United States Patent

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[54] **HYDRAULIC CUSHIONING APPARATUS FOR RAILWAY CARS**
13 Claims, 12 Drawing Figs.

[52] U.S. Cl. **213/8,** 213/43, 267/115
[51] Int. Cl. **B61g 9/08**
[50] Field of Search 213/8, 43, 223; 188/88.506, 88.510, 96; 267/64, 65; 267/115

[56] **References Cited**

UNITED STATES PATENTS

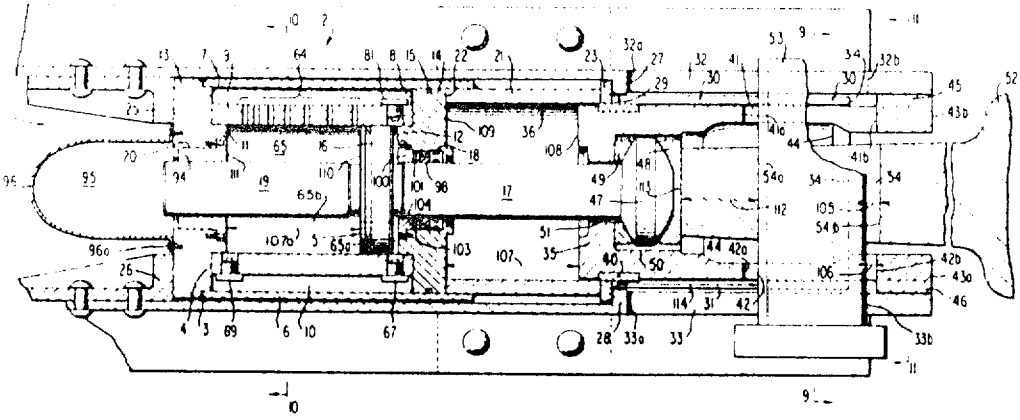
3,217,897	11/1965	Peterson	213/43
3,301,410	1/1967	Seay	213/43
3,451,561	6/1969	Stephenson et al.	213/43
3,463,328	8/1969	Blake	213/43

Primary Examiner—Drayton E. Hoffman
Attorney—Burns, Doane, Benedict, Swecker & Mathis

ABSTRACT: Cushioning apparatus for railway cars, which apparatus includes an hydraulic impedance mechanism having a high pressure cylinder and a low pressure cylinder. The high pressure cylinder is operable to transmit mechanical buff [illegible].

A coupling apparatus for a railway car where a draft key is limited to a fixed increment of movement while buff movement of a coupler under the continuous control of an hydraulic impedance mechanism takes place over an increment exceeding the length of the fixed movement increment of the draft key.

A method and apparatus for cushioning forces imposed on a railway coupling wherein draft key movement is limited to a first increment, hydraulically controlled buff movement of a coupler takes place over a second increment exceeding the length of the first increment, and mechanical force is transmitted through a high pressure cylinder of an impedance mechanism, substantially to the exclusion of forced transmission through a low pressure cylinder.

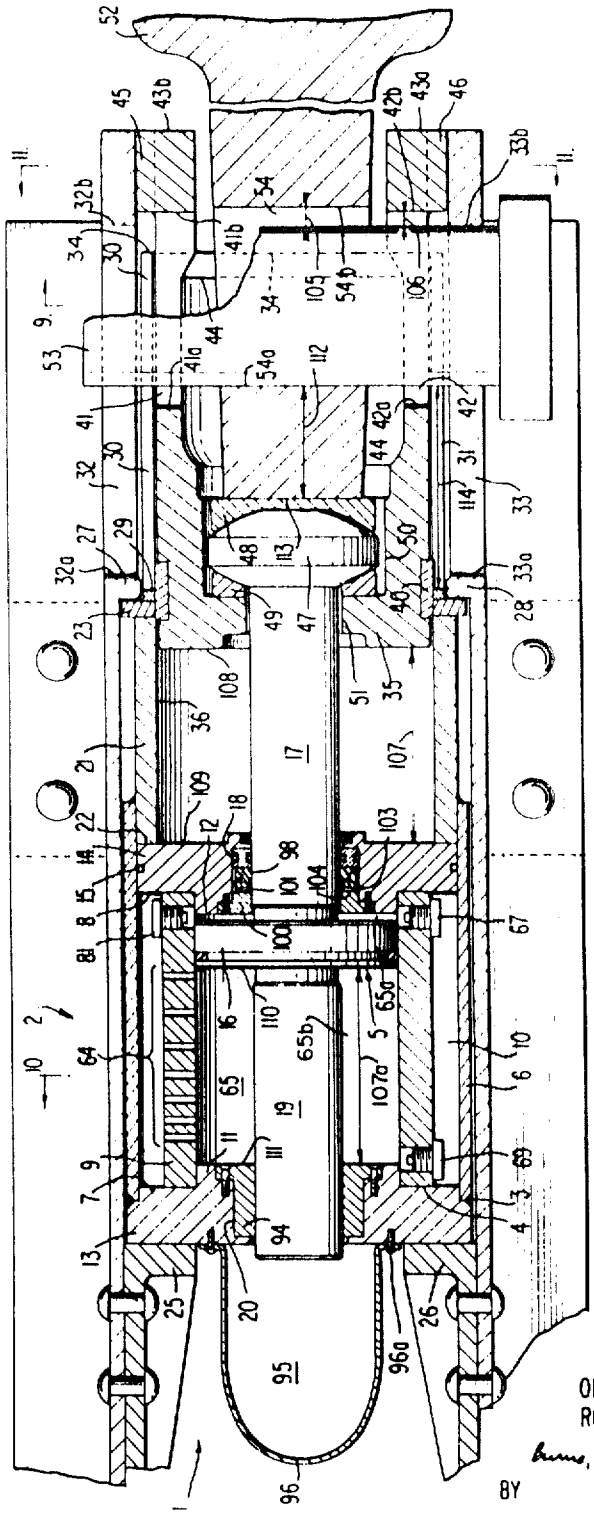


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SHEET 1 OF 5

FIG 1



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SHEET 2 OF 5

FIG. 2

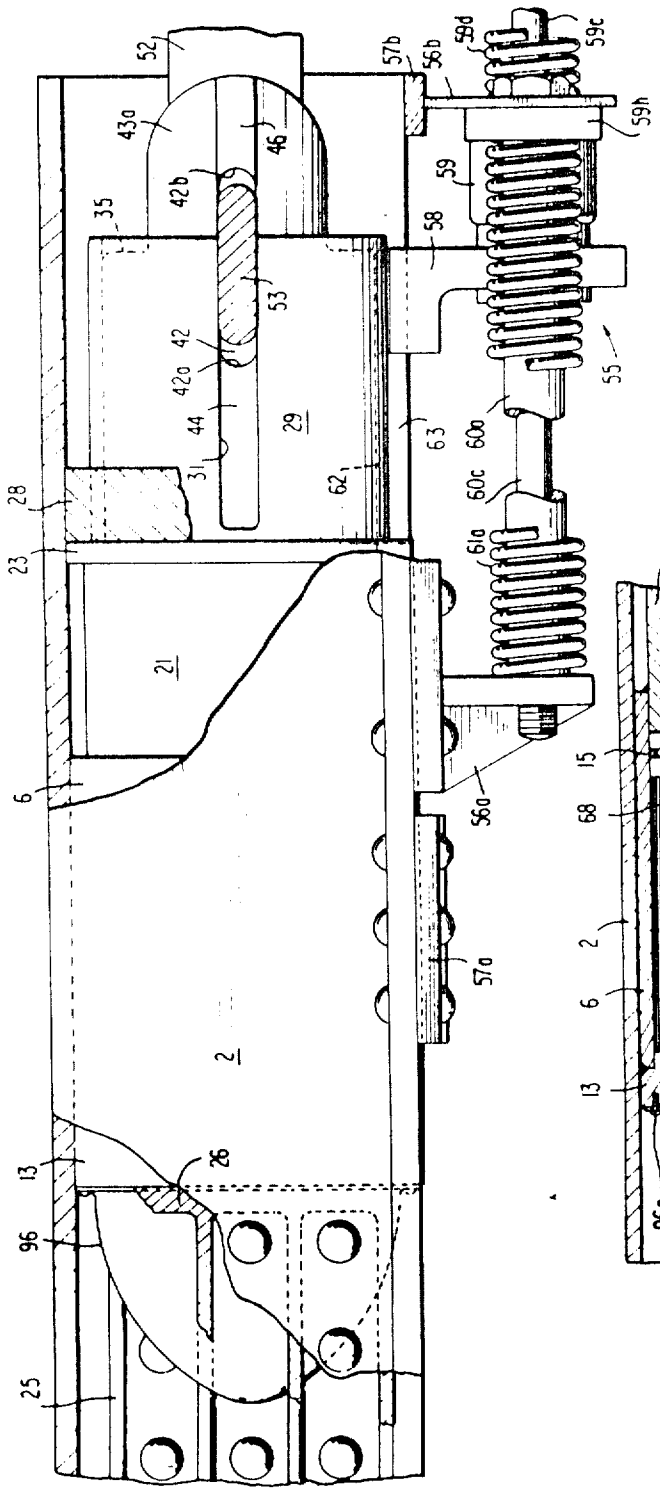
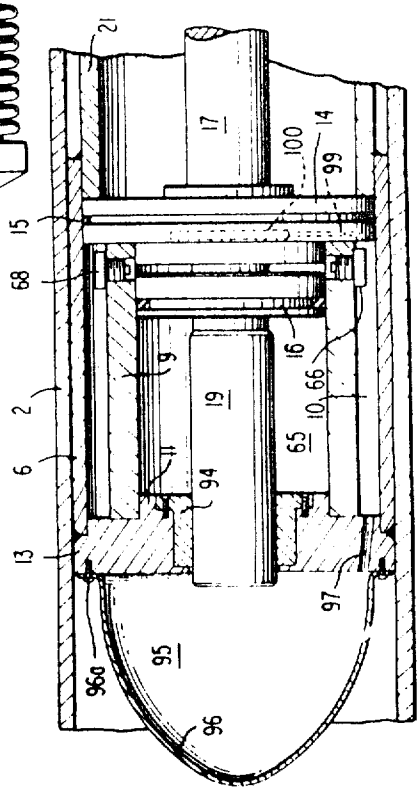


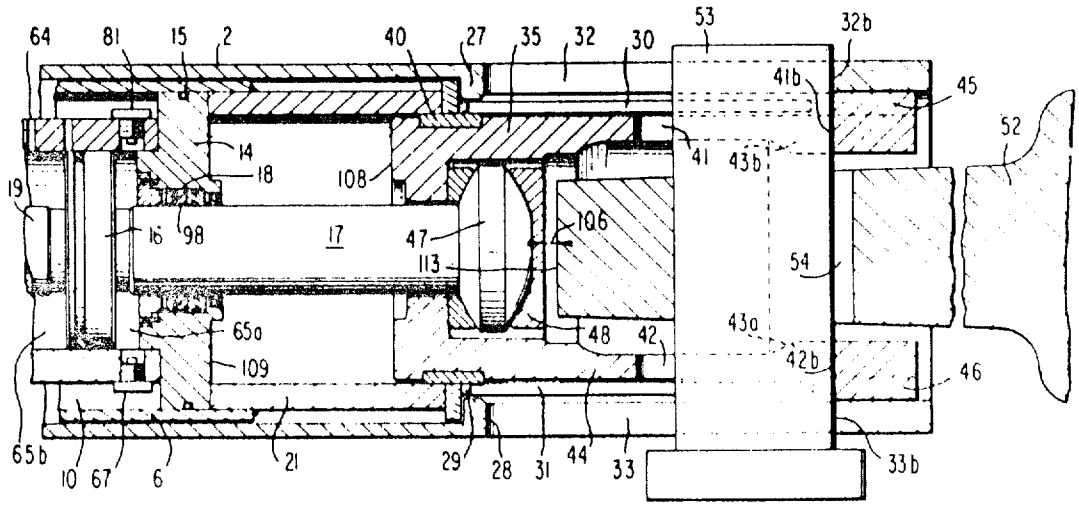
FIG 3



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FIG. 5



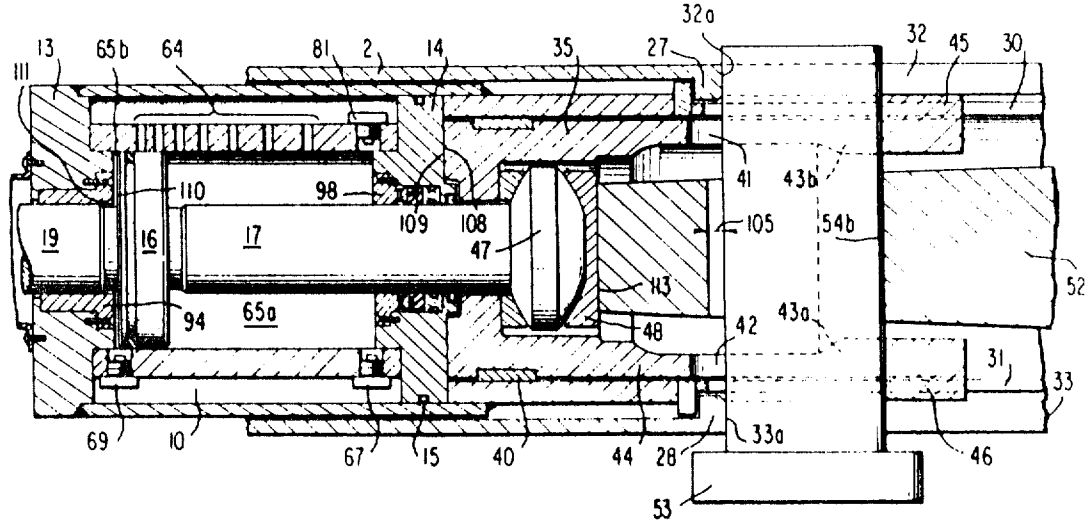


FIG. 4

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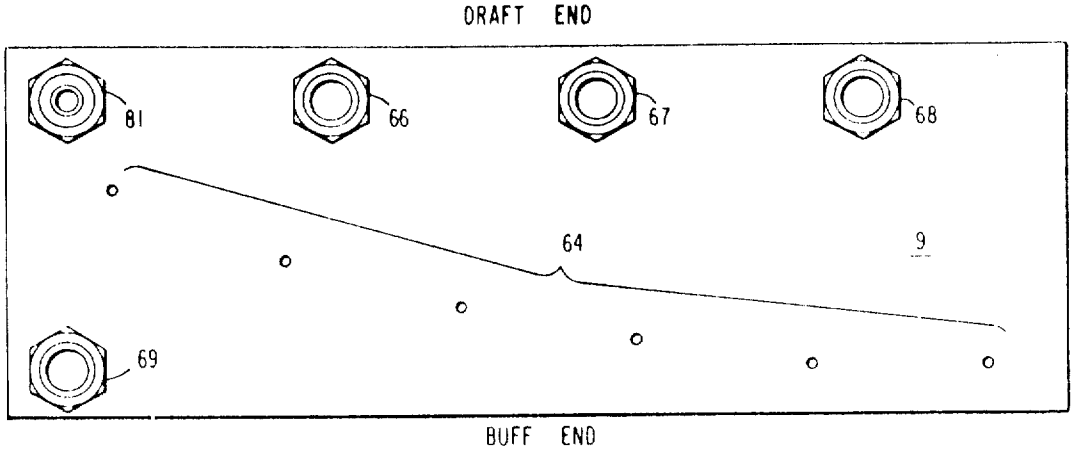


FIG. 6

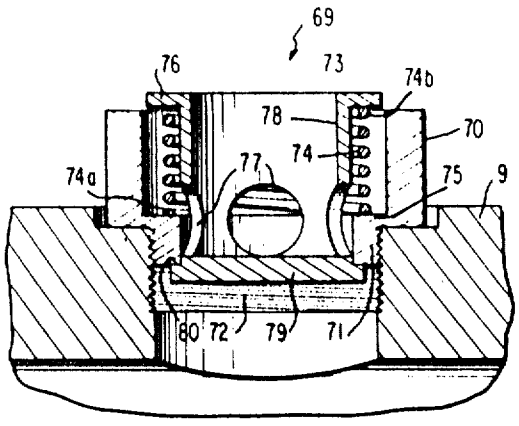


FIG. 7

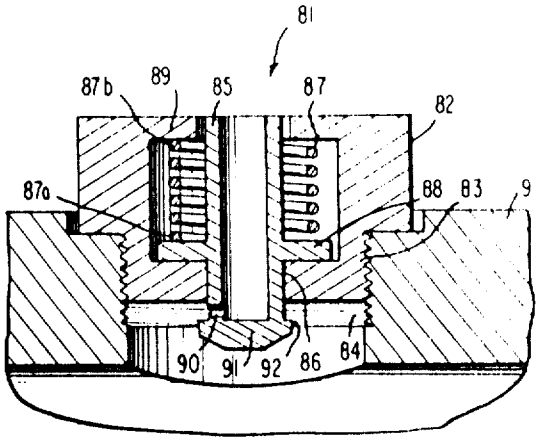


FIG. 8

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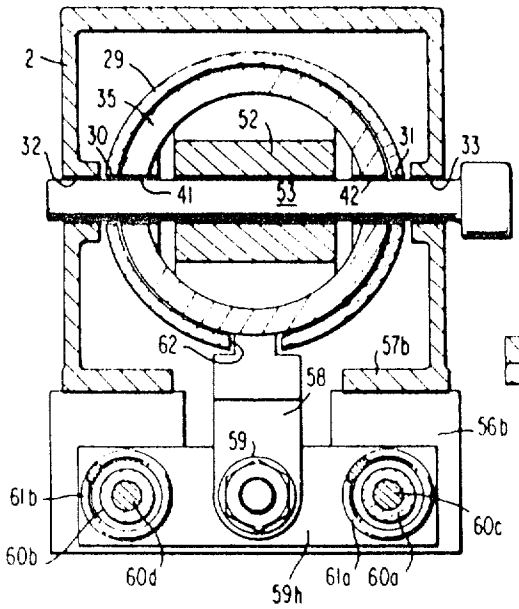


FIG 9

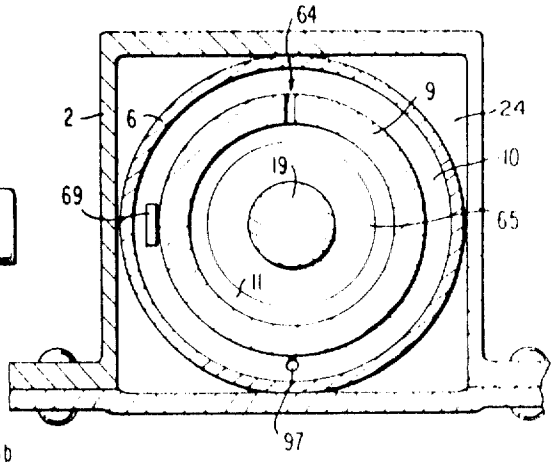


FIG 10

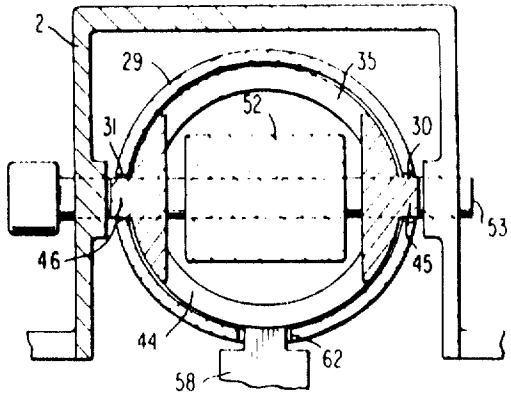
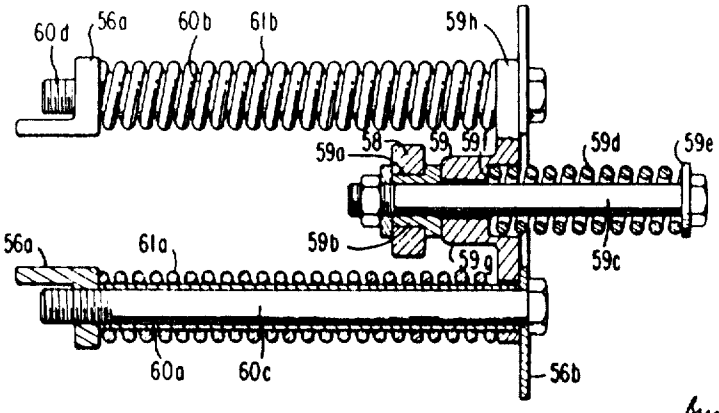


FIG 11

FIG 12



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HYDRAULIC CUSHIONING APPARATUS FOR RAILWAY CARS

GENERAL BACKGROUND, OBJECTS, AND SUMMARY OF INVENTION

The railway art is replete with devices designed to afford a cushioning action.

Such cushioning devices are particularly necessary in conjunction with the handling of freight cars. The severe shocks imposed upon freight cars in loading yards must be cushioned or absorbed if damage to goods contained in the cars is to be avoided.

In addition to being able to effectively absorb or cushion extreme buff shocks, cushioning devices must effectively control and minimize what is often termed "train action" events. Train action events occur while a train is in motion and result from the existence of "slack" in the coupling devices. Where previously extended coupling units are contracted, the train action phenomena is termed a "runin." Where contracted units are extended, the train action is termed a "runout."

This train action phenomena is discussed in detail in U.S. Pat. No. 3,451,561, of Stephenson, assigned to the assignee of the present application.

In this Stephenson application there is disclosed a highly effective concept for controlling train action events.

The efficiency of the Stephenson et al. unit notwithstanding, there remains a need for simplified cushioning devices which may be installed in existing railway cars at a nominal cost.

In consideration of effecting such installations, it would be desirable to provide an hydraulically impeded buff stroke greater than that which would be allowed by the draft movement of a conventional draft key in a conventional sill slot. Such an extended buff stroke would provide a greater shock absorbing capacity than that which would be afforded by the limited movement of the conventional draft key in the conventional sill slots.

Thus, one object of the invention is to provide a shock absorbing, buff stroke longer than that which would be provided by the buff movement of a conventional draft key through conventional sill slots.

Heretofore, efforts have been made to prevent the piston of an hydraulic impedance mechanism from engaging a cylinder head so as to avoid cylinder damage and the generation of excessive fluid pressure. By and large, such efforts have required a substantial modification of existing sill structures or extensive modifications of cushioning device structures.

Thus, a further object of the invention is to provide a simplified arrangement for transmitting mechanical buff shock to a sill, which arrangement does not require sill alterations and effectively prevents cylinder damage and the generation of excessive pressure.

An overall object of the invention is to provide a simplified cushioning device including an impedance mechanism characterized by component modularization.

In accomplishing at least some of the foregoing objects, there is presented through the invention a cushioning apparatus which includes outer cylinder means. An inner cylinder means is contained within and spaced from the outer cylinder means to define an annular space. A piston means is mounted for axial slidable movement within and relative to the inner cylinder means. A hydraulic impedance mechanism is operable to impede but permit a flow of fluid from the interior of one end portion of the cylinder means to and through the annular space and into the interior of another end portion of the inner cylinder means. A connecting means included in the apparatus is operable to connect one of the piston means and outer cylinder means with coupling means. Means are provided to transmit mechanical buff shock longitudinally through the inner cylinder means and substantially prevent the transmission of such mechanical buff shock through the outer cylinder means.

Another independently significant facet of the invention resides in a cushioning apparatus comprising cylinder means and piston means mounted for telescoping movement within and relative to the cylinder means. One of the piston means and cylinder means is adapted to be fixedly positioned on a railway car. A key means is operable to connect the other of the piston means and cylinder means with coupling means. A movement limiting means is operable to limit draft and buff movement of the key means to a first fixed increment. An extensible connection between the coupling means and the other of the piston means and cylinder means is operable to permit a second increment of buff movement of the coupling means under the continuous control of the impedance means. This second increment exceeds the length of the first increment.

A third basic aspect of the invention entails method and apparatus facets of an overall cushioning concept. In practicing this concept, a railway coupling is connected a railway car sill with key means. Buff movement of the coupling is hydraulically impeded continuously over a predetermined increment of buff movement of the coupling. Hydraulic fluid, operable to impede movement of the coupling, is circulated through an annular space located between a high pressure cylinder wall and a low pressure cylinder wall. Mechanical buff shock is transmitted from the coupling to a railway car portion through the high pressure cylinder, substantially to the exclusion of force transmission through the low pressure cylinder. The coupling is restored along an increment of draft movement while limiting draft movement of the key means to an increment less than that of the buff increment.

Other significant facets of the invention involve a uniquely simplified cylinder structure in combination with a stabilized piston and also involve a modularized valve system for controlling fluid flow in the hydraulic impedance mechanism.

DRAWINGS

In describing the invention, reference will be made to a preferred embodiment shown in the appended drawings.

In the Drawings

FIG. 1 provides a top plan, horizontally-sectioned view of a railway car sill in which is mounted a cushioning apparatus and coupling of present present invention. The cushioning apparatus is illustrated in FIG. 1 in its fully restored or neutral position;

FIG. 2 provides a partially-sectioned, side elevational view of the FIG. 1 assembly;

FIG. 3 provides a partially-sectioned, side elevational view of the FIG. 1 assembly in the left end portion of the assembly as viewed in FIG. 1;

FIG. 4 provides a top plan view of the cushioning and coupling components of the FIG. 1 assembly, illustrating these components at the extremity of a buff stroke;

FIG. 5 provides a reduced scale, partially-sectioned, top plan view of the cushioning and coupling components of the FIG. 1 assembly illustrating the disposition of components at the end of a draft stroke of the draft key;

FIG. 6 provides a plan view of the exterior of the sidewall of the high pressure cylinder of the FIG. 1 assembly "laid out flat" to illustrate the location of flow control ports and valves;

FIG. 7 provides an enlarged, vertically-sectioned, elevational view of a representative check valve mounted on the inner cylinder shown in FIG. 6, which check valve is operable to permit a return flow of fluid to the interior of the high pressure cylinder;

FIG. 8 provides a vertically-sectioned, enlarged elevational view of a control valve located in the draft end of the high pressure cylinder and operable to effectively control runout train action events;

FIG. 9 provides a reduced scale, cross-sectional view of sill, cylinder extension, yoke, draft key, and coupler components of the FIG. 1 assembly as viewed along section line 9–9 of FIG. 1;

FIG. 10 provides a reduced scale, cross-sectional view of sill, outer cylinder, inner cylinder and piston components of the FIG. 1 assembly as viewed along section line 10–10 of FIG. 1;

FIG. 11 provides a transverse sectional view, at reduced scale, of the yoke lugs, cylinder extension and sill as viewed along section line 11–11 of FIG. 1; and

FIG. 12 provides a top plan view of a coil spring restoring mechanism incorporated in the FIG. 1 assembly, and viewed in detached relation to this assembly.

PRINCIPAL COMPONENTS

FIGS. 1 and 2 illustrate the principal components of the cushioning apparatus 1 of the present invention and the positional relationships which exist between this cushioning apparatus, a coupler, and a sill of a railway car.

As shown in FIG. 1, cushioning apparatus 1 is positioned within a conventional railway car sill 2. Apparatus 1 includes an outer cylinder means 3, an inner cylinder means 4, and a piston means 5.

Outer cylinder means 3, which may be deemed a low-pressure cylinder, includes a cylindrical sidewall 6. A cylinder head wall 7 is positioned at the buff end of the cylinder means 3 while another cylinder head 8 is positioned at the draft end of the sidewall 6.

Inner cylinder means 4 which comprises a high-pressure cylinder, includes a relatively thick cylindrical sidewall 9. Relatively thick wall 9 is spaced radially inwardly from the relatively thin sidewall 6 of outer cylinder means 3. The spacing between sidewalls 6 and 9 provides an annular space 10 extending coaxially of the coaxial cylinder walls 6 and 9.

The buff end of cylinder means 4 is closed by a cylinder head 11 while the draft end is closed by a cylinder head 12.

As shown in FIG. 1, a unitary annular plate 13 provides each of the cylinder heads 7 and 11. Cylinder head 11 comprises a generally annular, ledgelike portion or plate 13 which is telescopingly received within the buff or leftmost end of the sidewall 9, viewing the apparatus as shown in FIG. 1. The portion of plate 13 which projects radially outwardly from the plate portion 11 defines the cylinder head 7, i.e. the buff end of the low pressure cylinder means 3.

Similarly, a unitary plate 14 provides and defines each of the cylinder heads 8 and 12. Cylinder head 12 comprises an annular ledgelike plate portion which is telescopingly received within the draft end of cylinder sidewall 9. Plate portions 11 and 12 are each disposed in an interfering fit relationship with the sidewall 9.

The portion of plate 14 which projects radially outwardly from cylinder head portion 12 defines the draft cylinder head 8 for the low pressure cylinder means 3.

Plate means 14 is mounted for axial slidable movement within cylinder wall 6. In this connection, a conventional O-ring type seal 15 may be interposed between the radial periphery of the plate 14 and the inner periphery of the sidewall 6 for sealing purposes.

With this arrangement, the cylinder heads 8 and 12 are each mounted within the cylinder wall 6 and are axially movable toward the plate 13. The movability of these cylinder head walls 8 and 12, in relation to the plate 13, is limited by the high pressure and relatively thick sidewall 9 which is interposed axially between the plates 13 and 14. Thus, in terming the cylinder heads 8 and 12 "movable," the term "movable" is being used in a sense to indicate that the plate 14 is not fixedly connected with the wall 6, but rather, as is now apparent is movable axially of wall 6 in response to buff shock-induced, axial contraction of wall 9.

Piston means 5 includes a piston 16 disposed for telescoping and axially slidable movement within and relative to the high pressure cylinder wall 9. A main piston rod 17 passes coaxially through the draft end plate 14 by way of a central aperture 18.

An auxiliary piston rod 19 extends coaxially of the piston rod 17, away from the piston 16 and rod 17, and coaxially through the end plate 13 by way of a plate aperture 20. The cross-sectional area of piston rods 17 and 19 are identical.

Movement of end wall 14 away from wall 13 is affirmatively prevented by a cylindrical extension 21. Cylindrical extension 21 is fixedly connected with sidewall 6 and extends coaxially away from wall 6 and end plate 14. Cylindrical extension 21 provides an annular ledge 22 which abuttingly engages the periphery of the plate 14 so as to prevent movement of the plate 14 away from the plate 13.

Cylindrical extension 21 engages, and is fixedly connected with, an end plate means 23. End plate means 23 has a rectangular configuration of the interior 24 of the sill 2. End plate 23 is receivable within the interior space in substantially conforming relation with the sill cross section and thus functions to align and stabilize the assembly 1.

As will be appreciated, reinforcing webs (not shown) may extend along cylindrical extension 21 between the sidewall 6 and the end plate 23 for reinforcing and strengthening purposes.

Conventionally, interior passage 24 of sill 2 will have a square cross section. Thus, as shown in FIG. 10, the outer diameter of wall 6 may be substantially the same as the width and height of the stabilizing end plate 23. With this dimensional relationship, the cylinder 6 will engage the sidewalls of the interior of the sill 2 so as to stabilize and align the cylinder 6 in coaxial alignment with the central longitudinal axis of sill 2.

Anchoring of the assembly 1 within the sill 2 is effected by a series of anchoring abutments. Two such bracketlike abutments 25 and 26, shown schematically in FIGS. 1 and 2, provide abutment means engaging opposite, horizontally spaced, sides of the end plate 13 so as to prevent buff movement of this plate.

A pair of ledgelike vertically extending stops or abutments 27 and 28 project laterally inwardly from the sill sides so as to abuttingly engage the forward edge of the plate 23. Thus, abutment stops 27 and 28 serve to prevent buff movement of the plate 23, cylinder extension 21, cylinder wall 6 and end plate 13.

Abutments 25, 26, 27 and 28 may be provided by a draft end sill casting of the general type manufactured by Scullen Steel Company of St. Louis, Missouri and illustrated on page 675 of the Car and Locomotive Encyclopedia (Simmons-Boardman 1966).

A second cylindrical extension 29 is connected with plate 23 and projects coaxially of plate 23 away from cylindrical extension 21. Extension 29 contains a pair of horizontally displaced slots 30 and 31. These slots 30 and 31 are horizontally aligned respectively with conventional sill slots 32 and 33. As illustrated, extension slots 30 and 31 intersect the free extremity 34 of cylindrical extension 29.

A yoke 35 is slidably supported within a common cylindrical wall 36 defined by axially contiguous portions of the extension 21, alignment plate 23 and extension 29. Thus yoke 35 has a substantially circular cross section so as to enable it to be telescopingly and slidably received within the guiding and constraining wall 36. Sliding movement of the yoke 35 along the wall 36 may be facilitated by a bushing 40.

Yoke 35 includes a pair of horizontally spaced yoke slots 41 and 42. Slot 41 is aligned horizontally with slots 30 and 32 while yoke slot 42 is aligned horizontally with slots 31 and 33.

Viewing the apparatus as shown in FIG. 1, the rightmost end of slots 41 and 42 are closed by longitudinally extending mirror image related, and horizontally spaced lugs 43*a* and 43*b*.

In this connection, it will be appreciated that yoke portion 44 which provides slots 41 and 42, is substantially cylindrical in character, Yoke portion 44 is disposed in coaxial relationship with the rim 43 and the piston means 5.

Sliding movement of yoke 43 may be stabilized by a pair of lugs 45 and 46. Lugs 45 and 46 project radially outwardly from rim 43 and are disposed in horizontal alignment, respectively, with extension slots 30 and 31. Thus, during buff movement, the lugs 45 and 46 will slidably enter the open ended slots 30 and 31 for yoke stabilization and guiding purposes.

Piston rod 17 is connected to yoke 35 by a conventional spherical bearing 47. Mounting plate means 48 and 49, each anchored to yoke 35 by known fastening means, not shown, provide spherical bearing surfaces cooperating with the spherical bearing 47 of rod 17. These plate means serve to fixedly anchor the spherical bearing 47 in a central pocket portion 50 of yoke 35 disposed in the left end of yoke 35, viewing the apparatus as shown in FIG. 1.

As illustrated, shaft 17 enters yoke 35 through a yoke aperture 51. With the spherical bearing arrangement being well known in the railway coupling art, its structural details need not be discussed. Suffice it to say that this bearing arrangement provides a mechanism for fixedly connecting the piston rod 17 to the yoke 35 so as to prevent axial movement between these components but permit proper accommodation of forces acting non-axially on the yoke 35.

A conventional coupler or draw bar 52 is interconnected with the sill 2 and yoke 35 by a conventional draft key 53. Draft key 53 has a substantially rectangular cross section in a direction extending longitudinally of sill 2. Key 53 is provided with a longitudinally extending slot 54 embracing key 53.

Key 53 passes consecutively through the sill slot 33, the extension slot 31, the yoke slot 34, the draw bar slot 54, the yoke slot 41, the extension slot 30 and the sill slot 32.

As shown, key 53 is capable of undergoing longitudinal sliding movement between the draft extremity 54*a* of slot 54 and the buff 54*b* of this slot.

Similarly, key 53 is operable to undergo longitudinal sliding movement between the buff extremities 41*a* and 42*a* of slots 41 and 42 and the draft extremities 41*b* and 42*b* of these slots.

Additionally, the key 53 is operable to undergo longitudinal sliding movement between the buff extremities 32*a* and 33*a* of sill slots 32 and 33, respectively, and the draft extremities 32*b* and 33*b* of these sill slots.

FIGS. 1 and 2 illustrate the piston 16 disposed in its fully restored or neutral position within the cylinder wall 9. This positioning of the piston 16, which occurs in the absence of extraneous coupler forces acting on the piston rod 17, results from a restoring mechanism 55.

As shown in FIGS. 2, 9 and 12, restoring mechanism 55 comprises rearward and forward mounting bracket means 56*a* and 56*b* respectively. Bracket 56*a* is attached to an under portion 57*a* of sill 2, while bracket means 56*b* is attached to an under portion 57*b* of the railway car sill.

A tongue 58 projects downwardly from the yoke 35. Tongue 58 is fixedly connected with a horizontally extending connecting means 59.

A pair of horizontally spaced and longitudinally extending sleeve or cylinderlike rods 60*a* and 60*b* are fixedly supported at their extremities by brackets 56*a* and 56*b*. Threaded rods 60*c* and 60*d* pass through sleeves 60*a* and 60*b* and connect these units to brackets 56*a* and 56*b*. A coil spring 61*a* is mounted on rod 60*a* with its leftmost extremity anchored by the bracket means 56*a*. Another coil 61*b* is anchored on rod means 60*b* with its leftmost end also engaged by the fixed bracket means 56*a*.

Tongue 58 fixedly engages an annular recessed portion or groove 59*a* *l of connecting means 59. This mounting groove 59a* is formed on a fitment 59*b* which is fixedly mounted on a rod 59*c*. A coil spring 59*d* is telescopingly mounted on rod 59*c*. A rod carried abutment 59*e* engages a rightmost extremity of the coil spring 59*d*. An annular flangelike abutment 59*f* engages the leftmost end of spring 59*d*. Flange 59*f* is formed, as shown in FIG. 12, on a cylindrical fitment 59*g* which is connected to and projects leftward from a plate 59*h*. Plate 59*h* is slidably mounted on rods 60*a* and 60*b* Plate 59*h* abuttingly engages the rightmost ends of springs 61*a* and 61*b* as shown in FIG. 12. Fitment 59*g* is axially apertured so as to accommodate axial sliding movement of the rod 59*c*.

By reference to FIGS. 2, 9 and 12, it will be appreciated that tongue 58 projects downwardly through a longitudinally extending slot 62 formed in the base of extension 29 and also downwardly through an opening 63 in the base of sill 2. Opening 63 and slot 62 accommodate buff and restoring draft movement of the tongue 58.

During buff movement, the tongue 58 carries the fitment 59*a* and to the left, viewing the apparatus as shown in FIGS. 2 and 12. This leftward movement tends to cause the plate 59*h* to compress the springs 61*a* and 61*b* as the plate moves slidably to the left over sleevelike rods 60*a* and 60*b*. The leftward movement of the tongue 58 and fitment 59*a* also tends to cause the rod 59*c* to move telescopingly through the axially apertured fitment 59*g* so as to cause the rod flange 59*e* to compress the spring 59*d*.

Thus, the springs 59*d*, 61*a* and 61*b* are all available to contribute to the resilient restoring of the tongue 58 to its neutral position. This restoring, of course, will result from the tendency of the spring 59*d* to restore the rod 59*c* to the position shown in FIG. 12, along with the tendency for the springs 61*a* and 61*b* to restore the plate 59*h* to its position of abutting engagement in relation to the mounting flange means 56*b*.

As will be appreciated, the abutment means 56*a* and the plate 59*h* provide abutment means operable to tend to compress the coil springs 61*a* and 61*b* in response to buff movement of the coupler 52. The energy stored in springs 61*a* and 61*b*, through this compression, tends to restore the coupler 52 to the extremity of draft movement shown in FIG. 1.

This restoring action is augmented by the additional or auxiliary coil spring 59*d*. Abutments 59*e* and 59*f*, in essence, provide abutment means interposed between the coupler 52 and the rightmost end of the springs 61*a* and 61*b*. This second abutment means tends to induce compression of the additional spring 59*d* when relative movement between tongue 58 and coil springs 61*a* and 61*b* occurs, i.e., when relative buff movement between the coupler 52 and this pair of horizontally spaced coil springs occurs. This compression of spring 59*d* provides an auxiliary restoring force tending to move the coupler 52 back to the extremity of its draft travel as shown in FIG. 1.

At this point, it will be recognized that the extremity of the draft position of coupler 52 is defined by concurrent engagement between the key 53 and sill slots 32*b* and 33*b*, between the key 53 and coupler slot end 54*a*, and between coupler face 113 and piston rod plate 48.

It is significant to here note that this position of neutrality completely negates the common notion that a restoring mechanism must provide a neutral position accommodating some draft movement.

IMPEDANCE SYSTEM

FIGS. 1, 2, 6, 7 and 8 illustrate structural details of the impedance system which serves to control train action events and effectively absorb extreme impact forces acting upon the coupler 52.

The impedance mechanism includes a series 64 of longitudinally displaced ports formed in high pressure cylinder wall 9.

At this point, it should be noted that in FIGS. 1 through 5, the ports in series 64 are illustrated in a schematic format only, for ease of overall comprehension. In fact, as shown in FIG. 6, these ports are staged about the circumference of wall 9 and are spaced longitudinally of the axis of cylinder wall 9 in an exponential fashion, with the port spacing decreasing exponentially in a direction extending away from the draft end of the cylinder means 4 toward the buff end, i.e., the cylinder end closed by cylinder head 11. This exponential spacing is described in detail in the U.S. Seay Pat. NO. 3,301,410. While exponential spacing is desirable, it is possible the exponential spacing may be modified or that additional nonexponentially spaced ports may be provided, depending upon anticipated operating conditions.

Thus, as the piston 16 undergoes buff movement from the neutral position shown in FIG. 1, hydraulic fluid, which fills high pressure zone 65 will be expelled from the zone 65 radially outwardly through the port series 64, and into the interior 10 of the low pressure cylinder means 3. This fluid expelled from zone 65, in response to buff movement of the piston 16, is returned to the draft side 65*a* of the interior space 65 by three check valves 66, 67 and 68.

Conversely, during draft movement of the piston 16, away
ım the full buff position of this piston shown in FIG. 4, fluid
:xpelled from high pressure zone 65*a* through the port series
into the low pressure zone 10. This fluid from the low pres-
re zone 10 returns to the buff end 65*b* of the high pressure
linder zone 65 by way of a fourth check valve 69.

From a structural standpoint, each of the check valves 66,
, 68 and 69 is identical such that it is appropriate to describe
uctural details of only one representative valve 69.

As shown in FIG. 7, valve 69 includes a cylindrical body
rtion 70, connected to the exterior of cylinder wall 9. This
dy portion includes a male threaded coupling portion 71
ıich is threadably connected with a female threaded aper-
e 72 in cylinder wall 9. A cylindrical valve member 73 is
ıunted for telescoping movement within body member 70. A
coil spring 74 biases valve 73 radially outwardly to the
ısed valve position shown in FIG. 7. This biasing is effected
having one end 74*a* of coil spring 74 disposed in abutting
gagement with an annular, valve body ledge 75, with the
ıer, outermost end 74*b* of spring 74 engaging an annular
lve flange 76. In the closed valve position a plurality of ports
, projecting radially through a cylindrical valve wall 78, are
lated from the high pressure zone 65. This isolation is ef-
:ted by having a closed plate 79 at the inner end of valve 73
lvingly and substantially sealingly engage a seat 80 formed
valve body 70.

With this valve structure, fluid pressure within the zone 65
ll tend to close the valve. Pressure in the zones 10, which ex-
:ds that in the zone 65, will overcome the biasing influence
the valve spring 74 and move the valve member 73 inwardly
an open valve condition.

The three valves 66, 67 and 68 at the draft end of the
inder wall 9 provide the necessary high flow capacity to
urn flow to the cylinder zone 65*a* during buff movement of
: piston 16. Indeed, the total capacity of the ports 77 of each
the valves 66, 67 and 68 may substantially exceed the total
w capacity of the ports 77 of the valve 69 so as to more ef-
:tively accommodate the buff return flow. As will be ap-
:ciated, with the draft shock forces being normally substan-
lly less than buff shock forces, the lower capacity of the sin-
valve unit 69 will provide a sufficient return flow capacity
enable fluid to be restored to the buff zone 65*b* in response
draft movement of the piston 16.

Effective control over runout type train action events is pro-
led by a control valve 81 mounted in the draft end of the
inder wall 9 as shown schematically in FIG. 6. Valve 81 is
the control valve type described in detail in the aforesaid
t. No. 3,451,561 to Stephenson et al.

To summarize briefly, valve 81 includes a valve body 82
:h an externally threaded, male coupling portion 83. Valve
dy 82 is connected to the exterior of high pressure cylinder
ll through a male, threaded coupling portion 83 which is
eadedly engaged with a female threaded aperture 84
med in wall 9.

As will be here appreciated, the radial width of the annular
ice 10 is sufficient to accommodate this mounting of the
ve 31, as well as the previously described and essentially
ilar mountings of the return valves 66, 67 68 and 69, and
ow for flow through these valves between the zones 10 and

Valve 81 includes cylindrical valve member 85 mounted for
escoping axial movement in a valve body aperture 86. A
l spring 87 biases the valve member 85 radially inwardly.
is biasing is effected by having the innermost end 87*a* of
ing 87 engage a flange 88 projecting radially outwardly
m the valve member 85, while an outermost end 87*b* of
ing 87 engages a flange 89 projecting radially inwardly
m cylindrical valve body 82.

With this biasing arrangement, one or more radially extend-
: ports 90 formed in valve member 85 are disposed inwardly
cylinder wall 9 so as to be in fluid communication with the
ıe 65. The innermost extremity of the valve member 85 is
ıed by a valve head plate portion 91, as schematically
own.

With the valve member 85 biased to the normally open valve position shown in FIG. 8, fluid may flow out of the draft zone 65*a* and into the lower pressure zone 10 in response to draft movement of the piston 16. Thus, in railway yards, if car coupling has been effected so as to induce some buff movements of the piston 16, the normally open condition of the valve 81 will provide for a relatively rapid restoration of the piston 16 to the neutral position illustrated in FIG. 1. However, with a train in motion, and with runout train action tending to impose relatively higher draft movement velocities on the piston 16, the fluid flowing through the port means 90 will be moving at such a velocity as to create a pressure drop across the wall 91 operable to move the valve member 85 outwardly to a closed valve position. This closed valve position will result by retracting the ports 90 into the wall aperture 86, and by moving the valve head 92 into substantially valve closing engagement with the wall portion 93 of valve body 82. Once valve 81 closes in response to such runout action, increased resistance to an outflow of fluid from zone 65*a* results. This increased resistance to an outflow of fluid flow effectively impedes the draft movement of the piston 16 so as to reduce the severity and extent of the runout event.

FLUID SCAVENGING AND RETENTION SYSTEM

A significant facet of the invention resides in a unique scavenging and fluid retention system which effectively eliminates the need for high precision seal structures.

As shown in FIGS. 1, 2 and 3, the auxiliary piston rod 19 is supported by a bushing 94. Bushing 94 is mounted in the aperture 20 and interposed radially between the edge of this aperture in plate 13 and the auxiliary piston rod 19. The bushing 94 provides effective stabilization and guiding for the auxiliary piston rod 19 but may permit some axial leakage between the bushing 94 and the shaft 19.

Hydraulic fluid which may have leaked between the bushing 94 and the shaft 19 will enter a fluid reservoir 95 defined by a vertically elongate housing wall 96. Housing wall 96 may be secured by threaded fastening means 96*a* to end plate 13 so as to enclose the end of auxiliary piston rod 19 which projects beyond wall 13 and away from the high pressure zone 65. Thus, wall 96 serves to protect the reciprocating or auxiliary piston rod 19 and also serves to retain hydraulic fluid which has leaked out of the zone 65*b*. This fluid is returned to the low pressure reservoir zone 10 by a passage means 97 formed in the lower end of the plate 13, as schematically shown in FIG. 3.

A seal assembly 98 fabricated of conventional sealing elements is interposed radially between the periphery of the aperture 18 of plate 14 and the outer periphery of the main piston rod 17. Fluid that may tend to leak along the interface of the seal means 98 and the shaft 17 is returned to low pressure reservoir 10 by way of the scavenging passage means 99 shown schematically in FIG. 3.

Passage means 99 communicates with the interface of the seal means 18 and shaft 17 by way of an annular fitment 100. This fitment includes an annular groove 101 adjacent the shaft 17, an annular groove 103 communicating with the scavenging passage means 99, and radial ports 104 which provide communication between the grooves 101 and 103.

In this connection, it will be understood that the cavities 65 and 10 and the reservoir 95 will be substantially filled with hydraulic fluid which serves to impede and control the movement of the piston 16. This hydraulic fluid will completely fill the space 65 and will occupy the void space of reservoir 95 and the void space in low pressure zone 10 so as to provide a fluid head operable to maintain complete filling of the high pressure zone 65. However, in zones 95 and 10, enough void space must be left to accommodate reciprocating movement of piston rod 19 in space 95.

DIMENSIONAL CRITERIA

With key 53 engaging coupler sill slot end 54*a*, a longitudinal gap 105 exists between coupler slot end 54*b* and key 53.

With key 53 engaged with all slot ends 32*b* and 33*b*, and with yoke 35 disposed at its fully restored position, a longitudinal gap 106 will exist between the key 53 and the yoke slot ends 41*b* and 42*b*.

The axial extent of the gap 105 slightly exceeds the longitudinal extent of the gap 106.

The longitudinal gap 107 between the leftmost end 108 of yoke 35 and the rightmost abutment defining end 109 of plate 14 determines the extent of draft travel of the yoke 35.

The increment 107 is slightly shorter than the longitudinal increment 107a existing between the leftmost side 110 of the piston 16 and the rightmost side 111 of cylinder zone 65, as defined by the bushing 94 and the cylinder head 11.

The longitudinal length 112 of the coupler portion extending between slot end 54*a* and the leftmost extremity 113 of the coupler 52 is such as to enable the plate 48 to abuttingly engage the coupler bar face 113, with the yoke 35 fully restored and the key 53 engaged with the sill slot ends 32*b* and 33*b*. In other words, the longitudinal extend of this portion of the coupling bar enables the yoke 35 to be fully restored without engagement between the key 53 and the sill slots and coupler slot preventing such full restoration.

The longitudinal gap 114 between key 53 and sill slot ends 32*a* and 33*a* (with key engaging slot ends 32*b* and 33*b*), augmented by the length of gap 106, yields an increment which is slightly less than the length of increment 107. This allows for a two stage transfer of buff shock to sill 2, in a manner to be now described.

MODE OF OPERATION OF UNIT

The operation of the cushioning device 1 will be described consecutively, from a condition of neutrality, through a full buff condition, and finally back to a condition of full restoration or neutrality.

Commencing with the neutral or fully restored condition of the apparatus shown in FIG. 1, it will be seen that the yoke 35, acting through the plate 48 is in engagement with the coupler end 113. As buff force is imposed on the coupler 52, the coupler end 113, acting on plate 48, presses the yoke 35 to the left. As this buff movement continues, under the full control of the hydraulic fluid within the zone 65*b*, the key 53 will be brought into engagement with the sill slot ends 32*a* and 33*a*. With the key 53 thus engaging these sill slot ends, the other or rightmost end of the key 53 will abuttingly engage the yoke slot ends 41*b* and 42*b*. This concurrent engagement between the yoke and sill slot ends and the key 53 will occur slightly before the yoke face 108 abuttingly engages the cylinder defined abutment 109, because of the previously described relations between increments 114, 106 and 107. Thus, the elasticity of the sill, key and yoke will provide some initial absorption of buff forces, while the yoke 35 continues limited buff movement equal to the difference between the increments or gaps 105 and 106. This difference in increments is sufficient to enable the continued buffed movement of the yoke 35 to bring the faces 108 and 109 into abutting engagement. When this abutting engagement occurs, shock forces will be transmitted, in a second phase through the plate 14 and heavy cylinder wall 9 to the end plate 13. This shock force transmitted to the plate 14 will be transmitted to the sill 2 trough the abutment defining brackets 25 and 26.

This, it will be appreciated that mechanical buff force is absorbed in two stages. The first stage of mechanical shock absorption occurred at the point where the yoke slot ends 41*b* and 42*b* and the sill slot ends 32*a* and 33*a* simultaneously engaged the key 53. The second, and subsequent, stage of mechanical shock absorption occurred at the point where the face 108 abuttingly engaged the cylinder face 109. At this point of second shock absorption, illustrated in FIG. 4, it is significant to note that mechanical shock is dissipated or transmitted through the unit 1 to the sill 2 without passing through the relatively thin walled, cylinder sidewall 6. In this manner, damage to the thin walled cylinder means 3 is effectively avoided.

Restoration of the piston 16 from the full buff condition shown in FIG. 4 to the control position shown in FIG. 1, is effected by springs of the restoring mechanism 55.

When faces 108 and 109 abut, some space remains in zone 65*b*, as shown in FIG. 4. This insures that, in the full buff position of piston 16, excessive fluid pressure is not developed. During the restoring or draft movement of the piston 16, influenced either by the mechanism 55 or a draft force acting on the coupler 52, the yoke 35 will move to the right, viewing the apparatus as shown in FIG. 1.

Near the end of this draft movement, the key 53 will be brought into abutting engagement with the sill slot ends 32*b* and 33*b*.

Where the draft force of coupler 52 exceeds the restoring force of unit 55, this abutting engagement between the key and the sill slot ends take place prior to the termination of the restoring movement of the piston 16 and the yoke 35 The previously noted gaps 106 and 105 will enable the yoke 35 to continue its restoring movement for an increment equal to the gap 106. This continued movement of the yoke 35, which will be effected by the restoring mechanism 55, will close the gap 106 between the coupler 52 and the yoke 35, i.e., bring the yoke face 48 into abutting engagement with the coupler end 113.

As shown in FIG. 5, with draft forces acting on the coupler 52, the gap 106 will exist longitudinally between the face 113 and the plate 48 at the point where the key 53 has engaged the slot ends 32*b* and 33*b*, assuming, of course, as earlier noted, that draft force on coupler 52, rather than the restoring spring force of unit 55 is governing restoration.

Where the restoring force of unit 55 governs, gap 106 between face 113 and plate 48 will have been closed prior to the engagement of key 53 with slot ends 32*b* and 33*b*. However, even under this mode of restoration, the unit parts, at full restoration, will assume the disposition shown in FIG. 1.

It will thus be appreciated that train action or runout events as determined by the sliding movement of the key 53 in the sill slots 32 and 33 are limited to the gap 114 schematically shown in FIG. 1. This gap 114 is less than the increment of buff movement of the coupler 52 under the continuous control of the fluid in the reservoir 65 of the impedance mechanism. As will be appreciated the difference between the key slot controlled increment 114 and the total increment 107 of controlled buff movement results from the gaps 105 and 106, i.e., lost-motion connections between the coupler and the key as well as between the yoke and the key.

SUMMARY OF MAJOR ADVANTAGES AND SCOPE OF INVENTION

A principal advantage of the invention resides in the provision of an effective system for transmitting mechanical shock through a cushioning device so as to transmit force through a heavy walled cylinder and the potentially injurious transmission of force trough a thin walled cylinder which encircles the thicker cylinder wall.

The two-stage force transfer, in buff action, tends to minimize mechanical damage during the handling of high buff shocks.

Another principal advantage of the invention resides in a lost-motion arrangement which affords an extent of hydraulically controlled buff movement greater than that which would result from the normal sliding movement of a draft key through sill slots. Thus, the shock absorbing advantages of a relatively long buff stroke are obtained, while maintaining key movement determined, train action phenomena at a somewhat lower level.

Since the severity of train action events increases with the extent of travel of the draft key in the sill slots, maintaining the key travel at the lowest possible level tends to reduce the severity of train action events.

The use of the auxiliary piston rod in conjunction with the main piston rod avoids the necessity of compensating for the entry of the main piston rod into the fluid reservoir 65. Thus

ilient accumulators, etc., previously often incorporated in shioning devices may be entirely eliminated.

It is also significant to note that the restoring mechanism itores the coupler to a position where no draft movement is esible. This restoration substantially simplifies overall shioning unit structure, in direct defiance of what was previsly thought to be the necessary accommodation of draft ovement from the neutral position of a hydraulic cushioning it.

The unique structure and disposition of the three coil rings of the restoring unit provides, in an axially compact d vertically compact package, a restoring mechanism of opium restoring capability.

The scavenging and fluid retention system of the unit enas the avoidance of high precision seals so as to maintain brication cost at a relatively low level.

The check valve flow control system, as well as the train acn control valve, provide a modular concept for controlling id flow in the impedance system. This unique modular apoach provides great versatility in manufacturing and enables its to be easily modified in accordance with different erating criteria.

As will be appreciated, the overall unit is characterized by treme structural simplicity and is readily incorporable in nventional railway car sills. Little or no modification of such s is required to effect the installation of the cushioning unit.

In describing and claiming the invention, reference has been ade to various key and slot structures. Where this terminolois employed it will be understood that it is intended to conplate and embrace the obvious reversal of parts, the use of s in lieu of flat platelike keys, etc. It will also be understood t to facilitate the disclosure of this invention, components ve been shown in a unitized format where, obviously, asnbly operations would require multielement units.

In describing the invention, reference has been made to a eferred embodiment. However, those skilled in the railway shioning art and familiar with the disclosure of this inven- n may well recognize additions, deletions, substitutions, or ier modifications which would fall within the purview of this vention as set forth in the appended claims.

We claim:

1. A railway cushioning apparatus comprising:

outer cylinder means;

said outer cylinder means to define an annular space;

piston means mounted for axial sliding movement within and relative to said inner cylinder means;

hydraulic impedance means operable to impede, but permit, a flow of fluid from the interior of one end of said inner cylinder means to and through said annular space and into the interior of another end portion of said inner cylinder means;

means operable to connect one of said piston means and outer cylinder means with coupling means;

means operable to transmit mechanical, buff shock longitudinally through said inner cylinder means and substantially prevent the transmission of said mechanical buff shock through said outer cylinder means;

said last named means comprising cylinder head means closing one end of said inner cylinder means, slidably mounted within said outer cylinder means, and operable in response to buff shock transmitted thereto, to transmit buff shock to said inner cylinder means, said cylinder head means being further operable in response to buff shock induced, axial contraction of said inner cylinder means to move longitudinally of and relative to said outer cylinder means.

2. A railway cushioning apparatus comprising:

outer cylinder means including:

a cylindrical outer sidewall having buff and draft end portions,

a first cylinder head disposed generally at said buff portion end of said outer sidewall,

means fixedly anchoring said first cylinder head in relation to said outer sidewall,

a second cylinder head disposed generally at said draft end portion of said outer sidewall, and

said second cylinder head being slidably mounted within said outer sidewall for axial movement relative to said outer side wall generally toward said first cylinder head;

inner cylinder means including:

a cylindrical, inner sidewall having buff and draft end portions,

a third cylinder head disposed generally at said buff end portion of said inner sidewall,

means fixedly anchoring said third cylinder head in relation to said inner sidewall,

a fourth cylinder head disposed generally at said draft end portion of said inner sidewall, and

said fourth cylinder head being mounted for axial movement relative to said outer sidewall, generally toward said third cylinder head;

said axial movement of said second cylinder head relative to said outer sidewall being permitted in response to axial contraction of said inner sidewall;

said first and third cylinder heads being provided, respectively, by portions of common plate means;

said second and fourth cylinder heads being provided respectively, by portions of other common plate means;

piston means including:

a piston head mounted for axial sliding movement within said inner sidewall;

a main piston rod projecting from said piston head slidably and telescopingly through said fourth cylinder head;

said inner sidewall being spaced inwardly from said outer sidewall to define an annular space;

said inner sidewall engaging said second cylinder head and being operable to elastically resist movement of said second cylinder head generally toward said first cylinder head;

yoke means connected with said main piston rod, said yoke means being operable to be connected with a coupling bar;

impedance means operable to impede but permit a flow of fluid between the interiors of the draft and buff end portions of said inner sidewall through said annular space;

said yoke means being operable to abuttingly engage said second cylinder head of said outer cylinder means and impart mechanical buff force thereto, with said force being transmitting through said inner sidewall to said first cylinder head, said axially movable second cylinder head substantially preventing the transmittal of said force through said outer sidewall.

3. Apparatus as described in claim 2:

said apparatus including first end plate means having:

a first plate portion defining said third cylinder head and telescopingly received within said buff end portion of said inner sidewall and disposed in interfering fit in relation to said inner sidewall, and

a second plate portion projecting radially outwardly from said first plate portion and defining said first cylinder head;

said apparatus including second end plate means having:

a third plate portion defining said fourth cylinder head and telescopingly received within said draft end portion of said inner sidewall and disposed in interfering fit in relation to said inner sidewall and

a fourth plate portion projecting radially outwardly from said third plate portion and defining said second cylinder head;

said piston means including an auxiliary piston rod extending axially away from said main piston rod and having a cross section equal to that of said main piston rod;

said first end plate means defining an aperture telescopingly and slidably receiving said auxiliary piston rod;

wall means attached to said first plate means externally of said outer cylinder means and enclosing said auxiliary piston rod, said wall means defining a fluid reservoir;

first passage means providing fluid communication between said fluid reservoir and said annular space;

seal means mounted in said second plate means and providing a substantial seal between said second plate means and said main piston rod;

second passage means providing fluid communication between said seal means and said annular space and operable to transmit fluid leaking between said main piston rod and said seal means to said annular space.

4. An apparatus as described in claim 3 wherein said impedance means comprises:

a plurality of check valves mounted on said draft end portion of said inner sidewall, each of said check valves being operable to transmit fluid from said annular space through said inner sidewall to the interior of said draft end portion of said inner sidewall in response to buff movement of said piston means;

control valve means mounted on said draft end portion of said inner sidewall, said control valve including valve means biased to an open condition and operable when open to permit a flow of fluid from the interior of said draft end of said inner sidewall to said annular space, said control valve means being operable to close and prevent said flow of fluid in response to a predetermined rate of draft movement of said piston means; and

a check valve mounted in said buff end of said inner sidewall and operable to permit a flow of fluid from said annular space into the interior of said buff end of said inner sidewall in response to draft movement of said piston means.

5. A railway cushioning apparatus comprising:

cylinder means;

piston means mounted for telescoping movement within and relative to said cylinder means;

impedance means operable to impede movement of said piston means within and relative to said cylinder means

one of said piston means and cylinder means being adapted to be fixedly positioned on a railway car;

the other of said piston means and cylinder means being operable to be connected with coupling means;

movement limiting means operable to limit draft movement of said coupling means to a first, fixed increment; and

extensible connection means between said coupling means and said other of s said piston means and cylinder means and operable to permit a second increment of buff movement of said coupling means under the continuous control of said impedance means, with said second increment exceeding the length of said first increment;

said extensible connection means including:

yoke means connected with said other of said piston means and cylinder means,

lost motion coupling means interconnecting said yoke means and said coupling means,

said lost motion coupling means including first sill slot means carried by said railway car and having a closed draft end, draw bar means in said coupling means, key means carried by said draw bar means, and

second, slot means in said yoke means extending longitudinally of said railway car and in the general direction of said buff and draft movements of said coupling means, said second, slot means supporting said key means for movement longitudinally of said railway car, and said yoke means,

said closed draft end of said sill slot means being operable to limit movement of said key means in response to draft force acting thereon through said draw bar means, with said second, slot means being operable to permit movement of said yoke means, in a draft direction, continued in said draft direction after said draft end of said sill slot means has limited said movement of sall key means.

6. A railway cushioning comprising;

cylinder means;

piston means mounted for telescoping movement within relative to said cylinder means;

hydraulic impedance means operable to impede but permit movement of said piston means within and relative to said cylinder means;

piston rod means extending from said piston means;

yoke means connected with said piston rod means;

said yoke means including longitudinally extending, yoke slot means;

sill means;

said sill means including longitudinally extending sill slot means;

key means interconnecting said sill means and said yoke means, said key means being slidably disposed in and intersecting said yoke slot means and said sill slot means;

coupling means connected with said key means;

said coupling means including longitudinally extending coupling slot means;

said key means being longitudinally movable through said yoke slot means;

said key means being longitudinally movable through said sill slot means;

said yoke slot means having:

a draft end engageable with said key means in response to draft movement of said coupling means, and

a buff end;

said sill slot means having;

a draft end engageable with said key means in response to draft movement of said coupling means, and

a buff end engageable with said key means in response to buff movement of said coupling means; and

resilient restoring means operable to move said yoke means away from said cylinder means, subsequent to engagement of said key means with the draft end of said sill slot means, and position said yoke means at a fully restored position with said draft end of said yoke slot means spaced from said key means;

said hydraulic impedance means being operable to continuously impede buff movement of said yoke means from said fully restored position.

7. A railway cushioning apparatus as described in claim 6 including:

abutment means mounted on said cylinder means and operable to engage and limit buff movement of said yoke means subsequent to engagement of said key means with said buff end of said sill slot means.

8. An apparatus as described in claim 7:

wherein, at an impact position of said yoke means, said buff end of said sill slot means is operable, to engage said key means with said draft end of said yoke slot means concurrently engaging said key means and with said abutment means being spaced from said yoke means;

said sill means, yoke means and key means being sufficiently elastic to permit continued buff movement of said yoke means beyond said impact position to bring said yoke means into abutting engagement with said abutment means.

9. An apparatus for cushioning forces imposed on a railway coupling, said apparatus comprising;

key means connecting a railway coupling to a railway car sill;

impedance means for hydraulically impeding buff movement of said railway coupling continuously over a predetermined increment of buff movement of said coupling, said impedance means including a low pressure cylinder wall encircling and spaced from a high pressure cylinder wall;

means for circulating hydraulic fluid operable to impede movement of said coupling through an annular space located between said high pressure cylinder wall and said low pressure cylinder wall of said impedance means;

means for transmitting mechanical shock from said coupling to a portion of a railway car through said high pressure cylinder wall while concurrently, substantially preventing the transmission of said mechanical shock through said low pressure cylinder wall to said portion of said railway car;

aid last named means comprising cylinder head means closing one end of said high pressure cylinder wall, slidably mounted within said low pressure cylinder wall, and operable in response to mechanical shock transmitted thereto, to transmit mechanical shock to said high pressure cylinder wall, said cylinder head means being further operable in response to mechanical shock induced, axial contraction of said high pressure cylinder wall to move longitudinally of and relative to said low pressure cylinder wall; and

eans for restoring said coupling along an increment of draft movement while limiting draft movement of said key means to an increment less that that of said buff increment.

0. An apparatus for cushioning forces imposed on a rail- coupling, said apparatus comprising:

ey means connecting a railway coupling to a railway car sill;

npedance means for hydraulically impeding buff movement of said railway coupling continuously over a predetermined increment of buff movement of said coupling, said impedance means including a low pressure cylinder wall encircling and spaced from a high pressure cylinder wall;

eans for circulating hydraulic fluid operable to impede movement of said coupling through an annular space located between said high pressure cylinder wall and said low pressure cylinder wall of said impedance means;

rst means for transmitting a first mechanical buff shock from said coupling to slotted sill sidewall means of said railway car;

cond means for transmitting a second mechanical buff shock from said coupling to a portion of said railway car through said high pressure cylinder wall while concurrently, substantially preventing the transmission of said mechanical buff shock through said low pressure cylinder wall to said portion of said railway car;

id second means comprising cylinder head means closing one end of said high pressure cylinder wall, slidably mounted within said low pressure cylinder wall, and operable in response to mechanical buff shock transmitted thereto, to transmit mechanical buff shock to said high pressure cylinder wall, said cylinder head means being further operable in response to mechanical buff shock induced, axial contraction of said high pressure cylinder wall to move longitudinally of and relative to said low pressure cylinder wall; and

eans for restoring said coupling along an increment of draft movement while limiting draft movement of said key means to an increment less than that of said buff increment.

1. An apparatus for cushioning forces imposed on a rail- coupling, said apparatus comprising:

y means connecting a railway coupling to a railway car sill with said car sill including first slot means extending longitudinally of said car sill and having longitudinally spaced, closed buff and draft ends, and with said key means being connected with said coupling and passing transversely through, and being longitudinally slidable in said first slot means;

ipedance means for hydraulically impeding buff movement of said railway coupling continuously over a predetermined increment of buff movement of said coupling, said impedance means extending longitudinally of said car sill and including a low pressure cylinder wall encircling and spaced from a high pressure cylinder wall;

eans for circulating hydraulic fluid operable to impede movement of said coupling through an annular space located between said high pressure cylinder wall and said low pressure cylinder wall of said impedance means;

st yoke means for transmitting a first mechanical buff shock from said coupling to slotted sill sidewall means of said railway car;

id first yoke means including:

yoke means connected with and extending longitudinally of said impedance means, and second slot means carried by and extending longitudinally of said yoke means and having longitudinally spaced, closed buff and draft ends, with said key means passing transversely through said second and first slot means and being longitudinally slidable in said second slot means;

second coupling carried abutment means for transmitting a second mechanical buff shock from said coupling to a portion of said railway car through said high pressure cylinder wall while concurrently, substantially preventing the transmission of said mechanical shock through said low pressure cylinder wall to said portion of said railway car;

said second coupling means including cylinder head means closing one end of said high pressure cylinder wall, slidably mounted within said low pressure cylinde. wall, and operable in response to mechanical buff shock transmitted thereto, to transmit mechanical buff shock to said high pressure cylinder wall, said cylinder head means being further operable in response to mechanical buff shock induced, axial contraction of said high pressure cylinder wall to move longitudinally of and relative to said low pressure cylinder wall; and

restoring means for restoring said coupling along an increment of draft movement, with said key means being engageable with the draft end of said first slot means in response to draft movement of said coupling prior to the termination of draft movement of said yoke means as caused by said restoring means;

said restoring means comprising spring means extending longitudinally of said draft and buff movement increments, said spring means being operable to restore said coupling to the draft extremity of said increment of draft movement and to tend to yieldably maintain said coupling at said extremity, said spring means including;

a pair of horizontally spaced coil springs,

first, mutually convergeable, abutment means spaced longitudinally of said buff increment and interconnecting said pair of coil springs with said coupling and said railway car whereby draft movement of said coupling induces compression of said pair of coil springs operable to tend to restore said coupling to said draft extremity.

additional coil spring means displaced at least in part axially from, and interposed, at least in pr rt, horizontally between said pair of coil springs, and

second mutually convergeable, abutment means spaced longitudinally of said buff increment and interconnecting said coupling and said pair of coil springs, said second abutment means being operable to induce compression of said additional coil spring means in response to draft movement of said coupling relative to said pair of coil springs, with said compression of said additional coil spring means tending to restore said coupling to said draft extremity.

12. A method of cushioning forces imposed on a railway coupling, said method comprising:

connecting a railway coupling to a railway car sill with key means;

hydraulically impeding buff movement of said railway coupling continuously over a predetermined increment of buff movement of said coupling;

circulating hydraulic fluid operable to impede movement of said coupling through an annular space located between a high pressure cylinder wall and a low pressure cylinder wall;

transmitting mechanical shock from said coupling to a portion of a railway car through cylinder head means closing one end of said high pressure cylinder wall while concurrently, substantially preventing the transmission of said mechanical shock through said low pressure cylinder wall to said portion of said railway car by moving said cylinder head means longitudinally along and relative to said low

pressure cylinder wall in response to axial contraction of said high pressure cylinder wall caused by said mechanical shock; and

restoring said coupling along an increment of draft movement while limiting draft movement of said key means to an increment less than that of said buff increment.

13. A method of cushioning forces imposed on a railway coupling, said method comprising:

connecting a railway coupling to a railway car sill with key means;

hydraulically impeding buff movement of said railway coupling continuously over a predetermined increment of buff movement of said coupling;

circulating hydraulic fluid operable to impede movement of said coupling through an annular space located between a high pressure cylinder wall and a low pressure cylinder wall;

transmitting a first mechanical buff shock from said coupling to slotted sill wall means of said railway car;

transmitting mechanical shock from said coupling to a portion of said railway car through cylinder head means closing one end of said high pressure cylinder wall while concurrently, substantially preventing the transmission of said mechanical shock through said low pressure cylinder wall to said portion of said railway car by moving said cylinder head means longitudinally along and relative to said low pressure cylinder wall in response to axial contraction of said high pressure cylinder wall caused by said mechanical shock; and

restoring said coupling along an increment of draft movement while limiting draft movement of said key means to an increment less than that of said buff increment.