

Aug. 9, 1966

C. B. GOLDMAN

3,265,222

RAILWAY CAR CUSHIONING DEVICE

Filed July 16, 1965

4 Sheets-Sheet 1

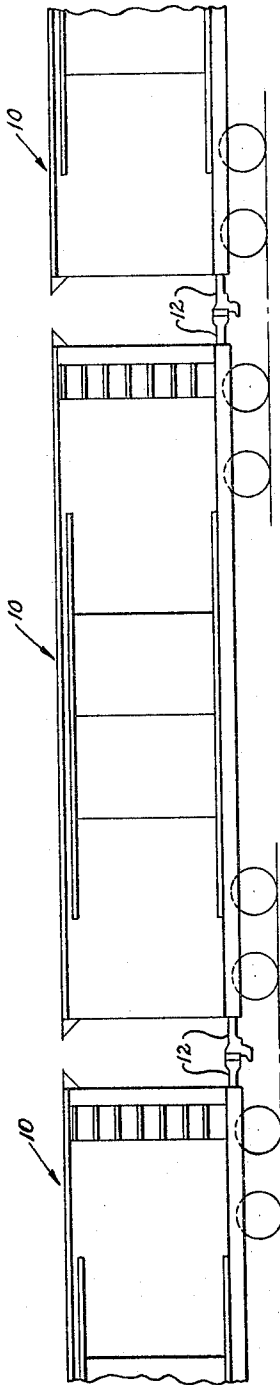


FIG. 1.

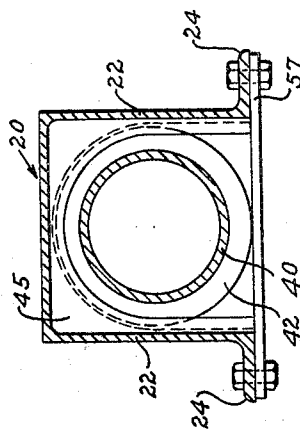


FIG. 5.

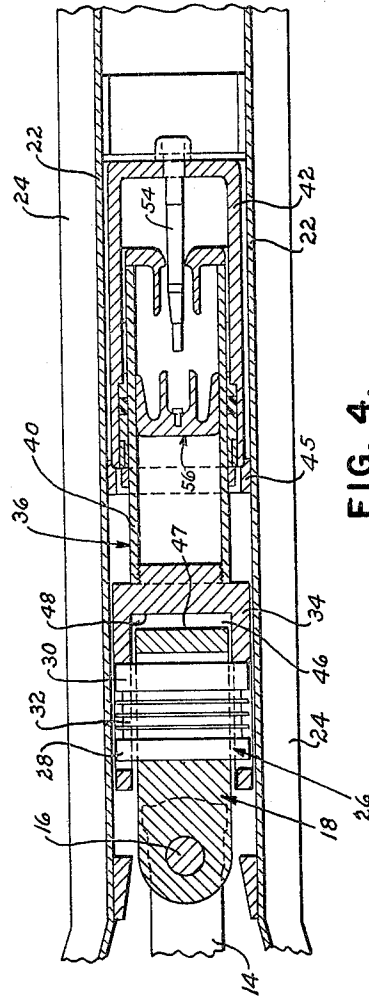


FIG. 4.

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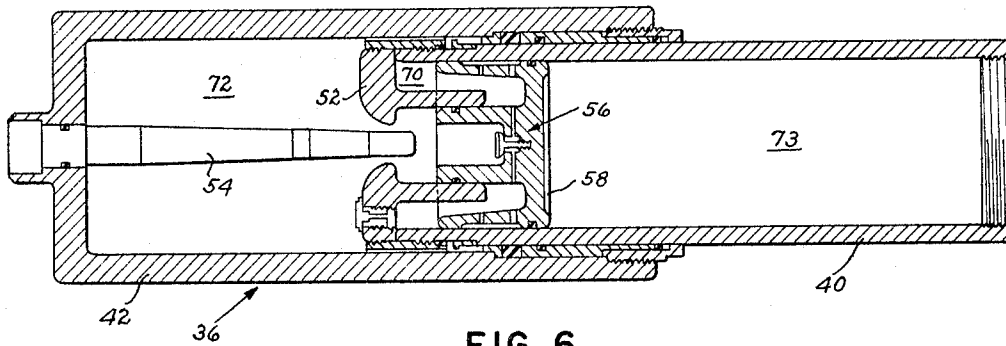


FIG. 6.

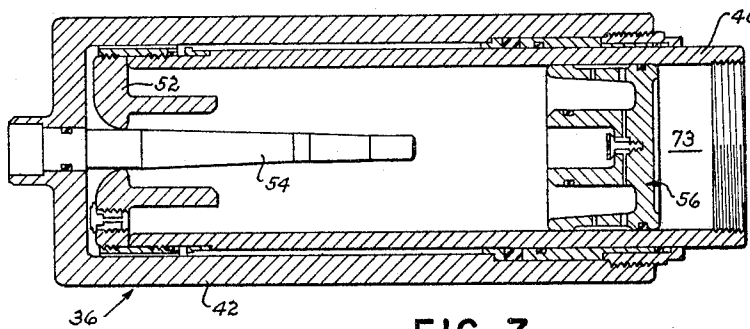


FIG. 7.

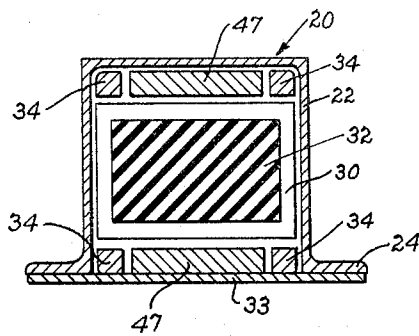


FIG. 5A.

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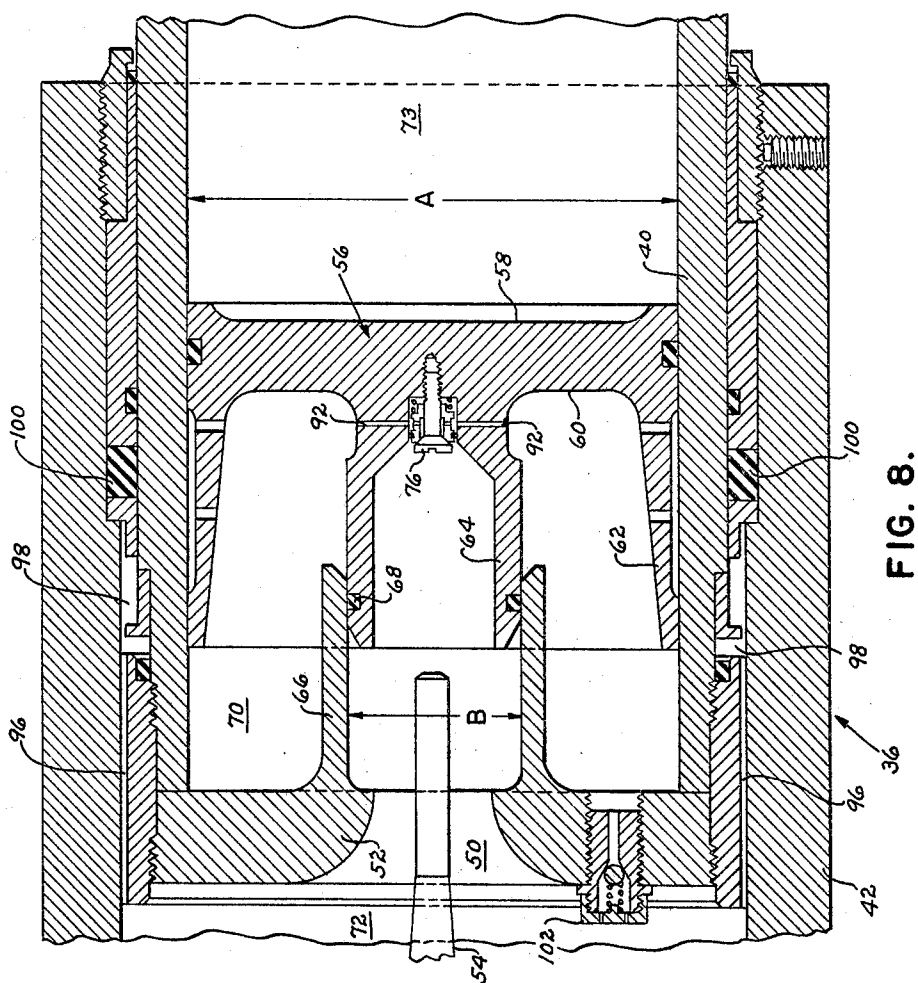
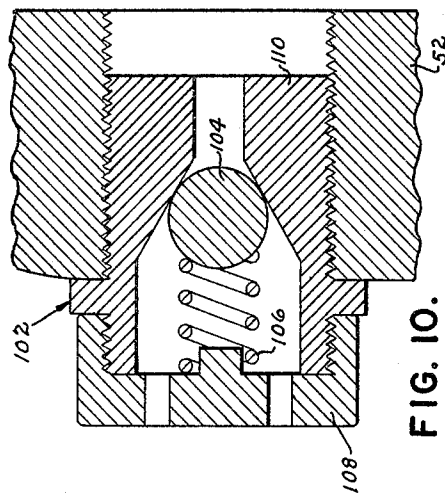
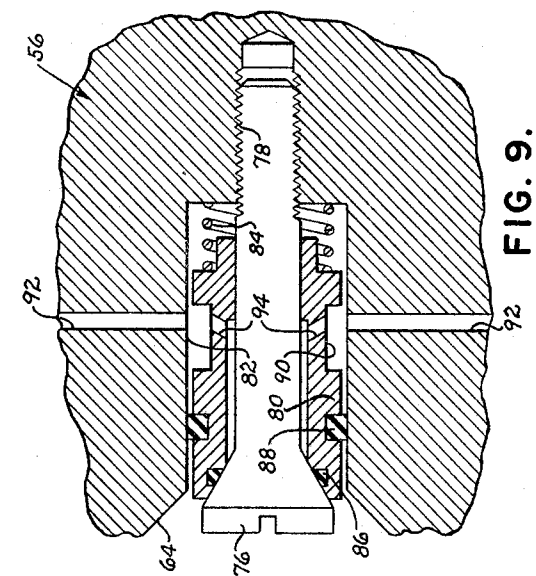
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RAILWAY CAR CUSHIONING DEVICE

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Filed July 16, 1965, Ser. No. 472,629

22 Claims. (Cl. 213—43)

This invention relates to cushioning devices for railway cars and more particularly to the cushioning device adapted to be operatively connected to a coupler adjacent the end of a railway car for absorbing impact forces exerted against the coupler.

The present invention is especially directed to a cushioning system or shock absorbing system in which the metering of a fluid is employed as an energy dissipating device. The majority of cushioning systems used for end-of-car cushioning employ the principle of hydraulic fluid metering to dissipate the energy. This method of energy dissipation is velocity sensitive and thereby permits the cushioning unit to go solid under the application of extremely low velocity impacts, such as slack run-ins during a downgrade locomotive braking condition. When a sizable number of railway cars are included in a single train, the length of the train may shorten considerably by the sum of the travels of the cushioning units on all of the railway cars equipped with such units. Additionally, slack run-outs of the coupled railway cars without a sufficient energy dissipation in each of the cushioning units creates an acceleration which increases with each successive car. Other objections which result from present end-of-car hydraulic fluid metering systems include the gradual lengthening of a train when the brakes are released after a stop, the creeping of cars at loading docks, and the inability of some cushioning units to return to neutral position sufficiently rapid after an impact to be ready for a second impact.

Another problem in present end-of-car fluid metering systems results from the wear of piston seals resulting from the continuous back and forth movement or hunting of the piston which is induced by normal train operation. With the present systems, the train action provides a continuous reciprocation of the piston with many reversals of seal directional movement. If a load is gradually applied, the train action produces a relatively large "drift" of the hydraulic cushioning unit, such as a contraction of several inches in the cushioning unit, with increased wear on the piston seals and other seals affected by the movement of the parts of the cushioning unit.

Thus, the two main undesirable features in present end-of-car cushioning units are: (1) the uncontrolled hunting or longitudinal reciprocation induced by train action on the piston or the movable portions of the unit, and (2) the run-in of the cushioning unit upon the application of continuous low velocity impacts with the unit going solid and thereby having insufficient energy dissipating capability when the cushioning unit is subjected to an additional buff force or a draft force when in the full buff position.

It is the object of the present invention to provide a cushioning device of the fluid metering type for an end-of-car cushioning system which eliminates the uncontrolled hunting or longitudinal back and forth movement of the piston which is induced by normal train action.

A further object of this invention is the provision of such a fluid metering type of cushioning device which retains its energy dissipating capability under ordinary train operating conditions.

Another object of this invention is the provision of a resilient draft gear in combination with such a fluid metering type of hydraulic cushioning device to supplement and

complement the cushioning action from the hydraulic cushioning device.

The present invention comprises a hydraulic cushioning device for a railway car of the fluid metering type in which a positive resistance to impact forces is maintained until a predetermined fluid pressure is reached. The cushioning device comprises a cylinder having a free floating piston mounted therein forming one end of a hydraulic fluid chamber which has an elongate metering member and an associated orifice for metering fluid flow upon contraction of the cushioning unit. Means separate the hydraulic fluid chamber into an enclosed low pressure portion and an enclosed high pressure portion in the neutral rest position of the cushioning device with the floating piston forming a portion of the low pressure portion and remaining in a fixed position until the fluid pressure in the high pressure portion reaches a predetermined amount. Upon a predetermined fluid pressure being reached in the high pressure portion the floating piston is unlocked and moves relative to the cylinder to permit fluid metering through the orifice and contraction of the cushioning device. The floating piston is unlocked upon the predetermined fluid pressure being reached by the combination of two fluid pressure responsive means comprising this invention each responsive to an increase in fluid pressure within the high pressure portion of the fluid chamber in the neutral position of the cushioning device. First, the face of the piston opposite the hydraulic fluid chamber is exposed to a compressible gaseous fluid to restrain movement of the piston. Only a portion of one face of the piston is exposed to hydraulic fluid within the high pressure portion in the neutral position of the cushioning unit while the entire opposite face of the piston is exposed to the compressible gaseous fluid. The ratio of the area exposed to the compressible gaseous fluid to the area exposed to the high pressure hydraulic fluid will determine to a certain extent the predetermined fluid pressure at which the piston will unlock or unlatch. A ratio of at least around five to one between these areas has been found necessary for effective functioning of the cushioning unit.

The second fluid pressure responsive means is a relief valve between the low pressure chamber and the high pressure chamber adapted to be actuated upon a predetermined pressure differential between the low pressure chamber and the high pressure chamber. Upon actuation of the relief valve a hydraulic fluid flow into the low pressure chamber unlocks the piston to permit retraction of the cushioning device. The relief valve supplements the action obtained by the ratio of areas on opposite faces of the piston and may be set to be opened at a predetermined pressure differential between the high pressure chamber and the low pressure chamber. The relief valve, if set to be opened at a relatively low pressure differential between the low pressure chamber and the high pressure chamber, could constitute the major force in unlocking the floating piston.

It is generally desirable to have a resilient cushion unit in combination with the hydraulic unit especially to provide cushioning before the predetermined impact force is reached at which the hydraulic cushioning becomes effective upon unlocking or unlatching of the piston. The resilient cushioning unit, such as the draft gear, is arranged so that minimal buff forces are dissipated thereby without any movement or compression of the hydraulic cushioning unit. The resilient cushioning unit permits a gradual increase in coupler force and tends to smoothen the stroke of the hydraulic cushioning unit after the unlocking of the piston at a predetermined high buff force exerted against the coupler.

The invention accordingly comprises the constructions

hereinafter described, the scope of the invention being indicated in the following claims.

In the accompanying drawings, in which one of various possible embodiments of the invention is illustrated,

FIGURE 1 is a side elevation of a plurality of railway box cars coupled to each other;

FIGURE 2 is a top plan with certain portions broken away showing the hydraulic cushioning device comprising this invention mounted within a fixed center sill adjacent the rear end of a draft gear and coupler structure, the cushioning device being illustrated in a neutral position;

FIGURE 3 is a side elevation with certain portions broken away of the structure of FIGURE 2;

FIGURE 4 is a top plan similar to FIGURE 2 but illustrating the position of the hydraulic cushioning device and draft gear acting in series under buff forces;

FIGURE 5 is a section taken generally along line 5—5 of FIGURE 2;

FIGURE 5A is a section taken generally along line 5A—5A of FIGURE 2;

FIGURE 6 is a longitudinal section of the hydraulic cushioning device shown removed from the center sill structure and in a neutral position;

FIGURE 7 is a longitudinal section of the hydraulic cushioning device similar to FIGURE 6 but showing the cushioning device after being subjected to buff forces and compressed;

FIGURE 8 is an enlarged fragment of FIGURE 6 showing the orifice plate and piston in a locked or latched position in the neutral position of the cushioning device;

FIGURE 9 is an enlarged fragment of FIGURE 8 showing the relief valve for permitting fluid flow between a high pressure chamber and a low pressure chamber; and

FIGURE 10 is an enlarged fragment of FIGURE 8 showing a check valve to permit fluid flow upon return of the cushioning device to neutral position.

Referring now to the drawings for a better understanding of this invention, railway cars 10 are coupled to each other by couplers 12. An end of car cushioning system is arranged inwardly of each of couplers 12. Each coupler 12 has a shank 14 pivotally connected by pin 16 to a yoke 18. A fixed center sill generally designated 20 is hat-shaped in cross section as shown in FIGURE 5 and has side webs 22 with bottom legs 24. A draft gear generally designated 26 is mounted within yoke 18 and comprise respective front and rear follower plates 28 and 30. A plurality of rubber buffer pads 32 are positioned between follower plates 28 and 30 and separated by metal discs. A support 33 extends beneath draft gear 26 and is secured to legs 24 of center sill structure 20.

Coupler yoke 18 is mounted within a second yoke 34 secured to a hydraulic cushioning device generally designated 36. Yoke 34 is urged by cushioning device 36 against stop lugs 38 secured to fixed center sill 20. Cushioning device 36 includes an inner cylinder 40 threaded on boss 41 of yoke 34 and an outer cylinder 42 secured to bracket 44 secured, such as by welding, to fixed center sill 20. A generally U-shaped stop 45 is secured to center sill 20 adjacent outer cylinder 42 to snub or restrain the inner movement of yoke 34.

Upon the exertion of draft forces, yoke 18 compresses draft gear 26 by pulling follower plate 30 forwardly with follower plate 28 being restrained by yoke 34 and lugs 38. Yoke 34 does not move upon the exertion of a draft force and hydraulic cushioning device 36 remains in a neutral position upon the exertion of a draft force with the draft forces being absorbed only by draft gear 26 without the assistance of hydraulic cushioning device 36.

Upon the exertion of buff forces against railway car 10, draft gear 26 and hydraulic cushioning device 36 act in series to absorb the buff forces and cushion the railway car. Referring to FIGURE 4, draft gear 26 and cushioning device 36 are shown in a buff position with draft gear 26 compressed and cushioning device 36 contracted or

compressed to dissipate the impact forces. In the buff position of FIGURE 4, yoke 34 is moved rearwardly by the action of follower plate 30 and follower plate 28 is spaced from yoke 34 an amount equal to the compression of draft gear 26. An adequate clearance shown at 46 between the rear end 47 of yoke 18 and the adjacent surface 48 of yoke 34 is provided to permit compression of draft gear 26 relative to hydraulic cushioning device 36. The rearward movement of yoke 34 contracts hydraulic cushioning device 36 as inner cylinder 40 is secured to yoke 34. The arrangement as shown in FIGURES 2-5 and 5A thus permits draft gear 26 to absorb at least a portion of the buff force exerted against the railway car before action of hydraulic cushioning device 36. As will be explained, cushioning device 36 is not contracted until a predetermined high buff force is reached thereby to permit relatively small buff forces as well as all draft forces to be absorbed and dissipated by the draft gear without the action of cushioning device 36.

Referring to FIGURES 6-10 and forming an important feature of this invention, hydraulic cushioning device 36 is particularly adapted to permit contraction of inner and outer cylinders 40, 42 only when a predetermined fluid pressure is reached within outer cylinder 42. Cushioning device 36 is generally of the oleopneumatic type in which the device is returned by the action of a compressed gaseous fluid, such as shown in Patent No. 3,171,546, issued March 2, 1965, to G. E. Frederick, and entitled Kinetic Energy Absorbing Device, the entire disclosure of which is incorporated by this reference.

Outer cylinder 42 contains a relatively incompressible fluid, such as hydraulic fluid, which is metered through an orifice 50 in orifice plate 52 on the inner end of inner cylinder 40 by a metering pin 54 secured to outer cylinder 42. A freely floating piston 56 is mounted for movement within inner cylinder 40 and separates a compressible fluid, such as air, within inner cylinder 40 from the hydraulic fluid within outer cylinder 42. Piston 56 has one face or surface 58 exposed to the compressible fluid and an opposite face 60 exposed to the relatively incompressible hydraulic fluid in outer cylinder 42. In order for cushioning device 36 to contract any appreciable amount, piston 56 must first move to allow a metered fluid flow through orifice 50. A support plate 57 shown in FIGURE 5 is secured to center sill structure 20 for supporting cushioning device 36.

Referring particularly to FIGURE 8, an arrangement is shown to lock or hold piston 56 in neutral position until a predetermined fluid pressure is reached in outer cylinder 42. Piston 56 includes an outer generally cylindrical wall 62 and an integral open ended cylindrical projection 64 extending in a direction toward the adjacent orifice plate 52. Orifice plate 52 has a complementary cylindrical projection 66 which telescopes projection 64. A suitable O-ring seal 68 is arranged between projections 64 and 66. In the neutral position of hydraulic cushioning device 36 as shown in FIGURE 8, a low pressure hydraulic fluid chamber 70 is provided between piston 56 and orifice plate 52 which is shut off from a high pressure hydraulic fluid chamber 72 formed by outer cylinder 42. The portion of piston 56 exposed to fluid pressure from fluid chamber 72 is the area denoted at B acting against projection 64. The area of the face of piston 56 denoted at A is exposed to fluid pressure from air chamber 73 and resists movement of piston 56 from pressure exerted by area B. The predetermined fluid pressure within chamber 72 at which piston 56 is unlocked or unlatched from projection 66 depends to a certain extent on the ratio of area A to area B. For effective operation, a ratio between areas A and B of at least around five to one is desirable.

As a specific example and employing an outer cylinder 42 having an inside diameter of around ten (10) inches, an inner cylinder 40 having an inside diameter of around nine (9) inches, and an air pressure within the compressi-

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ble fluid chamber of inner cylinder 40 of around two hundred (200) p.s.i., a ratio between areas A and B of around ten (10) to one (1) has worked effectively. Ratios between areas A and B as high as thirty (30) to one (1) have been found to be effective dependent on various factors such as, the diameters of the inner and outer cylinders, the initial air pressure within the inner cylinder, and the pressure at which the relief valve is actuated.

To supplement the action obtained from the ratio of area A to area B, a pressure relief to permit fluid flow from high pressure fluid chamber 72 into low pressure fluid chamber 70 is illustrated in FIGURES 8 and 9. A stud 76 is threaded in bore 78 in piston 56. A sleeve or valve member 80 fits around stud 76 within a chamber 82 in piston 56. Spring 84 urges sleeve 80 into engagement with the head of stud 76. Suitable O-rings 86 and 88 provide seals for sleeve 80. A circumferential groove 90 communicates with ports 92 leading to low pressure chamber 70. Upon the reaching of a predetermined fluid pressure on the outer face of sleeve 80 which is exposed to fluid within high pressure chamber 72, sleeve 80 moves inwardly against the bias of spring 84 to permit the flow of fluid from chamber 72 through openings 94, circumferential groove 90 and ports 92 into low pressure chamber 70. Stud 76 may be adjusted to control the bias of spring 84 and the fluid pressure at which sleeve 80 is actuated. Upon the unlatching of piston 56, hydraulic fluid flows through a plurality of ports 96 into an annular chamber 98 formed between outer cylinder 42 and inner cylinder 40 which increases in size as the cushioning device contracts. A suitable O-ring 100 controls leakage of fluid upon movement of inner cylinder 40 relative to outer cylinder 42. FIGURE 7 shows the cushioning device in the full contracted position.

FIGURE 10 shows a return check valve 102 in orifice plate 52 to permit flow of hydraulic fluid into chamber 72 upon the return movement of inner cylinder 40 after the impact forces have been dissipated. Check valve 102 comprises a ball valve 104 urged into closed position by spring 106. An internally threaded cap 108 secures spring 106 and valve 104 in position on main body 110 which forms a seat for ball valve 104.

Operation is as follows:

Upon an impact of a predetermined magnitude being exerted against railway car 10, draft gear 26 is compressed and exerts force against yoke 34. Inward pressure against cylinder 40 increases the fluid pressure within chamber 72 until fluid pressure against area B overcomes the fluid pressure exerted against face 58 of piston 56 and valve member 80 is actuated to permit fluid flow into chamber 70. Valve member 80 is set to be actuated before piston 56 unlocks thereby to aid in unlocking of the piston and opening of low pressure chamber 70. Upon unlocking and movement of piston 56, hydraulic fluid metered through orifice 50 flows from chamber 72 into chamber 70 and the cushioning device 36 is contracted as shown in FIGURE 4. Upon dissipation and absorption of the impact forces by metering of the fluid through orifice 50, the compressed gaseous fluid adjacent face 58 of piston 56 moves piston 56 in a return direction to exhaust the hydraulic fluid from inner cylinder 40. Upon reaching the end of the return stroke, cylindrical projection 64 is received in substantially fluid tight relation within cylindrical projection 66 to close low pressure chamber 70 and permit movement of piston 56 only when a predetermined fluid pressure is again reached in fluid chamber 72.

From the foregoing, an end of car cushioning system for a railway car has been provided in which draft forces are dissipated by a suitable resilient draft gear without action of the hydraulic cushioning device. Impact or buff forces of a relatively small magnitude are likewise dissipated by the draft gear without action of the hydraulic cushioning device. The draft gear is mounted so that it

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may compress under impact loads relative to the hydraulic cushioning device thereby not actuating the hydraulic cushioning device at relatively low buff forces. The hydraulic cushioning device is arranged to be actuated when a predetermined buff force is reached and acts in series with the draft gear to dissipate and absorb the buff forces.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A railway car having a center sill structure with an open outer end, a coupler structure carried by said center sill structure, a cushioning device mounted within said center sill structure rearwardly of said coupler structure for cushioning the coupler structure upon the exertion of buff forces, said cushioning device comprising a cylinder forming a hydraulic fluid chamber, a piston mounted within said cylinder and forming one end of said fluid chamber, means separating the hydraulic fluid chamber into an enclosed low pressure portion and an enclosed high pressure portion in a neutral position of the cushioning device with said piston forming a portion of said low pressure portion, and fluid pressure responsive means responsive to fluid pressure in the high pressure portion and adapted to be actuated upon a predetermined pressure being reached in said high pressure portion to permit flow of hydraulic fluid into said low pressure portion and subsequent movement of said piston, said means separating the fluid chamber into said portions being operatively connected to said coupler structure and responsive to the exertion of buff forces against said coupler structure to increase the pressure in said high pressure portion whereby upon a predetermined pressure being reached in said high pressure portion said fluid pressure responsive means is actuated to allow a flow of fluid into said low pressure portion for permitting a cushioned movement of said cushioning device.

2. A railway car having a center sill structure with an open outer end, a coupler structure carried by said center sill structure, a hydraulic cushioning device mounted within said center sill structure rearwardly of said coupler structure for cushioning the coupler structure upon the exertion of buff forces, said cushioning device comprising an outer fluid cylinder and an inner fluid cylinder movable relative to each other, an orifice plate on the inner end of said inner cylinder, a metering member on said outer cylinder cooperating with said orifice plate to meter the flow of fluid between the inner cylinder and the outer cylinder upon a contraction of the cushioning device, a freely movable piston mounted within said inner fluid cylinder and forming with said orifice plate an enclosed low pressure hydraulic fluid chamber in a neutral position of the cushioning device, said outer cylinder forming a high pressure hydraulic fluid chamber adjacent the orifice plate, and fluid pressure responsive means between the low pressure chamber and the high pressure chamber in the neutral position of the cushioning device responsive to fluid pressure in the high pressure chamber and adapted to be actuated upon a predetermined pressure being reached in said high pressure chamber to permit flow of hydraulic fluid into said low pressure chamber, said cushioning device being operatively connected to said coupler structure and responsive to the exertion of buff forces against said coupler structure whereby upon reaching a predetermined pressure in said high pressure chamber said fluid pressure responsive means is actuated to allow a flow of hydraulic fluid into the low pressure chamber and contraction of the cushioning device for absorbing the buff forces.

3. A hydraulic cushioning device for use in railway cars comprising an outer fluid cylinder and an inner fluid cylinder movable relative to each other, an orifice plate on the inner end of said inner cylinder, a metering member on said outer cylinder cooperating with said orifice plate to meter the flow of fluid between the inner cylinder and the outer cylinder upon relative movement therebetween when the cushioning device is contracted, a freely movable piston mounted within said inner fluid cylinder and having one face forming with said orifice plate an enclosed low pressure hydraulic fluid chamber on one side of said piston in a neutral position of the cushioning device, said outer cylinder forming with the orifice plate a high pressure hydraulic fluid chamber, fluid pressure responsive means between the low pressure chamber and the high pressure chamber in the neutral position of the cushioning device responsive to fluid pressure in the high pressure chamber and adapted to be actuated upon a predetermined pressure being reached in said high pressure chamber to permit flow of hydraulic fluid into said low pressure chamber and contraction of the cushioning device, said piston and said cushioning device remaining in a neutral rest position until said fluid pressure responsive means is actuated, and means adjacent the opposite face of said piston to return the piston and cushioning device to neutral position after contraction of the cushioning device.

4. A hydraulic cushioning device for use in railway cars comprising a cylinder forming a hydraulic fluid chamber, a piston mounted within said cylinder and having one face forming one end of said fluid chamber, means separating the hydraulic fluid chamber into an enclosed low pressure portion and an enclosed high pressure portion in a neutral position of the cushioning device and said piston forming a portion of the low pressure portion, fluid pressure responsive means responsive to fluid pressure in the high pressure portion and adapted to be actuated upon a predetermined fluid pressure being reached in said high pressure portion to permit flow of hydraulic fluid into said low pressure portion and contraction of the cushioning device, said cushioning device remaining in a neutral rest position until said fluid pressure responsive means is actuated, and means adjacent the opposite face of the piston to return the cushioning device to neutral position after contraction of the cushioning device.

5. A hydraulic cushioning device for use in railway cars as set forth in claim 4 wherein said fluid pressure responsive means comprises a relief valve between the low pressure portion and the high pressure portion in the neutral position of the cushioning device.

6. A hydraulic cushioning device for use in railway cars as set forth in claim 4 wherein said fluid pressure responsive means comprises a movable member having one side thereof exposed to hydraulic fluid in the high pressure portion and the opposite side exposed to a fluid pressure resisting actuation of the movable member, said opposite side having an area exposed to fluid pressure at least around five times the area of said one side exposed to hydraulic fluid in the high pressure portion.

7. A hydraulic cushioning device for use in railway cars comprising an outer fluid cylinder and an inner fluid cylinder movable relative to each other, an orifice plate on the inner end of said inner cylinder, a metering member on said outer cylinder cooperating with said orifice plate to meter the flow of fluid between the inner cylinder and the outer cylinder upon relative movement therebetween, a freely movable piston mounted within said inner fluid cylinder and having one face forming with said orifice plate an enclosed low pressure hydraulic fluid chamber on one side of said piston in a neutral position of the cushioning device, said outer cylinder forming with the orifice plate a high pressure hydraulic fluid chamber, said inner cylinder forming with the other face of said piston a fluid chamber for a compressible fluid, said one

face of said piston being arranged so that a minor area thereof is exposed to hydraulic fluid in the high pressure chamber and a major area thereof is exposed to hydraulic fluid in the low pressure chamber with the entire other face of the piston being exposed to the compressible fluid in the inner cylinder, the ratio of the area on said other piston face exposed to the compressible fluid in the inner cylinder to the area on said one piston face exposed to hydraulic fluid in the high pressure chamber being at least around five to one, said piston being movable from its neutral position when a predetermined pressure differential is reached between said high pressure chamber and said compressible fluid chamber to pressurize the compressible fluid in said inner cylinder and to provide fluid communication between the high pressure chamber and the low pressure chamber upon movement, said piston returning under bias of said pressurized fluid to neutral position after absorption of energy by the cushioning device and closing said low pressure chamber from fluid communication with said high pressure chamber, and a relief valve between the low pressure chamber and the high pressure chamber adapted to be opened upon a predetermined pressure being reached in said high pressure chamber to permit a flow of fluid from the high pressure chamber to the low pressure chamber.

8. A railway car having a center sill structure with an open outer end, a coupler structure carried by said center sill structure, a hydraulic cushioning device mounted within said center sill structure rearwardly of said coupler structure for cushioning the coupler structure upon the exertion of buff forces, said cushioning device comprising an outer fluid cylinder and an inner fluid cylinder movable relative to each other, an orifice plate on the inner end of said inner cylinder, a metering member on said outer cylinder cooperating with said orifice plate to meter the flow of fluid between the inner cylinder and the outer cylinder upon relative movement, a freely movable piston mounted within said inner fluid cylinder and having one face forming with said orifice plate an enclosed low pressure chamber in a neutral position of the cushioning device, said outer cylinder forming with the orifice plate a high pressure hydraulic fluid chamber, said inner cylinder forming with the other face of said piston a fluid chamber for a compressible fluid, said one face of said piston being arranged so that a minor area thereof is exposed to hydraulic fluid in the low pressure chamber with the entire other face of the piston being exposed to the compressible fluid in the inner cylinder, the ratio of the area on said other piston face exposed to the compressible fluid in the inner cylinder to the area on said one piston face exposed to hydraulic fluid in the high pressure chamber being at least around five to one, said piston being movable from its neutral position when a predetermined pressure differential is reached between said high pressure chamber and said compressible fluid chamber to pressurize the compressible fluid in said inner cylinder and to provide fluid communication between the high pressure chamber and the low pressure chamber upon movement, said piston returning under bias of said pressurized fluid to its neutral position after absorption of buff forces by the cushioning device and closing said low pressure chamber from fluid communication with said high pressure chamber.

9. A railway car as set forth in claim 8 wherein the piston of said hydraulic cushioning device has an open ended generally cylindrical projection on said one face thereof and said orifice plate has a complementary open ended cylindrical projection about an orifice in said plate and telescoping the cylindrical projection on said piston in the neutral position of the cushioning device, said projections in said neutral position providing a fluid tight connection therebetween to close the low pressure chamber formed laterally outwardly of the cylindrical projections between the orifice plate and said piston.

10. A railway car having a center sill structure with

an open outer end, a coupler structure carried by said center sill structure, a hydraulic cushioning device mounted within said center sill structure rearwardly of said coupler structure for cushioning the coupler structure upon the exertion of buff forces, said cushioning device comprising an outer fluid cylinder and an inner fluid cylinder movable relative to each other, an orifice plate on the inner end of said inner cylinder, a metering member on said outer cylinder cooperating with said orifice plate to meter the flow of fluid between the inner cylinder and the outer cylinder upon relative movement, a freely movable piston mounted within said inner fluid cylinder and having one face forming with said orifice plate an enclosed low pressure chamber in a neutral position of the cushioning device, said outer cylinder forming with the orifice plate a high pressure hydraulic fluid chamber, said inner cylinder forming with the other face of said piston a fluid chamber for a compressible fluid, said one face of said piston being arranged in the neutral position of the cushioning device so that a minor area thereof is exposed to hydraulic fluid in the high pressure chamber and a major area thereof is exposed to hydraulic fluid in the low pressure chamber with the entire other face of the piston being exposed to the compressible fluid in the inner cylinder, the ratio of the area on said other piston face exposed to the compressible fluid in the inner cylinder to the area on said one piston face exposed to hydraulic fluid in the high pressure chamber being at least around five to one, said piston being unlocked from its neutral position when a predetermined pressure differential is reached between said high pressure chamber and said compressible fluid chamber to pressurize the compressible fluid in said inner cylinder and to provide fluid communication between the high pressure chamber and the low pressure chamber, said piston returning under bias of said pressurized fluid to its neutral position and closing said low pressure chamber from fluid communication with said high pressure chamber thereby to lock the piston, and a relief valve between the low pressure chamber and the high pressure chamber adapted to be opened upon a predetermined pressure being reached in said high pressure chamber to permit a flow of fluid from the high pressure chamber to the low pressure chamber, said predetermined high pressure being reached before said piston is moved from its neutral position thereby to aid in unlocking of the piston.

11. A railway car having a center sill with an open outer end, a coupler structure mounted for movement within said center sill, a resilient draft gear adjacent the inner end of said coupler structure, said coupler structure having a yoke extending about said resilient draft gear, a hydraulic cushioning device mounted within said center sill rearwardly of said draft gear, means connecting said hydraulic cushioning device and said resilient draft gear in series upon the exertion of buff forces against said coupler structure and permitting a limited cushioning movement of said resilient draft gear relative to the hydraulic cushioning device, said hydraulic cushioning device comprising an outer cylinder and an inner cylinder movable relative to each other for contraction and extension of the cushioning device, a hydraulic fluid chamber formed within said cylinders, a movable member separating the hydraulic fluid chamber into a low pressure portion and a high pressure portion in a neutral position of the cushioning device and adapted to be actuated upon a predetermined fluid pressure being reached in said high pressure portion to permit flow of hydraulic fluid into said low pressure portion and contraction of the cushioning device, said movable member and said cushioning device remaining in a neutral rest position until said movable member is actuated at a predetermined fluid pressure in said high pressure portion whereby minimal buff forces may be dissipated by said resilient draft gear without cushioning action of said hydraulic cushioning device, and means to return the cushioning unit to neutral position after contraction thereof.

12. A railway car as set forth in claim 11 wherein an orifice is carried by said inner cylinder, and a metering member is carried by said outer cylinder to cooperate with the orifice to meter the flow of fluid between the inner cylinder and outer cylinder upon contraction of the cushioning device, said movable member upon actuation permitting fluid communication between the high pressure portion and the low pressure portion until the cushioning device returns to neutral position.

13. A railway car as set forth in claim 11 wherein means is positioned between the draft gear and the hydraulic cushioning device to permit compression of the resilient draft gear relative to the hydraulic cushioning device upon the exertion of draft forces and to prevent extension of the hydraulic cushioning device when draft forces are exerted against the railway car.

14. A railway car as set forth in claim 11 wherein a second yoke is secured to the forward end of said hydraulic cushioning device, said second yoke receiving the first mentioned yoke of said coupler structure and permitting relative movement of said first mentioned yoke, lugs on said fixed center sill to restrain said second yoke against movement in a direction toward the coupler structure from the neutral position of the cushioning device, said second yoke moving rearwardly upon the exertion of buff forces when said predetermined high fluid pressure is reached in the fluid chamber.

15. A railway car having a fixed center sill with an open outer end, a coupler structure mounted for movement within said center sill, a resilient draft gear adjacent the inner end of said coupler structure, means connecting said coupler structure to said resilient draft gear, a hydraulic cushioning device mounted within said center sill rearwardly of said draft gear, means connecting said hydraulic cushioning device and said resilient draft gear in series upon the exertion of buff forces against said coupler structure and permitting a limited cushioned movement of said resilient draft gear relative to the hydraulic cushioning device, said hydraulic cushioning device comprising a cylinder forming a hydraulic fluid chamber, a piston mounted within said cylinder and forming one end of said fluid chamber, means separating the hydraulic fluid chamber into an enclosed low pressure portion and an enclosed high pressure portion in a neutral position of the cushioning device with said piston forming a portion of said low pressure portion, normally closed fluid pressure responsive means between the low pressure portion and the high pressure portion in the neutral position of the cushioning unit responsive to fluid pressure in the high pressure portion and adapted to be opened upon a predetermined pressure being reached in said high pressure portion to permit flow of hydraulic fluid into said low pressure portion and a contraction of the cushioning device, said cushioning device remaining in a neutral position until said fluid pressure responsive means is opened whereby minimal buff forces may be dissipated by said resilient draft gear without cushioning action of said hydraulic cushioning device, and means to return the hydraulic cushioning device to neutral position after contraction thereof and absorption of buff forces, said fluid pressure responsive means after being opened permitting fluid communication between the high pressure portion and the low pressure portion until the cushioning device returns to neutral position.

16. A railway car having a fixed center sill with an open outer end, a coupler structure mounted for movement within said center sill, a resilient draft gear adjacent the inner end of said coupler structure, means connecting said coupler structure to said resilient draft gear, a hydraulic cushioning device mounted within said center sill rearwardly of said draft gear, means connecting said hydraulic cushioning device and said resilient draft gear in series upon the exertion of buff forces against said coupler structure and permitting cushioned movement of said resilient draft gear relative to the hydraulic cushioning device, said

hydraulic cushioning device comprising an outer fluid cylinder and an inner fluid cylinder movable relative to each other, an orifice plate on the inner end of said inner cylinder, a metering member on said outer cylinder cooperating with said orifice plate to meter the flow of fluid between the inner cylinder and the outer cylinder upon relative movement therebetween, a freely movable piston mounted within said inner fluid cylinder and having one face forming with said orifice plate an enclosed low pressure hydraulic fluid chamber on one side of said piston in a neutral position of the hydraulic cushioning device, said outer cylinder forming with the orifice plate a high pressure hydraulic fluid chamber, a relief valve providing fluid communication between the low pressure chamber and the high pressure chamber and adapted to be opened upon a predetermined pressure being reached in said high pressure chamber to permit a metered flow of fluid from the high pressure chamber to the low pressure chamber and cushioned contraction of the cushioning device, a gas chamber formed by said inner fluid cylinder on the other side of said piston, said piston upon actuation of said relief valve in said gas chamber and being returned by said pressurized gas after cushioned movement of the cushioning device to return the cushioning device to its neutral position.

17. A railway car having a center sill with an open outer end, a coupler structure mounted for cushioned movement within said center sill, a resilient draft gear adjacent the inner end of said coupler structure, said coupler structure having a yoke extending about said resilient draft gear, a hydraulic cushioning device mounted within said center sill rearwardly of said draft gear, means connecting said hydraulic cushioning device and said resilient draft gear in series upon the exertion of buff forces against said coupler structure and permitting a cushioned movement of said resilient draft gear relative to the hydraulic cushioning device, said hydraulic cushioning device comprising an outer fluid cylinder and an inner fluid cylinder movable relative to each other, an orifice plate on the inner end of said inner cylinder, a metering member on said outer cylinder cooperating with said orifice plate to meter the flow of fluid between the inner cylinder and the outer cylinder upon relative movement therebetween, and a freely movable piston mounted within said inner fluid cylinder and having one face forming with said orifice plate an enclosed low pressure hydraulic fluid chamber on one side of said piston in a neutral position of the hydraulic cushioning device, said outer cylinder forming with the orifice plate a high pressure hydraulic fluid chamber, said inner cylinder forming with the other face of said piston a fluid chamber for a compressible fluid, said one face of said piston being arranged in the neutral position of the cushioning device so that a minor area thereof is exposed to hydraulic fluid in the high pressure chamber and a major area thereof is exposed to hydraulic fluid in the low pressure chamber with the entire other face of the piston being exposed to the compressible fluid in the inner cylinder, the ratio of the area of said other piston face exposed to the compressible fluid in the inner cylinder to the area of said one piston face exposed to hydraulic fluid in the high pressure chamber being at least around five to one, said piston being movable from its neutral position when a predetermined high pressure is reached in said high pressure chamber to pressurize the compressible fluid in said inner cylinder and to provide fluid communication between the high pressure chamber and the low pressure chamber, said piston returning under bias of said pressurized fluid to its neutral position and closing said low pressure chamber from fluid communication with said high pressure chamber.

18. A railway car having a fixed center sill with an open outer end, a coupler structure mounted for movement within said center sill, a resilient draft gear adjacent the inner end of said coupler structure, said coupler

structure having a yoke extending about said resilient draft gear, a hydraulic cushioning device mounted within said center sill rearwardly of said draft gear, means connecting said hydraulic cushioning device and said resilient draft gear in series upon the exertion of buff forces against said coupler structure and permitting a limited cushioned movement of said resilient draft gear relative to the hydraulic cushioning device, said hydraulic cushioning device comprising an outer fluid cylinder and an inner fluid cylinder movable relative to each other, an orifice plate on the inner end of said inner cylinder, a metering member on said outer cylinder cooperating with said orifice plate to meter the flow of fluid between the inner cylinder and the outer cylinder upon relative movement therebetween, a freely movable piston mounted within said inner fluid cylinder and having one face forming with said orifice plate an enclosed low pressure hydraulic fluid chamber on one side of said piston in a neutral position of the hydraulic cushioning device, said outer cylinder forming with the orifice plate a high pressure hydraulic fluid chamber, said inner cylinder forming with the other face of said piston a fluid chamber for a compressible fluid, said one face of said piston being arranged in the neutral position of the cushioning device so that a minor area thereof is exposed to hydraulic fluid in the high pressure chamber and a major area thereof is exposed to hydraulic fluid in the low pressure chamber with the entire other face of the piston being exposed to the compressible fluid in the inner cylinder, the ratio of the area of said other piston face exposed to the compressible fluid in the inner cylinder to the area of said one piston face exposed to hydraulic fluid in the high pressure chamber being at least around five to one, said piston being unlocked from its neutral position to open the low pressure chamber when a predetermined pressure differential is reached between said high pressure chamber and said compressible fluid chamber to pressurize the compressible fluid in said inner cylinder and to provide fluid communication between the high pressure chamber and the low pressure chamber, said piston returning under bias of said pressurized fluid to its neutral position and closing said low pressure chamber from fluid communication with said high pressure chamber, and a relief valve between the low pressure chamber and the high pressure chamber adapted to be opened upon a predetermined pressure being reached in said high pressure chamber to permit a flow of fluid from the high pressure chamber to the low pressure chamber, said predetermined high pressure being reached before said piston is unlocked from its neutral position thereby to aid in unlocking of the piston.

19. A hydraulic cushioning device for use in railway cars comprising an outer fluid cylinder and an inner fluid cylinder movable relative to each other, an orifice plate on the inner end of said inner cylinder, a metering member on said outer cylinder cooperating with said orifice plate to meter the flow of fluid between the inner cylinder and the outer cylinder upon relative movement therebetween, and a freely movable piston mounted within said inner fluid cylinder and having one face forming with said orifice plate an enclosed low pressure hydraulic fluid chamber on one side of said piston in a neutral position of the cushioning device, said outer cylinder forming with the orifice plate a high pressure hydraulic fluid chamber, said inner cylinder forming with the other face of said piston a fluid chamber for a compressible fluid, said one face of said piston being arranged so that a minor area thereof is exposed to hydraulic fluid in the high pressure chamber and a major area thereof is exposed to hydraulic fluid in the low pressure chamber with the entire other face of the piston being exposed to the compressible fluid in the inner cylinder, the ratio of the area on said other piston face exposed to the compressible fluid in the inner cylinder to the area on said one piston face exposed to hydraulic fluid in the high

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pressure chamber being at least around five to one, said piston being movable from its neutral position when a predetermined pressure differential is reached between said high pressure chamber and said compressible fluid chamber to pressurize the compressible fluid in said inner cylinder and to provide fluid communication between the high pressure chamber and the low pressure chamber upon movement, said piston returning under bias of said pressurized fluid to its neutral position after absorption of energy by the cushioning device and closing said low pressure chamber from fluid communication with said high pressure chamber.

20. A hydraulic cushioning device as set forth in claim 19 wherein said piston has an open ended generally cylindrical projection on said one face thereof and said orifice plate has a complementary open ended cylindrical projection about an orifice in said plate and telescoping the cylindrical projection on said piston in the neutral position of the cushioning device, said projections in said neutral position providing a fluid tight connection therebetween to close the low pressure chamber formed laterally outwardly of the cylindrical projections between the orifice plate and said piston.

21. A hydraulic cushioning device for use in railway cars comprising an outer cylinder and an inner cylinder movable relative to each other for contraction and extension of the cushioning device, an orifice carried by said inner cylinder, a metering member carried by said outer cylinder cooperating with the orifice to meter the flow of fluid between the inner cylinder and outer cylinder upon contraction of the cushioning device, a hydraulic fluid chamber formed within said cylinders, a movable member separating the hydraulic fluid chamber into a low pressure portion and a high pressure portion in a neutral position of the cushioning device, said movable member responsive to fluid pressure in the high pressure portion and adapted to be actuated upon a predetermined fluid pressure being reached in said high pressure portion to permit flow of hydraulic fluid into said low pressure portion and contraction of the cushioning device, said movable member and said cushioning device remaining in a neutral rest position until said movable member is actuated, and means to return the cushioning device to neutral position after contraction.

22. A railway car having a center sill structure with an open outer end, a coupler structure carried by said center sill structure, a hydraulic cushioning device mount-

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ed within said center sill structure rearwardly of said coupler structure for cushioning the coupler structure upon the exertion of buff forces, said cushioning device comprising an outer fluid cylinder and an inner fluid cylinder movable relative to each other, an orifice plate on the inner end of said inner cylinder, a metering member on said outer cylinder cooperating with said orifice plate to meter the flow of fluid between the inner cylinder and the outer cylinder upon a contraction of the cushioning device, a freely movable piston mounted within said inner fluid cylinder and forming with said orifice plate an enclosed low pressure hydraulic fluid chamber in a neutral position of the cushioning device, said outer cylinder forming a high pressure hydraulic fluid chamber adjacent the orifice plate, and a movable member responsive to fluid pressure in the high pressure chamber and adapted to be actuated upon a predetermined pressure being reached in said high pressure chamber to permit flow of hydraulic fluid into said low pressure chamber, said movable member having one side thereof exposed to hydraulic fluid in the high pressure portion and the opposite side exposed to a fluid pressure resisting actuation of the movable member, said opposite side having an area exposed to fluid pressure at least around five times the area of said one side exposed to hydraulic fluid in the high pressure portion, said cushioning device being operatively connected to said coupler structure and responsive to the exertion of buff forces against said coupler structure whereby upon reaching a predetermined pressure in said high pressure chamber said fluid pressure responsive means is actuated to allow a flow of hydraulic fluid into the low pressure chamber and contraction of the cushioning device for absorbing the buff forces, and means to return the piston and cushioning device to neutral position after contraction of the cushioning device.

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