

July 31, 1962

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3,047,162

HYDRAULIC AND RESILIENT CUSHIONED RAILWAY CAR DRAFT ASSEMBLY

Filed Jan. 16, 1961

6 Sheets-Sheet 1

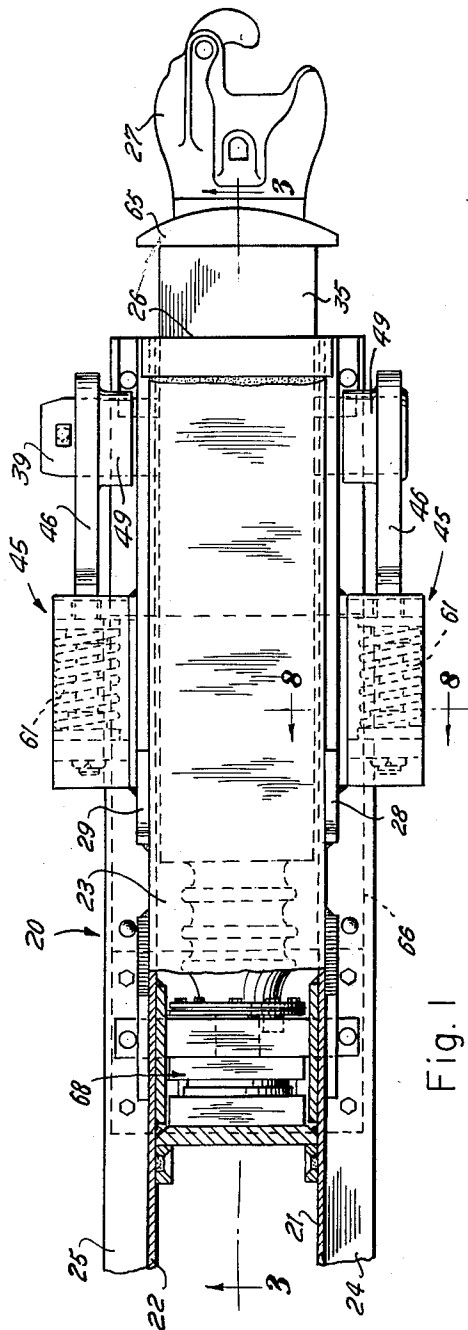


Fig. 1

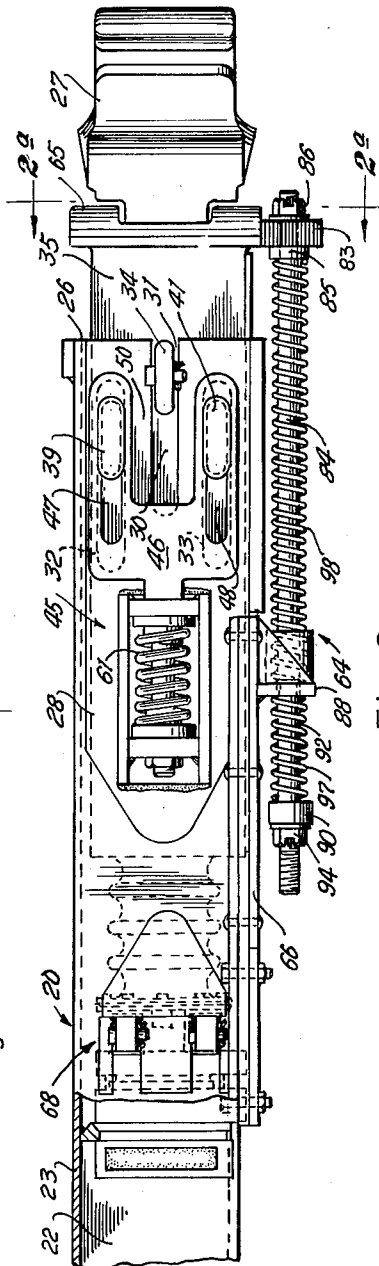


Fig. 2

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6 Sheets-Sheet 2

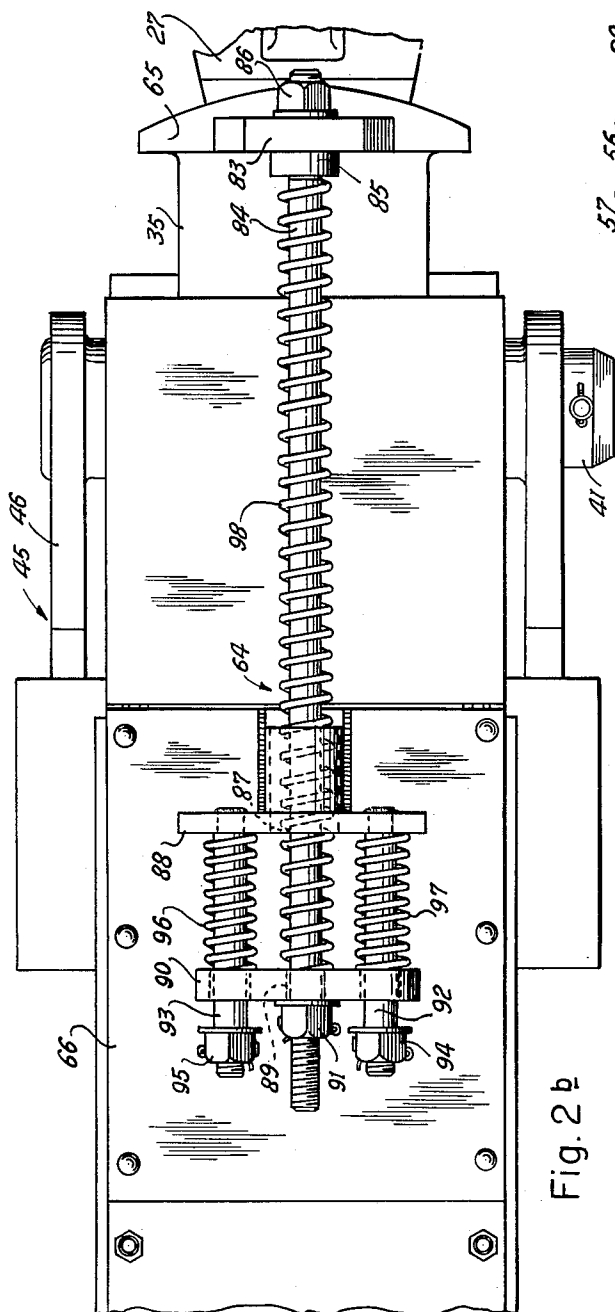


Fig. 2 b

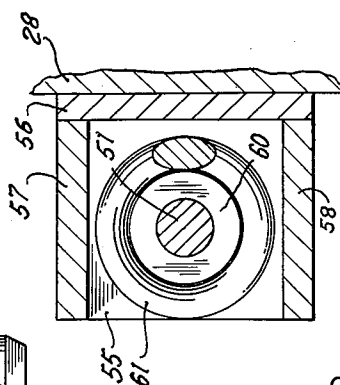


Fig. 8

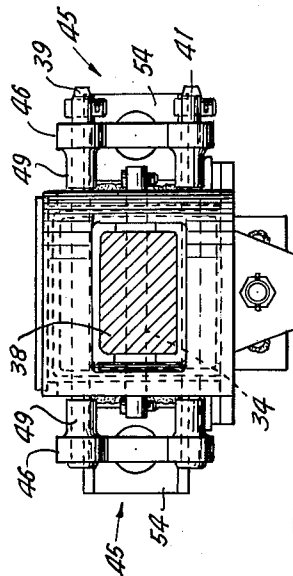


Fig. 2 a

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6 Sheets-Sheet 3

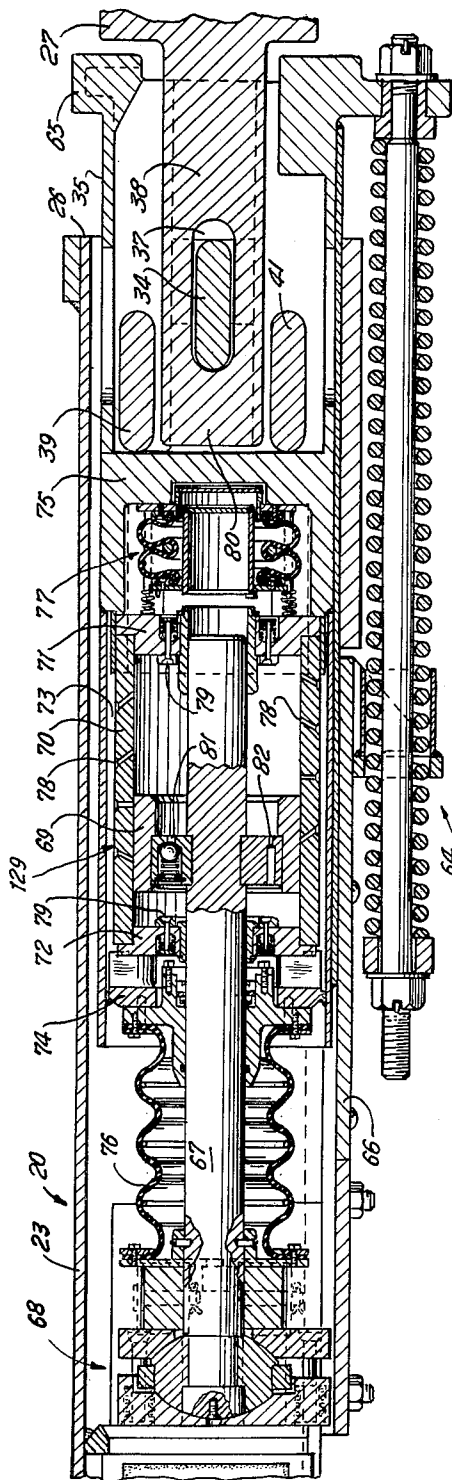


Fig. 3

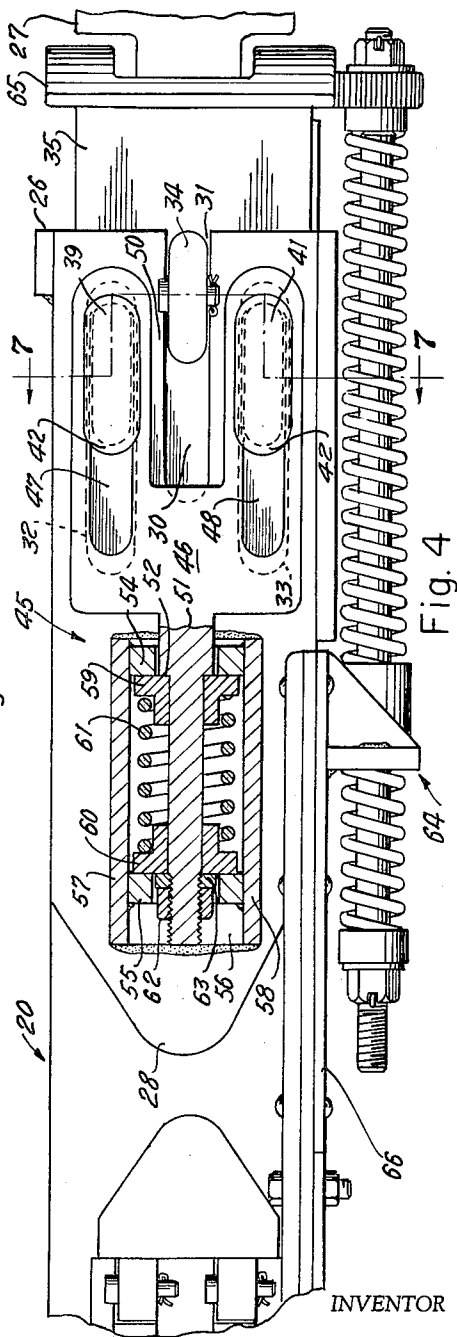


Fig. 4

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6 Sheets-Sheet 4

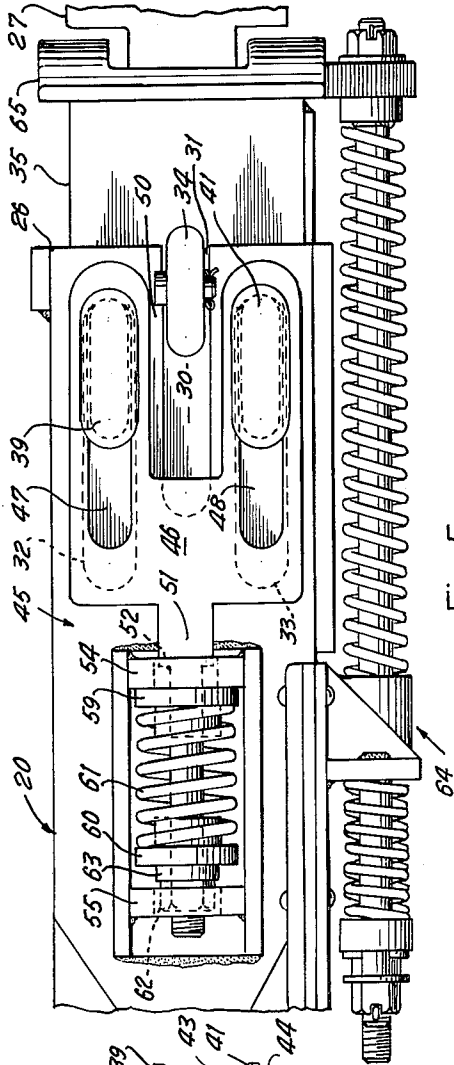


Fig. 5

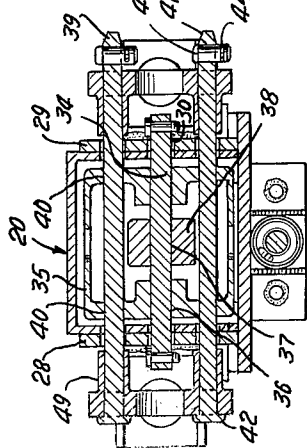


Fig. 7

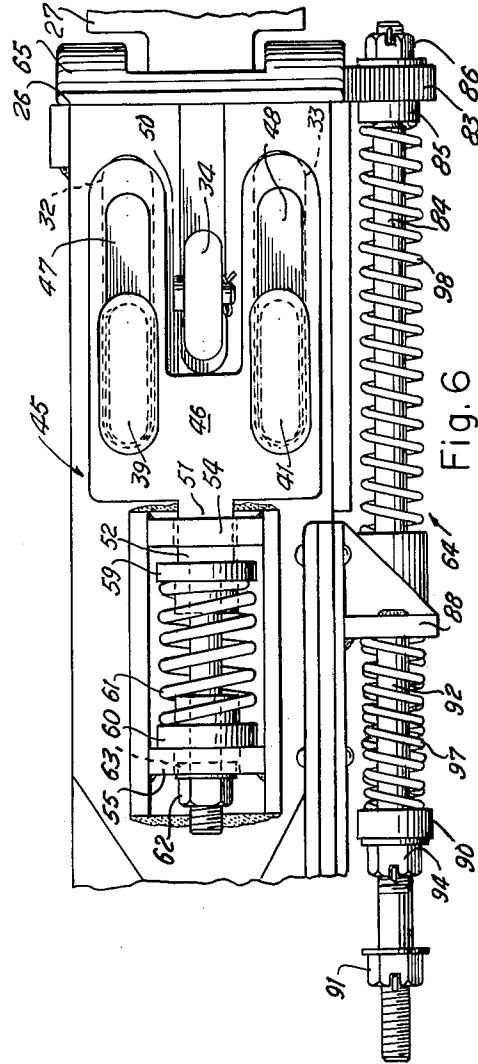


Fig. 6

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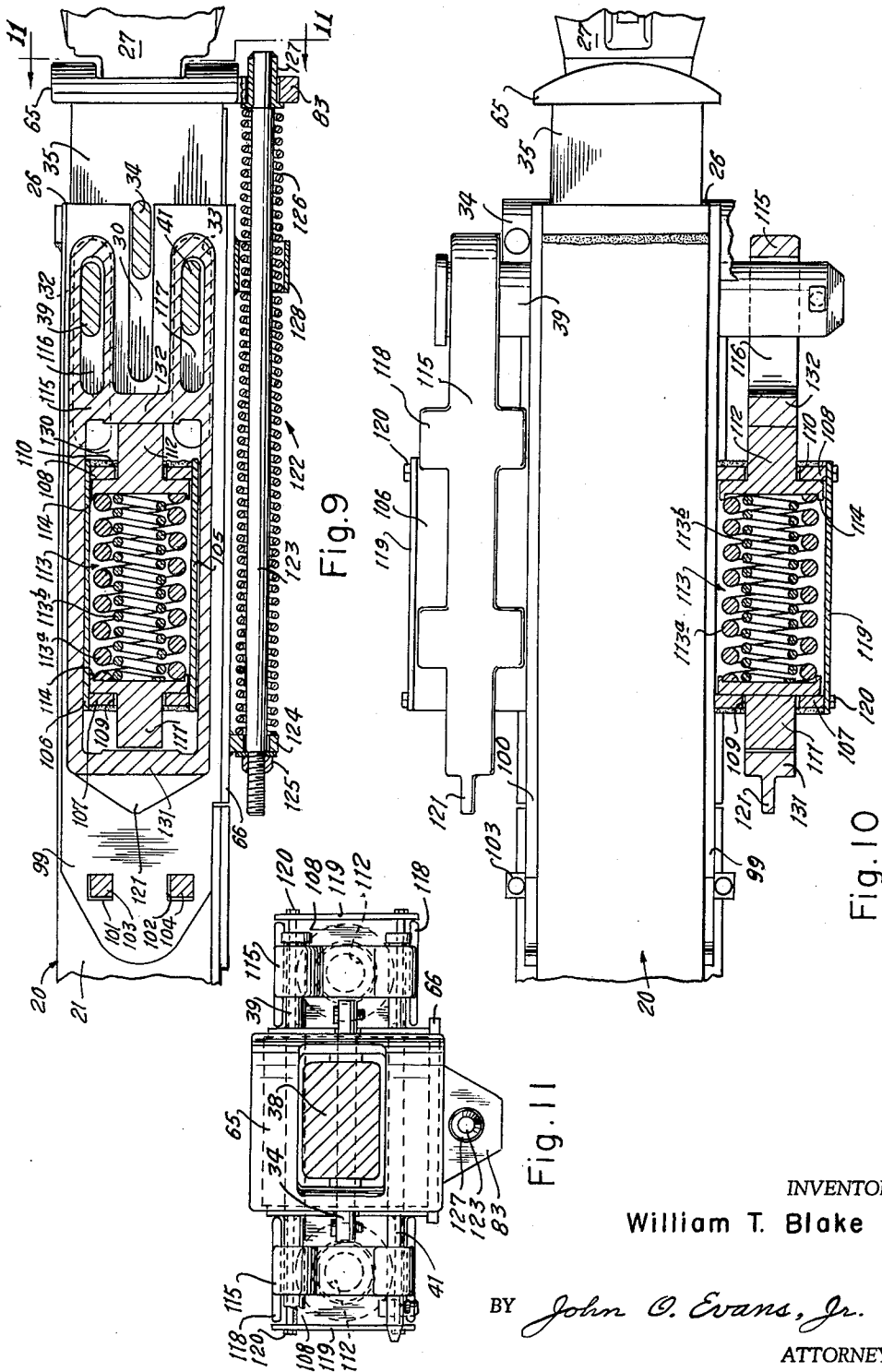
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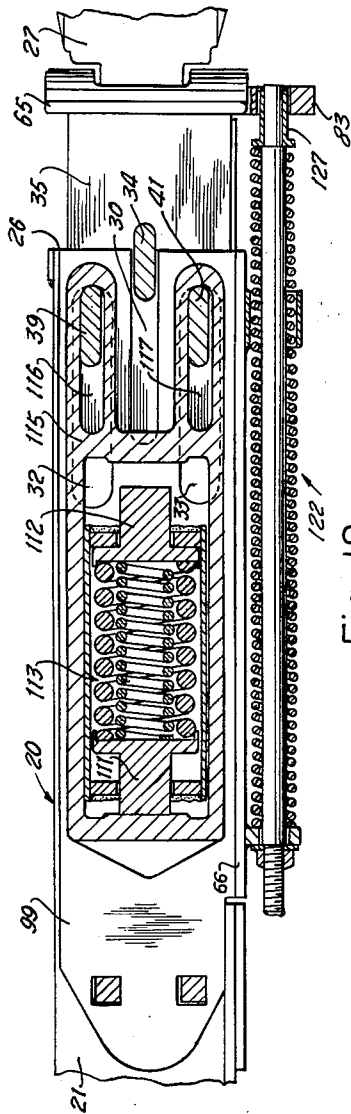


Fig. 12

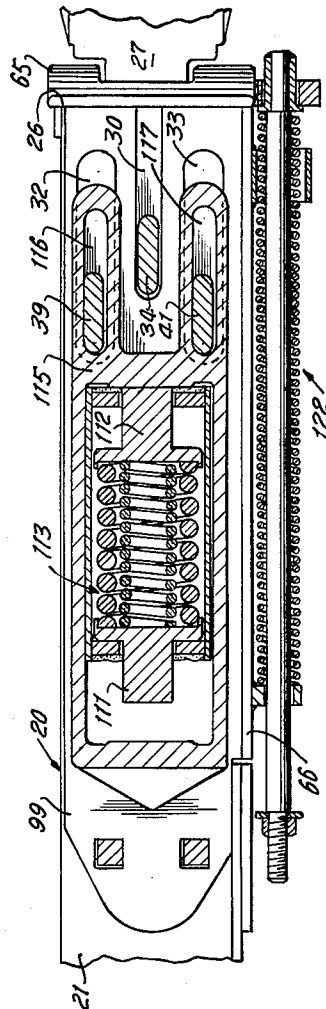


Fig. 13

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**HYDRAULIC AND RESILIENT CUSHIONED
RAILWAY CAR DRAFT ASSEMBLY**
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Filed Jan. 16, 1961, Ser. No. 83,021
10 Claims. (Cl. 213-8)

This invention relates to railway car draft assemblies, and more particularly to railway car draft assemblies utilizing combined hydraulic and resilient cushioning to absorb the shock forces encountered in the movement of railroad cars.

The railway industry is constantly seeking a solution to the problem of damage to rolling stock and to car lading resulting from the severe shocks to which railway cars are subjected in normal movement. Railway freight cars, and their contents in particular, are subject to severe impact forces when a train is made up in the freight yards by coupling free-rolling, individual freight cars into a stationary car or group of stationary cars. Additional shocks are imparted to the cars and their contents when a train is in motion due to the slack that exists between the couplers of each car. When a train is started into motion, each car is jerked by the car ahead and, upon braking a train to a stop, each car is bumped by the car behind it, thus imparting additional damaging shocks to the railway cars and their contents.

In my copending application Serial No. 41,586, filed July 8, 1960, for "Railway Car Draft Appliance," there is disclosed a draft appliance for railway cars especially adapted to be mounted in the end of the car's center sill which effectively cushions the impacts and shocks encountered in train operation.

The present invention relates to an improved railway draft appliance that may effectively, if desired, utilize portions of the draft appliance disclosed in my beforementioned copending application.

An object of the invention is to provide a draft appliance for railway cars adapted to reduce appreciably the impacts or shocks exerted on railway cars and their contents when such cars are made up into trains and the trains are moved upon the tracks.

Another object of the invention is to provide an improved hydraulically buffered draft appliance having a resilient cushion assembly cooperating therewith in a new way.

Another object is to provide such a draft appliance that is capable of being readily attached to the center sill of a conventional railway car.

An additional object of the invention is to provide an improved draft appliance having a cooperating resilient cushion assembly coupled to a hydraulic buffer mechanism in the railway car so that the buffer mechanism will function properly under all conditions of train operation and so that the buffer mechanism will be properly protected from undue stresses.

A particular object of the invention is to provide an improved draft appliance utilizing a combination of a double-acting hydraulic buffer mechanism and resilient cushion assemblies for absorbing the shock forces to which railway cars are subjected.

An important object of the invention is to provide additional cushioning means for railway cars equipped with double-acting hydraulic buffer mechanisms.

A further object of the invention is to provide a secondary shock absorbing assembly that may be conveniently attached to railway cars equipped with existing primary shock absorbing mechanisms.

The foregoing, and other aims, objects, and advantages of the invention as may appear hereinafter, are realized in a railway car having a center sill member affixed to

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the car and a sliding member longitudinally slidably mounted in the center sill member. A car coupler is attached to the sliding member. A double-acting hydraulic buffer mechanism has a fixed element and a moving element, one of the elements being attached to the center sill member, and the other of the elements being attached to the sliding member. Cooperating stop means on the center sill member and the sliding member permit longitudinal movement of the sliding member in the center sill member. Light-duty resilient means are provided, acting between the center sill member and the sliding member in at least one longitudinal direction, urging the sliding member to a neutral position between its limits of travel. Heavy-duty resilient means is mounted on one of the members. Lost motion coupler means couples the heavy-duty resilient means to the other of the members over a terminal portion of the total permitted movement of the sliding member, the coupler means uncoupling the heavy-duty resilient means from the other of the members over an intermediate portion of the total permitted movement of the sliding member.

The object relating to a secondary shock absorber assembly for railway cars is realized in an assembly including a box-like unitary structure having spaced apart bracket members forming the end walls thereof. The bracket members provide central openings therein. A spring compressor element abuts the inside wall of each of the brackets. Each spring compressor element has a reduced portion extending rearwardly therefrom through the opening in the bracket members. A helical compression spring is mounted in the structure between the compressor elements. A lost motion coupler yoke is provided having an opening therein fitting over the structure with opposite surfaces of the yoke abutting the outer ends of the compressor elements. The yoke provides a longitudinally extending slot in one end thereof for receiving a draft gear key.

In the drawings:

FIG. 1 is a plan view of one end of a railway car center sill having installed therein a draft appliance in accordance with the invention, a portion of the center sill being broken away to show internal structure;

FIG. 2 is an elevational view of the assembly shown in FIG. 1 with a portion of the center sill being broken away to show internal construction;

FIG. 2a is a sectional view along line 2a-2a of FIG. 2;

FIG. 2b is a bottom view on an enlarged scale, of the assembly shown in FIGS. 1 and 2;

FIG. 3 is a vertical, longitudinal sectional view, on an enlarged scale, taken along line 3-3 of FIG. 1;

FIG. 4 is an elevational view of the assembly, on the same scale as FIG. 3, showing portions of the secondary shock absorbing assembly in cross section;

FIG. 5 is an elevational view of a portion of the appliance showing the draft assembly in the full draft position;

FIG. 6 is an elevational view of a portion of the appliance showing the draft assembly in the full buff position;

FIG. 7 is a sectional view along line 7-7 of FIG. 4;

FIG. 8 is an enlarged sectional view along the line 8-8 of FIG. 1;

FIG. 9 is an elevational view of one end of a railway car center sill having installed thereon another form of draft appliance in accordance with the invention, certain parts being shown in section and the draft appliance being in neutral position;

FIG. 10 is a plan view of the assembly of FIG. 9;

FIG. 11 is a sectional view along line 11-11 of FIG. 9;

FIG. 12 is an elevational view similar to FIG. 9 showing the draft appliance in the full draft position; and

FIG. 13 is an elevational view similar to FIG. 9 showing the draft appliance in the full buff position.

Referring to the drawings, particularly to FIGS. 1 and 2 thereof, the railway car draft appliance of the present invention is shown as being installed at one end of a conventional railway car center sill 20. Since such a center sill is well known in the prior art, it will be understood that it provides the main support for the car body which is mounted on top thereof and that it, in turn, is supported on the usual bolsters and trucks, the wheels of which ride upon the track rails. The center sill 20 has longitudinal side walls 21 and 22 and a top plate 23. The center sill is open at the bottom and the side walls have outwardly extending bottom flanges 24 and 25. As is conventional, the end 26 of the center sill is open. It will be understood that the other end of the center sill, not shown, is similarly constructed and is also open.

The draft assembly of the present invention is attached to the center sill 20 adjacent the open end thereof, as can be seen in FIGS. 1, 2 and 3. A double-acting hydraulic buffer mechanism (designated generally 129 in FIG. 3) is contained within a housing or sliding member 35 that is longitudinally slidably mounted in the open end of the center sill 20. A car coupler 27 projects from the end of the housing and is connected thereto by a coupler key 34. A cross plate 66 extending across the bottom of the center sill 20 supports the housing 35 within the center sill. The rearwardly extending piston rod 67 of the hydraulic buffer mechanism is anchored to the center sill by anchor assembly 68. A secondary shock absorbing assembly 45 is mounted on the outside of each side wall of the center sill and engages the housing 35 through stop keys 39 and 41. The housing and the associated hydraulic buffer mechanism are urged to a neutral position by a return spring mechanism 64 mounted underneath cross plate 66.

The structure by which buff and draft forces are applied from the coupler 27 directly to the center sill will be described with reference to FIGS. 1 through 4 and 7. As can be seen in FIGS. 1 and 2, the side walls 21 and 22 of the center sill are strengthened by reinforcing plates 28 and 29 welded to the side walls. A central longitudinal slot 30 is cut through the reinforcing plate 28 and side wall 21, this slot being open, as shown at 31, through the end 26 of the center sill. Upper and lower longitudinal slots 32 and 33 are also cut through the reinforcing plate and side walls, these slots being closed at both ends. Corresponding slots are provided in the reinforcing plate 29 and center sill side wall 22 laterally opposite the aforementioned slots. A coupler key 34 extends through the central slots 30 and transversely through the housing or sliding member 35, as seen in FIG. 7. The coupler key 34 is snugly received in keyways 36 in the sides of the housing 35. The coupler key 34 passes with a fairly loose fit through a transverse slot 37 in the shank 38 of the coupler 27, as shown in FIG. 3, so that the coupler may pivot to a limited extent on the key.

An upper stop key 39 passes transversely through the housing 35 and through the upper longitudinal slots 32 in the side walls of the center sill. This key is loosely received in the slots and fits snugly in keyways 40 in the side walls of housing 35. A lower stop key 41, similar to the key 39, is similarly associated with the lower longitudinal slots 33 in the side walls of the center sill and with the housing 35. The keys 39 and 41 are prevented from moving transversely to any substantial extent by integrally formed shoulders 42 on one end, as shown in dotted outline in FIG. 4. Retainer pins 43 are inserted through holes provided in the opposite ends of the keys and retained therein by cotter keys 44. The coupler key 34 is held within its cooperating slots by similar retainer pins received in openings at each end thereof.

When buff forces are received by the coupler 27, they are transmitted to the housing 35 by contact between the inner end 80 of the coupler shank and a transverse partition 75 in the housing, as may be seen in FIG. 3. The stop keys 39 and 41 move rearwardly with the housing

in slots 32 and 33 and the coupler key 34 moves rearwardly in slot 30. If the impact forces exceed the combined cushioning capacity of the hydraulic buffer mechanism and the secondary shock absorbing assembly, the housing flange 65 contacts the reinforced end 26 of the center sill to transmit the unabsorbed force directly to the center sill 20. Contact is made between the housing flange and center sill end before the keys 34, 39 and 41 reach the rearward end of the slots 30, 32 and 33, respectively. Upon application of draft forces to the coupler, the coupler key 34 transmits the force to the housing 35. As the housing moves forward, the key 34 moves partially out of slot 30 through the open end 31 thereof. The stop keys 39 and 41 contact the forward ends of the slots 32 and 33 in the center sill side wall to apply the draft force directly to the center sill if the draft forces exceed the combined cushioning capacity of the hydraulic mechanism and the secondary cushion assembly.

The construction of the secondary shock absorbing assemblies, designated generally 45, will now be described with reference to FIGS. 1, 2, 2a, 4 and 8.

A secondary shock absorbing assembly 45 is fixed to each reinforcing plate 28 and 29 on the side walls 21 and 22 of center sill 20. Each assembly has a longitudinally extending lost motion coupler plate 46 which provides an upper slot 47 and a lower slot 48 positioned parallel to the upper slot 32 and lower slot 33 in the reinforcing plate and side wall of the center sill. The slots in each pickup plate loosely receive the respective stop keys 39 and 41 for limited longitudinal movement therein. The coupler plate slots 47 and 48 have a shorter longitudinal opening than the corresponding slots 32 and 33 in the reinforcing plate and center sill side wall, as can be seen in FIG. 2 and 4. Each coupler plate has a reinforcing shoulder member 49 formed adjacent to the forward portion of slots 47 and 48, as may be seen in FIGS. 1 and 2a, the shoulder members being open at the rear to permit the keys 39 and 41 to move in the slots 47 and 48. A generally rectangular recess 50 is provided in the coupler plate intermediate the upper and lower slots to permit access to the coupler key 34. Referring now to FIG. 4, the coupler plate provides an integrally formed, rearwardly extending shaft 51 which has a shoulder 52 adjacent its forward end. The shaft is cylindrical, as may be seen in FIG. 8, from the shoulder 52 to the rearward end thereof. A vertically extending forward bracket member 54 and a spaced apart rearward bracket member 55 are welded to a side plate 56, to a top plate 57 and to a bottom plate 58 to provide a rigid box-like bracket structure, as shown in FIGS. 4 and 8. The forward and rearward bracket members provide cylindrical openings therethrough freely receiving the shaft 51. The side plate 56 is fixed to the reinforcing plate 29 by welding or other suitable means. A cylindrical collar 59 is slidably received on shaft 51 and abuts the shoulder 52 thereon, and also abuts the inner face of bracket member 54. A similar collar 60 is received on the rear of the shaft and abuts the inner face of the rearward bracket member 55. A heavy-duty helical compression spring 61 is mounted around the shaft 51 between the collar members 59 and 60. A nut 62 and washer 63, which are freely received in the opening provided in the rear bracket member 55, abut the rear face of the cylindrical collar 60.

The draft assembly is equipped with a return spring mechanism designated generally 64, as shown in FIGS. 2, 2b and 6. The return spring mechanism 64 restores the housing 35 to a neutral position following the application of buff or draft forces to the coupler 27. Housing flange 65 has a depending ear 83, providing a hole therethrough, in which is received a tie rod 84. The tie rod has a collar 85 abutting the inside of the ear 83 and is fixed to the ear by nut 86 received on the threaded end of the tie rod. Referring now specifically to FIG. 2b, it can be seen that the tie rod 84 passes freely through

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a hole 87 in a bracket 88, which is welded or otherwise suitably secured to the bottom of a cross plate 66. The rear end of the tie rod is slidably received in a hole 89 in a yoke bar 90. A nut 91, threaded on the inner end of the tie rod, bears against the rear surface of yoke bar 90.

The yoke bar is slidable on a pair of guide rods 92 and 93 fixed at their front ends to the bracket 88 and having nuts 94 and 95, respectively, threaded to the rear end of the guide rods. Helical springs 96 and 97 surround the guide rods and are compressed between bracket 88 and yoke bar 90. A longer compression spring 98 surrounds tie rod 84 and is compressed between collar 85 and the front face of the yoke bar 90. This spring 98 passes freely through the hole 87 in bracket 88.

In the full draft position, as seen in FIG. 2b, the short springs 96 and 97 are under compression and tend to move the yoke bar 90 rearwardly into abutment with the nuts 94 and 95 to restore the housing 35 to the neutral position seen in FIG. 2. In the full buff position, as seen in FIG. 6, the tie rod 84 moves to a position wherein the nut 91 is spaced rearwardly from the yoke bar and the long spring 98 is under compression between the collar 85 and the yoke bar 90. When the buff forces are removed from the coupler, the long spring 98 acts to restore the housing to the neutral position. The return spring mechanism 64 is conveniently located beneath the fixed center sill of the car for easy access in case of needed adjustment or repair.

The springs 96, 97 and 98 of the return mechanism 64 are relatively light-duty compression springs as compared to the heavy-duty cushion assembly spring 61. It is only necessary that the return springs have sufficient strength to move the housing 35 and its associated hydraulic mechanism to the neutral position after the draft assembly absorbs buff or draft forces.

Between the forward and rearward limits of movement of the housing 35, housing motion is cushioned by a double-acting hydraulic mechanism. Referring to FIG. 3, the hydraulic mechanism shown has a piston rod 67 anchored to the center sill on one end by an anchor assembly, designated generally 68. The piston rod carries a piston 69 slidable in a working cylinder 70. The ends of the working cylinder are closed by a front cylinder head 71 and a rear cylinder head 72. The forward end of the piston rod is slidably received in a central opening provided in the front cylinder head and the rear end of the piston rod is slidably received in a like opening provided in the rear cylinder head. The working cylinder is mounted in a sealed chamber 73 in the housing 35. The chamber is closed at the rear by a rear closure plate 74 which provides an opening for the piston rod and is welded to the housing 35. The front end of the chamber is closed by a transverse partition 75 forming a part of the housing. A flexible bellows 76 protects the piston rod from external dust and moisture. A compensating device 77 compensates for volume changes occasioned by movement of the piston rod into and out of the chamber and by temperature changes. The chamber 73 and the working cylinder 70 are completely filled with a suitable hydraulic fluid.

The foregoing brief description of the double-acting hydraulic mechanism is believed sufficient to acquaint those skilled in the art with the structure of the mechanism. Reference is made to the aforementioned copending application for a more complete disclosure of the hydraulic mechanism.

The operation of the draft appliance of the present invention will now be described with reference particularly to FIGS. 2, 3, 5 and 6. In making up a train of railway cars, the cars are coupled together by moving a car into coupling engagement with a stationary car. The moving car may strike the stationary car at speeds as low as $\frac{1}{2}$ or 1 mile per hour or as high as 10 or 12 miles per hour. The force of impact, unless adequate-

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ly cushioned, may cause damage to the cars and to their lading. Consider a stationary car equipped with the draft appliance of the present invention having the several parts of the appliance in the neutral position as shown in FIGS. 2 and 3. When a moving car approaching from the right strikes the coupler 27, the coupler shank 38 is moved rearwardly until the inner end 80 of the coupler shank strikes the transverse partition 75 of the housing 35. Rearward movement is imparted to the housing 35 which slides within the center sill 20, compressing the return spring mechanism 64. The piston 69, being anchored through piston rod 67 and anchor structure 68 to the center sill 20, remains relatively stationary and the housing 35 and working cylinder move rearwardly with respect to the piston. Hydraulic fluid within the working cylinder in front of the piston is forced out through the fixed openings 78 in the cylinder which are forward of the piston, thereby absorbing energy and cushioning the rearward movement of the housing. Hydraulic fluid returns to the working cylinder behind the piston through openings 78 as they are uncovered by the piston and also through the inwardly opening check valve 79 in the rear cylinder head 72. The decrease in effective internal volume of the hydraulic system due to piston displacement thereinto is compensated by the compensating device 77 which contracts in volume and prevents any substantial increase in pressure in the sealed chamber 73 surrounding the working cylinder.

At low coupling speeds, when the impact against the coupler 27 is not great, the fixed openings 78 provide sufficient throttling to absorb the energy. At higher coupling impacts, the ball check valve 81 in the piston 69 opens to afford passage for some of the hydraulic fluid through the piston from front to rear, thus relieving dangerously high pressures in the working cylinder and, at the same time, absorbing additional impact energy. The small fixed opening 82 in the piston 69 permits a small amount of fluid to flow through the piston.

As housing 35 moves rearwardly into the center sill 20, stop keys 39 and 41 move rearwardly in slots 32, 33 and 47, 48 provided in the center sill side wall 21 and reinforcing plate 28 and the coupler plate 46 respectively, as can be seen in FIG. 2. If the buff forces imparted to the coupler are of moderate intensity, the hydraulic mechanism will arrest the rearward movement of the housing before the stop keys 39 and 41 engage the rearward ends of slots 47 and 48 in the coupler plate 46. A higher impact force on the coupler will move the stop keys into engagement with the rearward slot ends of the coupler plate forcing the coupler plate rearwardly and causing the shoulder 52 of the shaft 51 to force the collar 59 against compression spring 61, as shown in FIG. 6. Thus, the secondary cushion spring assembly 45 provides additional shock absorbing means when the forces applied are greater than can be absorbed by the hydraulic mechanism. Under extremely heavy buff forces that exceed the combined shock absorbing capacity of the hydraulic mechanism and the secondary spring cushion assembly, the housing flange 65 contacts the reinforced end 26 of center sill 20 to transmit the unabsorbed force directly to the center sill.

After the moving and stationary cars have been coupled, the return spring mechanism 64 returns the housing to the neutral position of FIG. 2.

When a train of cars has been made up and the train is started, draft forces on the coupler 27 urge the housing to move from the neutral position of FIG. 2 to the fully extended position of FIG. 5. Energy is absorbed largely by the throttling of the fluid through the fixed opening 82 in the piston and through the rear-most of the fixed openings 78 in the side wall of the working cylinder 70. It will be understood that the check valve 79 in the rear cylinder head 72 is closed and that fluid is returned to the working cylinder in front of the piston through fixed openings 78 and, if

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required, through the inwardly opening check valve 79 in the front cylinder head 71. The compensating unit 77 will expand, as required by withdrawal of the piston from the housing, to prevent the formation of a vacuum in the hydraulic system.

In the neutral position, as shown in FIGS. 1, 2 and 4, it can be seen that the forward edge of the upper and lower stop keys 39, 41 are positioned very close to the forward end of slots 47 and 48, and the reinforcing shoulder 49 of the lost motion coupler plate 46. Thus, the spring cushion assembly 45 is almost immediately engaged upon the application of draft forces to the coupler 27. As the stop keys move forward with the housing 35, the lost motion coupler plate shaft 51 moves forward through the openings in the bracket members 54 and 55, as shown in FIG. 5. The nut 62 and washer 63 affixed to the end of shaft 51 pick up collar 60 which, in turn, compresses spring 61, thereby transmitting a portion of the draft forces to compression spring 61. Under normal application of draft forces, the coacting hydraulic mechanism and secondary shock absorbing assembly are sufficient to absorb the full draft force. In very rare instances, where the draft forces are in excess of the capacity of the combined cushioning assemblies, the forward edge of stop keys 39, 41 will strike the ends of slots 32, 33 to transmit the unabsorbed force directly to the center sill 20. Upon the removal of draft forces from the coupler, the secondary shock absorbing assembly 45 will cooperate with the return spring mechanism 64 to return the draft assembly to the neutral position of FIG. 1.

It is contemplated that the length of the slots 47 and 48 in the lost motion coupler plate 46 may be varied over a considerable range to provide any desired degree of co-operative cushioning by the hydraulic mechanism and the secondary cushion assembly 45. Coil springs of very high compression strength are preferably used for the spring 61 to prevent the housing 35 and the center sill 20 from making solid contact except in instances involving extremely high bluff or draft forces. Standard railway truck coil springs may conveniently be used for coil spring 61.

In a specific exemplary construction of the present draft assembly utilizing the hereinbefore described form of secondary cushioning assembly, the distance between the reinforced end 26 of the center sill and the rearward face of the housing flange is 7 inches when the draft assembly is in the neutral position shown in FIG. 2. The slots 47 and 48 are dimensioned to permit the rearward edges of the stop keys 39 and 41 to move 6 inches to the rear in the slots before contacting the coupler plate to engage the helical spring 61. Thus, the first 6 inches of rearward travel of the housing 35 is cushioned mainly by the hydraulic mechanism. The brackets and coupler plate shafts are positioned to permit a one inch rearward compression of the helical spring 61 before the housing flange 65 engages the reinforced end 26 of the center sill. Over the last one inch of travel, the housing is cushioned primarily by the combined resistance of the hydraulic mechanism and the two helical springs 61, with a minor contribution from the return spring assembly 64. The coil spring used on each side of the center sill in the cushion spring assemblies is the 5½ inch diameter spring described in the specification sheet of Recommended Practice of the Association of American Railroads for Freight Car Truck Springs, Total Travel 2½ Inches, Alternate Standard, adopted 1947. The helical truck spring is compressed 1 inch when placed between the collars 59 and 60 inside the brackets. When under the 1 inch of additional compression in the full buff position, the two sets of helical truck springs exert a forward acting force of 16,356 lbs. The return spring 98 contributes a forward acting force of 2,757 lbs., for a total forward acting force of 19,113 lbs.

The draft assembly is dimensioned to permit a 1 inch maximum forward movement of the housing from the

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neutral position when draft force is applied to the coupler. The brackets and a coupled plate shafts are positioned to permit a 1 inch forward compression of the helical springs 61 before the stop keys engage the forward ends of the slots in the reinforced side walls of the center sill. The two sets of helical truck springs exert a rearward acting force of 16,356 lbs. The two draft return springs 96 and 97 are also compressed 1 inch and contribute a rearward acting force of 4,734 lbs., for a total rearward acting force of 21,090 lbs.

It can be seen that the draft assembly of the present invention overcomes one of the major disadvantages of the resilient cushion type of draft gear in that no snap-back occurs after the draft assembly is compressed by buff or draft forces. The secondary shock absorbing assemblies utilized in the present draft assembly are always under the control of the double-acting hydraulic buffer mechanism. The damping action exerted by the hydraulic mechanism permits a soft, controlled return of the compressed springs to their neutral position without the usual violent rebound common to resilient cushion draft gear.

Other forms of cushion means, such as leaf springs or rubber shock absorbers, are contemplated for use in the cushion assembly 45.

A modified form of draft appliance, including a different form of secondary shock absorbing assembly, will now be described with reference to FIGS. 9 through 13.

It can be seen in FIGS. 9 and 10 that much longer side reinforcing plates 99 and 100 are fixed to each side of the fixed center sill 20 than are used in the previously described form of the invention. Each of the reinforcing plates provides two vertically spaced openings 101 and 102 to receive keys 103 and 104 which retain the piston rod anchor assembly within the center sill 20.

Referring to FIG. 9, a holder for the compression spring is formed by welding a bottom plate 105, a top plate 106, a rearward bracket 107 and a forward bracket 108 into box-like structure. A separate box-like structure is welded to each of the side reinforcing plates 99 and 100. The rearward and forward bracket members provide central cylindrical openings 109 and 110, respectively. These openings receive the rearward and forward cylindrical spring compressor members 111 and 112, respectively. A double helical coil spring 113 is mounted in compression between the spring compressors and is retained therebetween by means of annular shoulders 114 provided on the peripheries of each compressor. The double helical coil spring includes a heavy-duty outer coil 113a and a lighter-duty inner coil 113b.

A lost motion coupler yoke member 115 provides a rectangular cutout section 130 which permits the yoke member to be loosely fitted over the spring box structure for longitudinal sliding movement thereon. The yoke member has a rearward end wall 131 and a forward end wall 132 which substantially abut the outer ends of the rearward compressor 111 and the forward compressor 112, respectively. Each yoke member provides an upper slot 116 and a lower slot 117 positioned parallel to the slots 32, 33 in the side wall and reinforcing plate. The slots 116 and 117 loosely receive the respective stop keys 39 and 41 for limited longitudinal movement therein. As in the case of the previously described shock absorbing assembly, the present slots are longitudinally shorter than the corresponding slots in the reinforcing plate and side wall. A generally rectangular opening is provided in the forward section of the yoke member between the slotted portions, to permit access to the coupler key 34. The yoke member has a triangular reinforcing fin 121 on the rear portion to strengthen this part of the yoke.

Referring now to FIGS. 10 and 11, the yoke members are provided with transverse, rectangular spacer plates 118 which serve to center the yoke members over the spring compressors. The spacer plates are retained in a loose sliding position between the reinforcing plates on the center sill and upper and lower projecting edge portions

of each spring box cover plate 119. The cover plates are removably attached to the spring boxes by bolts 120. It is preferable to pack the interior of the spring boxes with a heavy grease to lubricate the spring compressors and to protect the springs from corrosion.

The lost motion coupler yoke member 115 is preferably made from steel by casting, but it can be fabricated by milling heavy steel plate with the spacer plates attached by welding.

A modified return spring mechanism, designated generally 122, is embodied in the assembly of FIGS. 9 to 13. It will be seen in FIG. 9 that the mechanism includes a tie rod 123 slidably mounted in a fixed bracket 124 which is welded to the underside of a cross plate 66. A nut 125 is threaded on the rear end of the tie rod and abuts the rear surface of the bracket 124. A return spring 126 is coiled around the tie rod and placed under compression between the bracket 124 and a collar member 127 that is welded or threaded on the forward end of the tie rod. The tie rod and coil spring are slidably supported within a support sleeve 128 that is welded to the cross plate 66 adjacent the open end of the center sill. The collar member 127 abuts the ear 83 on the housing flange 65, and has a turned-down forward section which is slidably received in an opening in the ear 83. The modified form of the return spring mechanism does not have any draft return springs.

In operation, the modified form of secondary shock absorbing assembly functions in a manner similar to the first described assembly. On buff impact, the housing 35 moves rearwardly into the fixed center sill 20, the keys 39 and 41 move freely in the slots in the center sill side wall, the reinforcing plate and the slots 116 and 117 in the yoke member, as can be seen in FIG. 9. If the impact is moderate, the hydraulic mechanism will arrest the rearward movement of the housing. If a heavy buff force is received, the housing will continue its rearward movement until stop keys 39 and 41 engage the yoke member at the rearward end of slots 116 and 117. The forward end wall 132 of the yoke member contacts the forward spring compressor 112 and forces the compressor rearwardly, compressing the double helical spring 113 against the rearward compressor 111, as is clearly shown in FIG. 13. Under extremely high buff forces, the housing flange 65 contacts the reinforced end 26 of the center sill to transmit any unabsorbed force directly to the fixed center sill 20 before either the hydraulic or spring cushion mechanism goes solid.

In the neutral position, as shown in FIGS. 9, 10 and 11, the forward edge of stop keys 39 and 41 are positioned very close to the forward end of slots 116 and 117 in the yoke member. Upon application of a draft force to the coupler, the rearward end wall 131 of the yoke member almost immediately engages the heavy-duty helical spring 113 through the rear spring compressor 111 to cushion the forward motion of the housing 35 in cooperation with the hydraulic mechanism. If an extremely heavy draft force is applied to the coupler, the spring 113 will be compressed until the forward edges of stop keys 39 and 41 strike the ends of the slots in the reinforcing plates and center sill side walls to transmit the unabsorbed draft force directly to center sill 20. The draft assembly is shown in this maximum draft position in FIG. 12.

When the draft force is removed from the coupler, the double helical springs 113, acting through the yoke members 115, restores the housing to the neutral position of FIG. 9. As shown in FIG. 12, the housing flange ear 83 moves out of abutting engagement with the collar 127 on draft pull-out. In the full buff position, shown in FIG. 13, the return spring is under compression and upon removal of the buff force will return the housing to the neutral position. The forward return of the housing is assisted by the double helical spring 113 until the forward spring compressor contacts the forward bracket and then the return spring mechanism 122 acts

alone to move the housing forward to the neutral position.

In one specific exemplary construction of the present draft assembly utilizing the modified form of secondary cushioning assembly, the distance between the reinforced end 26 of the center sill and the rearward face of the housing flange 65 is 8 inches when the draft assembly is in the neutral position shown in FIG. 9. The slots 116 and 117 are dimensioned to permit the rearward edges of stop keys 39 and 41 to move 5 inches to the rear in the slots before contacting the yoke member to engage the helical spring 113. Thus, the first 5 inches of rearward travel of the housing 35 is cushioned solely by the hydraulic mechanism. The spring boxes and yoke members are positioned to permit a 3 inch rearward compression of the helical springs 113 before the housing flange 65 engages the reinforced end 26 of the center sill. Over these last 3 inches of travel, the housing is cushioned primarily by the combined resistance of the hydraulic mechanism and the two double helical coil springs, with a minor contribution from the return spring 126. The coil spring used on each side of the center sill in the spring cushion assemblies is a helical truck spring for 1,000 H.P. diesel switching locomotives, meeting the specification as set out in Recommended Practice of the Association of American Railroads, adopted 1949. The helical truck spring is initially compressed 1 inch when placed between the spring compressors in the spring box with the compressors in the positions shown in FIG. 9. When under 3 inches of additional compression in the full buff position, the two sets of helical truck springs exert a total forwardly acting force of 50,450 lbs. The single return spring 126 contributes a forwardly acting force of 3,285 lbs. for a total forwardly acting force of 53,735 lbs.

The draft assembly is dimensioned to permit a 2 inch maximum forward movement of the housing from the neutral position when draft force is applied to the coupler. The yoke and compression members are constructed to permit a 2 inch forward compression of the two sets of helical truck springs before the stop keys engage the forward ends of the slots in the reinforced side walls of the center sill. The two sets of helical truck springs exert a rearwardly acting force of 37,648 lbs. when under the additional 2 inch compression. As explained before, no cushioning force is obtained from the return spring assembly in the modified arrangement when the draft assembly is forward of the neutral position.

In addition to the herein described helical springs, it is contemplated that the yoke type cushion assembly may be readily adapted to use other cushion means, such as leaf spring or rubber shock absorbers.

The draft appliance of the present invention provides an efficient cushioning mechanism for all buff and draft shocks encountered in the make up and operation of a train of railway cars. The cooperation of the secondary cushion assembly with the hydraulic shock absorbing mechanism provides numerous benefits not attained by either type of shock absorbing device acting alone. As stated hereinbefore, the present draft assembly overcomes the objectionable rebound which is common to the resilient cushion type of draft appliances. The hydraulic mechanism dampens the recoil of the springs and permits a gentle restoration of the draft assembly to its neutral position. The secondary shock absorbing assembly functions over the terminal portion of the stroke of the hydraulic mechanism and provides a high resistance force to prevent building up high hydraulic pressure within the cylinder of the hydraulic mechanism. Thus, the hydraulic mechanism will have a longer life expectancy with less maintenance being required. The lost motion coupler utilized in the present draft assembly allows the hydraulic mechanism to have full control for absorbing buff impacts of moderate intensity and couples the secondary cushion assemblies to the hydraulic mechanism only when

heavy buff forces are encountered. An advantage of the secondary shock absorbing assembly of the present invention is its simple construction and the ease with which it may be installed on existing railway cars without extensive modifications to the cars. Any degree of cooperation between the secondary shock absorbing assembly and the hydraulic mechanism may be obtained by varying the length of the slots in the lost motion coupler. Further advantages may be obtained by varying the strength of the helical springs utilized in the secondary shock absorbing assemblies to suit the particular service for which the railway car is to be used. The present draft assembly can be readily modified to provide secondary shock absorbers which function to absorb shocks received from one direction instead of both directions. The secondary shock absorbers may be modified to cushion buff forces alone by providing open forward ends in the lost motion coupler slots so that the stop keys do not engage the lost motion coupler upon the application of draft forces to the car coupler. If it is desired to utilize the secondary shock absorbers only when draft forces are applied to the draft assembly, the slots in the lost motion coupler may be extended to the rear so that no contact is made between the stop keys and the rearward end of the slots. The modified form of the return spring assembly has the advantage of eliminating two springs and other accessory parts from the previously used form of the return spring assembly.

The utilization of the disclosed cushion assembly in a draft appliance employing a primary hydraulic shock absorber greatly improves the ability of the draft appliance to absorb severe shocks even when the assembly is under an existing draft or buff condition. For example, a group of cars having hydraulic draft gears is coupled to an engine and the train is moved rearwardly with sufficient force to cause the hydraulic shock absorbers of all the cars to reach their limits of travel and the cars to be in a state of relatively solid engagement. If the train continues its rearward movement and couples into a standing car or group of cars, the coupling impact will impose a severe shock force to the solidly engaged forward cars. Consider the same situation with the moving cars equipped with the draft assembly of the present invention, including the herein disclosed secondary shock absorbing assembly. When the engine couples into the first set of cars, the shock will be initially absorbed by the hydraulic mechanism and then, additionally, by the secondary cushion mechanisms if the coupling force is severe enough. The secondary cushion assemblies will store some of the impact energy in the cushion springs and, immediately after contact, this energy will be returned by the cushion springs to urge the draft assemblies to a position in which the hydraulic mechanism of each car is capable of absorbing additional impact shock. Then, when the train impacts the standing car or group of cars, the draft assemblies of the moving cars are not in the solid condition and can absorb the impact forces. It can be readily seen that the secondary shock absorbing assemblies urge the draft assembly of the present invention to positions to absorb shock forces regardless of the direction from which these forces are received or the rapidity with which the shock forces occur.

The foregoing disclosure and description of the invention is illustrative and explanatory thereof and, in the light thereof, other modifications will be apparent to those skilled in the art. Therefore, the present invention is to be limited only by the scope of the appended claims.

I claim:

1. In a railway car having a center sill member affixed to the car, a draft assembly comprising: a sliding member longitudinally slidably mounted in said center sill member; a car coupler attached to said sliding member; a double-acting hydraulic buffer mechanism having a fixed element and a moving element, one of said elements being attached to the center sill member and the other of said elements

being attached to said sliding member; cooperating stop means on said center sill member and said sliding member permitting limited longitudinal movement of said sliding member in said center sill member; light-duty resilient means acting between said center sill member and said sliding member in at least one longitudinal direction urging said sliding member to a neutral position between its limits of travel; heavy-duty resilient means mounted on one of said members; and lost motion coupler means coupling said heavy-duty resilient means to the other of said members over a terminal portion of the total permitted movement of said sliding member, said lost motion coupler means uncoupling said heavy-duty resilient means from said other of said members over an intermediate portion of the total permitted movement of said sliding member.

2. In a railway car having a center sill member affixed to the car, a draft assembly comprising: a sliding member longitudinally slidably mounted in said center sill member; a car coupler attached to said sliding member; a double-acting hydraulic buffer mechanism having a fixed element attached to one of said members and a moving element attached to the other of said members; cooperating stop means on said members permitting limited longitudinal movement between the elements of said hydraulic mechanism; light-duty resilient means acting in at least one longitudinal direction to urge said sliding member to a neutral position between the limits of travel of the elements of said hydraulic mechanism; heavy-duty resilient means mounted on said fixed center sill member; and lost motion coupler means coupling said heavy-duty resilient means to said sliding member over a single terminal portion of the total permitted movement of said sliding member, said lost motion coupler means uncoupling said heavy-duty resilient means from said sliding member over the remaining portion of the total permitted movement of said sliding member.

3. In a railway car having a center sill member affixed to the car, a draft assembly comprising: a sliding member longitudinally slidably mounted in said center sill member; a car coupler attached to said sliding member; a double-acting hydraulic buffer mechanism having a fixed element attached to one of said members and a moving element attached to the other of said members; cooperating stop means on said members permitting limited longitudinal movement between the elements of said hydraulic mechanism; light-duty resilient means acting in at least one longitudinal direction to urge said sliding member to a neutral position between the limits of travel of the elements of said hydraulic mechanism; heavy-duty resilient means mounted on said fixed center sill member; and lost motion coupler means coupling said heavy-duty resilient means to said sliding member over both of the terminal portions of the total permitted longitudinal movement of said sliding member, said lost motion coupler means uncoupling said heavy-duty resilient means from said sliding member over an intermediate portion of the total permitted movement of said sliding member.

4. In a railway car having a center sill member affixed to the car, a draft assembly comprising: a housing supported and longitudinally slidable in said center sill member; a car coupler attached to said housing; a double-acting hydraulic buffer mechanism mounted within said housing and having a piston rod extending rearwardly therefrom; means anchoring the rearward end of said piston rod to said fixed center sill member; cooperating stop means on said center sill member and said housing permitting limited longitudinal movement of said housing in said center sill member; light-duty resilient means coupled to said fixed center sill member and engaging said housing, acting in at least one longitudinal direction to urge said housing to a neutral position between the limits of movement of said housing; heavy-duty resilient means mounted on said fixed center sill member; and lost motion coupler means coupling said heavy-duty re-

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silient means to said housing over the terminal portions of the total permitted longitudinal movement of said housing, said lost motion coupler means uncoupling said heavy-duty resilient means from said housing over an intermediate portion of the total permitted movement of said housing.

5. In the combination defined in claim 4, wherein the said heavy-duty resilient means comprises a helical spring.

6. In a railway car having a center sill member affixed to the car, a draft assembly comprising: a housing supported and longitudinally slidable in said center sill member; a car coupler attached to said housing; a double-acting hydraulic buffer mechanism mounted within said housing and having a piston rod extending rearwardly therefrom; means anchoring the rearward end of said piston rod to said fixed center sill member; cooperating stop means carried by said fixed center sill member and by said housing limiting rearward movement of said housing in said center sill member; said center sill member providing opposed longitudinally extending slot means therein and said housing providing narrower opposed slot means aligned with the slot means in said center sill member; a key extending through the aligned slot means in said housing and said center sill member, said key limiting forward movement of said housing in said center sill member by abutment with the forward ends of the slot means in said center sill member; heavy-duty resilient means mounted on said fixed center sill member; a lost motion coupler member engaging said heavy-duty resilient means, said coupler member providing a longitudinally extending slot receiving said key, said slot being shorter than the slots in said fixed center sill member and longer than the slots in said housing, to engage said heavy-duty resilient means with said housing through said key only near either end of the limit of movement of said housing in said center sill member; and light-duty resilient means coupled to said fixed center sill member and engaging said housing, acting in at least one longitudinal direction to urge said housing to a neutral position between the limits of movement of said housing.

7. In a railway car having a center sill member affixed to the car, a draft assembly comprising: a housing supported and longitudinally slidable in said center sill member; a car coupler attached to said housing; a double-acting hydraulic buffer mechanism mounted within said housing and having a piston rod extending rearwardly therefrom; means anchoring the rearward end of said piston rod to said fixed center sill member; cooperating stop means carried by said fixed center sill member and by said housing limiting rearward movement of said housing in said center sill member; said center sill member providing upper opposed and lower opposed longitudinally extending slot means therein and said housing providing upper and lower opposed slot means aligned with and shorter than the slot means in said center sill member; a key extending through each of the upper and lower aligned slot means in said housing and center sill member limiting forward movement of said housing by abutment with the forward ends of said slot means in said center sill member; heavy-duty resilient means mounted on said fixed center sill member; a lost motion coupler member attached to said heavy-duty resilient means, said coupler member providing a pair of longitudinally extending slots therein receiving said keys, said slots being shorter than the slots in said fixed center sill member and longer than the slots in said housing, to engage said heavy-duty resilient means with said housing through said keys only near either end of the limit of movement of said housing in said center sill member; and light-duty resilient means coupled to said fixed center sill member and engaging said housing, acting in at least one

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longitudinal direction to urge said housing to a neutral position between the limits of movement of said housing.

8. In a railway car having a center sill member affixed to the car, a draft assembly comprising: a housing supported and longitudinally slidable in said center sill member; a car coupler attached to said housing; a double-acting hydraulic buffer mechanism mounted within said housing and having a piston rod extending rearwardly therefrom; means anchoring the rearward end of said piston rod to said fixed center sill member; cooperating stop means carried by said fixed center sill member and by said housing limiting rearward movement of said housing in said center sill member; said center sill member providing upper opposed and lower opposed longitudinally extending slot means therein and said housing providing shorter upper and lower opposed slot means aligned with the slot means in said center sill member; a key extending through each of the upper and lower aligned slot means in said housing and center sill member limiting forward movement of said housing by abutment with the forward ends of said slot means in said center sill; a pair of heavy-duty coil springs, one mounted on each exterior side wall of said fixed center sill rearwardly of said keys; a pair of lost motion coupler members, one engaging each of said heavy-duty coil springs, each said coupler member providing a pair of longitudinally extending slots receiving the ends of said keys, said slots being shorter than the slots in said fixed center sill and longer than the slots in said housing, to couple said heavy-duty coil spring means with said housing through said keys only near either end of the limit of movement of said housing in said center sill member; and light-duty spring means coupled to said fixed center sill member and engaging said housing, acting in at least one longitudinal direction to urge said housing to a neutral position between the limits of movement of said housing.

9. A secondary shock absorbing assembly for railway cars comprising: a box-like unitary structure having spaced apart end walls serving as bracket members, said bracket members providing central openings therein; a collar member abutting the inside wall of each of said bracket members, each of said collar members providing a central opening therein aligned with the opening provided in said bracket members; a helical compression spring mounted in said structure between said collar members; a lost motion coupler plate having a shaft extending longitudinally therefrom through the aligned openings in said bracket and collar members, said coupler plate providing a longitudinally extending slot therein for receiving a draft gear key; and engaging means provided on said shaft for engaging each of said collar members to compress said spring upon longitudinal movement of said coupler plate.

10. A secondary shock absorbing assembly for railway cars comprising: a box-like unitary structure having spaced apart end walls serving as bracket members, said bracket members providing central openings therein; a spring compressor member abutting the inside wall of each of said bracket members, said spring compressors having a reduced portion extending rearwardly therefrom through the openings provided in said bracket members; a helical compression spring mounted in said structure between said compressor members; a lost motion coupler yoke having a cutout section therein fitting loosely over said structure with the end walls of said yoke substantially abutting the outer ends of said compressor members, and said yoke providing a longitudinally extending slot in one end thereof for receiving a draft gear key.

No references cited.