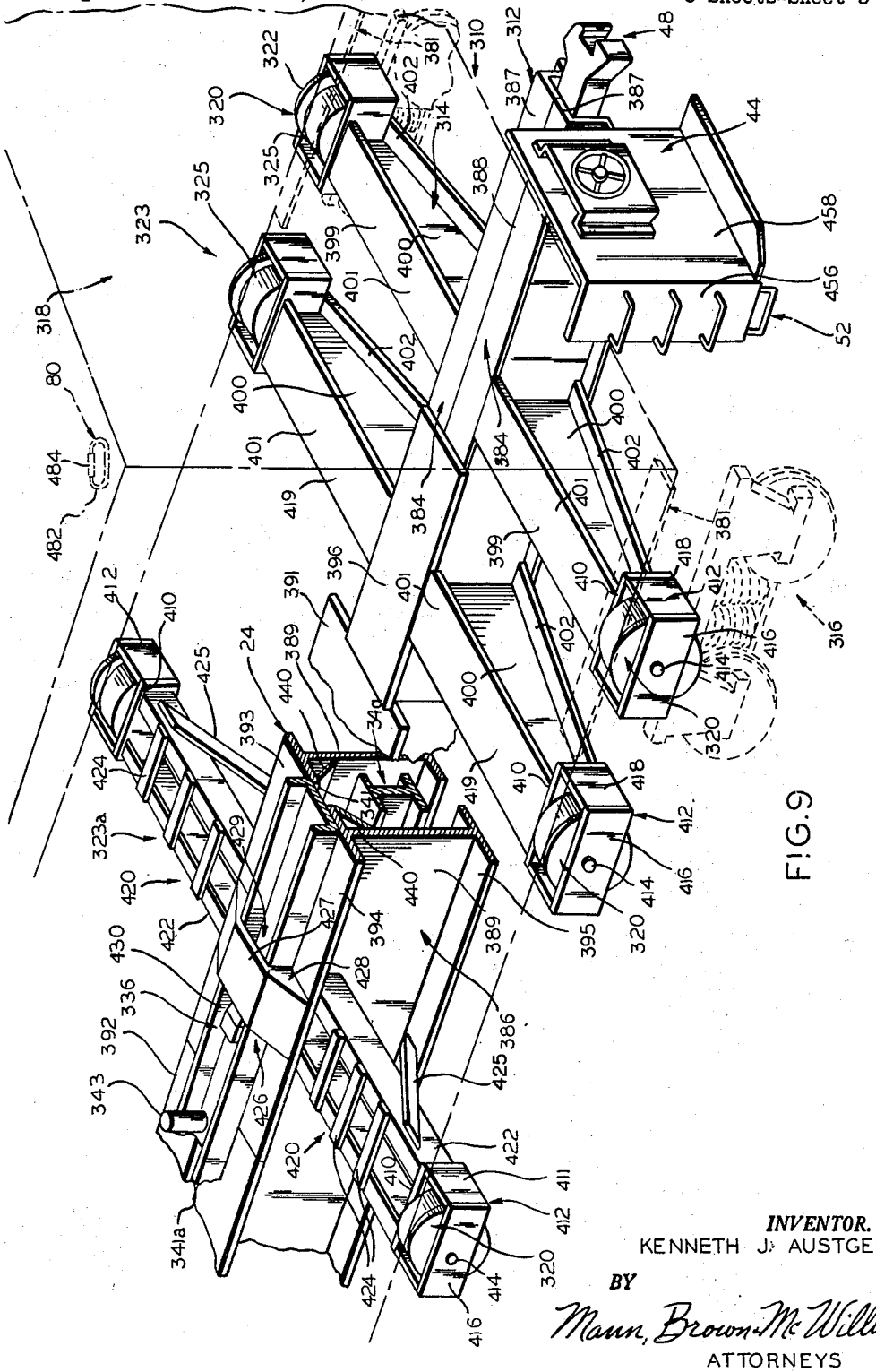


FIG. 9

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Aug. 4, 1964 K. J. AUSTGEN 3,143,082

DECKLESS LONG TRAVEL CUSHION CAR FOR FREIGHT CONTAINERS

Original Filed Feb. 16, 1960 9 Sheets-Sheet 6

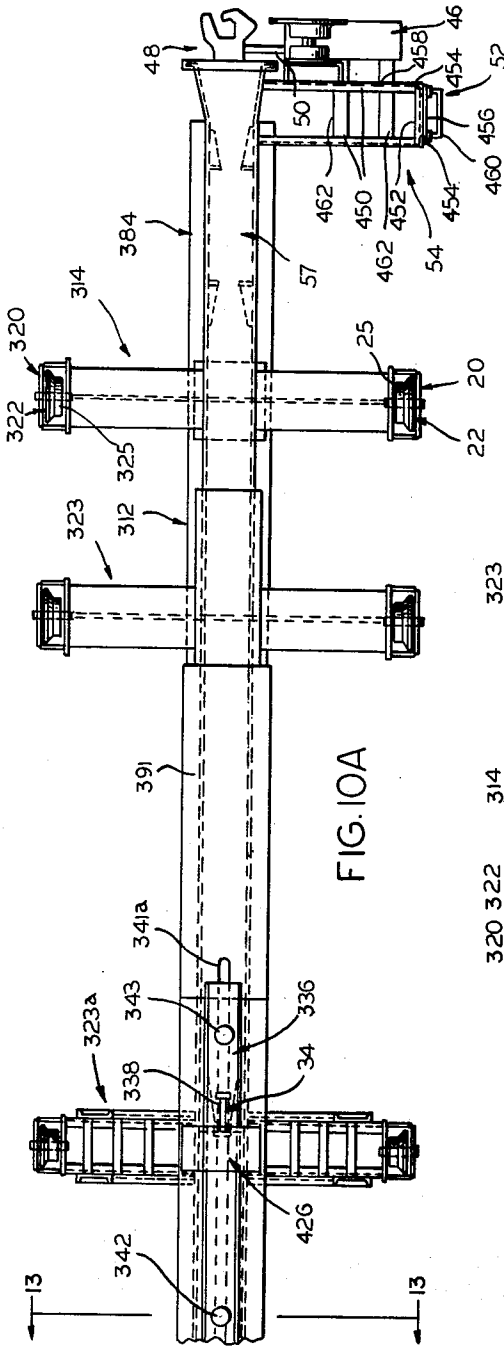


FIG. 10A

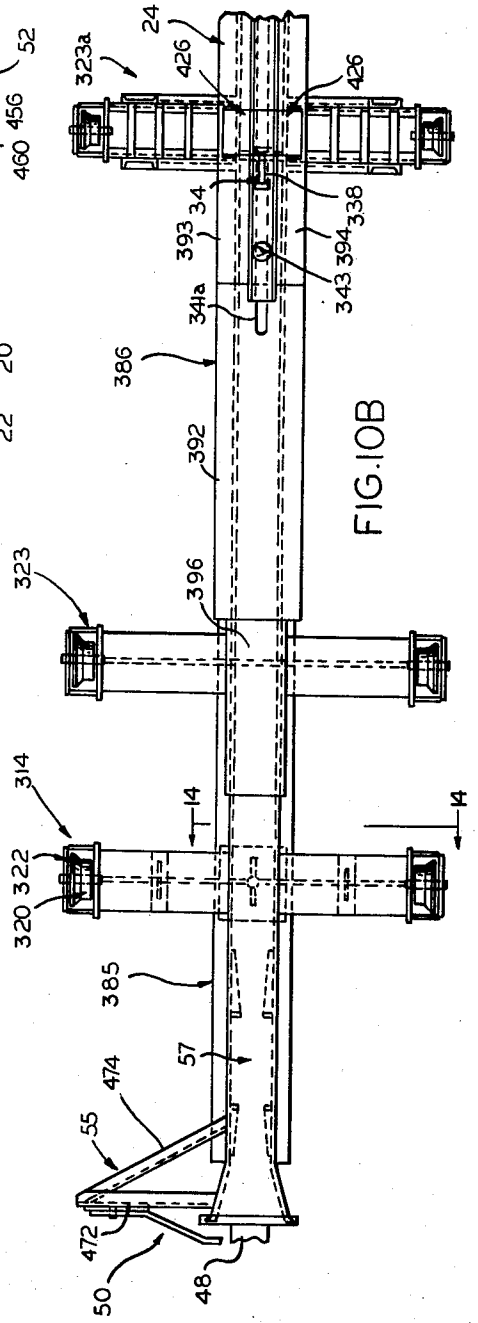


FIG. 10B

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DECKLESS LONG TRAVEL CUSHION CAR FOR FREIGHT CONTAINERS

Original Filed Feb. 16, 1960 9 Sheets-Sheet 7

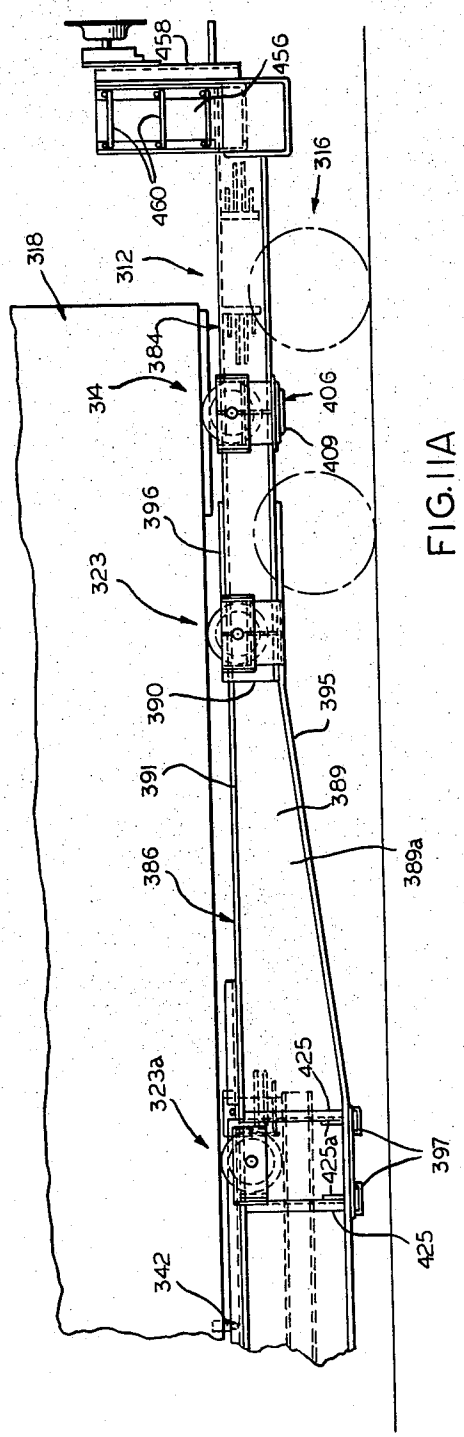


FIG. 11A

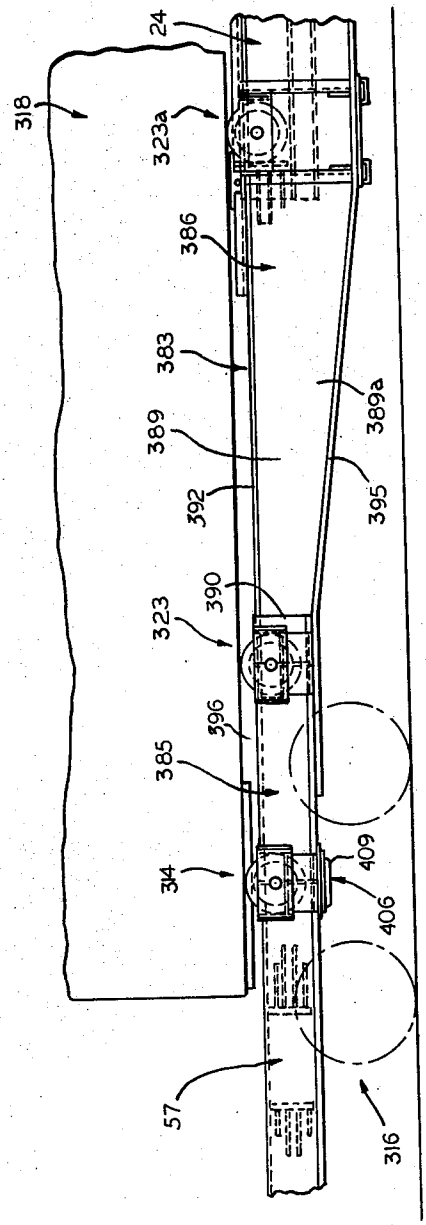


FIG. 11B

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Original Filed Feb. 16, 1960 9 Sheets-Sheet 8

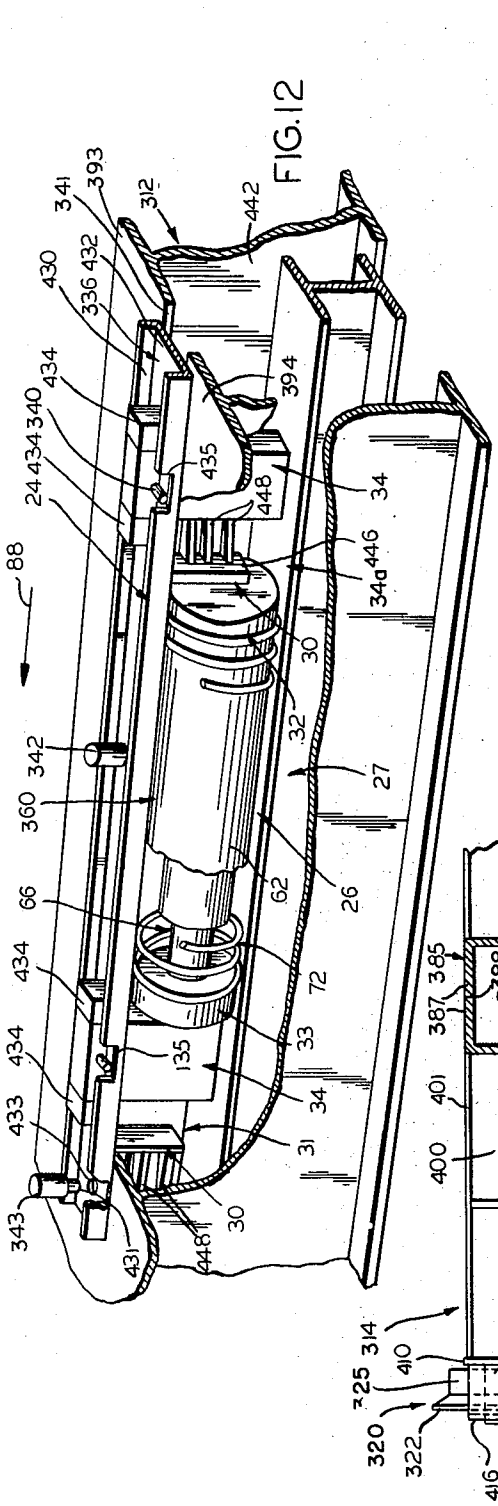


FIG. 12

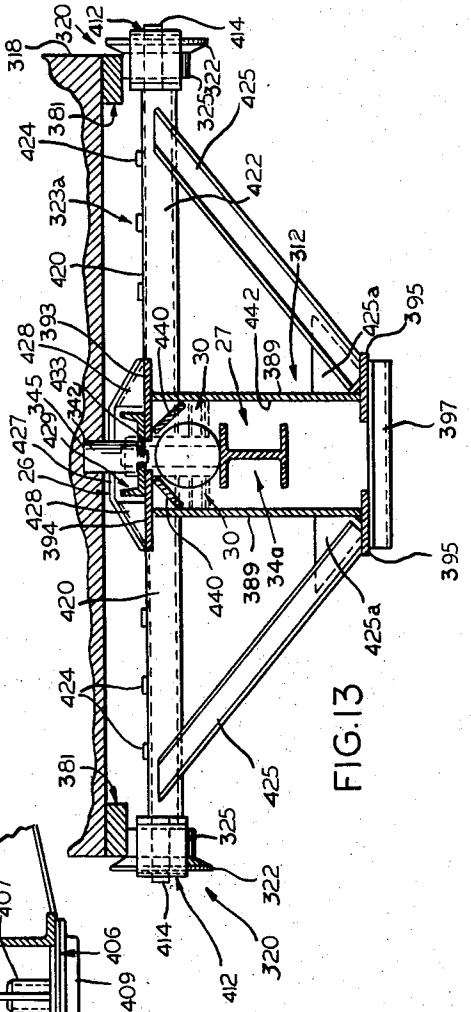


FIG. 13

FIG. 14

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DECKLESS LONG TRAVEL CUSHION CAR FOR FREIGHT CONTAINERS

Original Filed Feb. 16, 1960 9 Sheets-Sheet 9

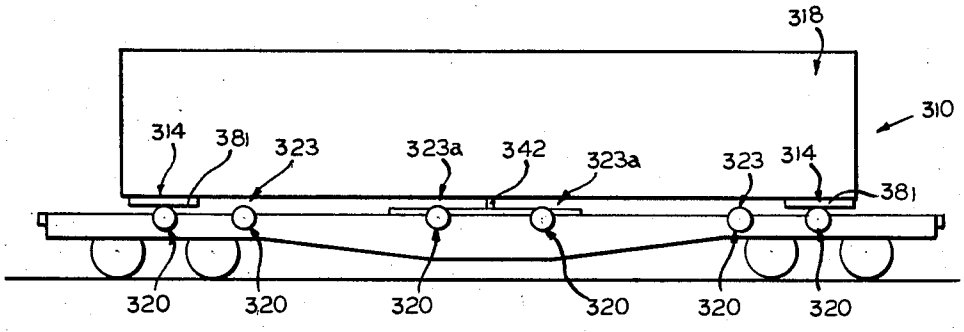


FIG.15

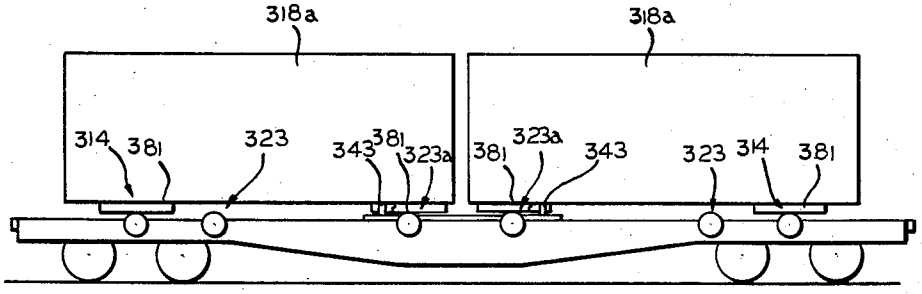


FIG.16

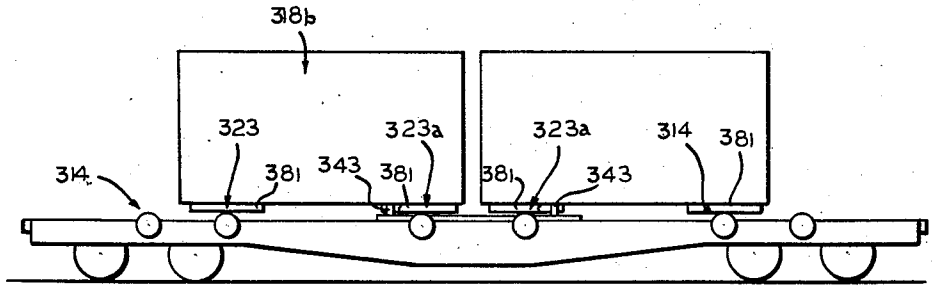


FIG.17

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United States Patent Office 3,143,082 Patented Aug. 4, 1964

3,143,082

DECKLESS LONG TRAVEL CUSHION CAR FOR FREIGHT CONTAINERS

Kenneth J. Austgen, Griffith, Ind., assignor to Pullman Incorporated, Chicago, Ill., a corporation of Delaware

Continuation of applications Ser. No. 9,135, Feb. 16, 1960, and Ser. No. 44,328, July 21, 1960. This application Sept. 27, 1962, Ser. No. 228,215

10 Claims. (Cl. 105—366)

My invention relates to a deckless long travel cushion car for freight containers, and more particularly, to a freight car of extremely simplified design that is arranged specifically to transport freight containers and to provide the container and its lading with effective protection against the adverse effects of longitudinal impacts, such as those encountered in humping yards.

This invention is closely related to that described in the copending application of William H. Peterson, Serial No. 856,963, filed December 3, 1959, now Patent 3,003,436, granted October 10, 1961 (the entire disclosure of which is hereby incorporated herein by this reference). As disclosed in said Peterson application, changes in the absolute velocity of the lading, which are normally caused by stopping and starting of the car, and by impacts against the car couplers during transit, are effected by adding or subtracting kinetic energy to the lading through the frictional forces acting between the lading and the car as well as the pressure of the car end wall on the lading (the car end wall involved depending on what car coupler is initially subjected to the longitudinal shock and whether the shock is in buff or in draft). Said Peterson application discloses that damage free lading protection against longitudinal impacts (that is, impacts applied against the car couplers) can be obtained if there is interposed between the couplers and the car body containing the lading a cushioning device or arrangement having a cushion travel sufficient in capacity and length that the absolute velocity of the lading is changed to that required by the Law of Conservation of Momentum for inelastic bodies by employing to a substantial degree the frictional forces acting between the lading and the car, as distinguished from the compressive forces applied to the lading by the car end wall. This novel approach is particularly applicable to resilient lading (goods packed in fibre boxes) and involves, among other things, extending the time of closure of the cushioning device employed sufficiently so that the changes that must occur to the absolute velocity of the lading (by reason of the aforementioned Law of Conservation of Momentum) occur to the lading as a unit. The length of travel found essential for U.S. railroad practice is in the range of 20 to 40 inches, and preferably is on the order of 30 inches.

It has been found, as disclosed in said Peterson application, that a cushion travel in this range permits the inherent stability of the load and the friction between the lading and the car body to act as substantial factors in creating the lading acceleration (either positive or negative) necessary to achieve the absolute velocity dictated by the aforementioned Law of Conservation of Momentum, without developing within the lading the destructive compressive forces which cause lading damage.

Said Peterson application also discloses that his invention protects the car structure as well as the lading, and further that the invention of said Peterson application is applicable to piggyback and container systems of freight handling, and permits damage free use of highly simplified freight cars and containers in the practice of said freight handling systems.

My invention is an example of the car simplification made possible by said Peterson invention. My invention contemplates a deckless railroad car consisting essentially

of a car frame composed of a center sill structure, which may be of the type known in the art as "Z–26," and bolster structures associated with each end of the center sill structure to which the car trucks are operatively connected; the bolsters have secured thereto rollers on which a simplified box type of freight container rides and the container is connected to a long travel cushioning device (of the type contemplated by said Peterson application) which is carried by the center sill structure. The car frame otherwise carries only sufficient structure necessary to support and make operable the conventional equipment required by A.A.R. regulations, such as couplers, draft gear, uncoupling devices, brakes, ladders, and the like.

It is therefore the principal object of this invention to provide a railroad car of radically simplified design which employs the principles of said Peterson application in transporting lading.

Another principal object of the present invention is to provide a car of radically simplified design which not only employs the principles of said Peterson application in transporting freight containers, but also is readily adapted to support and transport freight containers of varied or different lengths.

Other objects of my invention are to provide a low cost railroad car specially adapted to transport simplified box-like containers, to provide a simplified car frame arrangement that consists essentially of more or less standard center sill and bolster designs while yet effecting the surprising results of said Peterson invention, to provide an improved system of handling freight that employs the principles of said Peterson application, to provide a guard arrangement at the ends of my simplified car to prevent one from falling to the track through the deckless space between the car frame end and the adjacent bolster structure, and to provide a car and freight container arrangement that is inexpensive of manufacture, convenient in use, and applicable to a wide variety of freight handling problems.

Still other objects of the present invention are to provide in a low cost railroad car especially adapted to transport simplified box-like containers a deckless car frame arrangement employing simplified center sill and bolster designs as well as cross bearer structures that permit the handling of shorter length containers, to provide a cushioning arrangement conforming to the principles of said Peterson application which is adapted for ready connection to both short and long freight containers, and to provide a car structure that is applicable to a wide variety of freight handling containers.

Still other objects, uses and advantages will be obvious or become apparent from a consideration of the following detailed description and the application drawings..

In the drawings:

FIGURE 1 is a diagrammatic perspective view of one embodiment of my railroad car, having a freight container applied thereto in accordance with this invention, with the container being shown in outline form;

FIGURE 2 is a plan view of the car structure shown in FIGURE 1, parts being broken away to facilitate illustration;

FIGURE 3 is a side elevational view of the car structure shown in FIGURE 2, parts being broken away to facilitate illustration;

FIGURE 4 is a fragmental diagrammatic perspective view of the central portion of the car of FIGURE 1, illustrating the cushioning device that is carried by the car center sill structure and the manner in which it is employed to cushion longitudinal impacts;

FIGURE 5 is a cross-sectional view along line 5—5 of FIGURES 2 and 3;

FIGURE 6 is a diagrammatic perspective view of one

end of the car of FIGURE 1, showing a modified form of the invention;

FIGURES 7 and 8 are diagrammatic perspective views, in section, illustrating one embodiment of the specific long travel hydraulic cushion device that may be used in practicing my invention and the invention of said Peterson application, showing said device in extended and contracted positions, respectively;

FIGURE 9 is a diagrammatic perspective view of another embodiment of my railroad car, showing on an enlarged scale approximately two-thirds of the car, with parts broken away to facilitate illustration, and with a container carried thereby shown in phantom;

FIGURES 10A and 10B are plan views that, when considered together, form a composite plan view of the car structure represented by FIGURE 9 (the conventional trucks being omitted);

FIGURES 11A and 11B are side elevational views that, when considered together, form a composite side elevational view of the car structure illustrated in FIGURES 10A and 10B showing fragmentally a full length container applied thereto;

FIGURE 12 is a fragmental, diagrammatic perspective view of the longitudinal central portion of the car of FIGURES 9–11B, illustrating the cushioning arrangement of the car center sill structure and the manner in which it is employed to cushion longitudinal impacts;

FIGURE 13 is a cross-sectional view along line **13—13** of FIGURE 10A;

FIGURE 14 is a cross-sectional view along line **14—14** of FIGURE 10B;

FIGURES 15, 16 and 17 are diagrammatic small scale side elevational views of the car showing several of the different freight container loading arrangements contemplated by this invention.

However, it is to be understood that the specific illustrations of the drawings are for purposes of complying with 35 U.S.C. 112 as the invention is susceptible of other embodiments, as will be apparent to those skilled in the art.

General Description of First Primary Embodiment of Invention

Reference numeral **10** of FIGURES 1–5 generally indicates one primary form of deckless railroad car conforming to the principles of my invention as well as those of said Peterson application, which is composed essentially of a center sill structure **12** connecting spaced bolster structures **14**, the latter being operatively secured through a conventional center plate and kingpin arrangement to conventional trucks **16** that are only diagrammatically illustrated.

The car **10** supports at its ends full length freight container **18** (which is shown in outline in FIGURE 1). The container **18** in practicing my invention rides on rollers **20** rotatably mounted in the illustrated embodiment at the ends of the bolster structures, rollers **20** being formed with annular tapering flanges **22** to aid in properly centering the container with respect to the car when the container is being applied to the car, and to maintain the freight container properly centered with respect to the car during transit.

A long travel cushioning arrangement having the characteristics contemplated by said Peterson application is interposed between the car **10** and the container **18** where indicated by reference numeral **24** (see FIGURES 1 and 4). The cushioning arrangement **24** includes a hydraulic cushion device **26** received between the two **Z** members **28** that are employed to make up the center sill structure **12** and applied between the spaced lugs **30** that are fixed in spaced pairs to the respective **Z** members **28**. The cushion device **26** includes follower members **32** and **33** which bear against the lugs **30** as well as spaced stops **34** that are fixed to a sliding or shiftably mounted platform or plate **36** carried by the center sill structure and operate between the lugs of the respective pairs of spaced lugs **30**. The platform or plate **36** forms a member for coupling the container **18** to cushion device **26**, and includes hook members **38** which are received over tracks **40** that are affixed to the sides of the center sill structure to hold the platform or plate **36** to the center sill and provide a fixed path of movement for it.

In the primary form illustrated in FIGURES 1–6, the coupling member that is defined by the platform or plate **36** is provided with an upstanding pin **42** which is adapted to lodge in a correspondingly located recess **82** formed in the undersurface of container **18** (see FIGURE 5).

The remainder of the car **10** need include only those structures necessary to make operative the conventional safety and other apparatus required by A.A.R. regulations, some of this apparatus being diagrammatically indicated in the drawings, such as the hand brake **44** and a platform **46** for operating same, couplers **48**, uncoupling devices **50**, and the ladder arrangement generally indicated at **52**. The hand brake and platform for operating same may be secured to the simplified end sill structure indicated at **54** in FIGURE 2. The brake rigging and trainline conduits, and other similar equipment, may be secured to the center sill structure in any suitable manner. The uncoupling device **50** at the brake end of the car may be supported by end sill structure **54**, and at the other end of the car the device **50** may be supported by end sill structure **55**.

The hydraulic device **26** is received in a cushion pocket **60** (see FIGURES 4 and 5) defined by the center sill structure **12** and the spaced pairs of lugs **30** carried by same. The hydraulic device **26** generally comprises (see FIGURES 7 and 8) a cylinder **62** and a piston **64** having fixed thereto a tubular piston rod **66** which projects outwardly of the cylinder **62**. The heads or closure members **68** and **70** form the cushion followers **32** and **33**, respectively, that are held against the spaced pairs of lugs **30** by high strength compression springs **72**.

The hydraulic unit **26** is designed to have a cushioned travel or closure distance in the range of 20 to 40 inches, and preferably on the order of 30 inches, and the platform or plate **36** and its tracks **40** are arranged to permit this amount of movement of the plate or platform **36** when longitudinal impacts are applied to the car **10** in service. The stop members **34** project upwardly through the top of the center sill structure through appropriate slots **73**, which likewise are proportioned to permit the above specified movement of the stop members with respect to the center sill structure. Unit **26** is double acting, as it effects a cushioned transfer of impacts applied to either end of car **10**, and it preferably is provided with a substantially constant force travel closure characteristic.

Container **18** may be of any conventional design, though preferably it is of simple box type construction employing suitable access openings and covers therefor (not shown) and may be of right parallelepiped construction. The container should have a length sufficient so that it will engage the rollers **20** at each end of the car with an overhang somewhat in excess of the amount of closure travel of the cushion device **26**. The container should have a width corresponding to the distance between the flanges **22** of rollers **20** of each bolster structure, though the actual width employed should be that which will permit the container to rest on the cylindrical portions **23** of the rollers without engaging the flanges **22** thereof.

The container **18** may be of the type that is adapted to be crane lifted onto the car **10** and for this purpose may be provided with conventional cable attachment devices where generally indicated by reference numeral **80**.

In practicing my invention, the car **10** is moved to a loading site, such as a dock, where loaded containers **18** may have been previously gathered. The container **18** is then crane lifted onto the car **10**, the container being lowered onto the car until the container rests on the cylindrical portions **23** of the rollers **20** (between roller

flanges 22) in the manner suggested by FIGURE 1, with the pin 42 of the platform or plate 36 engaging in the corresponding recess 82 formed in the undersurface 84 of the container (see FIGURE 5). The roller flanges provide a lateral centering action on the container as it is lowered into position. As clearly indicated in FIGURES 3 and 5, the cylindrical portions 23 of the rollers 20 are sufficiently elevated above the top of the center sill structure so that the undersurface 84 of the container does not contact either the center sill structure or the platform or plate 36. Thus, the cylindrical portions 23 of rollers 20 at their upper portions are tangent with a common plane which is coincident with the bottom of the container that is to rest on same, which plane is substantially horizontally disposed and parallels the center sill structure.

The container car is now ready for transit. When an impact occurs, for instance, in the direction of the arrow 86 of FIGURE 8, or in the direction of the arrow 88 of FIGURE 4, the center sill structure 12 moves under the impetus of the impact against one end of the hydraulic device 26 to move the latter from its extended position of FIGURE 7 to its contracted position of FIGURE 8. As the hydraulic device moves to its contracted position, hydraulic liquid is forced through orifices to dissipate in the form of heat substantially all of the energy that is involved in the so-called "impact effect" when a car impacts against, or is impacted by, one or more other cars; the cushion also adds to or subtracts from the container 18 and its lading the energy of the impact that is to be acquired by or lost from the container (as kinetic energy) as a result of the impact (depending on the condition of impact).

Under the impact condition of FIGURE 4, the impact has been applied to the coupler 48 at the right hand end of the car shown in FIGURE 1, and this forces the right hand pair of lugs 30 against the hydraulic device closure member 68 forming follower 32, which presses it against the left hand stop member 34, as indicated in FIGURE 4. Due to the inertia of the container 18 and its lading, and the connection between platform or plate 36 and the container, the absolute velocity of the platform or plate 36 is initially unaffected by the impact, but the pressure of the hydraulic device follower 33 acting on stop 34 gradually transfers the kinetic energy of the impact to the container and plate 36 by reason of the pressure against the stop member 34. The cushion device continues to close until its parts have the operative relation indicated by FIGURE 8, at which time, the container 18 and platform or plate 36 have the ultimate velocity dictated by the aforementioned Law of Conservation of Momentum.

After the impetus of an impact has been dissipated and the kinetic energy involved in the impact has been transferred to the container through the cushion device, springs 72 acting in tandem on heads 68 and 70 restore platform or plate 36 and container 18 to its normal central position with respect to the car 10.

When the direction of impact is in the opposite direction, as indicated in the showing of FIGURE 8, the functioning of the hydraulic device 26 is the same, though the forces involved act in the opposite direction; thus, the impact is against the left hand coupler 48 and in the direction of arrow 86, and the left hand lugs 30 press follower 32 against stop member 34, as indicated in the figure. Draft forces are handled in a similar manner, although the actual operation of the cushion device will depend upon the direction of the draft force, as will be understood by those skilled in the art.

The roller flanges 22 keep the container properly centered during relative movement between the container and the center sill structure.

Specific Description of First Primary Embodiment of the Invention

As already mentioned, the center sill structure 12 may be of the standard Z–26 type and thus includes the two Z members 28 welded together as at 90 along the length of the center sill structure. The Z members 28 when united as shown define an inverted channel shape configuration having an open bottom 92 and laterally extending flanges 94. The Z members may be initially formed as at 96 to define the respective slots 73 when they are joined together. The center sill structure may be provided at its ends with the customary draft gear pocket, lugs, draft gear, yoke, coupler key and the like for operatively mounting couplers 48 within the ends of the center sill structure (some of this conventional structure being indicated in the drawings). Strikers 98 form the ultimate ends of the center sill structure.

The bolster structures 14 are essentially of the standard box type including spaced webs 100 (see FIGURES 1–3) fixed as by welding between upper and lower cover plates 102 and 104. As indicated in FIGURE 1, the top cover plates 102 extend across the width of the car, while the bottom cover plates 104 extend between the upper surfaces of center sill structure flanges 94 and the respective outer ends of bolster structures, the webs 100 being fixed at their inner ends to the center still structure, as by welding; plates 102 and 104 are fixed to the portions of the center sill structure that they abut, as by welding. As seen in FIGURES 2 and 3, a conventional center plate structure 106 is fixed between the bolster members 108 defined on either side of the car by the webs 100 and plates 102 and 104, the center plate structure including a plate 107 affixed to the undersurfaces of bottom cover plates 104 and center sill structure flanges 94 and extending across the open bottom of the center sill structure. It is the center plate structure 106 which forms the upper center plate of the conventional pivotal connection between railroad car body bolsters and railroad car truck bolsters and it carries the bearing portion 109 which cooperates in the conventional manner with truck bolster center plate structure (not shown as this may be of any conventional type). The kingpin connection between the upper and lower center plates may be effected in any conventional way.

At the ends of the bolster members 108, the webs 100 and the top and bottom plates 104 are welded to an end plate structure 110 (defined by a pair of plates 111 rigidly affixed to each other) which has fixed thereto frame 112 that together with plate 110 journals shaft 114 which rotatably mounts the respective rollers 20. Frame 112 is only diagrammatically illustrated and may take the form of end member 116 welded to the respective bolster members by side members 118, and of course, any additional bracing necessary will be obvious to those skilled in the art.

The platform or plate 36 may take the form of any suitable rigid member having the approximate shape indicated, to the edges of which are fixed, as by welding the angle brackets 38 which are engaged underneath tracks 40. Pin 42 may be welded to the upper surface of plate 36, as indicated in FIGURE 5.

Tracks 40 may take the form of bars 120 welded to the outer sides 122 of the respective Z members 28.

The cushion device 26 is supported within the cushion pocket 60 and underneath platform or plate 36 by the spaced carrier plates 130 (see FIGURES 4 and 5), which may be fixed to the center sill structure flanges 94 as by appropriate bolts 132. Adjacent the center of the cushion pocket 60, the center sill structure flanges 94 are preferably connected by a reinforcing plate 134 held in place in any suitable manner, as by several of the bolts 132. The cushion 26 in the illustrated embodiment is centered within the cushion pocket both by the cushion carrier plates 130, which are arcuately formed as at 136 to index the cushion, as well as guide members 138, which in the form illustrated comprise channels 140 welded to the internal surfaces 142 of the respective Z members 28 between the lugs 30 thereof.

The stop members 34 are affixed to the undersurface of the plate or platform 36 in any suitable manner, as by welding, and are preferably interconnected by the elongate rigid member 144 which in the form illustrated comprises a channel-shaped beam.

The lugs 30 may comprise plates 146 affixed to the inner surfaces 142 of the center sill structure, as by welding, and are arranged in spaced pairs in which the individual lugs are aligned transversely of the center sill structure. The respective plates 146 may be reinforced by strengthening webs 148 of any suitable character and affixed in place between the respective plates 146 and the Z members 28 as by welding.

The end sill arrangement 54 may take the form of spaced channel members 150 fixed together, as by welding, at their outer ends by channel member 152; members 150 may be secured to the center sill structure in a like manner. Spaced vertical angles 154 fixed to the connecting channel 152 have affixed thereto guard plates 156 and 158; plate 156 extends between the two angle members 154 and carries the steps 160 of ladder 52 while plate 158 is fixed between the corner angle member 154 and the center sill structure and supports the hand brake 44 and its associated structures. Platform 46 may be fixed to the end sill structure by appropriate angles 162 affixed to channels 150 in any suitable manner. The uncoupling device 50 may be associated with the end sill 54 in any suitable manner.

The other end of the car is also provided with an end sill structure where indicated at 55 for supporting an uncoupling device at this end of the car. The end sill structure 55 may be of any suitable form and in the embodiment illustrated comprises a transversely extending channel member 172 braced by diagonal angle member 174, both being welded together and welded to the center sill structure 12.

As already mentioned, the container 18 may be of any suitable design, the crane cable brackets 80 in the form shown comprising metal loops 182 pivotally secured to brackets 184 affixed in any suitable manner to the top of the container. As indicated in FIGURE 5, the pin 42 of plate 36 is received in opening 82 in the undersurface of the container, and opening 82 is formed or defined in any suitable manner.

It may be mentioned that the pin 42 and recess 82 are only one form of interconnection that may be employed between the platform or plate 36 and the container 18 to make the container fast to the platform. The connection may be made by applying the pin to the container and the recess to plate or platform 36, or by employing a plurality of such pins and recesses, or any other suitable interengaging means may be employed, as will be apparent to those skilled in the art.

Hydraulic Cushion Device

The hydraulic cushion device 26 is preferably that described in the copending application of William H. Peterson, Serial No. 782,786, filed December 24, 1958, now Patent No. 3,035,827, granted May 22, 1962, the entire disclosure of which is hereby incorporated herein by this reference. The device 26 is a dissipative energy system type constant force travel long travel cushioning mechanism arranged to transfer and dissipate substantially all kinetic energy imposed upon the center sill structure 12 by draft and buff forces applied to the car couplers (in excess of the minor amounts absorbed by the draft gear and return springs of the device 26). This is to be distinguished from conservative energy system type cushioning devices that merely store the energy on impact and return it in the form of oscillations. As described in said Peterson application Serial No. 856,963, device 26 is a 100 percent efficient cushion travel device meaning that it transfers and dissipates the required energy with minimum travel and no uncontrolled recoil.

In other words, and as specified in said Peterson application Serial No. 856,963, the cushioning device 26 should have a travel of from about 20 to about 40 inches, or its equivalent, and be characterized by its ability to dissipate a sufficient amount of energy of impact (other than that portion of such energy needed to recenter the cushioning device), either on closing of the device, or on closing and return of the device (note that the restricted flow of hydraulic liquid in cushioning device 26 on its return to normal is energy dissipating and thus cushion 26 has controlled recoil), so that the major portion of the remaining energy of impact is transmitted as kinetic energy to the load. Thus, in essence this makes the cushioning device 26 a dissipative energy system cushion as opposed to a conservative energy system cushion that stores and returns substantially all kinetic energy applied to it, although such dissipative energy system cushion should have sufficient energy storing and return characteristics to return the cushion and the container load to neutral or recentered position.

By employing the long travel cushioning device 26, the time required for the transfer, of for instance, the momentum of a striking car to a struck car (carrying the lading in question) is prolonged sufficiently to achieve the afore-described benefits that are disclosed in said Peterson application Serial No. 856,963.

The device 26 generally comprises the aforementioned tubular cylinder 62 in which piston head 64 is reciprocably mounted, tubular piston rod 66 affixed to piston head 64, and invaginating tubular member or boot 200 connected between the tubular cylinder 62 and the tubular piston rod 66, and the helical compression springs 72 extending between the closure members 68 and 70 of the tubular cylinder 62 and the tubular piston rod 133 and a spring seat 202.

The closure member 68 and tubular cylinder 62 carry a metering pin 204 that is reciprocably received within the bore 206 of the tubular piston rod 66. The metering pin 204 preferably is provided with a guide member 208 at its projecting end.

The internal surface 210 of tubular cylinder 62 is formed in any suitable manner as at 212 (see FIGURES 7 and 8) to receive three snap rings 214, 216 and 218. The snap ring 214 serves as a stop for piston head 64 when the devices is in its extended position of FIGURE 7, while the snap rings 216 and 218 hold in place a piston rod guide member 220 to which one end 222 of the invaginating boot or tubular member 200 is secured by a suitable clamp 224. The other end 226 of the boot or tubular member 200 is turned outside in, and is secured to the external surface 228 of the piston rod 66 by a suitable clamp 230.

The device 26 is charged with hydraulic liquid as described in said copending application Serial No. 782,786 to completely fill the space defined by the tubular cylinder 62, the tubular piston rod 66, and the invaginating boot or tubular member 200. When in use, the device 26 has the normal positioning indicated in FIGURE 7, and in the illustrated arrangement, the device 26 engages the lugs 30 and stops 34 at both ends of cushion pocket 60, as previously described. When the center sill structure 12 receives a shock either in buff or draft, either the tubular member 62 will commence movement to the left of FIGURE 7 or the tubular piston rod 66 and piston head 64 will commence movement to the right of FIGURE 7, or possibly both movements may occur. In any event, as the device 26 retracts under the force being pushed, the metering pin 204 displaces hydraulic liquid contained within the tubular piston rod 66 and the piston head 64 causes a hydraulic liquid flow through its orifice 232 through which the metering pin 204 extends. As shown, metering pin 204 is provided with a tapered surface 234 that preferably is designed to provide a constant force travel characteristic as the hydraulic cushion 26 contracts under the shock opposed on it; that is, the arrangement is such that for

every unit of travel, the cushioning device provides a substantially constant cushioning effect.

As indicated in FIGURE 7, the oil flow then initiated is from the chamber 236 on the high pressure side of the piston head 64 through the orifice 232 and into the bore 206 of tubular piston rod 66, thence radially outwardly of the piston rod 66 through orifices or ports 238 of the tubular piston rod 66. As the hydraulic liquid within the tubular piston rod is displaced by the metering pin 204, it likewise moves through the ports 238, as indicated by the arrows in FIGURE 7. Metering pin guide member 208 is formed with relatively large apertures 240 to permit a free flow of hydraulic liquid during movement of the metering pin.

The hydraulic liquid flow through ports 238 is under relatively high velocity and creates great turbulence in the chamber 242 that is formed by the space between the tubular piston rod guide member 220 and the piston head 64. This great turbulence is caused at least in part by the radically directed flow of hydraulic liquid impinging directly against the inner surface 210 of tubular cylinder 62, and is responsible for dissipation of much of the kinetic energy of the hydraulic liquid in the form of heat.

As the contraction of the hydraulic cushion device 26 proceeds, the high pressure chamber 236 is reduced in volume by the advancement of the piston head 64 toward the tubular cylinder closure member 68. The hydraulic liquid passing through orifice 232 fills the chamber 242 behind the piston head 64, while a volume of hydraulic liquid equivalent to that displaced by the total entry into the fluid chamber of the piston rod 66 passes through apertures 244 of guide member 220 into the space 246 enclosed by the invaginating boot or tubular member 200 which inflates or expands and rolls to the position suggested by FIGURE 8. The apertures 244 are relatively large in cross-sectional area which provides and permits the relatively large volume and consequently low pressure hydraulic liquid flow from chamber 242 to space 246. This avoids generation of any appreciable compressive force on the relatively slender metering pin and prevents any possibility of its buckling.

After the shock has been fully dissipated, the compression springs 72, acting in tandem, return the hydraulic cushioning components to the initial extended position of FIGURE 7. During this movement under the action of the compression springs, the oil flow illustrated in FIGURE 7 is reversed, and invaginating tubular member or boot 200 deflates and returns to the position of FIGURE 7 thereby insuring that the hydraulic liquid displaced by the piston head 64 and piston rod 66 is restored to its normal operative locations.

It will therefore be seen that not only is the device 26 composed of few and simple components, and that all sliding or dynamic seals are eliminated, but a reliable long travel cushioning action is provided. Furthermore, all kinetic energy applied to the cushion device, with the exception of the small potential energy stored in the return springs 72, is either dissipated in the form of heat by the passing of the hydraulic liquid through orifice 232 and the turbulence in chamber 242, or is transferred as kinetic energy (positive or negative, depending on the condition of impact) to the struck car with its load.

Reference may be had to said copending application Serial No. 782,786, for a more specific description of this unit. It may be added, however, that the tapering surface 234 of the metering pin 204 extends between points 250 and 252 (see FIGURE 7) and that the contour of tapered surface 234 in the illustrated embodiment is designed from the relationship

$$A_x = A_0\sqrt{1-\frac{x}{d}}$$

wherein A_x is the orifice area at any position x (see FIGURE 7) along the total nominal stroke d (the length of the tapered surface 234), and A_0 is the initial orifice area defined by the orifice 232 at the beginning of a stroke, in the case where a completely rigid body is being cushioned from impact. While in most cases and for a given car weight this assumption will result in a reasonably efficient design, small alterations can be readily made to this shape to give it a closer approach to the optimum of constant force travel characteristic for a given situation after a few experimental trials. However, the shape given by the above formula is the best starting point. Furthermore, it is usually possible to obtain a reasonably efficient design by approximating the curved shape given by the above expression as by calculating a series of spaced cross-sectional areas so determined by straight tapers, if this facilitates manufacture. Moreover, the pin could be contoured so as to provide for the desired stroke of from about 20 to 40 inches while having a reserve stroke which would give a substantially higher force travel characteristic than that throughout the normal stroke, in order to protect against overloads or other unusually severe condition. In fact there is no limit to the possibilities of how the pin might be shaped to suit special situations or the application of existing knowledge of this art. The orifice areas referred to are the orifice area of orifice 232 minus the cross-sectional area of the metering pin at any given position along the stroke of the metering pin.

The components of the unit 26 may be formed from any suitable materials, boot 200 of the illustrated embodiments being formed from suitable impervious, flexible, rubber-like material with special additives for low temperature flexibility and clamps 224 and 230 being of the type of clamp sold under the trademark "Punch-Lok," made and sold by the Punch-lok Company of Chicago, Illinois. The unit 26 of the illustrated embodiments is preferably charged with the high viscosity index oil sold by Shell Oil Company under the trade designation Aeroshell No. 4, as this oil desirably has a relatively small variation in viscosity between the extremes of minus 60 degrees F. and 150 degrees F.

The hydraulic liquid when the device 20 is in fully extended position is under very little pressure, perhaps no more than 2 p.s.i., but even though the pressures in the high pressure chamber 236 may rise to as much as 8,000 p.s.i. as when the device is employed in railroad cars to cushion buff and draft forces, the maximum pressure within the invaginating boot 200 (when fully inflated) is believed to be about 10 p.s.i. Boot 200 stretches about 100 percent when fully inflated. Units 26 can be designed for operating pressures up to the limit of the yield strength of cylinder 62 and the device of FIGURES 7 and 8 when employed as indicated, is capable of handling kinetic energy on the order of a million foot pounds, depending, of course, on the specific design required for a specific purpose. Units 26 will thus easily handle 15 miles per hour impacts when applied to, for instance, the railroad car structure of FIGURES 1–6.

Referring now to the embodiment of FIGURE 6, the car 300 therein illustrated is substantially the same as car 10 except at the ends thereof. In accordance with this embodiment of the invention, the end sill structure 54 is applied to both sides of the car, thus providing a support for car plates 302 and 304. A similar arrangement is effected on both sides of the other end of the car in place of the end sill structure 55, although the hand brake 44 would not be required at that end of the car. This arrangement forms a barrier across the end sills on either side of the center sill structure at each end of the car, but defines a passage 306 through which one may pass if desired in moving, for instance, from a flatcar bed 308 of a flatcar 309 that may be coupled to car 300.

The car plates 156, 158, 302 and 304 in forming a barrier across the end sills of the car prevent one from accidentally falling through the opening between the car end sills and bolster structures. It frequently happens

that members of train crews and others that may be on or about a train may wish to go from one car to another by negotiating the space between the cars. Without the illustrated barrier arrangement at the end sills of my car, one might be tempted to jump from say the flatcar bed 308 onto an end sill 54 and then be surprised by the open space between the end sill and the adjacent bolster, with the result that a bad fall may be occasioned to the track below. The guard plate arrangement illustrated insures that those passing from an adjacent car to a car of my invention will have to go through end sill gate 306, which places them on top of the continuous center sill structure 12.

It is apparent that the end sill guard arrangement may be provided by rails or other fencing in place of the illustrated plates.

General Description of Second Primary Embodiment of Invention

Reference numeral 310 of FIGURES 9–11B generally indicates another form of deckless railroad car conforming to the principles of my present invention as well as those of said Peterson application, and car 310 also is composed essentially of a center sill structure 312 connecting spaced bolster structures 314, the latter being operatively secured through a conventional center plate and kingpin arrangement to conventional trucks 316, which are only diagrammatically represented, where illustrated, as they may be of any suitable type.

In accordance with the invention described in connection with the embodiment of FIGURES 1–8, the car 10 supports at its ends a single full length freight container 318 (see FIGURES 7 and 15). The container 318 in practicing by invention rides on rollers 320 that are rotatably mounted at the ends of the bolster structures 314, rollers 320 being formed with annular tapering flanges 322 to aid in properly centering the container with respect to the car when the container is applied to the car, and to maintain the container properly centered with respect to the car during transit.

As will be apparent from FIGURES 11B and 15, the containers 318 must be of a length to extend between the bolster structures and thus extends over the effective load carrying length of car 310.

In accordance with the embodiment of FIGURES 9–17, the center sill structure 312 is provided with cross bearer structures 323 and 323*a*, also carrying the rollers 320, for supporting less than full length containers in the manner suggested in FIGURES 16 and 17.

A long travel cushioning arrangement having the characteristics contemplated by said Peterson application is interposed between the car 310 and the containers where indicated by reference numeral 24 (see FIGURES 9–12). The cushioning arrangement 24 includes the hydraulic cushion device 26 of FIGURES 7 and 8 (see FIGURES 12 and 13) received within the hollow center portion 27 of the center sill structure and applied between spaced lugs 30 (see FIGURE 12) that are fixed in spaced pairs 31 to the center sill structure. The cushioning device 26 illustrated includes follower members 32 and 33 which bear against the lugs 30 as well as stop members 34 that are keyed to a sliding or floating beam 336 (see FIGURE 4) which may also be termed a platform carried by the center sill structure and operate between the lugs of the respective pairs 31 of spaced lugs 30. The floating beam 336 is formed with perforations 338 through which the respective stop members 34 extend from within the center sill structure, and pins 340 (see FIGURE 12) pendantly hold the stop members in assembled relation with beam 336. The center sill structure 312 is formed with appropriate slotting 341 to accommodate relative movement of the stop members with respect to the center sill structure. Cushioning device 26 rests on rigid member 34*a* that is fixed between stop members 34, the latter in turn being supported by beam 36 through pins 340.

In accordance with the embodiment of FIGURES 9–17, the floating beam 336 is formed to receive upstanding pins 342 and 343 which are adapted to lodge in appropriately located recesses 345 (see FIGURE 13) formed in the undersurface of the respective containers (for instance, the container 318 of FIGURE 13) for purposes of keying the respective containers to the beam 336. Beam 336 thus forms a member for coupling the containers to cushion device 26.

The remainder of the car 310 need include only those structures necessary to make operative the conventional safety and other apparatus required by A.A.R. regulations, some of this apparatus being diagrammatically indicated in the drawings, such as hand brake 44 and a platform 46 for operating same, couplers 48, uncoupling devices 50 (see FIGURES 10A and 10B), and the ladder arrangement generally indicated at 52. The hand brake and platform for operating same may be secured to the simplified end sill structure indicated at 54 in FIGURE 10A. The brake rigging, trainline conduits, and other similar equipment may be secured to the center sill structure in any suitable manner. The uncoupling device 50 at the brake end of the car may be supported by end sill structure 54, while at the other end of the car the device 50 may be supported by end sill structure 55. Appropriate draft gear may be applied in any well known manner to conventional draft gear pockets indicated at 57.

The hydraulic cushion device 26 is received in what may be called a cushion pocket 360 (see FIGURES 12 and 13) defined by the center sill structure 312 and the spaced pairs of lugs 30 carried by same. The hydraulic device 26 illustrated in FIGURES 12 and 13 is the same as shown in FIGURES 7 and 8 and comprises a cylinder 62 and a piston 64 having fixed thereto a tubular piston rod 66 which projects outwardly of the cylinder 62. The heads or closure members 68 and 70 form the cushion followers 32 and 33, respectively, that are held against the spaced pairs of lugs 30 by high strength compression springs 72 (the latter being only partially illustrated in FIGURE 7). As the hydraulic unit 26 is designed to have a cushion travel or closure distance in the range of 20–40 inches, and preferably on the order of 30 inches, the floating beam or cushion coupling member 336 as well as center sill slotting 341 are arranged to permit this amount of movement of the floating beam 336 when longitudinal impacts act on the car 310 in service.

The containers of this embodiment of the invention likewise may be of any conventional design, though preferably they are of a simplified box type construction employing suitable access openings and covers therefor (not shown) and they ordinarily will be of right parallelepiped construction. The container 318, as already mentioned, will have a length sufficient so that it will engage the rollers 320 that are carried by the bolster structures 314, and preferably there should be an overhang somewhat in excess of the amount of closure travel of the cushion device 26. The containers should have a width corresponding to the distance between the flanges 322 of rollers 320, though the actual width employed should be that which will permit the container to rest on the cylindrical portions 323 of the rollers without engaging the flanges 322 thereof.

The containers may be of the type that are adapted to be crane lifted onto the car 310 and for this purpose may be provided with conventional cable attachment devices where generally indicated by reference numeral 80 in FIGURE 1.

The containers 318*a* and 318*b* of FIGURES 16 and 17, respectively, are identical to container 318 except that they are proportioned in length to engage the respective bolster and cross bearer structures indicated in these figures. A suitable length relation is represented by a specific embodiment of the invention wherein the con-

tainer 318 is 45 feet in length, the containers 318*a* are 24 feet in length and the containers 318*b* are 17 feet in length.

When container 318 is to be applied to car 310, the pin 342 is received in a corresponding recess 345 formed in the undersurface of the container 318, and the pins 343 are removed or retracted.

When the containers 318*a* or 318*b* are applied to the car 310, the pins 343 are received in recesses 345 (not shown) formed in the ends of the respective containers, the respective containers at their outer ends resting on either the bolster structures 314 or the outer cross bearer structures 323, depending upon the length of the container.

The containers are preferably provided with a wear plate structure 381 at their respective ends for engagement with the rollers that the respective containers are to rest on so that the undersurface of the container will be spaced above the other rollers and any outwardly projecting structure carried by the center sill structure.

In practicing the invention of FIGURES 9–17, the car 310 is moved to a loading site, such as a dock, where, for instance, loaded containers 318 have been previously gathered. The container 318 is then crane lifted onto the car 310, the container being loaded onto the car until the container rests on the cylindrical portions 325 of the rollers that are carried by the bolster structures, with the pin 342 of the floating beam engaging in the corresponding recess 345 of the undersurface of the container. The roller flanges 322 provide a lateral centering action on the container as it is lowered into position. As clearly indicated in FIGURES 10A, 11B and 13, the cylindrical portions of the rollers are sufficiently elevated above the top of the center sill structure so that the undersurface 383 of the container does not contact either the center sill structure or the floating beam 336. Thus, the cylindrical portions 325 of rollers 320 at their upper portions are tangent with a common plane which is coincident with the bottom of the container (as defined by the undersurfaces of plates 381) that is to rest on same, which plane is substantially horizontally disposed and parallels the center sill structure.

Alternately, either containers 318*a* or 318*b* are applied to the car 310 in the manner suggested by FIGURES 16 and 17, the appropriate pin 343 being applied to the appropriate recess 345 in the container undersurface on either side of the center of the car. The centering action of the rollers 320 of the cross bearer structures 323 and 323*a* on containers 318*a* and 318*b* is the same as that described in connection with rollers carried by the bolster structures, and furthermore, the said rollers of the cross bearer structures are at the same elevation as that previously mentioned.

Another way of loading the car 310 is to apply a container 318*a* and a container 318*b* to the car in the manner already mentioned. The exact loading arrangement employed for any one car 310 will depend upon the number of containers 318, 318*a* and 318*b* awaiting rail transit as well as the destination and urgency of the respective shipments.

Assuming that the car 310 has ben loaded and is ready for transit, when an impact occurs, for instance, in the direction of the arrow 86 of FIGURE 8, or in the direction of the arrow 88 of FIGURE 12, the center sill structure 312 moves under the impetus of the impact against one end of the hydraulic device 26 to move the latter from its extended position of FIGURE 7 to its contracted position of FIGURE 8. As hydraulic device 26 moves to its contracted position, hydraulic liquid is forced through orifices to dissipate in the form of heat substantially all of the energy that is involved in the so-called "impact effect" when a car impacts against, or is impacted by, one or more other cars; the cushion also adds to or subtracts from the container or containers and their lading the energy of the impact that is to be acquired by or lost from the container (as kinetic energy) as a result of the impact (depending upon the condition of impact.

Under the impact condition of FIGURE 12, the impact has been applied to the coupler 48 at the right hand end of the car shown in FIGURE 9, and this forces the right hand pair of lugs 30 against the hydraulic device closure member 68 forming follower 32, which presses it against the left hand stop member 34, as indicated in FIGURE 12. Due to the inertia of the container or containers and their lading, and the connection between the floating beam 336 and the respective containers, the absolute velocity of the floating beam is initially unaffected by the impacts, but the pressure of the hydraulic device follower 33 acting on stop 34 gradually transfers the kinetic energy of the impact to the container or containers and beam 336 by reason of the pressure against the stop members 34. The cushion device continues to close until its parts per se have the operative relation indicated by FIGURE 8, at which time, the container or containers and floating beam have the ultimate velocity dictated by the aforementioned Law of Conservation of Momentum.

After the impetus of an impact has been dissipated and the kinetic energy involved in the impact has been transferred to the container or containers through the cushioning device, springs 72 acting in tandem on ends 68 and 70 restore beam 336 and the container or containers to their normal central positions with respect to the car 10.

When the direction of impact is in the opposite direction, as indicated in the showing of FIGURE 8, the functioning of the hydraulic device 26 is the same, though the forces involved act in the opposite direction; thus, the impact is against the left hand coupler 48 and in the direction of arrow 86, and the left hand lugs 30 press follower 32 against right hand stop member 34, as indicated in the figure. Draft forces are handled in a similar manner, although the actual operation of the cushion device will depend upon the direction of the draft force, as will be understood by those skilled in the art.

Specific Description of Second Primary Embodiment of the Invention

As it is apparent from the showing of FIGURES 16 and 17 that the center sill structure 312 illustrated will have to withstand vertical loads applied at points between the bolster structures 314, the center sill structure 312 of this embodiment is of the fish-belly type so as to provide the necessary structural strength at the longitudinal center of the car. In the form illustrated, center sill structure 312 comprises end structures 384 and 385 joined together by a center section 386 to thus provide a composite fish-belly type center load bearing member. The end sections 384 and 385 are essentially the same and may be formed by two Z members 87 welded together as at 388 to define the familiar standard Z–26 type section sill to which draft gear pockets 57 are applied in any suitable manner.

The center section 386 comprises (see FIGURES 9 and 13) spaced-vertical plates 389 welded to the adjacent ends of the end sections 384 and 385 as at 390 (see FIGURES 11A and 11B) and joined together on either side of the center of the car by top plates 391 and 392. As will be seen from FIGURES 10A and 10B, the top plates 391 and 392 are positioned on either side of the cushion pocket 360 and are joined along the top of the center sill structure by spaced cover plates 393 and 394, which are positioned to define the operating slotting 341 for the stop members 34. Plates 391 and 392 may be formed as at 341*a* to complete the length of slotting 341 required for proper functioning of the long travel cushioning action desired.

The vertical plates 389 include tapering portions 389*a* that define the fish-belly shape, and have reinforcing plates 395 fixed along their lower edges, which plates extend under and are fixed, as by welding, to the lower edges of respective Z members 387 at each end of the car (see FIGURES 11A and 11B) for reinforcing purposes. A

suitable brace plate 396 is affixed to the top of the respective end sections 384 and 385 and the adjacent top plates 391 and 392, respectively, for reinforcing purposes, in the illustrated form of FIGURES 9–17, and, of course, any other reinforcing and bracing that may be necessary may be applied as and where considered necessary or desirable. For instance, reinforcing channels 397 are fixed between the reinforcing plates 395 in the planes of the respective center cross bearer structures 323*a* (see FIGURE 13).

The bolster structures 314 may be of any suitable type, those illustrated being formed by bolster members 399 each comprising a vertical web 400 fixed as by welding between upper and lower cover plates 401 and 402, all fixed to the Z members 387 making up the respective end sections of the center sill as by welding. As seen in FIGURES 11A, 11B and 14, a conventional center plate structure 406 is fixed between the bolster members 399, the said center plate structure extending across the open bottom of the Z–26 section defined by the ends of the center sill structure and supporting the conventional pivotal connecting structure 407 which together with a kingpin forms a conventional pivotal connection between the railroad car body bolsters and railroad car truck bolsters; the center plate structure also carries the conventional bearing portion 409 (see FIGURE 14) which cooperates in the conventional manner with the truck bolster center plate structure (not shown as this may be of any conventional type). The kingipn connection between the upper and lower center plates may be effected in any conventional manner.

The bolsters may also be provided with conventional side bearings 405 reinforced by suitable brace plates 403 (shown only in FIGURE 14).

The ends of the boster members 399, the web 400 and the top and bottom plates 401 and 402 are welded to an end plate structure 410 which has fixed thereto frame 412 that together with plate 410 journals shaft 414 which rotatably mounts the respective rollers 320 of the bolsters. Frame 412 is only diagrammatically illustrated and may take the form of end member 416 and side members 418 welded together to the bolster members, and, of course, any additional bracing necessary will be obvious to those skilled in the art.

The end or outer cross bearer structures 323 in the illustrated embodiment are defined by cross bearer members 419 that have the same structural features as the bolster structures 314, as indicated by corresponding reference numerals; of course, the center plate structure and side bearings are omitted.

The center or intermediate cross bearer structures 325 each comprise cross bearer members 420 formed by suitable rigid members 422 (shown as angle irons) welded to the outer surfaces of vertical plates 389 and the undersurfaces of cover plates 393 and 394, respectively (see FIGURE 13). Angle irons 422 of each cross bearer member 420 are held in spaced relation by brace bars or plates 424 and reinforcing channels 425 and their brace plates 425*a* are applied between the outer ends of the cross bearer members 420 and the reinforcing plates 395 of the vertical plates 389 (see FIGURES 9 and 13). A reinforcing bridge plate structure 426, composed of top member 427 and bracing webs 428, is fixed, as by welding, between the cross bearer members 420 of each cross bearer structure 323*a*. The bridge plate structures each define an opening 429 through which beam 336 extends and stop members 334 operate.

Fixed to the outer ends of the respective cross bearer members 420 is an end plate structure 410 to which a roller support frame 412 is affixed, as by welding, for journalling the rollers 320 of the center cross bearer members.

The floating beam 336 in the form illustrated rests on the center sill structure, and takes the form of a channel shaped member 430, made from an appropriate rigid material, which has fixed to the web 432 thereof as by welding the pairs of spaced abutments 434 (positioned at either end of openings 338) between which the stop members 34 are disposed (see FIGURE 12) when the cushioning mechanism is fully assembled. The channel member 430 is also recessed as at 435 to permit application of pins 340 and is formed with appropriate holes to receive the lower ends 431 of the pins 342 and 343 that key the respective containers to the floating beam 336. The pins 342 and 343 should be proportioned to withstand the forces that are to be applied to them, and are removably secured to the beams 336 in any suitable manner, as by having their lower ends 431 (see FIGURE 12) of reduced diameter which fit into appropriate holes 423 of a complementary diameter formed in the channel member 430 so that they are adequately supported by channel member 430. As a matter of fact, any arrangement for detachably connecting the pins 342 and 343 to channel member 430 will be satisfactory so long as the pins may be removed when not needed (compare FIGURES 15, 16 and 17). Of course, suitable retaining devices may be employed for securing those pins 342 and 343 to the center sill structure not in use to the car. For instance, a suitable receptacle might be affixed to the outer surface of one of the vertical plates 389, or the pins may be chained to the center sill structure.

The pins 342 and 343 are aligned with slotting 341, which may be extended into top plates 391 and 392 to permit the long travel cushioning action desired.

Pins 340 securing stop members 34 to beam 336 are preferably releasably secured against displacement in any suitable manner, and, of course, they rest on the web 432 of beam 336.

As already mentioned, the cushion device 26 is supported within the cushion pocket 60 by the stop members 34 and the rigid member 34*a* connecting them. The cushion device 26 in the illustrated embodiment is centered within the cushion pocket by guide plates 440 (see FIGURE 13) welded between the internal surfaces 142 of the respective plates 389 and the undersurfaces of cover plates 393 and 394, respectively. The elongate member 34*a* and the guide members 440 guide the contraction and extension movement of the cushion and prevent the particular cushion shown from jackknifing.

The lugs 30 may comprise plates 446 affixed to the inner surfaces 442 of the spaced vertical plates 389, as by welding, and are arranged in spaced pairs 31 in which the individual lugs 30 are aligned transversely of the center sill structure 312. The respective plates 446 may be reinforced by strengthening webs 448 of any suitable character and may be affixed in place between the respective plate 446 and the plates 389 as by welding.

The end sill arrangement 54 of FIGURES 9–17 may take the form of spaced channel members 450 fixed together at their outer ends by channel member 452 by welding; members 450 may be secured to the center sill structure 312 in like manner. Spaced vertical angles 454 fixed to the connecting channel 452 have affixed thereto guard plates 456 and 458; plate 456 extends between the two angle members 454 and carries the steps 460 of ladder 52 while plate 458 is fixed between the corner angle member 454 and the center sill structure, and supports the hand brake 44 and its associated structures. Platform 46 may be fixed to the end sill structure by appropriate angles 462 (see FIGURE 10A) affixed to channels 450 in any suitable manner. The uncoupling device 50 may be associated with the end sill 54 in any suitable manner.

The end sill structure 55 at the upper end of the car may be of any suitable form and the embodiment illustrated in FIGURES 9–11B comprises a transversely extending channel member 472 braced by diagonal angle member 474, both being welded together to the center sill structure 312.

As already mentioned, the containers 318, 318*a*, and

318*b* may be of any suitable design, the crane cable brackets **80** in the form shown comprising metal loops **482** (see FIGURE 1) pivotally secured to brackets **484** affixed in any suitable manner to the top of the container. The openings **345** in the undersurfaces of the containers for receiving the respective pins **342** and **343** may be formed or defined in any suitable manner.

It may be mentioned that the pins **342** and **343** and recesses **345** are only one form of interconnection that may be employed between the platform **336** and the containers to make the containers fast to the beam. The connection may be made by fixing, for instance, similar pins to the containers and lodging them in the respective beam openings **433** when the containers are applied to the car. Of course, the location of the pins and recesses on the floating beam and the respective containers should be made consistent with the actual container lengths employed.

Distinguishing Characteristics of the Invention

It will therefore be seen that I have provided a highly simplified railway car that is especially adapted for carrying containers and providing the container and its lading with the benefits of the long travel cushioning action contemplated by said Peterson application Serial No. 856,963. My radically simplified car of FIGURES 1–8 is made possible not only by the practice of the invention of Peterson application Serial No. 856,963, but also by reason of the fact that no vertical loads are applied to the center sill structure **12** at points spaced from bolsters **14** except for reaction forces resulting from operation of the cushion **26**. Thus, it will be noted that the weight of the container **18** is applied directly to the bolsters **14**, and then is transferred directly to the car trucks. Furthermore, the container itself may be simplified since it is supported only along its side edges, which are inherently the strongest part of the container.

It will also be seen that I have provided a railroad car for carrying freight containers which is adaptable for use in transporting both full size and less than full size containers while still retaining essentially the basic simplified framing arrangement contemplated by the embodiment of FIGURES 1–8 and providing the containers and their lading with the benefits of the long travel cushioning action contemplated by said Peterson application Serial No. 856,963.

It should further be apparent that the embodiment of FIGURES 9–17 contemplates a freight container system involving a railroad car and freight containers of more or less standard lengths including a full length container that forms the normal full load of a car, containers on the order of half the length of the full length container, and containers of a length less than the said half length containers. These containers are provided with standard interconnection devices of simplified form and located in accordance with the respective lengths of the containers for ready connection to a floating beam or member that is operatively associated with the car cushioning apparatus for providing the containers with the long travel cushioning action that has been found to be so necessary to achieve the ultimate in lading protection.

It should be pointed out that my invention eliminates the need for the conventional car bed or decking forming same.

By way of example to indicate relative lengths, the arrangements of FIGURES 1–8 were devised to transport a container 45 feet long and 8 feet wide and a suitable car length would be 51 feet 9 inches between strikers, this allowing sufficient distances between the container (when mounted on the car) and the end sill structure **54** for the cushioning device **26** to operate in its indicated range of travel. The car of the embodiment of FIGURES 1–8 is in the $5,000–$6,000 price range, which is a fraction of the cost of standard freight cars.

This application is a continuation of my copending applications Serial No. 9,135, filed February 16, 1960, and Serial No. 44,328, filed July 21, 1960, now abandoned.

The foregoing description and the drawings are given merely to explain and illustrate my invention and the invention is not to be limited thereto, except insofar as the appended claims are so limited, since those skilled in the art who have my disclosure before them will be able to make modifications and variations therein without departing from the scope of the invention.

I claim:

1. A railroad car for transporting containers, said car comprising a frame composed of a center sill structure, a bolster structure secured adjacent each end of the center sill structure, each bolster structure including means for securing same to a car truck, a platform riding on and carried by said center sill structure, said platform being mounted for movement longitudinally of said center sill and having a width substantially conforming to the width of said center sill structure, a cushioning device interposed between said center sill structure and said platform, means securing a container to said platform when the container is placed on the car, said center sill and bolster structures defining an open framework, an end sill secured to the center sill structure at each end thereof spaced from the adjacent bolster structure, and projecting laterally of said center sill structure, said frame being open between the respective end sills and bolster structures, and a vertical guard structure carried by each of said end sills, said guard structures being coextensive with the portions of the respective end sills that project away from said center sill structure, said guard structures at each end of the center sill structure defining an intervening gateway across the width of the center sill structure.

2. In a railroad car for transporting containers, a frame structure therefor comprising a center sill structure having a bolster structure secured adjacent each end thereof, each bolster structure including means securing same to a car truck, roller means carried by each of said bolster structures on opposite sides of the center sill structure for shiftably supporting between said bolster structures a freight container load when on the car, said roller means comprising rollers journalled for rotation about axes extending transversely of said center sill structure and substantially parallel to the respective bolster structures, a cushion coupling member carried by said center sill structure and mounted for movement longitudinally of said sill structure, cushioning means operatively interposed between said center sill structure and said coupling member for cushioning impacts applied longitudinally of said sill structure, and means for securing the container to said coupling member when the container is placed on said roller means, said rollers being proportioned with respect to said coupling member and said center sill structure to dispose their upper load supporting portions above the level of said coupling member and said center sill structure to directly support the container when on the car to the exclusion of said coupling member.

3. A railroad car for transporting containers, said car comprising a wheeled center sill structure, a bolster structure secured adjacent each end of the center sill structure, each bolster structure including means securing same to a car truck, roller means carried by each of said bolster structures on opposite sides of the center sill structure for shiftably supporting between said bolster structures a freight container load when on the car, said roller means comprising rollers journalled for rotation about axes extending transversely of said center sill structure and substantially parallel to the respective bolster structures, a cushion coupling member carried by said center sill structure and mounted for movement longitudinally of said sill structure, cushioning means operatively interposed between said center sill structure and said coupling member for cushioning impacts applied longitudinally of said sill structure, and means for securing the container to said coupling member when the container is placed on said

roller means, said rollers being positioned with respect to said coupling member and said center sill structure to dispose their upper load supporting portions above the level of said coupling member and said center sill structure to directly support the container to the exclusion of said coupling member when the container is on the car.

4. Railroad car freight container apparatus including: a rail vehicle comprising a wheeled center sill structure including bolster structures at each end thereof, roller means carried by said bolster structures on opposite sides of the center sill structure for shiftably supporting between said bolster structures a freight container load, said roller means comprising rollers journalled for rotation about axes extending transversely of said center sill structure and substantially parallel to the respective bolster structures, a cushion coupling member carried by said center sill structure and mounted for movement longitudinally of said sill structure, cushioning means operatively interposed between said center sill structure and said coupling member for cushioning impacts applied longitudinally of said sill structure, a freight container adapted to be mounted on and supported by said rollers, and means for securing the container to said coupling member when the container is placed on said rollers, said rollers being positioned with respect to said coupling member and said center sill structure to dispose their upper load supporting portions above the level of said coupling member and said center sill structure to directly support the container to the exclusion of said coupling member when the container is on the car.

5. A railroad car for transporting containers, said car comprising a center sill structure, a bolster structure secured adjacent each end of said center sill structure, said center sill and bolster structures forming the framework of the car, roller means carried by said bolster structures on opposite sides of the center sill structure for shiftably supporting between said bolster structures a freight container load, said roller means comprising spaced rollers journalled for rotation about axes extending transversely of said center sill structure and substantially parallel to the respective bolster structures, with the upper peripheries of said rollers being tangent with a common plane that is disposed above the top of said center sill structure and is parallel thereto, a cushion coupling member carried by said center sill structure and mounted below said plane for movement longitudinally of said sill structure, cushioning means operatively interposed between said center sill structure and said coupling member for cushioning impacts applied longitudinally of said sill structure, and means associated with said coupling member for making same fast to the container when the container is applied to the car, said rollers thereby being positioned with respect to said coupling member to directly support the container to the exclusion of said coupling member when the container is on the car.

6. The railroad car set forth in claim 5 wherein said rollers have flanged outer edges for guiding the movement of the container longitudinally of said center sill structure when the container has been applied to the car.

7. In a railroad car for transporting freight containers with the car including a center sill structure having bolster structures secured adjacent each other thereof, with said bolster structures each including means securing same to a car truck, the improvement wherein said bolster structures carry roller means on opposite sides of the center sill structure for shiftably supporting a freight container load between said bolster structures, said roller means comprising rollers journalled for rotation about axes extending transversely of said center sill structure and substantially parallel to the respective bolster structures, wherein a cushion coupling member is carried by the car and is mounted for movement longitudinally of said sill member, with said cushion coupling member including means for making same fast to a container placed on said roller means, wherein said coupling member is positioned below the load supporting sides of said rollers whereby said rollers directly support the container when on the car to the exclusion of said coupling member, and including cushioning means operatively interposed between said coupling member and said center sill structure for cushioning the container, when on the car, against impacts applied longitudinally of said sill structure.

8. In a freight container transporting railroad car of the type including a wheeled center sill structure carrying a bolster structure adjacent each end of the center sill structure that is operatively connected to a railroad car truck with the bolster structures each carrying roller means for shiftably supporting on said bolster structures a single full length freight container having a length greater than the distance between the bolster structures when on the car with the roller means comprising rollers journalled for rotation about axes extending transversely of the center sill structure and substantially parallel to the respective bolster structures, and the sill structure carrying a cushion coupling member mounted for movement longitudinally of the car, means for securing the container to the coupling member when the container is on the car, and cushion means operatively interposed between the center sill structure and the cushion coupling member for cushioning impacts applied longitudinally of the center sill structure, and with the said roller means being positionally disposed with respect to said coupling member to directly support the container to the exclusion of said coupling member when the container is on the car, the improvement wherein said car is arranged to alternatively carry, in addition to said full length container, a pair of containers each either having a length on the order of half the length of said full length container, or, a length less than half the length of said full length container, said improvement including a cross bearer structure arrangement carried by said center sill structure intermediate said bolster structures, said cross bearer structure arrangement comprising two cross bearer structures positioned adjacent each other adjacent to and on each side of the longitudinal center of the car, and two further cross bearer structures each respectively positioned adjacent to but spaced inwardly from one of the respective bolster structures, said cross bearer structures each including roller means for supporting a container when applied to the car, said cross bearer roller means comprising rollers journalled for rotation about axes extending transversely of the center sill structure and substantially parallel to the respective bolster structures, said first mentioned cross bearer structure of each longitudinal half of the car being respectively spaced from the respective bolster structures of each car half the distance required to support between the two on said roller means thereof the half length container, said further cross bearer structures of each longitudinal half of the car being respectively spaced from the respective first mentioned cross bearer structures of each car half the distance required to support between the two on said roller means thereof the less than half length container, and means for securing the half length and less than half length containers, respectively, when applied to the car, to the coupling member, said roller means of said cross bearer structures being positionally disposed with respect to the coupling member to directly support the respective containers to the exclusion of said coupling member when the respective containers are on the car.

9. The improvement set forth in claim 8 wherein said coupling member slidably engages the upper surface of said center sill structure, and wherein the means for securing the respective containers to the coupling member comprises a plurality of pins adapted to be carried by said coupling member and spaced for alternate engagement with the respective full, half length and less than half length containers.

10. In a freight container transporting railroad car of the type including a wheeled center sill structure carrying a bolster structure adjacent each end of the center sill structure that is operatively connected to a railroad car truck with the bolster structures each carrying roller means for shiftably supporting on said bolster structures a single full length freight container having a length greater than the distance between the bolster structures when on the car, with the roller means comprising rollers journalled for rotation about axes extending transversely of the center sill structure and substantially parallel to the respective bolster structures, and the sill structure carrying a cushion coupling member mounted for movement longitudinally of the car, means for securing the container to the coupling member when the container is on the car, and cushion means operatively interposed between the center sill structure and the cushion coupling member for cushioning impacts applied longitudinally of the center sill structure, and with said rollers means being positionally disposed with respect to said coupling member to directly support the container to the exclusion of said coupling member when the container is on the car, the improvement wherein said sill structure is formed to define a cushion pocket extending longitudinally of the car, and including a first pair of lugs secured to said frame adjacent one end of said cushion pocket and aligned transversely thereof, a second pair of lugs secured to said sill structure adjacent the other end of said cushion pocket and aligned transversely of said sill structure, a first stop member positioned between said first pair of lugs and in substantial alignment therewith transversely of said sill structure, a second stop member positioned between said second pair of lugs and in substantial alignment therewith transversely of said sill structure, said cushion means comprising a cushion device interposed between said pairs of lugs and stop members, respectively, a rigid member fixed between said stop members and supporting said cushion device, said coupling member comprising an elongate member extending longitudinally of said sill structure and riding on top thereof, and means for detachably securing said stop members to said coupling member in pendant relation thereto, said stop members projecting through openings formed in said sill structure that are proportioned to permit the movement of said stop members longitudinally of said sill structure that is permitted by said cushioning device.

No references cited.