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[56] **References Cited**
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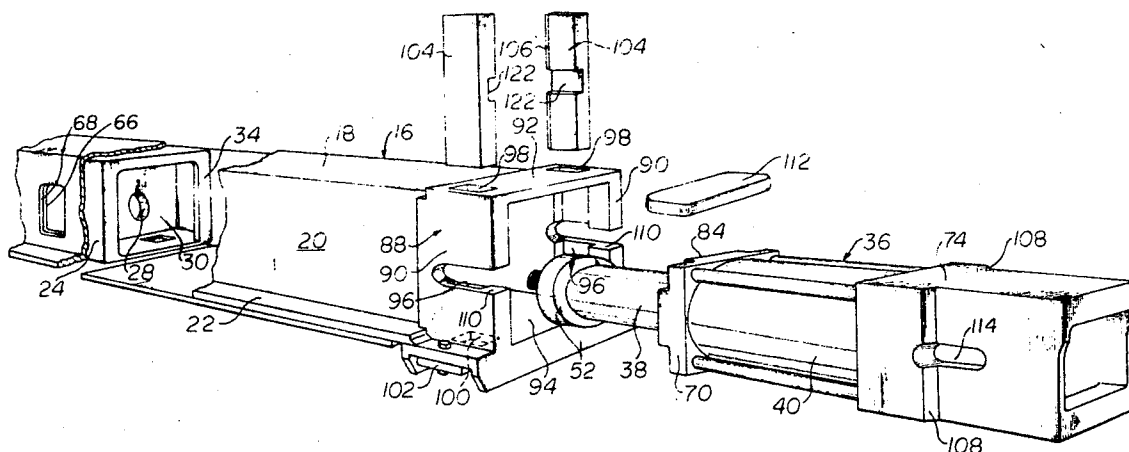
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[54] **END-OF-CAR CUSHIONING MECHANISM**
14 Claims, 8 Drawing Figs.

[52] U.S. Cl..... 213/8,
 213/50, 213/54, 213/64
 [51] Int. Cl..... B61g 9/04,
 B61g 9/12
 [50] Field of Search..... 213/8, 43,
 50, 50.5, 54, 56, 69, 64

ABSTRACT: A railway car having an open-ended sill through which buff and draft forces are transmitted to the car and including a buff- and force-cushioning unit which is capable of being installed and removed from the end of the sill. The sill includes a connector structure which retains a pair of removable draft lugs in position for draft contact with draft stop shoulders formed on the cushioning unit. The removable draft lugs cooperate with the draft stop shoulders to achieve positive centering of the cushioning unit within the sill and also to serve as retaining means for a coupler key establishing connection between the cushioning unit and a railway car coupler.



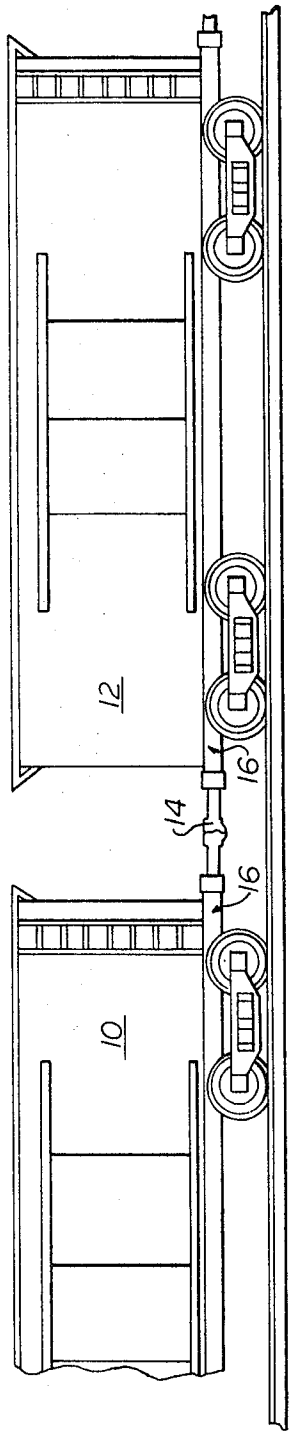


FIG. 1

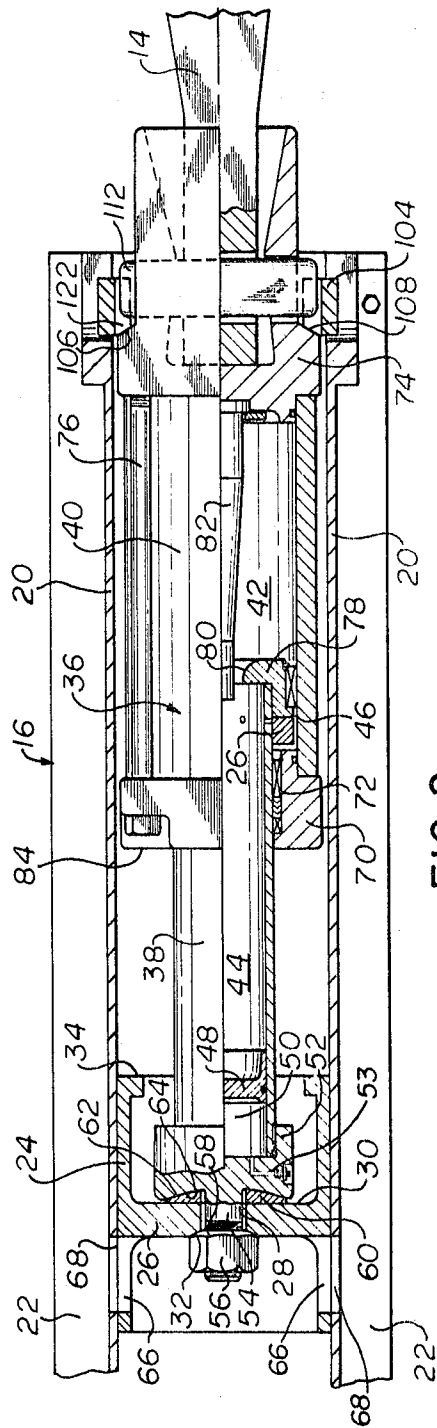
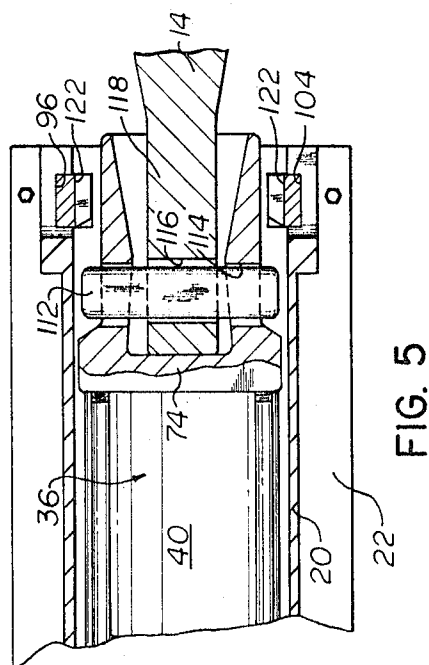
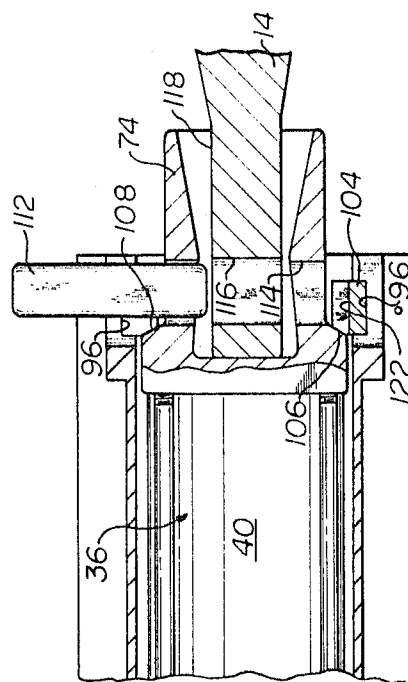
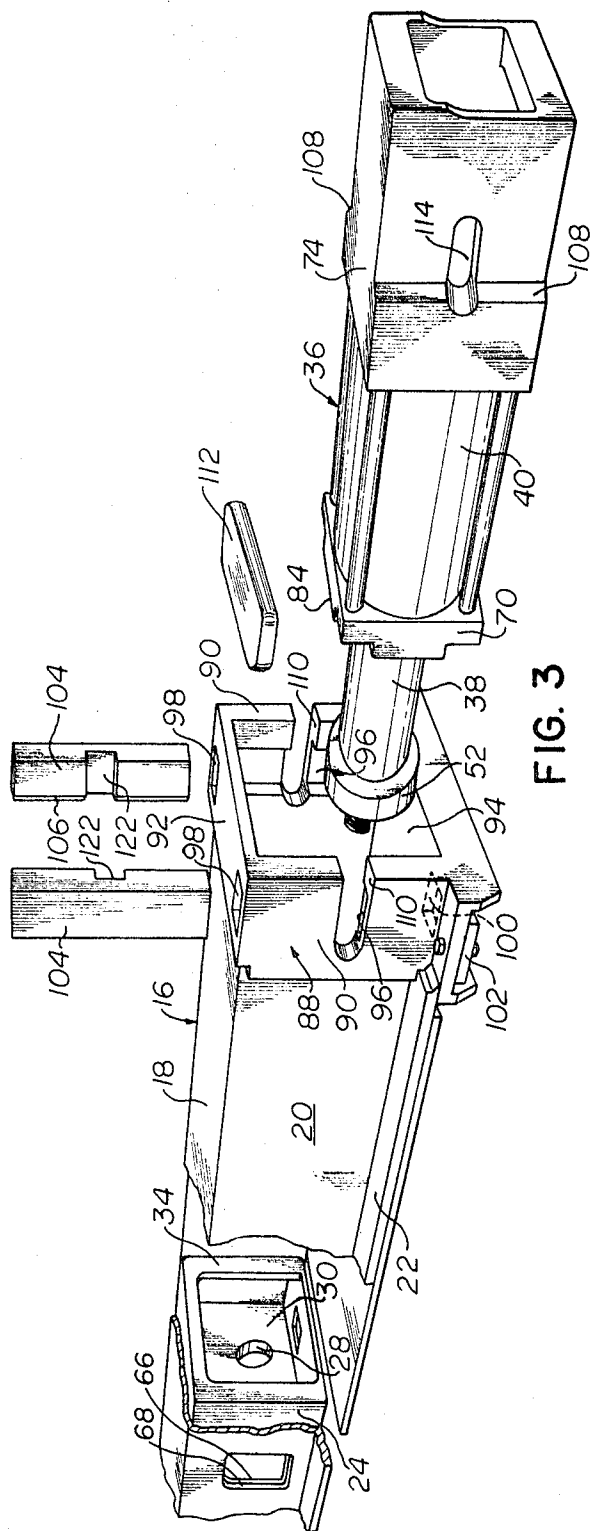


FIG. 2

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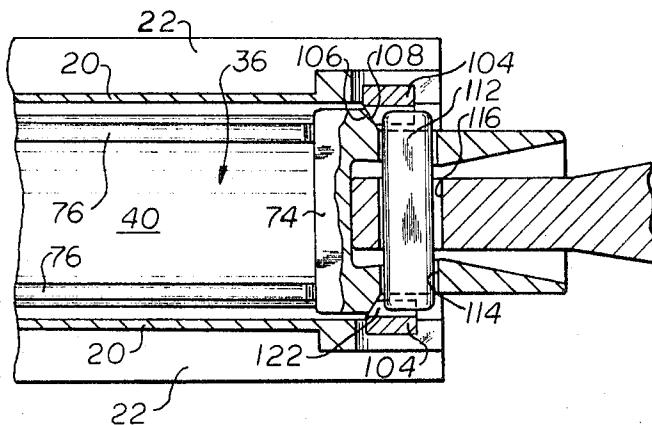


FIG. 6

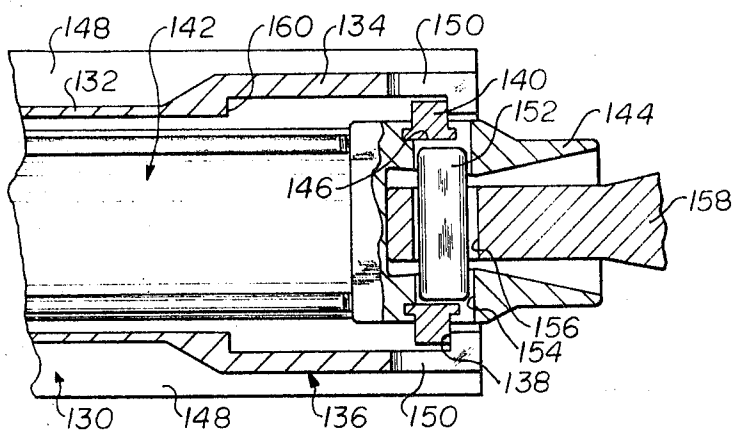


FIG. 7

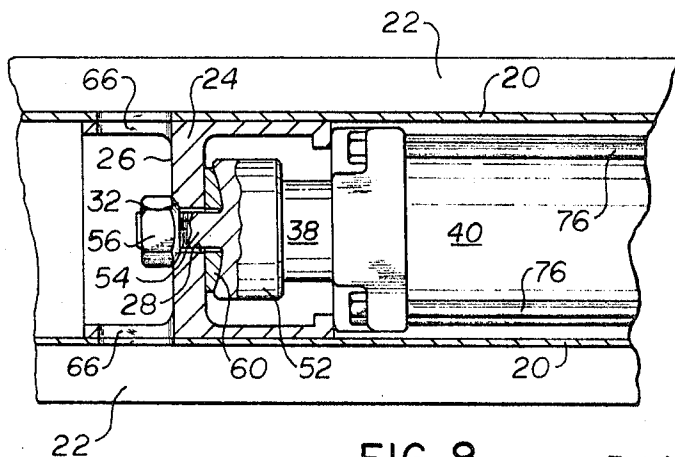


FIG. 8

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END-OF-CAR CUSHIONING MECHANISM

BACKGROUND OF THE INVENTION

This invention relates generally to railway car structures and more particularly to cushioned railway car structures which include a cushioning unit capable of being installed and removed from the end of a railway car sill. Hydraulic or oleopneumatic cushioning units capable of being installed and removed from the end of a railway car center sill are commercially available, but these cushioning unit structures have a number of limitations which detract from the commercial acceptability thereof. It is frequently necessary to provide a sill end connection structure of substantial length in order to provide for end entry-type installations of cushioning units mounted within a railway car center sill. Such length is necessary because a coupler carrier mechanism is mounted for reciprocation within the center sill and must be adequately supported throughout its length of travel relative to the center sill. The manufacturing costs of sill end connection structures of substantial length adversely affects the commercial acceptability thereof.

The sill end connection structure may also include stop keys which are received in registering slots in the center sill and reciprocable coupler carrier structures. These slots obviously tend to weaken the sill structure and require expensive reinforcement which also tends to adversely affect the commercial acceptability of the sill end connection structure.

Provision of an end entry hydraulic end-of-car cushioning mechanism may also be accomplished by omitting any draft stop arrangement and by requiring all draft forces to be transmitted through the entire length of an internally mounted cushioning mechanism. A structure of this nature is obviously disadvantageous because transmission of draft forces in this manner tends to accelerate wear characteristics in addition to allowing possible overstressing of the cushioning mechanism by draft forces of large magnitude. Moreover, such cushioning unit construction is subject to the disadvantage that it could become completely disconnected from the railway car sill in the event the inner connection structure of the cushioning unit should break due to excessive application of forces or due to fatigue of the metal from which the unit is composed. When this occurs, the train may be broken and severe damage may occur.

It is, therefore, a primary object of this invention to provide a novel cushioning unit structure for railway cars, which is capable of being assembled from the end of the railway car sill and which is also capable of bypassing the cushioning unit and applying draft forces directly from the coupler into the center sill structure in the full draft position of the cushioning unit.

It is a further object of this invention to provide a novel cushioning unit structure for railway cars which, even though installed and removed from the end of the center sill, does not allow the possibility of train separation in the event the inner portion of the cushioning unit should become disengaged from its connection with the center sill.

It is an even further object of this invention to provide a novel hydraulic cushioning unit structure for railway cars, which is designed to allow field interchange of coupler structures and also allows field interchange of the cushioning unit structure itself without necessitating detrucking of the railway car.

It is among the several objects of this invention to provide a novel cushioning unit structure for railway cars, which is capable, upon being compressed by buff forces of transmitting accurately aligned forces below a predetermined force magnitude through the cushioning unit and into the center sill structure and which is capable of transmitting excessive buff forces only through the outer cylinder structure of the cushioning unit structure and into the center sill directly in such manner as to bypass the inner cylinder structure thereof.

An even further object of this invention involves the provision of a novel hydraulic cushioning unit structure for railway cars, which includes removable draft lug members which ef-

fectively achieve lateral centering of the cushioning unit within the sill, upon full extension of the cushioning unit.

Among the several objects of this invention is contemplated the provision of a novel cushioning unit structure for railway cars, which is simple in nature, reliable in use and low in cost.

Other and further objects, advantages and features of this invention will become apparent to one skilled in the art upon consideration of the written specification, the attached claims and the annexed drawings. The form of the invention, which will now be described in detail, illustrates the general principles of the invention, but it is understood that this detailed description is not to be taken as limiting, since the scope of the invention is best defined by the appended claims. Such description will be referred to by reference characters in the drawing in which:

FIG. 1 is a side elevational view illustrating a pair of railway box cars, which are connected by means of couplers of the E-type connected to hydraulic cushioning systems constructed in accordance with the present invention.

FIG. 2 is a fragmentary plan view of a portion of the center sill structure of the railway car of FIG. 1 shown in partial section and illustrating positioning of a hydraulic cushioning unit disposed within the center sill.

FIG. 3 is an exploded view in perspective illustrating one end of the center sill of the railway car of FIG. 1 and illustrating the cushioning unit structure, removable draft lugs and the coupler key in disassembled position.

FIG. 4 is a fragmentary plan view of the center sill structure of the railway car of FIG. 1 illustrating insertion of the coupler key into its coupling position with one draft lug removed.

FIG. 5 is a fragmentary plan view of the center sill structure of the railway car of FIG. 1 illustrating compression of the cushioning unit and assembly of the second draft lug subsequent to proper positioning of the coupler key element.

FIG. 6 is a fragmentary plan view of the railway car center sill structure illustrating positioning of the removable draft lugs, the coupler key and the end cap portion of the cushioning unit in the fully extended position thereof.

FIG. 7 is a partial sectional view of a center sill and hydraulic cushioning unit structure illustrating a modified embodiment of this invention.

FIG. 8 is a partial plan view of the center sill structure of the railway car illustrating the backstop element and the structural connection between the cushioning unit and the backstop element in detail.

Briefly, the invention comprises a railway car having an open-ended center sill structure with a backstop buff and draft force structural element disposed within the center sill intermediate the extremities thereof. A collapsible cushioning unit is inserted through the open end of the center sill and is retained in fixed assembly with the backstop element by bolt and nut connection at the inner extremity of the cushioning unit. A sill end connector unit, which defines the extremity of a center sill is provided with a pair of vertical draft lug slots in which are retained a pair of removable draft lugs. The draft lugs are disposed for engagement with draft shoulders formed on the cushioning unit structure to maintain the cushioning unit against complete separation from the center sill in the event the bolted connection between the cushioning unit and the backstop element should become disconnected. The removable draft lugs are provided with transverse slots which cooperate to retain a coupler key which establishes connection between the cushioning unit and a railway car coupler. The draft lugs are provided with alignment surfaces which cooperate with guide surfaces formed on the hydraulic cushioning unit to provide for positive lateral centering of the cushioning unit within the center sill structure upon full extension of the cushioning unit. This feature assures transmission of buff forces in a positively aligned condition through the cushioning unit structure and, therefore, precludes the development of eccentric or misaligned buff forces as the cushioning unit is compressed.

Referring now to the drawings for a better understanding of this invention, railway cars 10 and 12 illustrated in FIG. 1, are interconnected by means of couplers 14. Assuming that each of the railway cars of FIG. 1 is of the cushioned underframe type, an end-of-car cushioning system will be arranged within the car center sill and inwardly of each of the couplers 14. The underframe of each of the railway cars 10 and 12 will include a longitudinally disposed fixed center sill generally designated 16 within which the cushioning system is arranged. The center sill structure is generally hat shaped, when viewed in cross section, having a horizontal top web 18 vertically disposed side webs 20 and horizontally disposed bottom flange 22, as best illustrated in FIG. 3. Although the drawings illustrate incorporation of this invention into railway car structures utilizing type E couplers such specific construction is not considered to limit the scope of this invention, it being obvious upon full understanding of the invention, that the invention is sufficiently broad in scope to cover other coupler designs.

With reference particularly to FIG. 2, a backstop element 24, which may be a fabrication or a casting is fixed to the side webs 20 of the center sill 16 by welding or the like to achieve an essentially integral relationship with the center sill. The backstop element includes a transverse structural wall 26 having a central aperture 28 formed therein. The transverse wall 26 defines a buff force transfer surface 30 of generally planar shape and a draft force transfer surface 32 of concave shape. At the forward portion of the backstop element 24 is provided a oversolid stop surface 34, which is engaged by the outer cylinder structure of the cushioning unit upon the application of excessively high buff forces thereto as will be described in detail hereinbelow.

A hydraulic cushioning unit, illustrated generally at 36 is comprised of a pair of telescoping inner and outer cylinders 38 and 40 respectively, which are adapted to dissipate energy on being compressed from the fully extended position thereof as shown in FIG. 2 to a partially or fully collapsed position. The inner and outer cylinders 38 and 40 cooperate to define a high-pressure hydraulic chamber 42, a low-pressure hydraulic fluid chamber 44 and a draft-cushioning chamber 46. A floating piston 48 is movably disposed within the inner cylinder 38 in sealed relation with the internal cylindrical wall of the inner cylinder and serves to separate the low-pressure hydraulic chamber 44 from a compressible fluid chamber 50 defined between the floating piston 48 and an inner cylinder end cap 52 which is threadedly received at the free extremity of the inner cylinder 38. The inner cylinder end cap 52 is provided with a fluid passage 53 through which pressurized compressible fluid such as air or nitrogen gas may be introduced to precharge the compressible fluid chamber 50 with sufficient pressure to return the cushioning unit to its fully extended position.

The inner cylinder end cap 52 is provided with a threaded extension 54, which extends through the aperture 28 of the transverse wall 26. A nut member 56 is threadedly retained on the extension 54 to establish mechanical connection between the backstop element 24 and the hydraulic cushioning unit structure. The nut member 56 is provided with an arcuate or spheroidal convex bearing surface 58 which is disposed in engagement with the concave draft surface 32 of the transverse wall 36, for the purpose of evenly distributing draft loads which are applied during draft runout of the cushioning unit. A buff force alignment plate 60 is interposed between the end cap 52 and the planar surface 30 of the transverse wall 36 and includes an arcuate or convex force alignment surface 62 disposed in engagement with a concave force alignment surface 64 of the end cap 52. The buff force alignment plate 60 positively assures equal distribution of buff forces between the cushioning unit and the transverse wall 36 of the backstop element even though the cushioning unit might be slightly misaligned within the center sill 16, thereby preventing possible overstressing of specific portions of the backstop element 24.

For the purpose of installing the nut 56 on the axial extension 54 of the inner cylinder end cap, the backstop element 24

and the vertical web 20 of the center sill are provided with access openings 66 and 68 respectively which are disposed in registry.

The outer cylinder 40 of the hydraulic cushioning unit 36 is provided at one extremity thereof with a combination packing adapter and oversolid stop 70 which maintains a packing and bearing assembly 72 in sealed bearing relation with the inner cylinder 38. At the other extremity of the outer cylinder an outer cylinder end cap 74 is maintained in sealed assembly with the outer cylinder 40 by a series of tie bolts 76, which extend through apertures in the packing adapter 70 and are received in threaded engagement within threaded apertures formed in the end cap 74.

For the purpose of metering hydraulic fluid between the high-pressure fluid chamber 42 and the low-pressure fluid chamber 44, an orifice plate member 78, illustrated in FIG. 2, is retained at the inner extremity of the inner cylinder 38. The orifice plate 78 is provided with a metering aperture or orifice 80 which receives a metering pin 82 supported by the outer cylinder end cap 74. The metering pin 82 is capable of varying the effective size of the metering orifice 80 during collapsing and extending movement of the hydraulic cushioning unit upon the application of a buff force thereto in order to achieve dissipation of energy by variably restricting the transfer of hydraulic fluid from the high-pressure fluid chamber to the low-pressure fluid chamber. As the hydraulic cushioning unit is collapsed by low-magnitude buff forces, the cushioned forces will be transmitted from the outer cylinder of the cushioning unit to the inner cylinder 38 thereof through the hydraulic fluid, and then will be transferred through the end cap structure 52 of the inner cylinder and through the buff force alignment plate 60 to the transverse wall 26 of the backstop element 24. As explained above, even though the hydraulic cushioning unit may be slightly misaligned during collapsing movement thereof, the cooperating arcuate surfaces 62 and 64 will assure even distribution of forces to the transverse wall 26 and the inner cylinder 38 in order to prevent the development of excessive localized metal stresses. In the event excessively high buff forces are transmitted through the outer cylinder end cap structure 74 of the cushioning unit, the unit will fully collapse, causing a stop shoulder 84 of the packing adapter 70 to contact the oversolid stop surface 34 of the backstop element 24. Under this condition, forces in excess of a predetermined maximum will be transferred directly through the outer cylinder of the cushioning unit into the backstop element 24 through the oversolid stop shoulder 34, thereby in effect, bypassing the excessive forces around the inner cylinder 38 to prevent excessive deflection or other damage to the inner cylinder.

In order to provide for cushioning ability during draft runout subsequent to collapsing of the cushioning unit under buff forces, the cushioning unit 36 is provided with a draft-cushioning valve 86, which is movably disposed within the variable volume draft-cushioning chamber 46 defined between the inner and outer cylinders 38 and 40. For so much of the structural details and operation of the draft cushion valve 86, as is essential to the understanding of this invention, reference may be had to U.S. Pat. No. 3,378,149, which covers the draft-cushioning valve structure in detail. During extension of the cushioning unit, subsequent to collapsing thereof under buff forces, cushioning during draft runout of the cushioning unit is applied from the transverse wall 26 of the backstop element, through the threaded extension 54 of the inner cylinder end cap 52 and through the inner cylinder and outer cylinder to the coupler structure of the railway car. The unit will have cushioning ability during draft runout until it reaches its fully extended condition at which time draft forces will be applied directly from the outer cylinder end cap into the center sill structure.

A sill end connector unit, illustrated generally at 88 in FIG. 3, which may be provided either in the form of a casting or a fabrication, is fixed to the extremity of the center sill by welding or the like in such manner as to become a substantially in-

tegral portion of the center sill structure. The sill end connector unit 88 includes parallel sidewalls 90, a top web 92 and a bottom wall 94. A pair of parallel, vertical draft lug retainer slots 96 are defined in the internal surfaces of the side webs 90. A pair of generally rectangular openings 98 are formed in the upper wall 92 of the sill end connector unit and are disposed in registry with the draft lug retainer slots 96. As illustrated in broken lines in FIG. 3, the bottom wall 94 of the sill end connector unit is also provided with a pair of generally rectangular openings 100, which are also disposed in registry with the draft lug retainer slots 96. A draft lug support plate 102 is bolted to the sill end connector unit, as illustrated in FIG. 7 and defines a support plate for a pair of removable draft lugs 104, which are retained within the draft lug retainer slots 96. The draft lugs 104 are elongated members which are generally rectangular in shape and which are receivable within the rectangular openings 98 of the top wall 92 and the openings 100 of the bottom wall 94. The lug members 104 include surfaces which correspond to the shape of the lug retainer grooves 96 in order to prevent undue lateral movement of the draft lugs within the draft lug grooves. The draft lugs 104 are also provided with beveled alignment surfaces 106, which are disposed for contact with guide surfaces 108 defining shoulders on the outer cylinder end cap 74 of the hydraulic cushioning unit. As the hydraulic cushioning unit is extended to its full length subsequent to being compressed, the alignment surfaces 106 of the draft lugs will cooperate with the guide surfaces 108 of the outer cylinder end cap to cam the outer cylinder end cap to a centered position within the center sill 16. Accurate alignment of the hydraulic cushioning units, in this manner, will insure against the development of eccentric loads on the hydraulic cushioning unit upon the application of subsequent buff forces.

The sill end connector unit is provided with a pair of coupler key insertion slots 110, which are open at the forward portion of the end sill connector unit and which intersect the draft lug retainer slots 96. A coupler key 112 may be inserted through the slots 110 and into corresponding slots 114 and 116, formed respectively in the outer cylinder end cap 74 and the shank portion 118 of the railway car coupler 14. The draft lugs 104 are provided with a pair of transverse slots 122, in which the end portions of the coupler key 112 are retained. The transverse slots 122 in the draft lugs 104 prevent the coupler key 112 from moving outwardly from either of the coupler key slots 110 and thereby releasing the connection between the coupler 120 and the outer cylinder end cap 74 of the cushioning unit.

The coupler key 112 also serves to retain or lock the removable draft lugs 104 in place within the draft lug slots 96. Since the coupler key 112 is disposed within the slots 122 of each of the removable draft lugs 104 in the fully extended position of the cushioning unit, it will not be possible to eject the draft lugs upwardly through the openings 98. It has been determined that violent oscillations of the sill end occur only upon initial impact of the coupler structure. The coupler key will insure against ejection of the draft lugs under this condition. After the outer cylinder and end cap structure of the hydraulic cushioning unit has moved rearwardly sufficient to clear the coupler key 112 from the transverse slots 123 of the draft lugs, oscillations will be diminished sufficiently to prevent ejection of the draft lugs 104 upwardly through the draft lug openings 98. It is anticipated, however, that a cover plate may be bolted or otherwise fixed to the upper wall 92 of the sill end connector 88 to positively retain the draft lugs under all conditions.

The transverse slots 122 in the draft lugs 104 effectively allow maximum lateral movement of the coupler key 112 within limits defined by the internal dimension of the center sill 16. Transverse slots 122 effectively assure that the coupler key 112 will not be capable of engaging any transversely extending structure and will remain free from transverse loads on the coupler ends as it travels with the outer cylinder end cap structure 74.

The hydraulic cushioning unit is installed within the center sill structure 16 by inserting the cushioning unit into the sill with the buff force alignment plate 60 in engagement with the inner cylinder end cap 52. After the threaded extension 54 of the inner cylinder end cap has been positioned through the aperture 28, the nut 56 will be threaded onto the extension 54 thereby locking the inner cylinder structure of the cushioning unit to the transverse wall 26 of the backstop element. Then, as illustrated in FIG. 4, one of the removable draft lugs 104 is installed through the opening 98 and 100 into proper position within the appropriate draft lug retainer groove 96. After the first removable draft lug has been installed, the cushioning unit may be allowed to extend until the alignment surface 108 of the outer cylinder end cap contacts the alignment surface 106 of the draft lug. The draft lug, therefore, acts as a stop to prevent further extension of the cushioning unit. The railway car coupler 14 then may be positioned with the shank portion 118 within the outer cylinder end cap 74, bringing the elongated slots 114 and 116 into registry. The coupler key 112 then will be inserted through the elongated slot 110 into connecting relationship within the slots 114 and 116 of the outer end cap and the coupler respectively. One extremity of the coupler key 112 will be received within the transverse slot 122 of the inserted draft lug 104. With the coupler key 112 properly positioned, the hydraulic cushioning unit will be collapsed rearwardly by applying a buff force on the coupler 14 thereby forcing the hydraulic cushioning unit to the position illustrated in FIG. 5. The other removable draft lug 104 will then be inserted through its openings 98 or 100 to its proper position within the draft lug retainer slot 96. The transverse slot 122 of the second draft lug 104 will then be positioned in registry with the other extremity of the coupler key 112. Although the draft lugs may be inserted upwardly through the openings 100 or downwardly through the openings 98 as desired, they will ordinarily be inserted through the upper openings 98 with the support plate assembled to the sill end connector unit because the support plate 102 provides a means for properly positioning the draft lugs within the sill end connector unit. As the force is removed from the coupler 120, the cushioning unit will expand to the fully extended position thereof, moving the outer cylinder end cap into a position causing abutment between the guide surfaces 108 of the outer cylinder end and the alignment surfaces 106 of the removable draft lugs. Simultaneously, the coupler key 112 will be moved to the FIG. 6 position thereof, causing the extremities of the coupler key to be retained within the transverse slots 122 of the draft lugs.

Removal of the hydraulic cushioning unit is accomplished essentially in a reverse manner by applying a compressive force on the coupler 120, causing the outer cylinder of the cushioning unit to move to the FIG. 5 position thereof. The draft lug support plate 102 is then unbolted from its position on the sill end connector unit and the draft lugs 104 may be removed downwardly through the openings 100 in the bottom wall 94 of the end sill connector unit. Alternatively, the draft lugs may be removed upwardly through the upper openings 98 without removing the support plate 102, if desired. The nut 56 will then be removed from the threaded extension 54 of the inner cylinder end cap, thereby releasing the connection between the inner cylinder and the transverse wall 26 of the backstop element 24. The hydraulic cushioning unit then may simply be withdrawn through the forward opening of the sill end connector unit and removed from its position within the sill.

In the event it should become necessary or desirable to remove the railway car coupler 120 from its connection with the outer cylinder end cap, a compressive force will be applied on the coupler 120, thereby moving the outer cylinder end cap to the FIG. 5 position thereof. One of the removable draft lugs 104, then may be removed either upwardly through the openings 98 or downwardly through the openings 100 as described above, leaving one of the draft lugs in position to engage the guide surface 108 of the outer cylinder end cap. The

hydraulic cushioning unit will then be allowed to extend to the FIG. 4 position thereof and the coupler key 112 may be removed through the coupler key slot 110, thereby disconnecting the coupler 120 from the outer cylinder end cap. After a new coupler has been positioned within the outer cylinder end cap, as illustrated in FIG. 4, the coupler key 112 may be reinserted through the registering slots 114 and 116 with one end of the key 112 disposed within the transverse slot 122 of the remaining draft lug 104. The hydraulic cushioning unit will then be compressed to the FIG. 5 position thereof and the second draft lug 104 will be inserted into its proper position within the draft lug retainer recess 96. The cushioning unit will then be allowed to extend to the FIG. 6 position to complete the coupler replacement operation.

As illustrated in FIG. 7, a modified embodiment of our invention may include a center sill structure 130, having side webs 132, thereof, which are provided with an offset portion 134, which defines an enlarged end portion of the center sill structure. The enlarged end portion of the center sill may be provided in a form of a fabrication or casting which is fixed to the extremities of the center sill 130 by means of welding or the like, thereby forming an enlarged sill end connector unit generally indicated at 136. The sill end connector unit 136 is provided with forward integral draft stops 138, which are engaged by a pair of removable draft lugs 140 in the fully extended position of the hydraulic cushioning unit 142 in order to limit movement of the hydraulic cushioning unit in the fully extended position thereof. The removable draft lugs 140, in the fully extended position of the cushioning unit, will transfer draft forces directly into the sill end connector unit 136 and into the center sill 130, thereby effectively bypassing the hydraulic cushioning unit to protect the same from undue wear during normal draft operation. The hydraulic cushioning unit 142 is constructed substantially identical as compared to the hydraulic cushioning unit 36, illustrated in FIGS. 2 through 6 and 8. The cushioning unit 142 includes an outer cylinder end cap 144 having vertical elongated slots 146 of generally tee-shaped cross section formed in each side thereof. The removable draft lugs 140 are of generally tee-shaped configuration and are retained within the slots 146 in the manner shown in FIG. 7.

While the slots are shown to be tee-shaped, it is not intended to limit the interlocking relation between the outer cylinder end cap and the removable draft lugs to this specific configuration, it being obvious that other interlocking structural configurations might be employed with equal success.

The sill end connector unit 136 is provided with upper and lower openings in the top and bottom walls thereof to allow for insertion and removal of the tee-shaped removable draft lugs 140. A removable draft lug support plate is fixed to the flange portion 148 of the sill 130 by bolting or the like in order to provide for normal support of the removable draft lugs during operation and to allow bottom removable or installation of the draft lugs during servicing of the cushioning unit structure.

The end sill connector unit 136 is provided with a pair of elongated opposed coupler slots 150, generally corresponding to the coupler slots 110, formed in the end sill connector unit 88, as illustrated in FIG. 3. With at least one of the removable draft lugs 40 removed, a coupler key 152 may be inserted through the coupler slots 150 into receiving position within registering coupler slots 154 formed in the outer cylinder end cap 144 and coupler slots 156 formed in the railway car coupler 158.

The enlarged sill end connector unit 136 defines internal rearward oversolid stop shoulders 160, which are disposed in position to contact the removable draft lugs 140 to provide an oversolid stop arrangement in the event they hydraulic cushioning unit is subjected to buff forces which are above a predetermined maximum level. In the event the hydraulic cushioning unit 142 is fully collapsed by excessively high loads, the removable draft lugs 140 will abut the rearward oversolid stop shoulders 160, thereby causing excessive buff forces to be transmitted directly into the center sill structure

rather than being transmitted through the hydraulic cushioning unit and into the railway car center sill through a transverse wall of a backstop element, essentially as is illustrated in FIGS. 2 and 8.

In order to remove the hydraulic cushioning unit 142 from the center sill structure 130, a small buff force will be applied on the coupler 158 causing the centering forces of the cushioning unit to be overcome, thereby relieving pressure between the removable draft lugs 140 and the draft shoulders 138. The draft lugs then may be removed upwardly through the top openings or the draft lug support plate may be unbolted and released from the center sill allowing the draft lugs 140 to be removed downwardly through the bottom of the sill end connector unit. With the removable draft lugs removed and with the innermost portion of the hydraulic cushioning unit disconnected from the transverse wall of the backstop element as illustrated in FIGS. 2 and 8, the hydraulic cushioning unit and the coupler may be simply withdrawn from the open end of the sill end connector unit. Installation of the hydraulic cushioning unit within the center sill 130 is accomplished in a reverse manner substantially as described above regarding installation of the hydraulic cushioning unit 36.

Field replacement or repair of the coupler 158 may be accomplished simply by removing one of the removable draft lugs 140 in the manner discussed above and by withdrawing the coupler key 152 from its interconnecting relationship with the registering slots 156 and 154 of the coupler and outer cylinder end cap respectively. When this is accomplished, the coupler 158 is released and may be withdrawn from the outer cylinder end cap 144. Installation of the coupler 158 is achieved simply by placing the internal slots 154 and 156 in registry and positioning the coupler key 152 within the slots. The removable draft lug 140 then may be replaced in its elongated tee-shaped slot 146, thereby locking the coupler key 152 in the position illustrated in FIG. 7.

It will be evident from the foregoing that we have provided a novel railway car structure including a center sill and hydraulic cushioning unit structure which may be installed and removed from the end of the center sill and yet which provides for draft capability in the fully extended position of the hydraulic cushioning unit as well as during draft runout of the cushioning unit. We have provided railway car structure including a hydraulic unit which may be removed and replaced in the field, if desired, and which allows the field replacement of a coupler structure without necessitating the use of special tools or equipment. We have utilized removable draft lug structures, which positively retain the hydraulic cushioning unit within the center sill structure even though the innermost portion of the center sill may become disconnected from backstop structure of the center sill. The removable draft lugs additionally provide for positive centering of the hydraulic cushioning unit within the center sill as the cushioning unit extends to the fully extended position thereof, thereby assuring accurate alignment of subsequent buff forces and preventing the creation of eccentric loads on the hydraulic cushioning unit as buff forces are applied. The removable draft lugs also function to retain a coupler key in a position connecting a coupler with the outer cylinder end of cap of the hydraulic cushioning unit. The coupler may be disconnected from the cushioning unit only by removing at least one of the removable draft lugs, thereby assuring against inadvertent disconnection of the coupler key from the outer cylinder end cap and coupler structure. The novel construction of our railway car structure also allows the transfer of low-level cushioned buff forces from the hydraulic cushioning unit through a backstop element and to the center sill structure in an evenly distributed manner. In the event the buff forces should become excessive, however, such forces are transmitted directly through the outer cylinder of the cushioning unit and into the center sill structure of the railway car through an oversolid stop portion of the structure. This feature allows only forces of a predetermined maximum level to be transferred through the inner cylinder structure of the hydraulic cushioning unit and

prevents excessive deflection and eccentric loading of the inner cylinder structure which might cause undue wear or damage to the inner cylinder structure. It is evident, therefore, that this invention is well adapted to attain all of the objects hereinabove set forth.

We claim:

1. A railway car having a longitudinal sill through which draft and buff forces are transmitted to the car, a collapsible draft and buff force cushioning unit disposed within said sill and having one extremity thereof fixed to said sill intermediate the extremities thereof, said cushioning unit having draft stop means defined thereon, draft lug retainer means defined by said sill, removable draft lug means received in fixed relation within said draft lug retainer means of said sill adjacent the extremity thereof and being disposed for abutment with said draft stop means to limit draft movement of said cushioning unit, coupler key means establishing connection between said cushioning unit and a railway car coupler and being movable with said cushioning unit and coupler.

2. A railway car as set forth in claim 1, said draft lug retainer means comprising a pair of draft lug slots formed in said sill, said removable draft lug means being loosely retained within each of said slots.

3. A railway car as set forth in claim 1, a pair of draft lug slots formed in said sill, a pair of removable draft lugs received one within each of said draft lug slots, said draft lugs being disposed at each extremity of said coupler key and retaining said coupler key means against disengagement from said cushioning unit and coupler.

4. A railway car as set forth in claim 1, said draft lugs defining alignment cam surfaces, said draft stop means comprising a pair of guide cam surfaces, said alignment surfaces and said guide surfaces moving into camming abutment upon full extension of said cushioning unit and cooperating to positively cam said cushioning mechanism to a centered position within said sill whereby eccentric loading of said cushioning unit is prevented upon subsequent compression thereof.

5. A railway car as set forth in claim 1, said sill having backstop means disposed intermediate the extremities thereof, said backstop means defining a buff and draft cushioning structural wall element, said cushioning unit being connected to said structural wall element for transmission of cushioned buff and draft forces between said sill and said cushioning mechanism, said backstop means defining oversolid stop means, a portion of said cushioning unit being movable into abutting relation with said oversolid stop means for transmitting excessive buff forces directly into said sill to protect said cushioning mechanism against the damaging effects of excessive buff forces.

6. A railway car having a longitudinal open-ended sill through which draft and buff forces are transmitted to the car, backstop means defined intermediate the extremities of said sill, draft lug retainer means defined at the extremities of said sill, a collapsible draft and buff force cushioning unit received within said sill and having the inner extremity thereof connected to said backstop means, a pair of draft stop shoulders defined on said cushioning unit, sill end connector means defining the extremities of said sill, said connector means defining draft lug retainer means, a pair of draft lugs being retained in substantially fixed relation within the said draft lug retainer means and being disposed for abutment with said draft stop shoulders in the fully extended position of said cushioning unit, whereby said cushioning unit may be installed or removed from the end of said sill simply by removing said

draft lugs.

7. A railway car as set forth in claim 6, said draft lug retaining means comprising a pair of parallel slots defined in said sill end connector means, said removable draft lugs being disposed within said parallel slots.

8. A railway car as set forth in claim 7, a coupler key retained within said sill end connector means and establishing connection between said cushioning unit and a railway car coupler, said removable draft lugs preventing disassembly of said coupler key from said sill end connector unit.

9. A railway car as set forth in claim 6, said draft lugs defining alignment surfaces, said draft stop shoulders defining a pair of guide surfaces which cooperate with said alignment surfaces in the fully extended position of said cushioning unit to positively center said cushioning unit within said sill, whereby eccentric buff loading of said cushioning unit will be prevented upon subsequent compression thereof.

10. A railway car as set forth in claim 6, said backstop means defining a buff and draft force cushioning structural element for transmission of cushioned buff and draft forces between said sill and said cushioning unit, said backstop means defining oversolid stop means for transmitting excessive buff forces directly into said sill to protect said cushioning unit against the damaging effects of excessive buff forces.

11. A railway car as set forth in claim 10, including means for positively centering the distribution of both buff and draft forces through said backstop means.

12. A railway car having a longitudinal open-ended sill through which draft and buff forces are transmitted to the car, a collapsible cushioning unit assembly disposed within said sill and capable of being inserted or removed from the open end of said sill, a pair of opposed internal draft stop shoulders defined internally of said sill substantially outwardly of said cushioning unit, a pair of draft lug slots formed in said cushioning unit assembly and disposed substantially inwardly of said draft stop shoulders, a pair of draft lugs disposed within said draft lug slots and being disposed for engagement with said draft stop shoulders at the fully extended position of said cushioning unit thereby limiting extension of said cushioning unit assembly, said draft lugs being removable from said draft lug slots to allow removal of said cushioning unit assembly from said sill.

13. A railway car having a longitudinal sill through which draft and buff forces are transmitted to the car, a collapsible draft and buff force cushioning unit disposed within said sill and having the inner extremity thereof fixed within said sill intermediate the extremities thereof, said cushioning unit having opposed draft stop shoulders formed thereon, vertical parallel draft lug slots formed in said sill, a pair of removable draft lugs retained within said slots and being disposed for engagement with said draft stop shoulders to limit extension of said cushioning unit and to transmit draft forces directly from said cushioning unit into said sill, openings formed in said sill structure for removal and installation of said draft lugs, a railway car coupler, a horizontal coupler key interconnecting said coupler and said cushioning unit, said removable draft lugs being disposed one at each extremity of said coupler key in the fully extended position of said cushioning unit and serving to retain said coupler key against inadvertent disassembly from said coupler and sill.

14. A railway car as set forth in claim 13, a coupler key connecting said cushioning unit with a railway car coupler, said removable draft lugs preventing inadvertent disconnection of said coupler key from said cushioning unit and coupler.