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F. E. EDWARDS ET AL

2,816,670

HYDRAULIC DRAFT GEAR

Filed Feb. 15, 1954

3 Sheets-Sheet 1

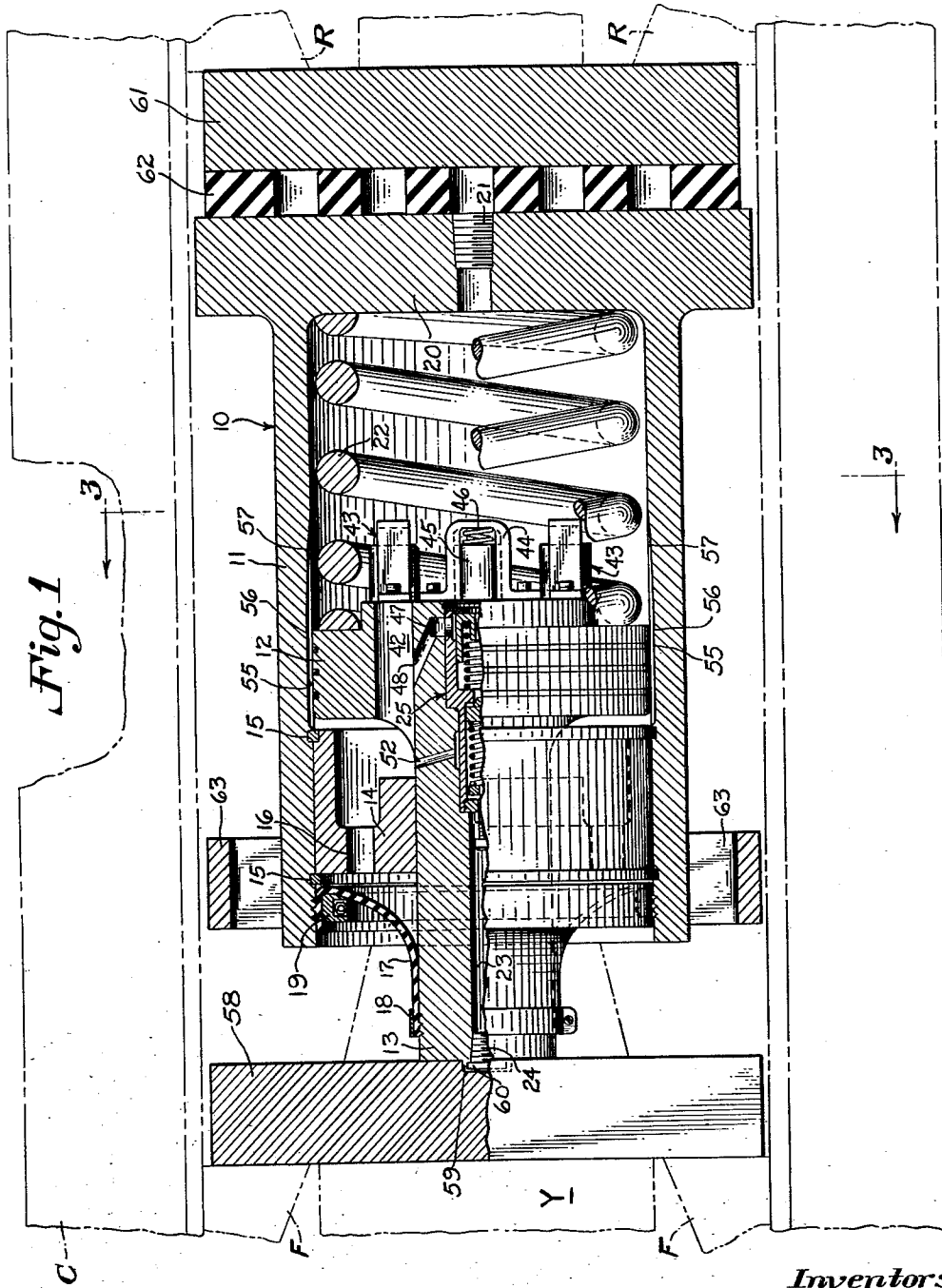


Fig. 1

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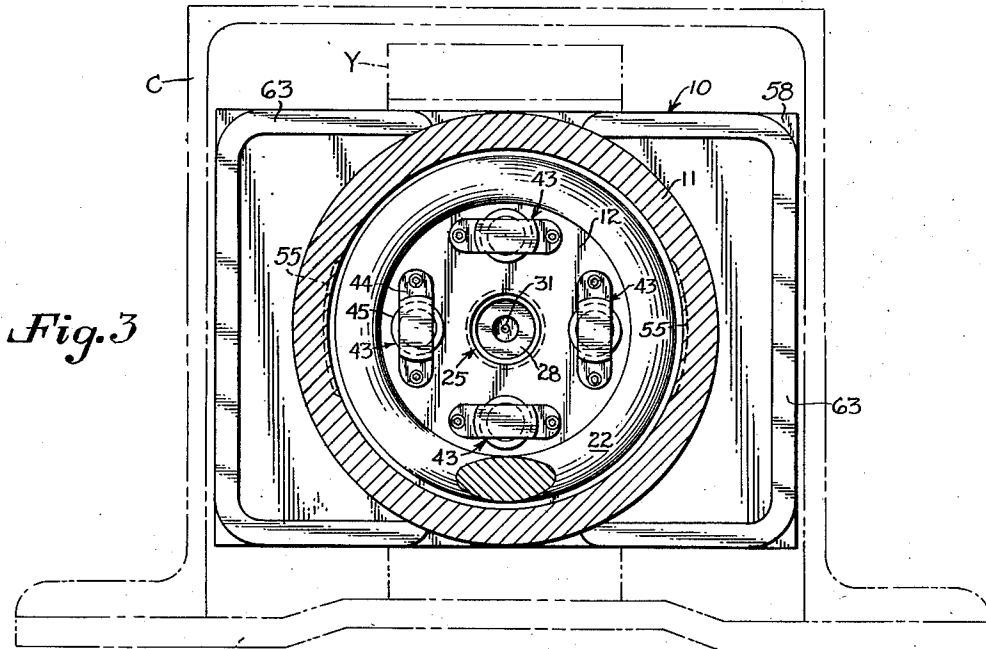


Fig. 3

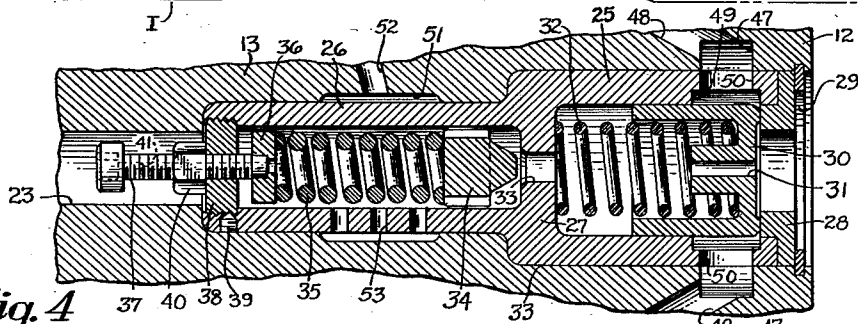


Fig. 4

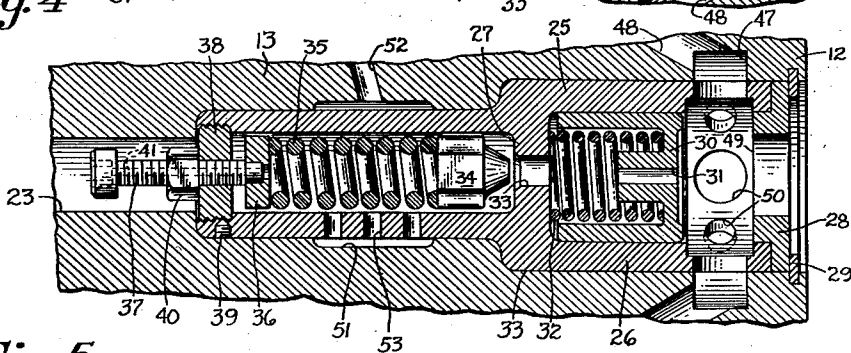


Fig. 5

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HYDRAULIC DRAFT GEAR

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8 Claims. (Cl. 213—43)

The present invention relates to a hydraulic draft gear for railway cars, and more particularly to a hydraulic draft gear which absorbs the energy of draft and buff forces by movement within the limit of coupler travel prescribed by A. A. R. regulations.

To avoid excessive slack in trains of railway cars, the travel permitted the couplers has been limited to 2 $\frac{3}{4}$ "', necessarily allowing only the same amount of movement for the draft gear associated with each coupler to absorb the energy of draft and buff impacts or forces to which the coupler is subjected. Friction draft gears, employing metal springs and friction elements, are at present commonly used in the coupler draft yokes to cushion the coupler shocks, but have proved inadequate because the restriction of energy-absorbing capacity due to the permissible movement and the limited space available results in transmission of the coupler forces, only slightly diminished, to the car frame and body, causing damage to both the car and lading. The present invention provides a hydraulic draft gear occupying no more space than a friction draft gear so that it may replace a friction gear in the draft yoke, and with the same allowable coupler travel providing energy absorption capacity sufficient for all normal train operations so that there is no such transmission of coupler forces to the car as to cause damage except under abnormally high impact conditions.

In the illustrated embodiment of the invention, a hydraulic cylinder with a piston is disposed between front and rear followers in a conventional draft yoke within the usual draft gear pocket of a railway car, so that relative movement of the cylinder and piston is effected by movement of the coupler and yoke in either direction. A pair of diametrically opposed longitudinal grooves are formed in the inner face of the cylinder wall to provide fluid passages between the pressure and relief sides of the piston. The end portions of the grooves at the pressure side, for a distance corresponding to the normal stroke of the piston, which again is the allowable travel of the coupler, are of progressively decreasing depth so that the orifices of the grooves at the pressure side are progressively reduced in cross section as the piston moves relatively in the cylinder in a pressure stroke. At the end of such stroke, which terminates short of the pressure end of the cylinder and is defined by the ends of the grooves, the orifices are closed and hydraulic fluid trapped at that end of the cylinder normally prevents further pressure-applying movement of the piston, the kinetic energy imparted to the coupler as by draft or buff forces being absorbed. Of course, provision cannot practically be made for all possible values of masses and velocities that may be involved, or in other words the energy-absorbing capacity of the draft gear must be limited because of practical considerations. Accordingly, the capacity of the gear is based on an assumed maximum or near-maximum energy value corresponding to reasonably expectable railway car masses and velocities, and the decreasing cross-sectional areas of the fluid passage orifices are calculated

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to provide a substantially constant force to arrest movement of the piston under the action of a given mass at a given velocity. If the energy to be absorbed is less than the capacity of the draft gear, the piston still moves to the limit of its normal stroke, closing the grooves against flow of fluid to the relief side, although the arresting force is not constant. If energy beyond the capacity of the gear results from abnormal conditions, only inadequate flow from the pressure side occurs through the grooves or passages so that the pressure would exceed safe limits save for a special quick-acting relief valve provided in the piston which opens to allow the fluid to pass to the relief side so that the pressure is reduced to a safe level. Under such conditions, the draft gear would not be fully effective and the car and lading would be subjected to shocks due to the unabsorbed energy, but over a wide range of conditions which may be termed normal the hydraulic draft gear provides for smooth car operation. A return spring is provided to move the piston back to retracted position after completion of its pressure stroke, and return passages through the piston controlled by check valves provide for flow of the fluid back to the pressure side upon return movement of the piston.

The draft gear of this invention effectually prevents structural and lading damage in freight cars due particularly to buff impacts on the coupler, bringing a struck and striking car smoothly to a common velocity even at relatively high speed, provides a cushioning or energy-absorbing capacity several times that of the conventional friction gear, and can be installed in the draft gear pocket without modification of the car structure or coupler appurtenances or the provision of special adapting devices. It represents a great improvement over previous draft gears in its performance and operation.

It is an object of the present invention to provide a railway car draft gear of greater energy-absorbing capacity than previous gears without requiring coupler travel in excess of the allowed limit.

Another object is the provision of a hydraulic draft gear which absorbs substantially all the energy of coupler impacts to protect a railway car and the lading therein against damage.

Another object is the provision of a hydraulic draft gear for absorbing the energy of coupler impacts which requires no more space than conventional draft gears and necessitates no modification of the car so that it may be disposed in the usual draft yoke within the draft gear pocket.

Another object is the provision of a hydraulic draft gear requiring movement only within the limit of allowable coupler travel to develop sufficient force for arresting coupler movement and preventing substantial transmission of impacts to a railway car body.

Another object is the provision of a hydraulic draft gear which smoothly cushions the forces imparted to a railway car coupler in draft or buff so as to avoid damage to the car or its lading.

Other and further objects, advantages, and features of the invention will be apparent to those skilled in the art from the following description, taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a view, partly in elevation and partly in horizontal section, through the draft gear in neutral or idle position;

Fig. 2 is a view, partly in elevation and partly in vertical longitudinal section, through the draft gear in an impact or active position under action of a draft force, the longitudinal grooves in the cylinder being shown as rotated 90° from their position in Fig. 1 for clearness;

Fig. 3 is a cross sectional view of the draft gear taken substantially as indicated by the line 3—3 of Fig. 1;

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Fig. 4 is an enlarged fragmentary sectional view of the relief valve in a first-stage or partially open position; and

Fig. 5 is a view similar to Fig. 4 showing the relief valve in a second-stage or fully open position.

Referring to the drawings, the hydraulic draft gear of this invention, generally designated 10, is illustrated as comprising a cylinder 11 in which works a piston 12 having a rod 13 projecting through an apertured guide 14 which serves as the forward end of the cylinder and is removably secured therein by a pair of locking rings 15 engaged in grooves in the inner surface of the cylinder wall. A plurality of passages 16 extend through the guide 14. An oil-tight enclosure for the forward end of the cylinder 11 is provided by a flexible diaphragm 17 held in sealing relation about the piston rod 13 by a clamp 18 and against the cylinder wall outwardly of the guide 14 by an expanding clamp 19. The opposite or rear end 20 of the cylinder 11 is provided with a charging aperture closed by a plug 21. The piston 12 is urged forwardly to a retracted position close to the rear face of the guide 14 by a return spring 22 disposed between the pressure face of the piston and the rear cylinder end 20. Extending through the piston 12 and piston rod 13 is a bore or passage 23 closed at its outer or forward end at the end of the piston rod by a threaded plug 24 and having successively stepped enlarged portions at its inner or rear end adjacent the piston. Disposed in the rear end of the passage 23 is a relief valve unit or assembly 25 comprising a cylindrical housing 26 having its rear portion of greater diameter than its forward portion with a transverse dividing web 27 between these portions, the outer surface of the housing corresponding to the stepped formation of the passage 23 so as to fit snugly therein with the forward end and intermediate shoulder of the housing abutting the steps or shoulders provided by the successive enlargements of the passage. An annular flanged endpiece 28 seats in the open rear end of the valve body or housing of the assembly 25 and engages against the forward face of a snap ring 29 seated in a suitable groove formed in the surface of the passage 23 adjacent the face of the piston 12, by which means the housing is retained in place. Slidable in the enlarged rear portion of the housing to and from engagement with the endpiece 28 is the relief valve piston 30 having a small central opening 31 there-through, and normally urged against the endpiece by a spring 32 bearing against the piston 30 and the transverse web 27. Extending through the web is an aperture 33 larger than the opening 31 of the relief valve piston and flared at its forward portion to seat a conical projection of a pilot valve disk 34 slidable in the reduced forward portion of the valve housing. The disk is suitably formed to permit fluid to flow past or through it, and is normally urged into seated position in the aperture 33 by a spring 35 disposed in the forward housing portion with one end engaging the pilot valve disk 34 and the other end engaging a follower 36 carried on the inner or rear end of an adjusting screw 37 projecting into the housing through a closure 38 threadedly secured in the forward end of the housing and fixed by a number of set screws 39. The adjusting screw 37 is threaded through the closure 38 so that it may be advanced or retracted to adjust the compression of the spring 35 and is secured in adjusted position by a lock nut 40. A bleeder bore 41 extends through the spring follower 36 and screw 37 to assure that all air will be vented from the cylinder 11 when it is charged with oil. The screw 38 and lock nut 40 may be manipulated by a suitable tool inserted through the forward end of the passage 23 upon removal of the plug 24.

A number of passages 42, in this instance four, extend through the piston 12 to provide communication between the pressure and relief sides thereof, and are closed by check valves 43 which may be of any suitable

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type, shown as each comprising a housing 44 secured on the pressure face of the piston 12 over the rear end of a passage 42, with a check valve piston 45 therein held seated against the piston 12 by a spring 46. Formed in the wall of the passage 23 about the rear portion of the relief valve housing 26 is a groove 47 from which passages 48 lead to each of the passages 42, and in the inner surface of the rear housing portion is a circumferential groove 49, normally closed by the relief valve piston 30, which provides communication between the interior of the housing and the groove 47 through a number of ports 50. Another peripheral groove 51 is formed in the surface of the passage 23 extending about the forward portion of the housing 26 and communicating through a passage 52 in the piston rod 13 with the relief chamber or side of the cylinder 11. A number of ports 53 formed in the forward housing portion provide communication between the interior thereof and the groove 51. It will thus be seen that under proper conditions communication between the pressure and relief sides is provided by the check valves 43 and the relief valve assembly 25 and the passages which they control, but in opposite directions.

A pair of longitudinal grooves 55 are formed in the inner face of the wall of the cylinder 11, diametrically opposite each other and each extending rearwardly from the rear face of the guide 14 a distance equal to the thickness or axial dimension of the main piston 12 at its periphery plus the stroke of the piston and the spacing from the guide of the piston in its retracted position. This stroke is no more than the permissible coupler travel of $2\frac{3}{4}$ ", previously referred to, and preferably is slightly less. The grooves 55 are of constant width throughout their length, and terminate forwardly of the rear end 20 of the cylinder. For a distance from the guide 14 corresponding to somewhat more than the thickness of the piston at its peripheral portion, each groove is of substantially constant depth, but from that point to its rear end its depth decreases progressively, the bottom of the groove meeting the inner surface of the cylinder at the rear end of the groove. In the illustrated embodiment, the bottom of each groove extends parallel to the inner surface of the cylinder wall from the guide 14 to a point 56, then at an angle from the point 56 to a more rearward point 57, and then at a somewhat sharper angle to the rear groove end. The distance between the point 56 and the rear end of the groove is equal to the piston stroke. The grooves 55 thus provide communication between the pressure and relief sides of the cylinder, the periphery of the main piston 12 with the sides and bottoms of the grooves defining orifices or passages for conducting fluid around the piston. As the piston 12 moves rearwardly in the cylinder 11, these orifices decrease progressively in cross section due to the tapered or angled bottoms of the grooves, so that the volume of fluid that may pass the piston is progressively decreased.

A front follower 58 is disposed forwardly of the cylinder and is provided with a groove or slot 59 in which a projection 60 on the end of the piston rod 13 engages to prevent rotation of the piston and consequent twisting of the diaphragm 17. A rear follower 61 is spaced from the rear end of the cylinder 11 by a resilient cushion or pad 62. The followers and pad are of rectangular form, and the rear end 20 of the cylinder is of similar shape, projecting from the outer surface of the cylinder. Adjacent the forward end of the cylinder, a pair of generally U-shaped rectangular brackets or supports 63 are welded thereto, providing a cross-sectional profile or outline corresponding to the forward follower 58 and the rear end of the cylinder, as best shown in Fig. 3.

The hydraulic draft gear 10 is inserted in a conventional draft yoke Y with the front follower 58 adjacent the forward or coupler-connected end of the yoke and the rear follower 61 at the rear yoke end, the height of the followers and of the supports 63 and rear cylinder end 20

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being substantially equal to the diameter of the cylinder 11, which in turn is slightly less than the internal vertical dimension of the yoke. The draft yoke Y is mounted in the draft gear pocket of a center sill C, supported on a carrier I extending across the open bottom of the center sill, and movable longitudinally in the sill between front draft lugs F on the opposite inner faces of the center sill sides and rear draft lugs R similarly provided on the sill and spaced rearwardly of the front lugs. In the normal or idle position of the draft gear 10, as shown in Fig. 1, the forward follower 58 engages against the lugs F and the rear follower against the rear lugs R, the width or transverse dimension of the followers, rear cylinder end 20, and the combined supports 63 being substantially the same as the interior width of the center sill C, with a slight allowance for clearance. The retracted position of the piston 12 is determined by the front follower, which when engaged with the front lugs limit the forward movement of the piston rod and piston under the urging of the return spring 22. The lengths of the cylinder 11 and piston rod 13 are such that in the normal position the front follower 58 is spaced forwardly of the cylinder piston 12.

Upon application of a buffing force to the car coupler, the coupler and its draft yoke Y are moved rearwardly, the yoke moving the forward follower 58 from the front draft lugs F so that the piston 12 is driven rearwardly in the cylinder 11, forcing the oil through the grooves 55 from the pressure side or chamber defined by the piston, cylinder wall, and rear end 20 to the relief side or chamber defined by the piston, cylinder wall and guide 14, and the flexible diaphragm 17. The rate of flow of the hydraulic fluid through the grooves 55 from the pressure side decreases progressively as the piston moves rearwardly along the grooves and the escape orifices defined by the piston and grooves are continuously reduced in area due to the progressive shallowing of the grooves, resulting in the piston movement being opposed by a substantially constant force to arrest the motion. The decreasing orifice area is calculated to approach as closely as possible to this ideal constant opposing force, for a given or assumed value of energy to be absorbed by the draft gear which may be a maximum or near-maximum, and the opposing force allowed to vary for energy values below or above the assumed or design value. The formation of the groove bottoms is a practical approximation of the theoretical curve of orifice area as against piston displacement or travel. When the piston has traveled its full pressure stroke, it is at the ends of the grooves 55 and closes the grooves entirely against further escape of fluid, or in other words the orifice area is reduced to zero. The trapped fluid in the pressure chamber prevents further rearward movement of the piston 12. At the same time, the forward follower 58 approaches and may engage the forward end of the cylinder 11, the resilient pad 62 being compressed in transmission of a portion of the coupler force to the center sill C. The relative positioning of the parts of the draft gear 10 under impact is the same whether a buff or draft force is applied to the coupler and draft yoke Y, and is shown in Fig. 2. The action of the draft gear in the case of a draft force on the coupler is the same as described in connection with a buff force, for although in such case the piston is held stationary by engagement of the forward follower 58 with the front draft lugs F and the cylinder 11 is moved forwardly by the action of the rear of the draft yoke Y on the rear follower 61, the relative movement of the piston and cylinder is the same. In Fig. 2, the draft yoke is illustrated as having been moved forwardly by a draft force acting on the coupler to move the rear follower 61 and cylinder 11 forwardly.

The draft gear acts smoothly and effectively to absorb the kinetic energy resulting from either draft or buff forces acting on the car coupler, practically all of which is transformed into heat as the oil passes through the pro-

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gressively more restricted orifices and is dissipated through the cylinder wall. Some of the energy of course acts upon the center sill and thus upon the underframe and the rest of the car and its lading, since relative rearward movement of the piston in the cylinder effects a rearward movement of the cylinder relative to the rear follower 61, compressing the resilient cushioning pad 52 which further serves to reduce the impact on the car structure. The energy not absorbed by the hydraulic draft gear is thus of minor consequence and well within the capacity of the car structure to absorb without deleterious effects on the car or lading. Cars equipped with this draft gear collide with great smoothness and little noise even at relatively high velocity, and come quickly and smoothly to a common velocity without the reactive separating movements usual with friction draft gears, so that repeated jars and shocks to the car and lading are avoided. The hydraulic draft gear 10 has several times the energy-absorbing capacity of the friction type draft gear, and affords much greater protection at higher car velocities.

Upon release of the force acting on the coupler, whether in draft or buff, the return spring 22 restores the piston and cylinder to their normal positions, moving the piston forwardly or the cylinder rearwardly, as the case may be, until the forward and rear followers again engage the front and rear draft lugs, respectively. During this return movement, the fluid in the relief chamber is placed under sufficient pressure to open the check valves 43 so that it flows through the passages 42 to the pressure side or chamber, a portion also passing through the grooves 55.

If because of masses or velocities greater than those assumed in the design of the draft gear, energy in excess of the capacity of the gear is developed, damage to or destruction of the gear might result were it not for the relief valve 25. When the pressure in the pressure side or chamber exceeds a predetermined safe value, the relief valve opens to permit escape of fluid to the relief side. While this is undesirable from the standpoint of lessening the absorption of energy by the draft gear and transmission of a higher proportion of the impact force to the railway car, it avoids failure of the draft gear, and results in no worse effects than would be caused by other types of draft gears, for example the commonly used friction draft gears, subjected to the same forces, and in fact represents an improvement thereover even under such extreme conditions. Under normal conditions, the relief valve piston 30 and the pilot valve disk 34 are held closed by their respective springs 32 and 35. The fluid pressure on the opposite faces of the piston 30 is equal due to the opening 31, care having been taken to assure that no air is enclosed in the larger rear end of the valve housing 26. When the pressure in the pressure chamber rises above the predetermined safe value, the same pressure acts upon the pilot valve disk 34 to overcome the force of spring 35. The disk is thus unseated, as shown in Fig. 4, and oil flows through the aperture 33, ports 53, groove 51, and passage 52 to the relief side, resulting in a lowering of the pressure in the rear end of the valve housing 26, since the opening 31, being smaller than the aperture 33, does not permit flow of oil into the housing at as great a rate as the outflow of oil through the aperture 33 and ports 53. This difference in pressure on the opposite faces of the relief valve piston 30 forces the piston 30 forwardly against the action of the spring 32 to open the groove 49 and ports 50, as shown in Fig. 5, so that oil flows from the pressure chamber through the ports, groove 47, and passages 48 and 42 to the relief side to reduce the pressure in the pressure chamber to the safe value. As the pressure is reduced, the pilot valve disk 34 is again closed by the spring 35, and the oil pressure on both sides of the relief valve piston 30 again becomes equalized so that the piston is returned to its normal closed position by the spring 32. The rate at which the piston 30 closes is determined by

the size of the opening 31, governing the time required for equalization of the oil pressure on the opposite piston faces. The action of the valve 25 is very fast, requiring a period of the order of only $\frac{1}{600}$ of a second, so that it is possible for the valve to close, after having opened, before the piston 12 reaches the end of its pressure stroke, depending upon the velocity of the piston 12 in a particular situation. In any case, the piston moves for a portion of its stroke before the relief valve opens, resulting in the absorption of some of the impact energy and thus protecting the car against the effects of the full impact. In the event that the relief valve does not close before completion of the piston stroke, the front follower 58 and the forward end of the cylinder 11 come into engagement, and the piston 12 does not travel beyond the rear ends of the grooves 55. The cylinder then acts as a strong horizontal column receiving the impact force and transmitting the unabsorbed portion of the kinetic energy to the car underframe through the pad 62, which serves as a cushion to aid in protecting the car. It will be evident that even under extreme conditions the hydraulic draft gear of this invention provides maximum protection to the underframe and hence to the entire car and its lading.

What is claimed is:

1. In combination with a draft yoke in a draft gear pocket defined by a railway car center sill portion of inverted channel section with longitudinally spaced front and rear stop means extending from the inner side surfaces thereof permitting longitudinal yoke movement and with carrier means extending across the open bottom of the sill portion to support the yoke, a hydraulic draft gear mounted in the yoke comprising longitudinally spaced front and rear followers engageable respectively with the front and rear stop means, a cylinder disposed between said followers, a cushioning pad disposed between the rear follower and the rear end of the cylinder, a piston in the cylinder having a piston rod extending through the front end of the cylinder and engaging with said front follower, a return spring between the rear end of the cylinder and the rear face of the piston, aperture means through the front cylinder end, an exterior diaphragm extending between and sealing the front end of the cylinder and the piston rod, a plurality of longitudinally extending circumferentially spaced grooves in the wall of the cylinder each having its rear end located at a predetermined limit of rearward travel and its forward end forward of the limit of forward travel of the piston relative to the cylinder and having its rear end portion of progressively decreasing depth in the direction of the rear cylinder end for a distance corresponding to the piston stroke, said grooves defining by-passes around the piston each having an orifice at the rear face of the piston defined by the piston and groove peripheries which decreases in cross section with relative rearward movement of the piston, return passage means through the piston providing communication between the pressure and relief sides thereof, check valve means preventing flow through the return passage means from the rear side of the piston, relief passage means through the piston providing communication between the rear and front sides, and relief valve means normally closing the relief passage means operable by pressure above a predetermined value on the rear face of the piston to allow flow from the rear to the front side of the piston.

2. In combination with a draft yoke in a railway car draft gear pocket having longitudinally spaced front and rear stop means arranged to permit longitudinal movement of the yoke, a hydraulic draft gear mounted in the yoke comprising longitudinally spaced front and rear followers engageable respectively with the front and rear stop means, a cylinder disposed between said followers, a piston in the cylinder having a piston rod extending through the front end of the cylinder engaging with said front follower, a return spring between the rear end of

the cylinder and the piston, aperture means through the front cylinder end, an exterior diaphragm extending between and sealing the front end of the cylinder and the piston rod, a plurality of longitudinally extending circumferentially spaced grooves in the inner face of the cylinder wall each of substantially constant width having a rear end thereof located at the limit of rearward movement of the piston relative to the cylinder and having its depth progressively decreasing to its rear end from a point spaced forwardly of the rear end a distance corresponding to the stroke of the piston, said grooves providing fluid passages between the rear and front sides of the piston and with the piston periphery defining at the rear side of the piston orifices for the respective fluid passages which decrease in cross-sectional area upon rearward movement of the piston relative to the cylinder, return passage means providing communication between the rear and front sides, check valve means preventing flow from the rear side through the return passage means, relief passage means providing communication between the rear and front sides, and relief valve means normally preventing flow through the relief passage means and operable by pressure above a predetermined value at the rear side of the piston to allow flow from the rear to the front side.

3. In combination with a draft yoke in a railway car draft gear pocket defined by a center sill portion of inverted channel section with longitudinally spaced front and rear draft lugs on the inner side surfaces thereof permitting longitudinal movement of the yoke and with carrier means extending across the open bottom of the sill portion between the front and rear lugs, a hydraulic draft gear comprising a cylinder disposed in the yoke with one end in engageable relation with the rear draft lugs and the rear end of the yoke, a piston in the cylinder having a piston rod extending through the other cylinder end, a follower on the outer end of the piston rod engageable with the front draft lugs and the front end of the yoke, a longitudinal groove in the cylinder wall terminating short of the cylinder ends having the end portion thereof adjacent said one cylinder end progressively decreasing in cross section in the direction of said one cylinder end for a distance corresponding to the travel of the piston and with the periphery of the piston defining a passage around the piston having an orifice at the face of the piston adjacent said one cylinder end decreasing in area with movement of the piston along said groove portion toward said one cylinder end, return passage means in the piston providing communication between the faces thereof, check valve means preventing flow through the return passage means from said adjacent face to the opposite face thereof, relief passage means through the piston providing communication between the piston faces, and relief valve means normally closing the relief passage means and operable by pressure on said adjacent face of the piston above a predetermined value to allow flow from said adjacent face to the opposite face of the piston.

4. In combination with a draft yoke in a railway car draft gear pocket defined by a center sill portion having a pair of longitudinal parallel vertical webs, longitudinally spaced front and rear stop means on the inner surfaces of the webs permitting longitudinal yoke movement, and carrier means extending across the space between the webs at the lower portions thereof to support the yoke, a hydraulic draft gear mounted in the yoke comprising a cylinder having at one end means engageable with one of said stop means, a piston in the cylinder having a piston rod extending through the other end of the cylinder, a follower engaged with the exterior end of the piston rod and engageable with the other of said stop means, a longitudinal groove in the cylinder wall of a length at least equal to the stroke plus the thickness of the piston providing a fluid passage between the opposite sides of the piston and having one end located at the limit of piston

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movement relative to the cylinder in the direction of said one cylinder end, said groove having a portion thereof of a length substantially corresponding to the piston stroke extending to said one groove end of progressively decreasing depth in the direction of said one groove end to provide with the piston periphery an orifice for the fluid passage at the side of the piston adjacent said one cylinder end decreasing in cross section upon movement of the piston relative to the cylinder toward said one end, and relief means operable by pressure above a predetermined value at said adjacent side to reduce the pressure below said value.

5. In combination with a draft yoke in a railway car draft gear pocket having longitudinally spaced front and rear stop means arranged to permit longitudinal movement of the yoke, a hydraulic draft gear disposed longitudinally in the yoke comprising a cylinder having one end in engageable relation with one of said front and rear stop means, a piston in the cylinder having a piston rod extending through the other end of the cylinder in engageable relation with the other stop means, a groove of substantially constant width extending longitudinally in the cylinder wall for a distance at least equal to the axial dimension of the piston at its periphery plus the length of the piston stroke providing a fluid passage between the sides of the piston having one end thereof located at the limit of piston movement relative to the cylinder toward said one cylinder end, said groove also having at its said one end a portion of progressively decreasing depth in the direction of said one groove end of a length corresponding to the piston stroke providing at the side of the piston adjacent said one cylinder end an orifice for said fluid passage decreasing in cross section upon movement of the piston relative to the cylinder toward said one cylinder end, and pressure relief means operable by pressure above a predetermined value at said adjacent side to reduce the pressure below said value.

6. In combination with a draft yoke in a railway car draft gear pocket having longitudinally spaced front and rear stop means arranged to permit longitudinal movement of the yoke, a hydraulic draft gear comprising a cylinder disposed longitudinally in the yoke with one end in abutting relation with one of said stop means, a piston in the cylinder having a piston rod extending through the other cylinder end in engageable relation with the other of said stop means, and a longitudinal groove of substantially constant width in the interior face of the cylinder wall of a length at least equal to the axial dimension of the piston at its periphery plus the length of the piston stroke having its ends located substantially at the opposite limits of relative piston travel in the cylinder to provide a fluid passage between the sides of the piston with the one groove end at the limit of piston movement toward said one cylinder end spaced from said one cylinder end, said groove also having its depth decreasing progressively to its said one end from a point spaced from said one groove end a distance corresponding to the piston stroke and with the piston periphery defining at the side of the piston adjacent said one cylinder end an orifice for said fluid passage decreasing in cross section upon movement of the piston relative to the cylinder toward said one cylinder end.

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7. A hydraulic draft gear for a railway car comprising a cylinder, a piston in the cylinder having a piston rod extending through one end of the cylinder, means for engaging the piston rod and the other end of the cylinder with parts of a car relatively movable toward each other longitudinally of the cylinder, aperture means in said one cylinder end, exterior flexible diaphragm means extending between and sealing said one cylinder end and the piston rod, a return spring between said other cylinder end and the piston, a plurality of longitudinal circumferentially equispaced grooves in the inner face of the cylinder wall each of substantially constant width and of a length at least equal to the axial dimension of the piston plus the length of the piston stroke having one end thereof adjacent said other cylinder end but spaced therefrom and located at the limit of piston movement toward said other cylinder end and also having a depth decreasing progressively to its said one end from a point spaced from said one groove end a distance corresponding to the piston stroke, said grooves providing fluid passages between the sides of the piston and with the periphery of the piston defining at the side adjacent said other cylinder end orifices for the respective fluid passages decreasing in cross section upon movement of the piston toward said other cylinder end, return passage means providing communication between the piston sides, check valve means preventing flow from said adjacent side through the return passage means, relief passage means providing communication between the piston sides, and relief valve means normally preventing flow through the relief passage means and operable by pressure at said adjacent side above a predetermined value to allow flow from said adjacent to the other side.

8. A hydraulic draft gear for a railway car, comprising a cylinder, a piston in the cylinder having a piston rod extending through one end of the cylinder, flexible diaphragm means extending between and sealing said one cylinder end and the piston rod exteriorly of the cylinder, means placing the interior of the diaphragm means in communication with the cylinder space between said one cylinder end and the piston, means for engaging the piston rod and the other end of the cylinder with parts of the car relatively movable toward each other longitudinally of the cylinder, and a longitudinal groove in the inner face of the cylinder wall of a length at least equal to the axial dimension of the piston plus the length of the piston stroke providing a fluid passage between the sides of the piston and having one of its ends adjacent said other cylinder end and defining the limit of piston movement relatively toward said other cylinder end and also having a cross section progressively decreasing to its said one end from a point spaced from said one groove end a distance corresponding to the piston stroke, said groove and piston defining at the side of the piston adjacent said other cylinder end an orifice for the fluid passage decreasing in cross section upon relative movement of the piston toward said other cylinder end.

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