United States Patent

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[54] **RAILWAY DRAFT APPLIANCE**
8 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **213/8,**
188/280, 188/282, 213/43
[51] **Int. Cl.** **B61g 9/12,**
B61g 11/12
[50] **Field of Search** 213/8, 43;
267/64, 65; 188/88.809, 88.510, 96

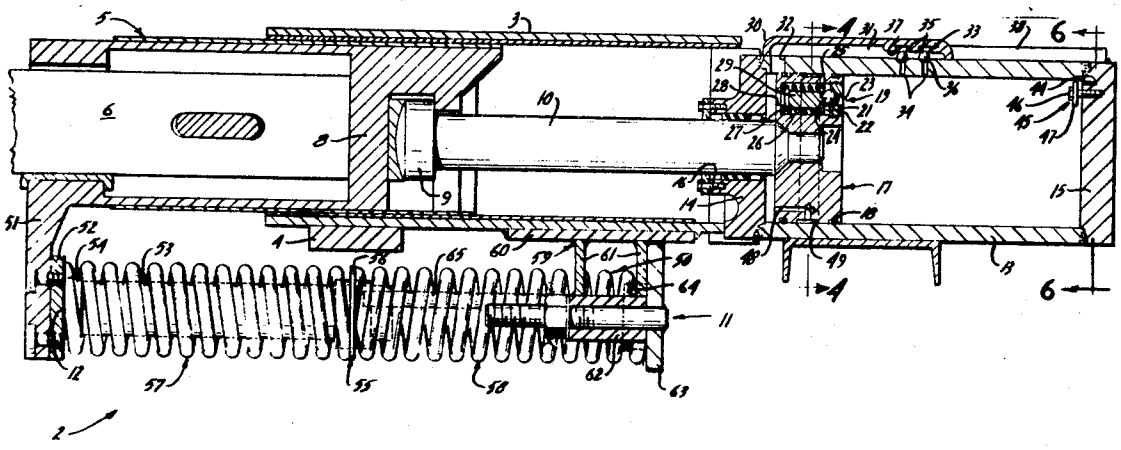
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ABSTRACT: A railroad car draft appliance has a hydraulic cushion assembly with a valving system including high-pressure responsive, buff metering valves set in the piston heads, and low-pressure responsive, one-way fluid passage through the cylinder walls for buff strokes. The hydraulic assembly includes one-way, high-pressure responsive valving which conducts hydraulic fluid from the draft end of the cylinder through a passage chamber disposed along the cylinder sidewall to the buff end on a draft stroke; and the assembly has a mechanical return spring operating to bias the piston to a zero draft neutral position for full stroke buff protection.



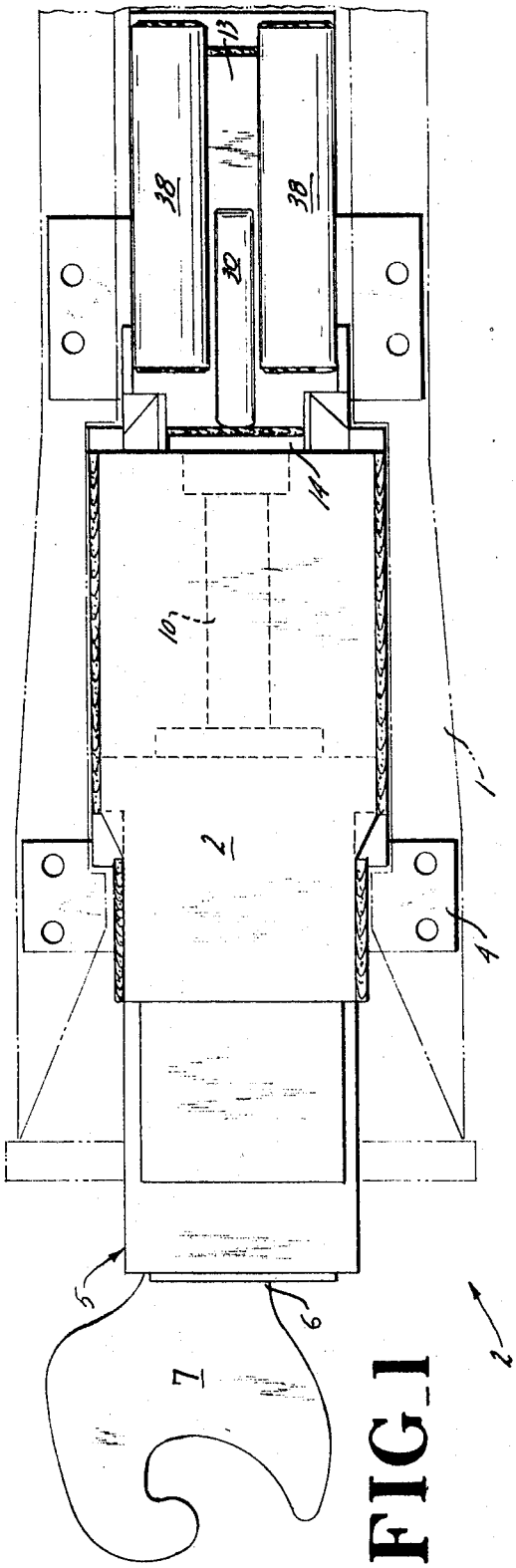


FIG_1

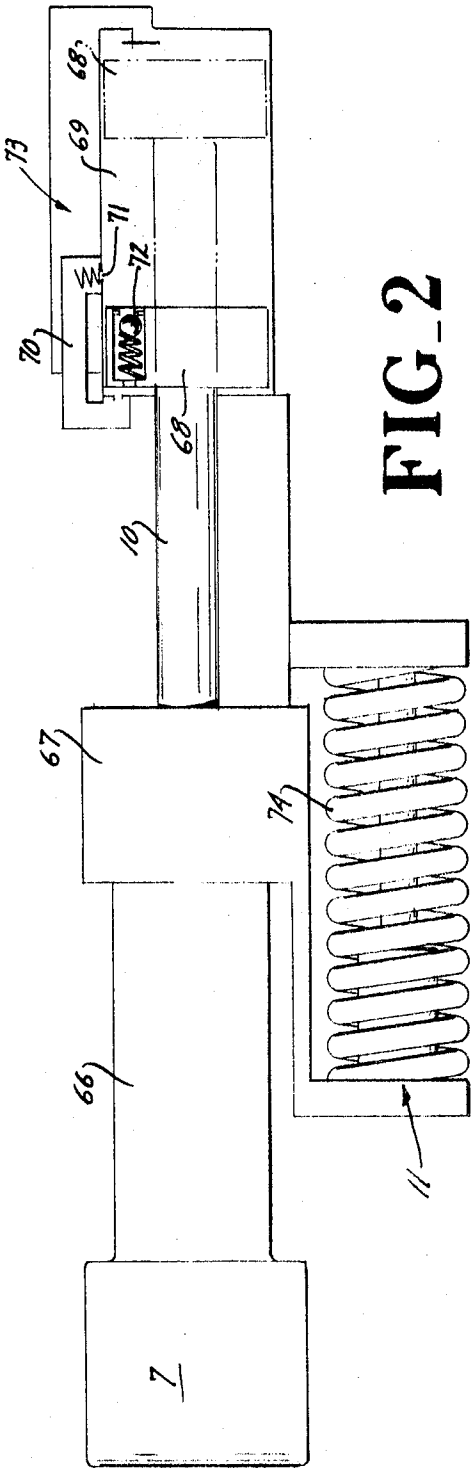
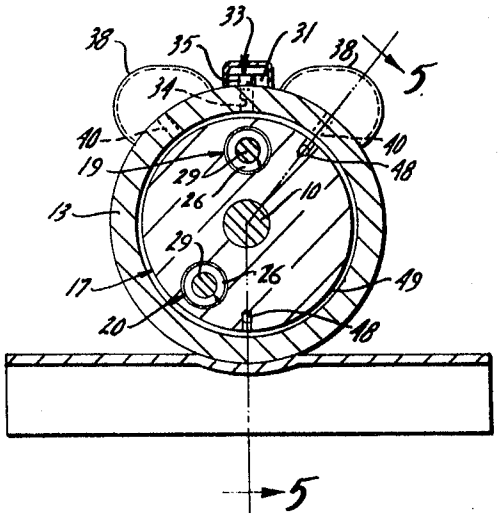


FIG_2

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FIG_4



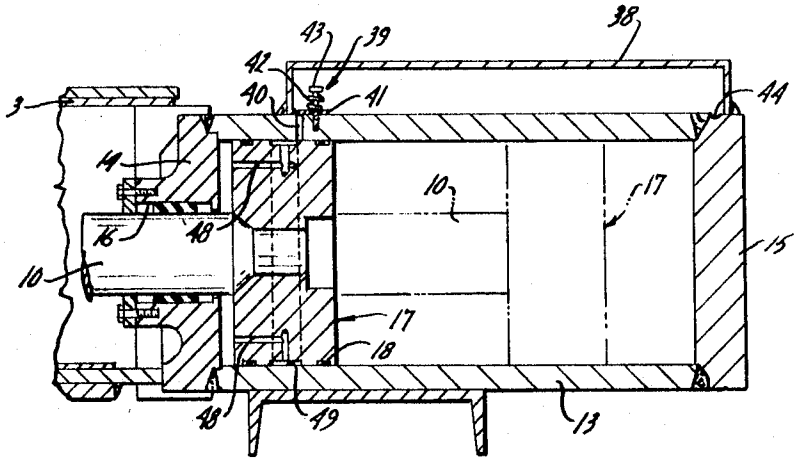


FIG_5

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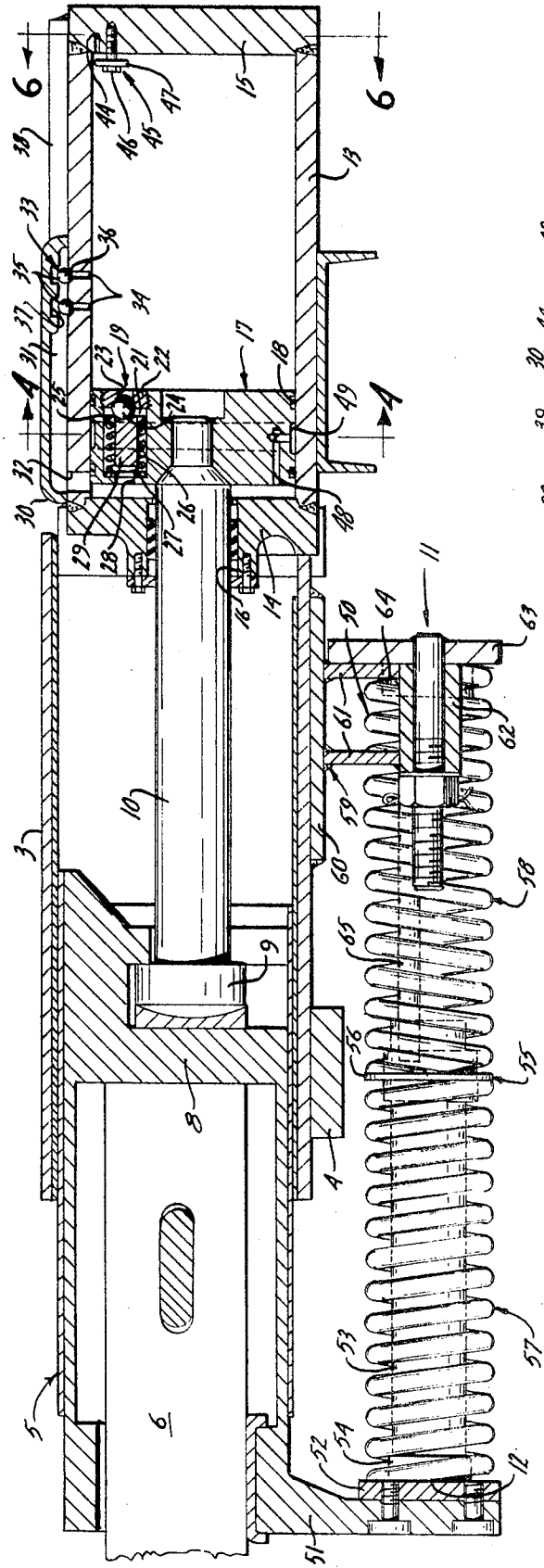


FIG_3

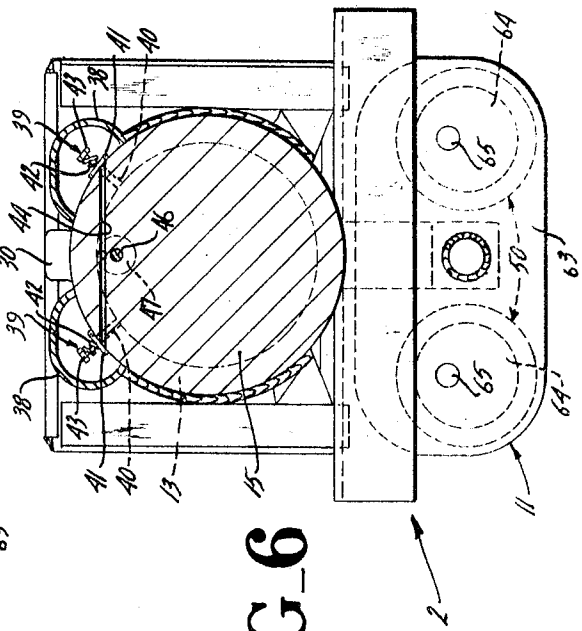


FIG_6

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RAILWAY DRAFT APPLIANCE

BACKGROUND OF THE INVENTION

This invention relates to a hydraulic draft appliance for use with railroad car coupling devices. More particularly, the invention provides a hydraulic cushion unit which optimizes the performance requirements for the variety of conditions experienced by draft appliances in use.

Coupling forces have long been a problem in railroad cars; some are associated with train consists in travel and are the result of relative movement between moving cars. More severe impacts, capable of damaging the lading and the cars, often occur in railroad yard operations where it is common to drive one or several cars into a stationary train consist for coupling purposes. For protection in these instances, draft appliances of the friction gear type have been incorporated into the coupling devices.

These draft appliances, however, increased problems having to do with in-train action. Run-in and runout of the units were increased in severity, limiting train lengths, since the slack action would generally increase the coupling forces as the accelerations and decelerations were transferred down the length of the train consists. Resultant control problems became a limiting factor for the makeup of the consists, as well as the length, as loaded cars mixed with unloaded ones would cause severe reactions to the relative in-train accelerations, and loaded cars could not always be coupled behind a long line of empty ones.

Generally, the run-in and runout of the cars caused high coupling forces, sometimes resulting in the breakage of coupling parts, and further increasing the chance of derailing. In more recent years, it has been recognized that hydraulic draft appliances were better suited to handle the coupler forces, and presently are replacing the older, friction clutch units. The hydraulic appliances usually provide longer travel, relatively soft cushioning and more complete energy absorption on both draft and buff action. However, because of the longer stroke, the problem of uncontrolled slack is further increased, due to the time delay in which the accelerating forces are transferred from car to car. The forces acting on couplings are therefore increased down the line of the consists, creating special breakage problems with any friction units which sometimes are included in the consists.

Further, train control problems have been increased because of the longer run-in and runouts experienced with the normal hydraulic units at low-force levels. The consists travel as a continually oscillating mass, particularly when traveling over undulating terrain.

In addition, the draft gear units have not been fully useful for yard impacts, which at times involves severe coupler forces in the buff direction. The problem is that proper design for the desired in-train characteristics comprises the effectiveness of such draft appliances in yard operations.

Generally, the units had not been designed for optimum performance during both yard and in-train operation.

SUMMARY OF THE INVENTION

The invention largely eliminates the above-noted problems by constructing a draft appliance with a hydraulic unit which provides full protection for severe yard impacts, yet provides relatively stiff resistance to buff and draft strokes for better in-train action.

The hydraulic cylinder has a fixed metering system, including a one-way valve and fluid metering passage from part way into the cylinder to the draft chamber end of the cylinder. This system operates to lessen initial resistance to severe buff impacts applied when, as in the static situation, the piston head is initially disposed toward the draft end of the cylinder.

The piston head includes meter valving designed to permit fluid passage to the draft chamber during a buff stroke of sufficient severity. In conjunction with the one-way fluid conduit, the meter valving reacts effectively independently of the piston position.

The one-way fluid metering conduit permits stiff hydraulic resistance to in-train draft strokes, since the system conducts fluid flow only on buff strokes, since the system conducts fluid flow only on buff strokes. The draft direction forces are cushioned by a second, independent one-way valve and external passage chamber system which conducts fluid from the draft end to the buff end of the cylinder. The valve is set to crack at relatively high-hydraulic pressure in the draft end of the chamber, thus giving the stiffness characteristic desired, but permitting fluid to be conducted from the cylinder's draft end through the passage chamber and to the buff end of the cylinder when the runout force is high. A one-way valve at the buff end of the passage chamber excludes fluid flow into the external chamber on buff strokes. A bleeder channel opens through the draft face of the piston head for purposes of allowing fluid to communicate with the second one-way valve to permit the piston to reach the zero draft position. The second one-way valve and external passage chamber has a further purpose in that it prevents damaging pressures from building up in the draft end of the cylinder due to fluid displacement by the piston rod during buff action.

The invention thus provides full protection for high-impact forces in the buff direction, as commonly occur in yard operations. The hydraulic unit serves to effectively protect the coupling and car from such occurrences by a two-stage metering characteristic, being relatively soft upon initial impact and absorbing most of the energy during a later stage of the buff stroke.

In-train buff forces are also effectively cushioned by the pressure responsive metering, which controls the final portion of the piston travel. This provides for a high-force transfer level at very low relative car velocity, maintaining cushion stroke over a longer period of time but minmizing incremental velocity between cars. The operation also facilitates a consistent response to in-train buff action, in that the run-in time through the first stage of the stroke is very short and the metering valve, which is entirely pressure responsive, in effect controls the response of the unit independently of piston position.

The valving of the invention provides stiff resistance to draft strokes, thus greatly reducing the lag time between transfer of in-train draft forces. This results in better train control, lessens the oscillation within consists, eliminates the undesirable buildup of forces transferred to couplings on cars down the line in the consist and does not compromise the desirable feature of adequate cushioning for coupling forces acting in either direction during train travel or yard operation.

Thus, the invention provides a construction which is advantageously produced and combines the most desirable features of high-impact cushioning and energy absorption with in-train control and coupling protection.

Other objects and advantages will appear in the course of the following description.

The drawings illustrate the best mode presently contemplated of carrying out the invention.

In the drawings:

FIG. 1 is a top view of the draft appliance and coupler apparatus with surrounding railway car parts;

FIG. 2 is a generally diagrammatic illustration in longitudinal section showing the general features of the invention and the parts with which it cooperates;

FIG. 3 is a longitudinal section of the piston and cylinder arrangement;

FIG. 4 is a cross section taken at lines 4–4 of FIG. 3 showing the features of the external fluid orificing for the buff strokes;

FIG. 5 is a second section of the piston and cylinder arrangement taken across the passage chamber and valve along lines 5–5 of FIG. 4; and

FIG. 6 is a cross section taken at lines 6–6 of FIG. 3.

Referring to the drawings, there is shown a railroad car center sill 1 of the usual construction, generally, and on either end of which the draft appliance 2 is fixed. Appliance 2 is constructed and attached to the railroad car, not shown, in general accordance with the arrangement described in

another patent of the same inventor, U.S. Pat. No. 3,152,699, issued on Oct. 13, 1964 to H.E. Vickerman. The present invention is best illustrated as a modification of that structure and accordingly, has housing 3 fixedly secured to center sill 1, as by the flanges 4 and bolt assemblies shown, and has a sliding coupler receiver assembly 5 which receives shank 6 of the coupler 7 within an adapter block 8 located in the receiver assembly. The invention could be incorporated into a unit which utilizes a different coupling arrangement, such as that shown in the patent to W. T. Black, U.S. Pat. No. 2,944,681. However, for purposes of illustration, the unit is described solely in connection with the system of the above Vickerman patent. For either arrangement, it is understood here that the draft end of the cylinder is at the wall which would be under pressure due to a draft stroke and vice versa for the buff end.

Within adapter 8, knuckle assembly 9 joins piston operating rod 10 to assembly 5, generally in the manner of a ball and socket arrangement. Adapter block 8 slides within housing 3 to provide the sliding buff and draft movement of the draft appliance corresponding to the run-in and runout of coupler 7 in service.

A return spring assembly 11 for returning adapter block 8 to the fully extended position is secured at its operating end 12 to adapter block 8 and on the opposite end to housing 3. Spring 11 continually urges adapter block 8, and thus coupler 7, to the fully extended position.

The hydraulic assembly of the invention includes a hydraulic cylinder 13 which is suitably secured at one end to housing 3 and is also secured to center sill 1. Hydraulic cylinder 13 is closed at the draft end by end wall 14 and at the buff end by end wall 15. End wall 14 includes a centrally disposed cylindrical hole 16 which receives operating rod 10 and has suitable bearings and packing for allowing sliding movement of rod 10 therethrough without loss of the hydraulic fluid filling cylinder 13.

In the conventional manner, piston head 17 is secured to operating rod 10 and is disposed to fit tightly within cylinder 13. The piston head 17 has suitable sealing members 18 to permit piston movement without directing excessive amounts of hydraulic fluid between cylinder 13 and piston head 17.

Piston head 17 has metering valve 19 which opens to permit fluid flow from the buff side to the draft side of head 17. The cracking pressure of valve 19 is set for opening only upon the more severe buff forces.

Referring particularly to FIG. 3, piston head 17 has a pair of identically constructed metering valves 19 and 20. Only one, valve 19, is shown and is disposed in a cylindrical passageway 21. Valve 19 has a valve seat 22 threaded into the buff face of piston head 17 at the end of passageway 21. Valve opening 23 is disposed coaxially within seat 22 and is normally closed at the inner end by the ball 24 which fits snugly within a semispherical socket in seat 22 and when seated, extends outwardly of seat 22. The construction provides a short seal and thereby makes metering valve 19 highly sensitive to pressure above or equal to the cracking pressure.

A collar 25, having a central semispherical recess corresponding to the surface of ball 24, freely engages that portion of ball 24 which projects from seat 22.

Coil spring 26 is secured to the forward side of collar 25, extends in the buff direction and seats on an annular plate 27, which in turn is disposed against an annular ledge 28 in piston head 17.

A generally small cylinder 29, which operates as a stop member, is lodged within the inside of coil spring 26 and engages collar 25. Stop 29 is spaced from spring seat plate 27 when valve 19 is closed, but is forced against the plate when pressure opens the valve. Thus, stop 29 limits the degree of opening valve 19.

The spring rate of coil spring 26 is the major factor determining the pressure response of valve 19. It is a variable within the limits of the purpose of the valve, which is to permit fluid passage to the draft side of piston head 17 in order to provide cushioning and energy absorption for the higher buff forces which produce, for example, cylinder fluid pressures of the order of 800 to 4,000 p.s.i. which could be produced by forces in the order of 100,000 lbs. The cracking pressure of valve 19 should be in the lower part of that p.s.i. range. The precise cracking pressure will be determined by considering the magnitude of forces which the designer decides must not be transmitted directly to the car, or be borne by coupler 7 without cushioning. Such forces can be experienced either during yard or in-train operation, but the usual high-impact buff forces would be in yard operation.

As well, the sizes and characteristics of valve opening 23 are variable and are determined in relation to its purpose. The above-noted pressures would dictate buff openings 23 of the order of 1 sq. in. for the desired operation.

Referring particularly to FIGS. 3 and 4, the top of cylinder 13 has a housing cap 30 secured to the external surface of cylinder 13, thus defining a metering passage 31 which extends from draft wall 14 a distance such as two and one-half times the depth of piston head 17 toward buff wall 15. A radial opening 32 is provided in the top of cylinder 13 adjacent draft wall 14 to permit relatively free flow of hydraulic fluid to and from cylinder 13 and passage 31.

A series of one-way valves 33 are included between passage 31 and the inside of cylinder 13, generally at the buff end of passage 31. Each valve has a radial opening 34 through the wall of cylinder 13, and the openings 34 are normally covered by a ball valve 35 located inside housing 30. To keep ball valve 35 in position, an annular recess 36 is provided in housing 30 and a cooperating recess 37 is provided in the cylinder wall. Thus, each ball 35 is free to open and close valves 33 for one-way fluid passage, but cannot escape through the recesses 36 and 37. Valves 33 have effectively no cracking pressure and would open pursuant to as little as 1 p.s.i. pressure drop across balls 35 in the direction of the cylinder 13 to passage 31. A pressure drop in the opposite direction will keep valves 33 closed.

The structure of valves 33 and passage 31 operates to conduct fluid from buff to draft sides of piston head 17 during a first portion of a buff stroke; but on a draft stroke, balls 35 are forced downwardly and no fluid passes through the orifice system. Thus, a one-way passage is provided. The plurality of valves 33 provide a more gradual increase in resistance to the buff stroke.

The structure of the invention provides stiff resistance to draft strokes. Referring to FIG. 5, piston head 17 is shown in phantom progressing through a draft stroke. To provide for fluid flow from draft to buff sides of head 17 in response to high-draft forces, a pair of passage chamber walls 38 are fixed on the top of cylinder 13 and extend from buff wall 15 to the area of draft wall 14. Each chamber wall 38 defines a draft relief chamber and has a valve 39 through the wall of cylinder 13 placed at approximately slightly more than one-half the depth of head 17 away from draft wall 14.

To provide a one-way orifice, valve 39 includes radial opening 40 through cylinder 13 and a washer 41 resting on the passage side of cylinder 13. Coil spring 42 biases washer 41 closed and has a spring rate giving valve 39 a characteristic high-cracking pressure in the order of 800 p.s.i. to 1,500 p.s.i.

As a further particular of valve 39, bolt 43 is threaded into the wall of cylinder 13 adjacent opening 40 and freely extends through washer 41, offset from the center. Spring 42 abuts the head on bolt 43. Washer 41 is thus adapted for sliding movement along bolt 43 for opening and closing valve 39.

At the buff end of each passage 38, a channel 44 is disposed within buff end wall 15 and opens into passage chamber 38, as shown best in FIG. 6. Each channel 44 extends generally to the center line above the central point of wall 15. At the juncture of the channels 44, a valve 45 is provided to exclude fluid therefrom during a buff stroke.

Referring particularly to FIG. 3, valve 45 has a bolt 46 threaded into wall 15 adjacent the cylinder opening of channels 44. Washer 47 covers the opening on the inside surface of cylinder 13 and is freely mounted on bolt 46. Thus, valve 45

will be closed by any pressure differential in the buff direction and opens by any differential in the draft direction. By reason of the fact that passages **38** are on top of cylinder **13**, no appreciable amount of fluid can enter through valve **45** when the appliance is in the static condition.

The operation of passages **38** and the related parts is readily apparent from the drawing. A draft stroke force in the order of 100,000 lbs. will crack valves **39** open, fluid will pass through passage chambers **38** and through channels **44**, valve **45** and into the buff end of cylinder **13**. When the cylinder pressure subsides, as the draft force is being absorbed, valve **39** will close and stiff resistance will be provided to further runout of coupler **5**. If the force does not initially surpass that needed to crack valves **39**, stiff resistance will be provided immediately and the force will be transmitted effectively directly to sill **1**, so that effectively, no runout will occur.

Since the draft appliance provides a zero draft neutral position for the piston head **17**, bleeder channels **48** are provided and extend to open the draft side of the piston head and to the annular recess **49** around the piston head circumference. As piston head **17** travels to near the zero draft position, as by the urging of return spring assembly **11**, fluid will pass through bleeder channels **48** to recess **49** and thence to valves **39**.

Return spring assembly **11** was earlier described generally, and the structure provides the zero draft feature. Two identical springs **50** are utilized and positioned in parallel planes within sill **1** beneath receiver assembly **5**. Only one is shown in FIG. **3**. Springs **50** are supported on the operable end by an operable spring carriage **51** which is secured to the front of adapter block **8**, and extends horizontally therefrom in the draft direction for several inches and then projects vertically downwardly beneath housing **3** to springs **50**.

A spring seat plate **52** is fixed to the bottom of the vertical portion of carriage **51** and on the surface thereof facing the buff direction. Spring seat **52** protrudes outwardly several inches both left and right of carriage **51** for supporting springs **50**, which are secured as by welding to the respective right and left sides of seat **52**. Also similarly secured to seat **52**, at each side, is a rigid guide tube **53** disposed lengthwise within coil spring **50**. Guide tube **53** extends in the buff direction from seat **52** a distance corresponding to the total length of buff stroke permitted by cylinder **13**. An annular collar **54** is secured to the extreme draft end of guide tube **53** and projects radially outward to fit snugly within coil spring **50**, which is welded thereto.

A sliding collar **55** is also fitted about guide tube **53** and is disposed for sliding movement along tube **53**. Collar **55** has an annular ridge **56** projecting radially outwardly a distance slightly beyond the diameter of coil spring **50**.

Collar **55** divides spring **50** generally into two equal segments, draft segment **57** and buff segment **58**. At the juncture of the two segments, the ring of collar **55** is interposed and the two halves of spring **50** are welded thereto.

At the fixed end of spring **50**, or the buff end, the assembly is secured to housing **3** by fixed spring carriage **59**. Carriage **59** has a base **60** welded along the centerline of housing **3**. Projecting vertically downward from base **60** are longitudinally spaced bracket legs **61**.

Block **62** is welded to the bottom surfaces of bracket legs **61** and is a generally solid member having dimensions permitting a clearance of several inches by springs **50** on either side of it, and extends from the leg **61** disposed nearest the buff end to just beyond the opposite leg **61**.

A spring seat plate **63** is disposed at the buff face of block **62** and secured there by a nut and bolt assembly which is through suitable horizontal holes in block **62** and plate **63**. Plate **63** extends beyond both sides of block **62** and to the buff ends of springs **50**.

At that end of each spring **50**, a round spring seat **64** is welded to the draft face of plate **63** and has a diameter corresponding to that of coil spring **50**. Spring **50** is secured as by welds to plate **63** and around seat **64**.

For guiding the buff and draft movement of guide tube **53**, guide bar **65** is fixed to seat **64** on the vertical radius and just above the central point of the seat. Guide bar **65** is of cylindrical cross section and extends in the draft direction for about the length of spring segment **58** and protrudes into the open end of guide tube **53**.

The spring carriage **51**, guide tube **53**, guide bar **65** and fixed carriage **59**, along with the related connecting parts, provide an operable return spring carriage which permits no more compression of springs **50** than allowable for cylinder **13**, and permits the fullest extension of springs **50** which would dispose piston head **17** vary near the zero draft neutral position. To visualize this operation, assume the static condition exists, and springs **50** are not compressed, as shown in FIG. **3**. A buff force on coupler **7** is transmitted to adapter block **8** which slides within housing **3** in the buff direction and forces carriage **51** against springs **50**, compressing the same in the buff direction. Guide tube **53** is driven along guide bar **65**, sliding through collar **55**, which would not move through the same distance. The buff stroke terminates either when guide tube **53** reaches plate **63**, or when the pressure within cylinder **13** stops the stroke before that point. Springs **50** will then reverse the force, having stored the energy of the buff stroke and urge the return of carriage **51** and thus adapter block **8** and coupler **7**.

Springs **50** should have a sufficient spring rate for the above operation and would be sufficiently stiff in most instances to overcome the high-cracking pressure of draft valves **39**. The assembly provides a zero draft, neutral position for piston head **17**, and will thus give the advantage of a fuller buff stroke for high impacts.

The overall operation of the invention is visualized best by reference to the generalized drawing of FIG. **2**. The parts shown in that drawing generally correspond to the same structures of the embodiment described relative to FIGS. **1** and **3**—**5**. The diagram of FIG. **2** shows a coupler **66** secured to a receiver assembly **67** from which piston **68** projects. A cylinder **69** has a one-way fluid metering system **70** opening through the draft end wall of cylinder **69** and through the cylinder. A one-way valve **71**, shown as being a spring biased washer valve on cylinder **69**, closes off the buff end of fluid system **70** a short distance from the draft end of cylinder **69**.

Piston **68** has a metering valve **72**, shown generally to correspond to valves **19** of the detailed drawings. A draft stroke fluid system **73**, in general accordance with that described in detail for passages **38**, is for illustration purposes shown extending to the opposite side of cylinder **69** from the buff system **70**.

A return spring assembly **74** corresponding to assembly **11** of the detailed description, completes the essentials of the draft appliance under consideration here.

The operation of the invention may be visualized by assuming that the piston **68** is first resting in the zero draft position, as shown in FIG. **2**, as under the biasing influence of spring assembly **74** and is driven toward the phantom position by a run-in force on coupler **66**.

If the run-in causes a moderate buff stroke, one-way valve **71** will rapidly open, permitting fluid flow through the one-way conducting system **70** and to the draft end of cylinder **69**. Thus, piston **68** will rapidly extend past valve **71**, closing it and hence meeting stiff resistance by the fluid beyond. The energy will partially absorbed by the fluid, but some of the force would very quickly be transmitted to the car. The characteristic cracking pressure of valve **71** will largely determine the proportion of absorption and transmission, but the designer must have regard to the purpose of providing initial little resistance to the higher impacts. It can be seen that if piston **68** is initially disposed further toward the buff end of cylinder **69**, the reaction of the appliance would be even more rapid.

A higher buff force or impact on coupler **66** will cause metering valve **72** to operate. Assuming again that piston **68** is initially resting at the zero draft position shown in FIG. **2**, the

impact will first open valve 71 and piston 68 will rapidly be driven past it as above, meeting little resistance for this portion of the stroke. The higher resistance of the fluid after piston 68 closes valve 71 forces metering valve 72 to open. Fluid will pass through valve 72 to the draft side of the piston 68 until the pressure on the buff side declines to become less than the cracking pressure. At this point, the buff stroke would effectively be ended and the remaining force is transmitted in large part to the car. Again, if the piston 66 is partially extended toward the buff end at impact, the same reaction occurs except through a shorter stroke, and depending on the degree of the extension, would possibly not have the initial soft cushioning effect provided by one-way fluid system 70. It is expected that the initial soft response would be needed mainly for the static conditions of yard operation, and piston 68 would then normally be at the zero draft position. The range of cracking pressures for metering valve 71 should, therefore, have as its upper limit, a value determined by considering primarily the maximum force during in-train action, which the car and coupler apparatus, including the draft appliance, should withstand and transmit down the line of cars.

Assuming, now, that piston 68 is starting near the position of the illustrated phantom head, a draft force is applied to coupler 66. Since one-way system 70 does not conduct fluid for a draft stroke, the resistance of the hydraulic fluid generally filling cylinder 69 on the draft side of piston 68 is relatively high. Much of the force is thereby transmitted directly to the car.

When the pressure at the draft end of cylinder 69 becomes sufficiently high, in accordance with the cracking pressure of the draft valve in fluid system 73, fluid will pass through the system to the buff end of cylinder 68, thus relieving the pressure and providing the desired cushioning effect. In determining the cracking pressure for this draft relief fluid system 73, it is to be remembered that the resistance to draft stroking is to be relatively stiff, so as to transmit a significant proportion of the draft force almost immediately to the car. If this is done, the lag time is lessened, since the car will be set in motion before the draft stroke allows significant runout of coupler 7.

It is to be noted that the generalized description incorporates a biasing spring in the one-way system 70, whereas the embodiment described in detail has effectively zero cracking pressure valves 33. Valves 33 are the most advantageous, as well as space saving, assemblage if consideration is given mainly to their purpose of providing high-velocity metering at the time of initial impact. This would give optimum performance for many yard operations. Also it provides the most consistent pressure responsive operation during in-train action by effectively eliminating the piston head 17 position as a cause of variant response to buff forces during the greater part of the stroke. However, as shown in FIG. 2, a valve 71, having a significant cracking pressure, could be incorporated in the system. This would be done if the designer gave more weight to energy absorption, and desired to compromise somewhat the advantages provided by the embodiment shown in FIGS. 1 and 3 through 5. The sizes and number of openings 32 and 34, and the passageway 31 defined by housing 30, can also be varied to provide more or less restriction to fluid flow, depending on the energy absorption which the designer wishes during this first portion of a buff stroke. It is contemplated that these sizes, as shown in FIG. 3, provide relatively free flow of fluid, even under high pressure conditions in cylinder 13 of the order of 10,000 p.s.i.

Further, the length of the high-velocity section of the buff stroke of piston 17 can be varied simply by the positioning of valves 33, the important considerations being to provide the appropriate initial resistance to a high-impact buff force.

Thus, the above noted variables may be changed somewhat from the described embodiment, if testing on actual railway cars would suggest the need. The designer must ultimately decide on the precise dimensions and cracking pressures, taking into account such things as the dimensions of the draft appliance employed, particularly the length of the buff stroke available, the strength of the materials in the unit, and the range of forces for which the appliance is designed to protect against. Always, the values must be related to the purpose of providing appropriate resistance to high impact buff forces, without significantly compromising the other operating characteristics of the invention, as previously noted.

I claim:

1. In a railway draft appliance for operably mounting a car coupling assembly to a railway car and having a hydraulic cushioning assembly which includes a cylinder member defining a fluid confining chamber and a piston member having a piston head mounted for sliding buff and draft strokes within the cylinder member, one of the piston and cylinder members being secured to the railway car and the other being secured to the car coupling assembly; the improvement comprising:

a buff metering valve disposed in an opening defining a passageway through the piston head for fluid flow from the buff to draft sides, the valve being biased to close the passageway to fluid flow in the draft direction and to open the passageway in response to a high-pressure differential across the head in the buff direction;

a fluid metering system having a first port through the cylinder at the draft end and a second port through the cylinder located a predetermined distance away from the draft cylinder located a predetermined distance away from the draft end; a metering passage disposed exteriorly of the cylinder between the second and first ports, and a one-way valve at the second port and controlling the metering passage, being closed to flow into the cylinder and open in response to a small pressure differential into the metering passage, to provide added orificing during a buff stroke and being ineffective during a draft stroke; and

a draft relief system on the cylinder and defining a draft relief chamber extending from generally the draft end to the buff end, said draft relief system having a first orifice to the cylinder chamber at the draft end and a second orifice to the cylinder chamber at the buff end, having further a first one-way draft relief valve at the first orifice which is biased closed and operative to open with high-cylinder pressure on the draft side of the piston head; and having a second one-way draft relief valve at the second orifice which is closed to fluid flow from the cylinder chamber and operative to open to fluid flow from the draft relief chamber.

2. The structure of claim 1, wherein the piston head has an annular recess about its periphery adjacent the cylinder, the recess being disposed a predetermined distance from the draft face of the piston, and the first orifice is disposed away from the draft end of the cylinder about the distance corresponding to the predetermined location of the recess said piston having an opening in the draft side of the head and a bleeder channel extending into the piston head from the draft side and opening to the annular recess, whereby fluid is in communication with the first orifice when the piston head is disposed near the draft end of the cylinder; and including a return spring situated in relation to the railway car for compression and extension in the buff and draft directions having one end connected with the member which moves in response to the buff and draft motion of the car coupling, and the opposite end connected with the railway car, the spring extension being opposed by the cylinder fluid pressure on the draft side of the piston head and the spring having the capability of extension to continuously urge the car coupling to the neutral position.

3. In a railway draft appliance for operably mounting a car coupling assembly to a railway car and having a hydraulic cushioning assembly which includes a cylinder member defining a fluid confining chamber and a piston member having a piston head mounted for sliding buff and draft strokes within the cylinder member, one of the piston and cylinder members being secured to the railway car and the other being secured to the car coupling assembly; the improvement comprising:

a buff metering valve disposed in an opening defining a passageway through the piston head for fluid flow from

the buff to draft sides, the valve being biased to close the passageway to fluid flow in the draft direction and to open the passageway in response to a high-pressure differential across the head in the buff direction; and

a fluid metering system on the top side of the cylinder, having a first port through the cylinder at the draft end, a plurality of second ports, one of the second ports being spaced a predetermined distance from the draft end and the remaining second ports being spaced adjacent further to the buff end, said second ports being closed by the piston during a buff stroke, said fluid metering system comprised further of an open face housing cap extending over the first and second ports, the cap being fixed generally to the top side of the cylinder with the open face down, and the cap defining a metering passage with a predetermined cross section in accordance with the resistance to flow desired for the metering system; and including one-way valves at said second ports and controlling the metering passage, with the one-way valves being closed to flow into the cylinder and operable to open in response to a small pressure differential in the opposite direction, whereby the metering system provides an initial soft response to a buff stroke and stiff resistance to a draft stroke.

4. The structure of claim 14, wherein the one-way valves are balls and the housing cap has cooperating recesses defining a restricted area for opening and closing movement of the balls.

5. In a railway draft appliance for operably mounting a car coupling assembly to a railway car and having a hydraulic cushioning assembly which includes a cylinder member defining a fluid confining chamber and a piston member having a piston head mounted for sliding buff and draft strokes within the cylinder member, one of the piston and cylinder members being secured to the railway car and the other being secured to the car coupling assembly; the improvement comprising:

a fluid metering system having a first port through the cylinder at the draft end and a second port through the cylinder located a predetermined distance away from the draft end; a metering passage disposed exteriorly of the cylinder between the second and first ports, and a one-way valve at the second port and controlling the metering passage, being closed to flow into the cylinder and open in response to a small pressure differential into the metering passage, to provide added orificing during a buff stroke and being ineffective during a draft stroke; and

a buff metering valve disposed in a generally cylindrical opening through the piston head defining a passageway through the piston head for fluid flow from the buff to draft sides, and said buff metering valve comprising: a valve seat at the buff end of the cylindrical opening and defining a buff orifice, and the seat having a widened ball seat about the buff orifice on the inside edge; a collar slidably mounted crosswise in the cylindrical opening toward the draft end from the valve seat, the collar having a ball seat spaced adjacent the valve seat; a ball disposed freely between the two ball seats; and a helical spring mounted with the cylindrical opening and extending between the draft side of the cylindrical opening to the collar, and the spring having a high-spring rate to hold the collar and ball against the valve seat to close the buff orifice up to a cracking pressure of the order of 4,000 p.s.i. on the buff side of the piston head.

6. The structure of claim 5, and including a draft relief member defining an external enclosed passage chamber on the top side of the cylinder and having a passage chamber opening through the draft end of the cylinder,

a draft relief valve operably mounted to the top part of the cylinder and within the passage chamber over the passage opening, the relief valve having a cover member and a high-rate spring holding the cover member over the top of the passage chamber opening and closing the same against cylinder pressures at the draft end which do not exceed the draft relief valve cracking pressure in the general range of 800 p.s.i. to 1,500 p.s.i.;

a buff end wall for the cylinder having an orifice defining a fluid passageway from the buff end of the passage chamber to an opening within the end wall to the cylinder chamber; and

a one-way sliding valve over the buff end wall opening comprising a pin projecting into the cylinder chamber from the end wall and a washer freely mounted on the pin, the valve being open in response to any pressure drop from the passage chamber to the cylinder chamber, and covering the orifice in response to any pressure drop in the opposite direction.

7. In a railway draft appliance for operably mounting a car coupler to a railway car and for controlling run-in and runout motion of the coupler, the appliance having a hydraulic cushioning assembly with a piston having a piston head mounted within a fluid confining cylinder for buff and draft strokes against the resistance of the fluid therein, the strokes being in response to the coupler run-in and runout, respectively, and the cylinder having a cylindrical sidewall extending between draft and buff end walls, the improvement comprising;

a one-way buff stroke metering valve in the piston,

a passage housing mounted generally on the top side of the cylinder sidewall and including an open face housing facing down on the sidewall and extending generally along the length of the sidewall, the housing and the sidewall defining a closed external passage chamber;

the sidewall having a first passage chamber orifice through the sidewall and into the passage chamber at the draft end wall;

the buff end wall having a second passage chamber orifice from the passage chamber into the cylinder;

a one-way draft relief valve mounted on top of the sidewall within the passage chamber at the first passage chamber orifice, and having a spring serving to hold the valve closed over the first passage opening, said spring having a high-spring rate in relation to cylinder pressures during a draft stroke; and

a one-way valve over the passage chamber orifice on the buff end wall and projecting into the chamber, said valve being constructed to close to fluid flow from the cylinder to the passage on a buff stroke.

8. The structure of claim 7, wherein

the one-way buff metering valve has a cracking pressure in excess of 800 p.s.i.;

the one-way draft relief valve has a cracking pressure in excess of 800 p.s.i.; and

the one-way draft relief valve has a cracking pressure in excess of 800 p.s.i.; and

including an external closed ended cap on the cylinder wall, the cap covering a sidewall orifice at the draft end wall and a second sidewall orifice spaced a distance from the draft end wall corresponding to more than twice the width of the piston head, the cap and the orifices defining a closed path for fluid flow from the cylinder through the orifices and beneath the cap back to the cylinder; and

a one-way valve over the top of the second orifice and beneath the cap, the valve being constructed to close to fluid flow into the cylinder and open to fluid flow from the cylinder into the cap.

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,598,249 Dated October 10, 1971

Inventor(s) HAROLD E. VICKERMAN

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 2, line 3, cancel ",since the system conducts fluid"
line 4, cancel "flow only on buff strokes"

Col. 3, line 10, cancel "Black" and substitute therefor ---Blake---

Col. 5, line 17, after "occur." insert ---It is found that on severe buff strokes the run-in of rod 10 can displace enough fluid and cause valve 39 to crack, thus providing a safety measure on buff as well.---

Col. 8, line 23 (claim 1), after "system" insert ---on the top side of the cylinder,---

Col. 10, line 55 (claim 8), cancel "the one-way draft relief valve has a cracking pressure in ex-"
line 56 (claim 8), cancel "cess of 800 p.s.i.; and"

Signed and sealed this 28th day of March 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

FORM PO-1050 (10-69)

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