United States Patent [19]

Seay et al.

[11] **3,752,329**

[45] **Aug. 14, 1973**

[54] **HYDRAULIC CUSHIONING APPARATUS FOR RAILWAY CARS**

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[73] Assignee: **Halliburton Company**, Duncan, Okla.

[22] Filed: **Mar. 2, 1972**

[21] Appl. No.: **231,202**

Related U.S. Application Data

[62] Division of Ser. Nos. 89,544, Nov. 16, 1970, Pat. No. 3,647,088, and Ser. No. 732,236, May 27, 1968, Pat. No. 3,568,855.

[52] **U.S. Cl.** **213/8,** 213/43, 213/67

[51] **Int. Cl.** **B61g 9/16**

[58] **Field of Search** 213/8, 22, 43, 61, 213/67, 69

[56] **References Cited**

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Primary Examiner—Drayton E. Hoffman

Attorney—Michael J. Caddell, James E. Cockfield et al.

[57] **ABSTRACT**

A cushioning apparatus for railway cars, which apparatus includes hydraulic cylinder means, piston means telescopingly disposed within the cylinder means, stabilizing housing means telescopingly receiving a connection between the piston means and draft means connected with the piston means, and additional movement limiting abutment means engaging or cooperable with the cylinder means and the stabilizing means. The cylinder means includes an inner high pressure cylinder side wall means and an outer relatively lower pressure containing side wall means. A force control means serves to prevent the transmission of cylinder damaging compressive force through the relatively lower pressure containing side wall means when the piston means has moved to its extreme buff position.

8 Claims, 13 Drawing Figures

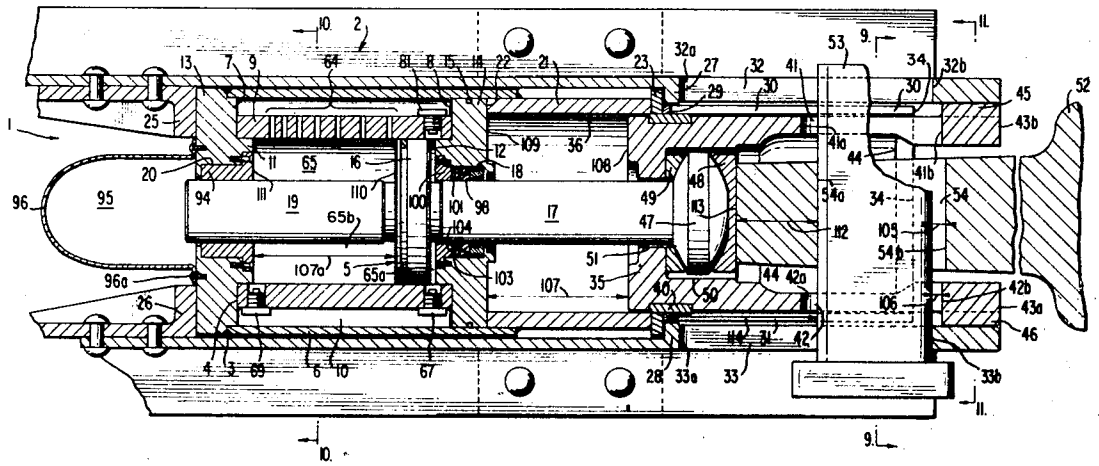
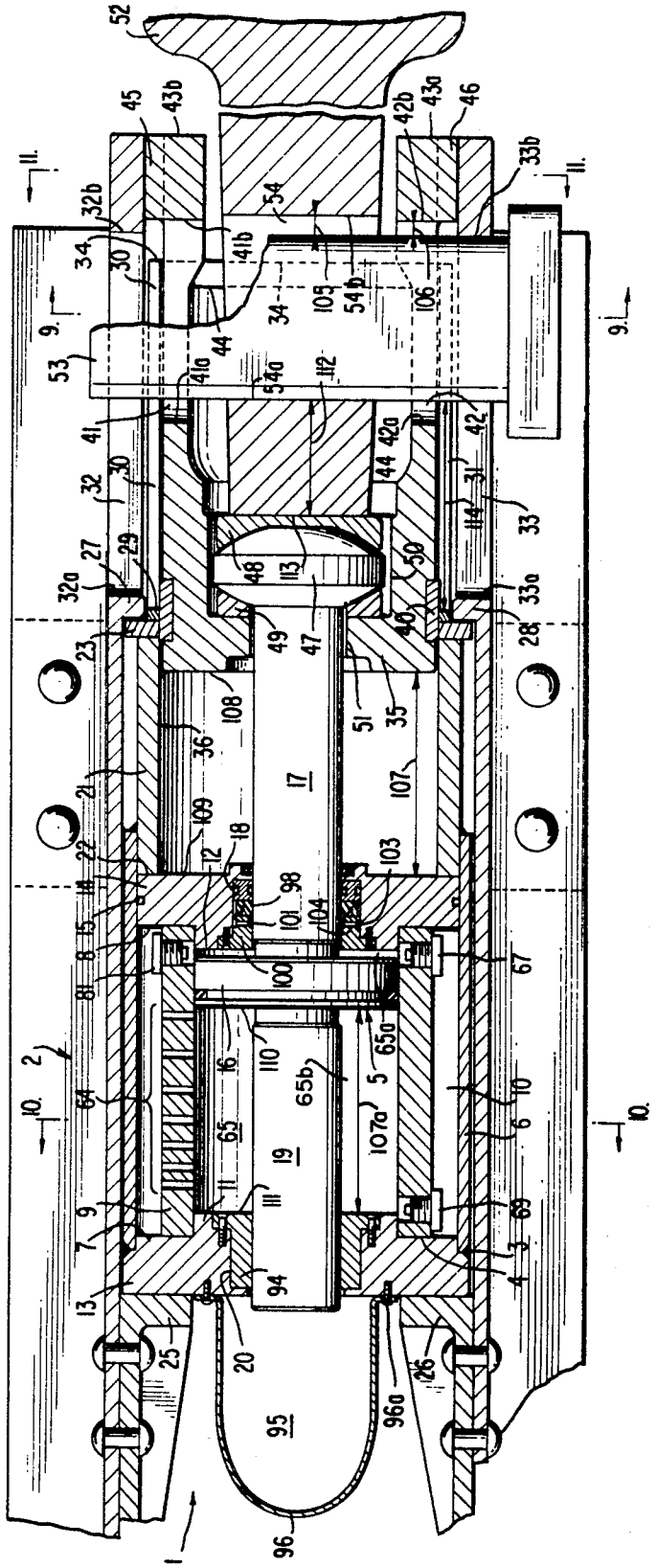


FIG. 1


52
45
43b
42b
43a
46
11.
33b
32b
34
30
41b
54
103
54b
106
9.
44
53
41a
94a
112
41
42a
42
144
31
32
30
114
33
27
29
48
113
50
32a
33a
23
49
47
40
28
108
51
35
36
17
107
21
109
18
12
103
22
98
101
104
14
15
81
100
67
2
110
65a
16
65b
5
10
64
65
107a
6
10.
19
11
111
69
9
7
3
4
13
94
25
20
26
95
96a
96
1

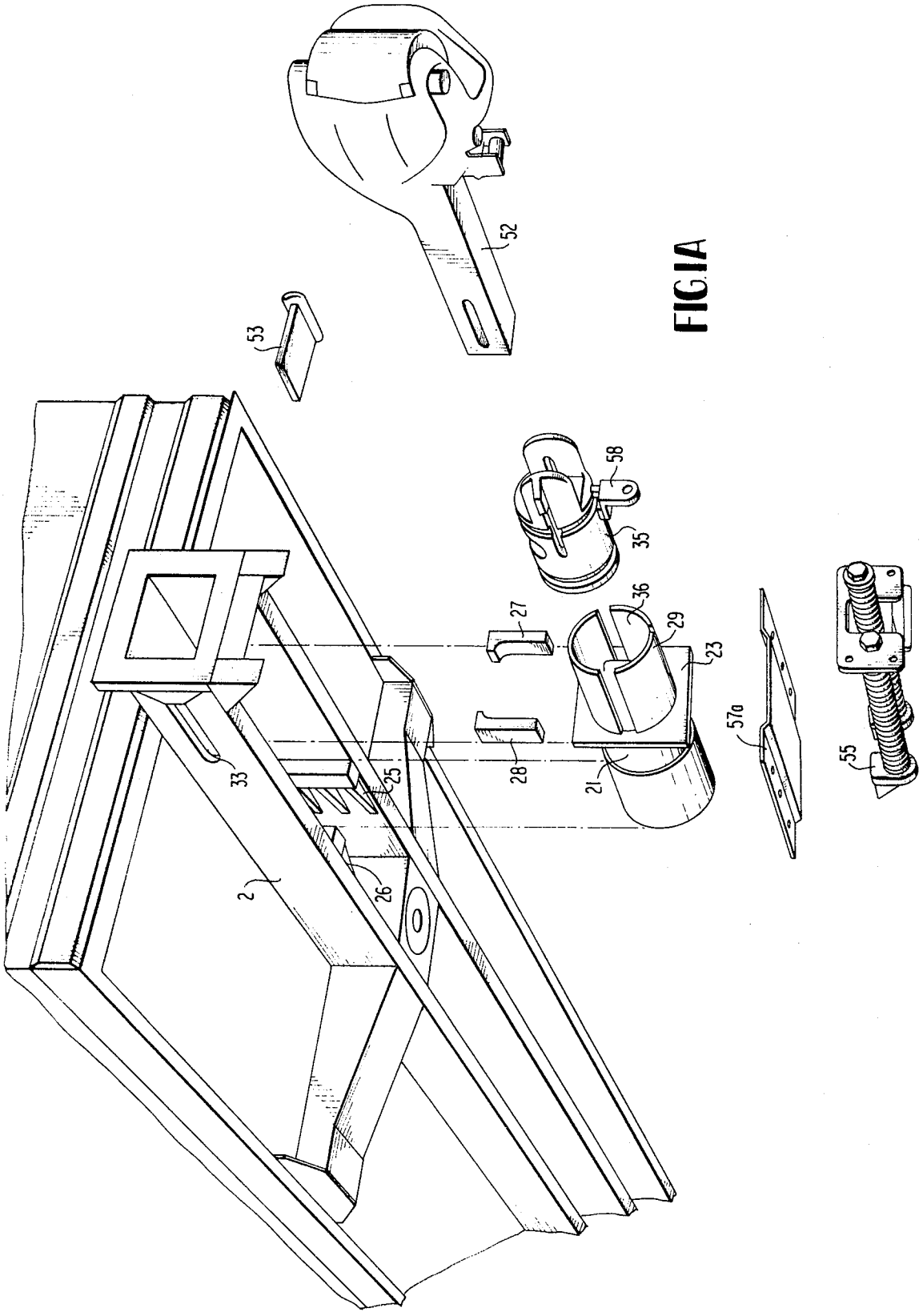


FIG.1A

6 Sheets-Sheet 3

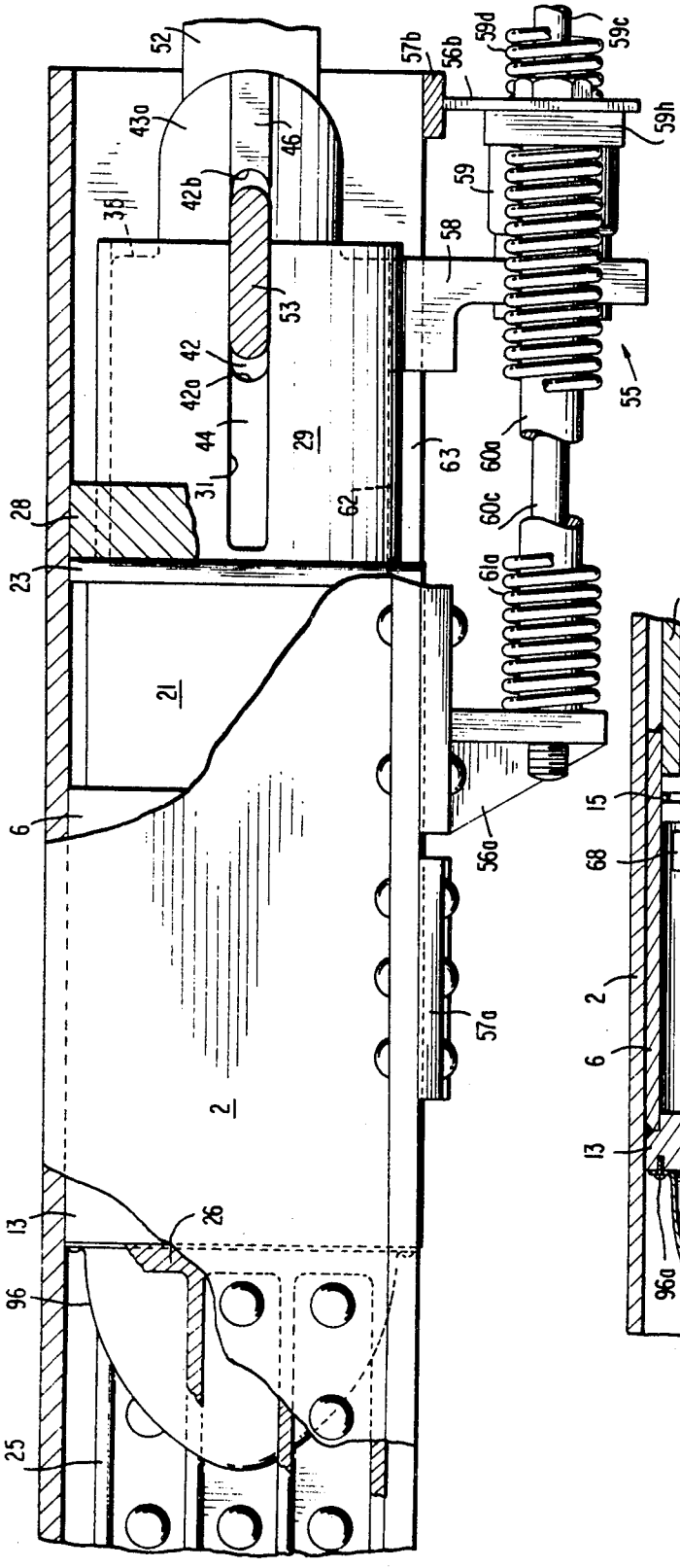


FIG. 2

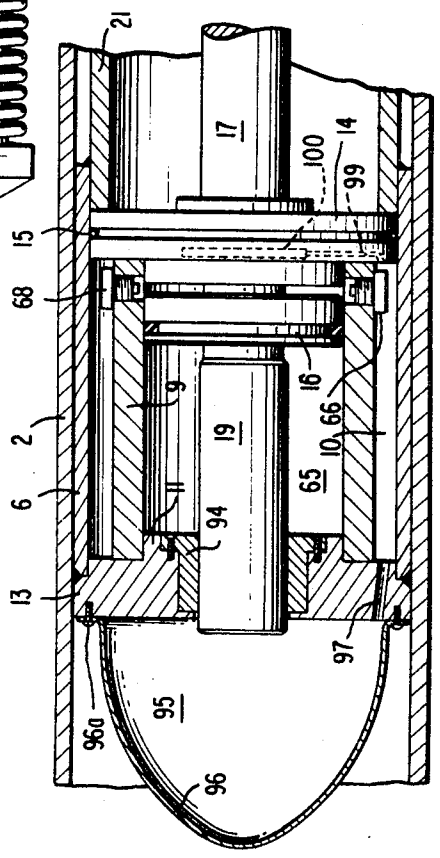
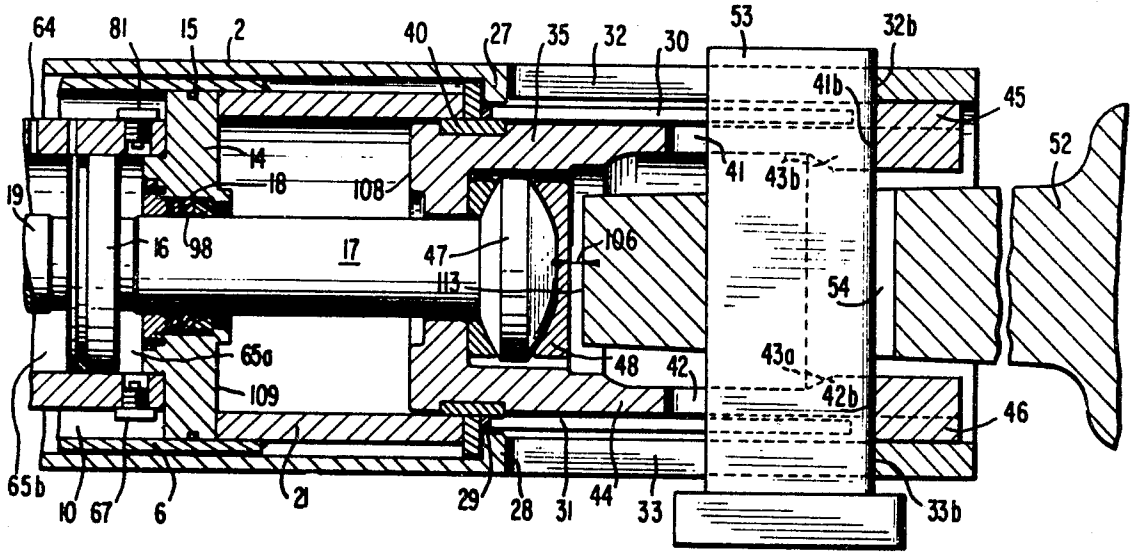


FIG. 3

FIG.5


64
81
15
2
40
27
35
32
30
53
32b
41b
45
52
14
18
108
41
43b
19
16
98
17
47
106
113
54
65a
48
42
43a
42b
46
109
65b
10
67
6
21
29
28
31
44
33
33b

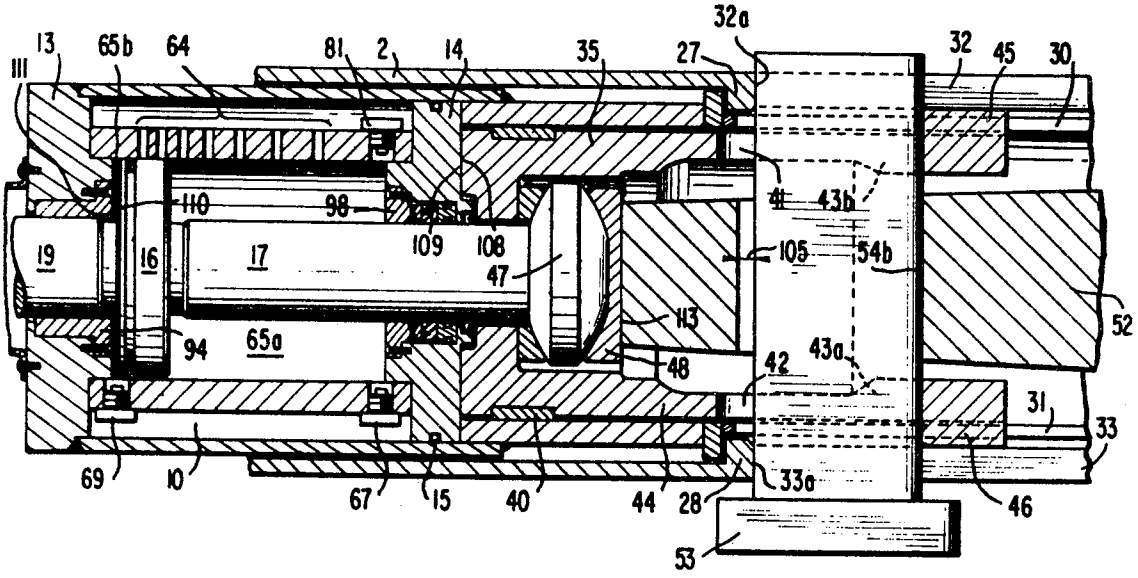

32a
13
65b
64
81
2
14
35
27
32
45
30
111
41
43b
110
98
109
108
105
54b
19
16
17
47
52
113
94
65a
48
42
43a
31
33
69
10
67
15
40
44
28
33a
46
53

FIG.4

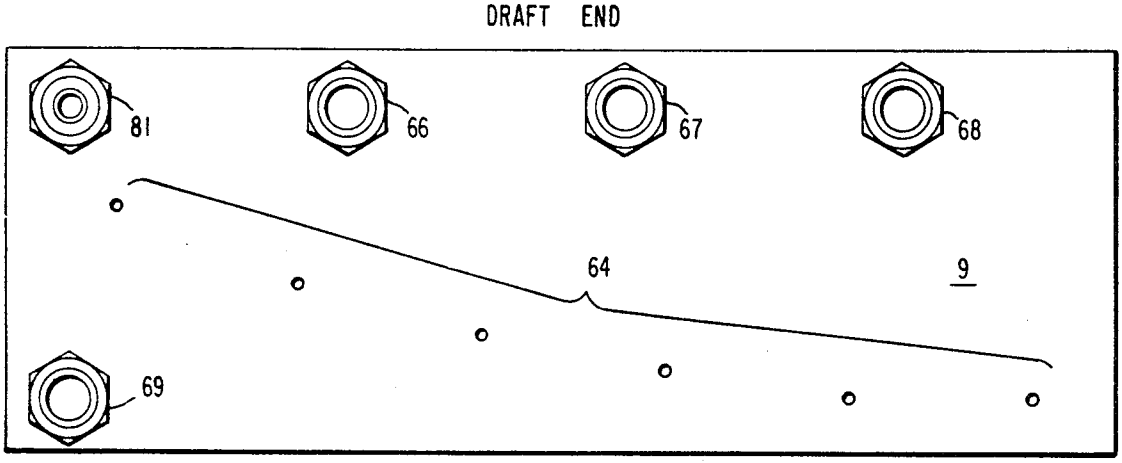


FIG.6

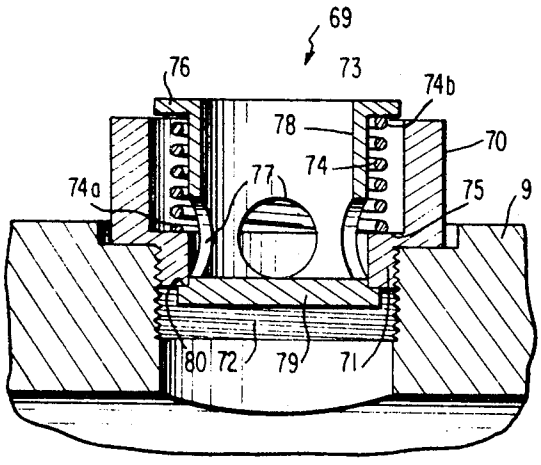


FIG.7

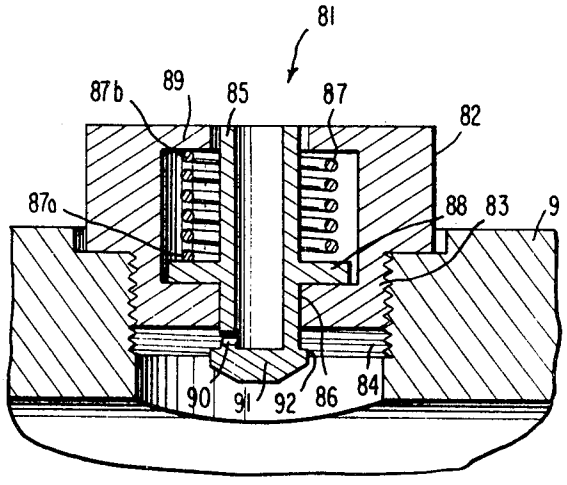


FIG.8

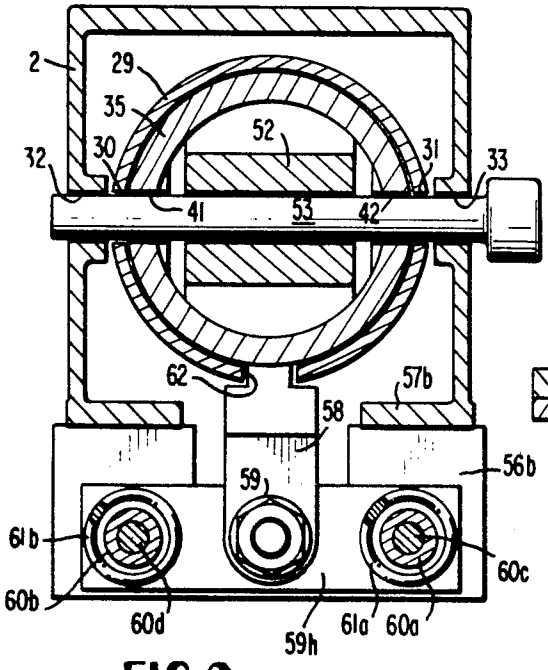


FIG. 9

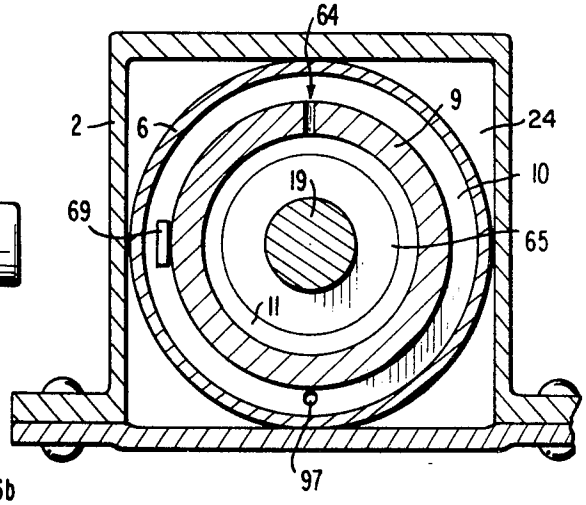


FIG. 10

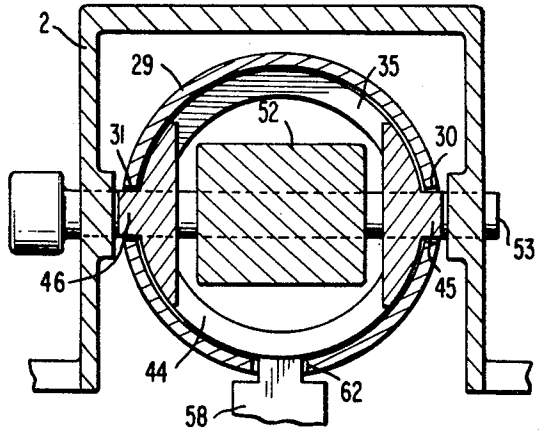
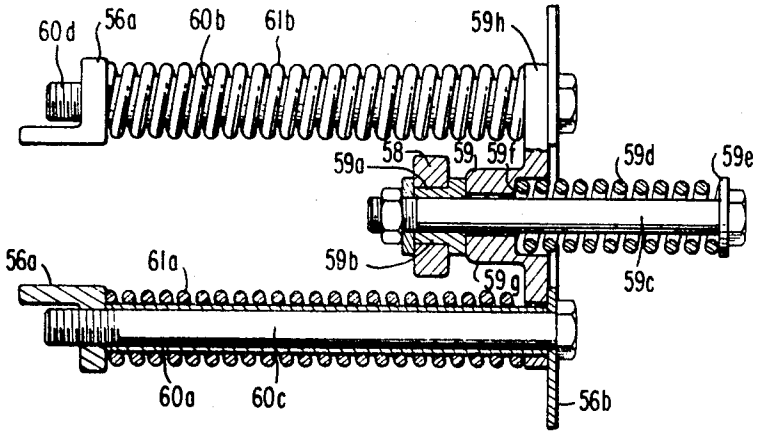


FIG. 11

FIG. 12



CARGO HANDLING SYSTEM AND METHOD

This application is a divisional of U.S. Pat. application Ser. No. 703,514 filed Jan. 23, 1968, now U.S. Pat. No. 3,592,333 issued July 13, 1971, entitled CARGO-HANDLING SYSTEM AND METHOD.

This invention, while useful in a number of applications, is particularly applicable to the handling of a palletized cargo at freight terminals. Originally, freight cargos were handled manually with individual items loaded, unloaded, stored, classified, and moved individually. As the volume of freight and the cost of direct labor increased, conveyors were introduced and in many cases, complex and sophisticated systems evolved. These systems, however, were generally limited to the mechanical handling of individual items and the collecting of them at central points for loading onto pallets. The handling of the loaded pallets was simply by movement along conventional conveyors.

These systems, while employing many standard conveyor components such as curves, switches, transfer tables, and roller bed conveyors, are carefully engineered systems with each system custom designed from the ground up. Further, these systems are static, inasmuch as once installed, they are not capable of modification without substantial re-engineering and the purchase of many additional, custom manufactured components. These systems also require a high degree of uniformity of size and shape of the pallets. As cargos have become more varied, with some of the articles much too big to be handled on the older type of pallets, these systems have proved inadequate.

Systems of the type described require, in addition to the capability of transporting an article from one location to another, storage areas where the pallets or other types of loads may be stored prior to their being loaded onto the aircraft or, alternatively, subsequent to their removal from the aircraft and, yet, prior to an opportunity to dispose of them. The ability of a system to store effectively and efficiently cargos of these types, providing for quick identification and access to them for loading or unloading, has long been recognized as a primary operative criterion in the field. Systems previously available have not effectively fulfilled this requirement. More particularly, the article transfer methods of prior art concepts have required the storage capabilities of the system, particularly as regards the functions of identification and retrieval, be compromised to a point greatly detracting from the overall capabilities of the system.

Another facet limiting the overall effectiveness of the prior art systems is a product of the limitations of space and required man power. The available area upon which such facilities are constructed is generally highly limited, particularly in the case of air cargo installations, and it is imperative that any cargo handling system be retained in as compact form as possible. Problems in procurement and compensation of workers, likewise, limit the number of employees which may be utilized in any given operation in order to retain turn around times for aircraft, trucks and the like to a minimum. Man power and space dictates, thus, have resulted in a marked compromise of overall operating efficiency in the systems available previous to the instant invention.

Consider, for example, a large jet freightliner, an item representing a considerable investment for the particular airline company involved. It is axiomatic, virtually, that the greater the percentage of the time such an aircraft spends in the air actually flying freight from one location to another, the greater will be the financial return on the investment. A corollary to this statement, of course, is that the longer the time elapse during the landing, unloading, reloading and departure of an aircraft, the less efficient the operation from a monitary standpoint. These statements hold true, additionally, regardless of the type of vehicle which is involved in the particular operation.

In the past years, the volume of freight handled by operations of the type described has and continues to increase markedly. As a result of this increase, the demand has been generated for freight handling concepts and hardware beyond the technology of the present art. An eye toward the future demands that installations should be capable of expansion and/or reorganization in order to accommodate new types of freight, increased volumes of freight and the like. Systems currently available, as noted previously, are generally composed of highly specialized, job-engineered components which have little value apart from the system in which they were designed to function. For example, present-day components are limited to highly specialized functions within the system such as turning, linear movement or the like. Any attempt to reorganize these components or to expand the system while utilizing them represents an extremely difficult, if not impossible, undertaking.

It is an object of this invention, therefore, to provide a novel concept of freight handling, storage, loading, unloading and the like which is keyed to present-day and anticipated future demands of transportation concerns. This invention contemplates, thus, the provision of specific representative hardware which has been evolved by the inventors for utilization in the execution of their concepts.

It is an object of this invention to provide such a system wherein freight transfer, storage and the like is executed virtually automatically, manpower requirements being minimized.

It is another object of this invention to provide a system of the type described which is capable of handling high volumes of freight in areas of limited space and, thus, which is feasible for utilization at airfreight terminals, downtown truck terminals and the like where space is always a premium factor in the selection of any type of equipment.

It is an object of this invention, additionally, to provide a novel method of accelerating and decelerating loads during the transfer thereof from module to module from one location to another within the system.

It is still a further object of this invention to provide a novel control concept for a system of the type described which minimizes manpower requirements while markedly increasing the speed, efficiency and other capabilities of the system. The fulfillment of this objective involves, inter alia, the provision of a preprogrammed computer adapted to route loads through the system via preferred and alternate paths, the latter paths being utilized in the event that the preferred path is busy.

It is an object of this invention, thus, to provide a novel method of handling freight within terminals, processing facilities and the like.

These as well as other objects of this invention will be readily understood with reference to the following specification and accompanying figures in which:

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 side wall 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 side wall 6.

Inner cylinder means 4 which comprises a high pressure cylinder, includes a relatively thick cylindrical side wall 9. Relatively thick wall 9 is spaced radially inwardly from the relatively thin side wall 6 of outer cylinder means 3. The spacing between side walls 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, ledge-like portion or plate 13 which is telescopingly received within the buff or left-most end of the side wall 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 ledge-like plate portion which is telescopingly received within the draft end of cylinder side wall 9. Plate portions 11 and 12 are each disposed in an interfering fit relationship with the side wall 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 6.

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 side wall 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 side wall 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 side wall 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 side wall 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 side walls 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 bracket-like 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 ledge-like 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 right-most 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.

As will be appreciated from the foregoing discussion, head and slot connecting means 47, 48, 49, 50 and 51, provides a stress relieving coupling between piston rod means 17 and the drawbar means 52. The interior of yoke 35 provides a socket within which the head end 47 of the piston rod 17 is received.

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 54a of slot 54 and the buff 54b of this slot.

Similarly, key 53 is operable to undergo longitudinal sliding movement between the buff extremities 41a and 42a 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 extremitites 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 56a 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 cylinder-like 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 left-most 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* of connecting means 59. This mounting groove 59*a* 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 right-most extremity of the coil spring 59*d*. An annular flange-like abutment 59*f* engages the left-most 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 right-most 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* 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 sleeve-like rods 60*a* and 60*b*. This 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 appreciated 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 right-most 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 United States Seay Pat. No. 3,301,410. While exponential spacing is desirable, it is possible the exponential spacing may be modified or that additional non-exponentially 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 relatively high capacity check valves 66, 67 and 68.

Conversely, during draft movement of the piston 16, away from the full buff position of this piston shown in FIG. 4, fluid is expelled from high pressure zone 65*a* through the port series 64 into the low pressure zone 10. This fluid from the low pressure zone 10 returns to the buff end 65*b* of the high pressure cylinder zone 65 by way of a fourth check valve 69.

From a structural standpoint, each of the check valves 66, 67, 68 and 69 is identical such that it is appropriate to describe structural details of only one representative valve 69.

As shown in FIG. 7, valve 69 includes a cylindrical body portion 70, connected to the exterior of cylinder wall 9. This body portion includes a male threaded coupling portion 71 which is threadably connected with a female threaded aperture 72 in cylinder wall 9. A cylindrical valve member 73 is mounted for telescoping movement within body member 70. A coil spring 74 biases valve 73 radially outwardly to the closed valve position shown in FIG. 7. This biasing is effected by having one end 74*a* of coil spring 74 disposed in abutting engagement with an annular, valve body ledge 75, with the other, outermost end 74*b* of spring 74 engaging an annular valve flange 76. In the closed valve position a plurality of ports 77, projecting radially through a cylindrical valve wall 78, are isolated from the high pressure zone 65. This isolation is effected by having a closed plate 79 at the inner end of valve 73 valvingly and substantially sealingly engage a seat 80 formed in valve body 70.

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

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

Effective control over run-out type train action events is provided by a control valve 81 mounted in the draft end of the cylinder wall 9 as shown schematically in FIG. 6. Valve 81 is of the control valve type described in detail in the aforesaid Stephenson et al. U.S. Pat. No. 3,451,561.

As is shown in FIG. 6, the plurality of relatively high capacity check valve means 66, 67 and 68 and the relief valve means 81 are located in general alignment with a common plane extending perpendicular to the axis of reciprocation of piston means 16.

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

As will be here appreciated, the radial width of the annular space 10 is sufficient to accommodate this mounting of the valve 31, as well as the previously de-

scribed and essentially similar mountings of the return valves **66, 67, 68** and **69**, and allow for flow through these valves between the zones **10** and **65**.

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

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

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 movement 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 run-out 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 run-out 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 run-out 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**, which is operable to telescopingly receive piston rod **19** during its buff movement, may be secured by threaded fastening means **96a** to end plate **13** so as to be located externally of the unit cylinder means and 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 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 slot end **54***a*, a longitudinal gap **105** exists between coupler slot and **54***b* and key **53**.

With key **53** engaged with sill 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 left-most end **108** of yoke **35** and the right-most 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 left-most 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 **54a** and the left-most 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 extent 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 incre-

ment **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 the 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 right-most 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** through the abutment defining brackets **25** and **26**.

Thus, 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 side wall **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 run-out 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.

ADDITIONAL CONTROL MEANS

Run-in control aspects of the invention may be able to be improved in certain instances by employing the run-in control valve means concepts featured in United States Stephenson et al. Patent No. 3,589,528 and U.S. Seay et al. Patent No. 3,589,527.

Thus, for example, the run-in control valve means **96** may be associated with one or more of the port means in port series **64**.

SUMMARY OF STABILIZING AND ANTI-DEFLECTION FEATURES

As will be apparent from the foregoing discussion, this invention contemplates certain significant stabilizing and anti-deflection features.

These features will now be reviewed with reference to FIG. **1***a* which illustrates various components of the system in an "exploded" or "prior to assembly", schematic format.

As shown in FIG. **1***a*, the stabilizing housing means **21**, **29** is connected with the cylinder means **3**, **4**. Of course, it will here be recalled from FIG. **1** that the connecting means **47** detachably connects the yoke means **35** with the piston means **17**.

The stabilizing housing means **21**, **29** includes connection stabilizing means **36** which telescopingly receives the connecting means **47** and stabilizes this connecting means against lateral deflection caused by buff force acting on the piston means **17**. The yoke means

35 is operable to abuttingly engage a draft end 109 of the cylinder means in response to buff force acting on the piston means, as was described in connection with FIG. 1.

The draft means 52 is connected with the yoke means 35. A first stop means 25, 26 is operable within the sill means 2 within which the cylinder means 3, 4 is positioned, to engage this cylinder means and prevent buff force induced movement of this cylinder means and the stabilizing housing means 21, 29. A second stop means 27, 28 is operable within the sill means 2 to be spaced from the cylinder means 3, 4 and engage the stabilizing housing means 21, 29 at plate 23 and prevent draft movement of this cylinder means and the stabilizing housing means 21, 29 connected therewith.

The antideflection functioning plate means 23 is operable within the sill means 2 to prevent substantial lateral deflection of the stabilizing housing means. This antideflection means 23 extends between the housing means 21, 29 and the sill means 2 at a location spaced from the cylinder means and located between a draft extremity 109 of the cylinder means and a coupling extremity of the draft means 52.

SUMMARY OF MAJOR ADVANTAGES AND SCOPE OF INVENTION

One advantage of the invention relates to the provision of a "pocket" or drop-in type draft gear which is characterized by a modularization of components which simplifies fabrication, installation and servicing.

Another advantage of the invention relates to the provision of a draft gear including means for minimizing the number of stops or abutments required to mount the draft gear in the interior of a railway sill and limited draft gear movement. Intermediate sill stops engaging the draft end of the cylinder means are eliminated.

Another advantage of the invention pertains to the provision of a unique mounting arrangement which stabilizes the connection between an hydraulic impedance mechanism and draft or coupling means, so as to prevent the imposition of substantial lateral deflection forces on the piston means of the impedance mechanism where it passes telescopingly through a wall means to a cylinder means component of the impedance mechanism.

A still further advantage of the invention relates to the provision of an arrangement which effectively prevents the transmission of excessive compressive forces through the relatively lower pressure containing, outer side wall means of an impedance mechanism at the extremity of buff movement of the impedance mechanism components.

It is also a significant advantage of the invention that a fitment scavening system provides a durable and reliable scavenging arrangement entirely housed within an impedance mechanism.

The stabilizing aspects of the invention are particularly advantageous. The cylinder-like extension or housing means, which projects forward of the cylinder means and telescopingly receives the yoke, effectively stabilizes the connection between the yoke and the piston component of the cushioning apparatus. The abutment system which serves to engage, and thus limit draft movement of, the stabilizing housing means operates to effectively prevent the imposition of excessive lateral forces on the piston of the cushioning apparatus where it enters the cylinder means of this apparatus and on the connecting means 47.

In preventing the imposition of substantial or meaningful compressive forces on the outer cylinder wall, the cushioning apparatus prevents the transmission of potentially injurious forces through this outer cylinder means wall in the extreme buff condition of the cushioning apparatus.

The overall combination of the sill mounted cylinder, the double rod piston, and the stress relieving coupling between the rod and a drawbar provides a uniquely easy to install "drop-in" type assembly. This assembly requires minimal sill modification, yet is rugged in its operating characteristics.

The arranging of the check valves and relief valves in general alignment with a common plane, at least at one end of the cylinder, as shown, for example, in FIG. 6, provides an installation which is relatively easy and convenient to fabricate and service.

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

The check valve flow control system, as well as the train action control valve, provide a modular concept for controlling fluid flow in the impedance system. This unique modular approach provides great versatility in manufacturing and enables units to be easily modified in accordance with different operating criteria.

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

In describing and claiming the invention, reference has been made to various key and slot structures. Where this terminology is employed it will be understood that it is intended to contemplate and embrace the obvious reversal of parts, the use of pins in lieu of flat plate-like keys, etc. It will also be understood that to facilitate the disclosure of this invention, components have been shown in a unitized format where, obviously, assembly operations would require multi-element units.

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

What is claimed is:

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

cushioning apparatus including

cylinder means,

piston means contained within and movable relative to said cylinder means,

hydraulic fluid impedance means contained within said cylinder means and operable to impede, buff force and draft force induced relative movement between said piston means and said cylinder means;

yoke means;

connecting means operable to interconnect said yoke means with said piston means;

stabilizing means operable to telescopingly receive said connecting means interconnecting said yoke means and said piston means; and

antideflection means operable to engage said stabilizing means and prevent substantial lateral deflection thereof.

2. An apparatus as described in claim 1 wherein:

said cylinder means includes

relatively high pressure containing, inner side wall means;

relatively lower pressure containing, outer side wall means; and

compression limiting means operable to prevent the transmission of excessive compressive forces through said relatively lower pressure containing outer side wall means when said piston means and cylinder means are in a full buff condition.

3. An apparatus for cushioning forces imposed on a train coupling, said apparatus comprising:

cushioning apparatus including

cylinder means,

piston means contained within and movable relative to said cylinder means,

hydraulic fluid impedance means contained within said cylinder means and operable to impede, buff force and draft force induced relative movement between said piston means and said cylinder means;

yoke means; and

connecting means operable to interconnect said yoke means with said piston means;

said cylinder means including

relatively high pressure containing inner side wall means;

relatively lower pressure containing outer side wall means; and

compression limiting means operable to prevent the transmission of excessive compressive forces through said relatively lower pressure containing outer side wall means when said piston means and cylinder means are in a full buff condition, with said yoke means engaged with said cylinder means.

4. An apparatus for cushioning forces imposed on a train coupling, said apparatus comprising:

cushioning apparatus including

cylinder means,

piston means contained within and movable relative to said cylinder means,

hydraulic fluid impedance means contained within said cylinder means and operable to impede, buff force and draft force indiced relative movement between said piston means and said cylinder means;

stabilizing housing means connected with said cylinder means;

yoke means;

connecting means detachably connecting said yoke means with said piston means;

said stabilizing housing means including connection stabilizing means telescopingly receiving said connecting means and stabilizing said connecting means against lateral deflection caused by buff force acting on said piston means;

said yoke means being operable to abuttingly engage a draft end of said cylinder means in response to said buff force acting on said piston means;

draft means connected with said yoke means;

first stop means operable within a sill means within which said cylinder means is positioned to engage said cylinder means and prevent buff force induced movement of said cylinder means and said stabilizing housing means;

second stop means operable within said sill means to be spaced from said cylinder means and engage said stabilizing housing means and prevent draft movement of said cylinder means and said stabilizing housing means; and

antideflection means operable within said sill means to prevent substantial lateral deflection of said stabilizing housing means,

said antideflection means extending between said stabilizing housing means and said sill means at a location spaced from said cylinder means and located between a draft extremity of said cylinder means and a coupling portion of said draft means.

5. 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;

stabilizing means operable to telescopingly receive said means operable to connect said coupling means and said piston means; and

antideflection means operable to engage said stabilizing means and prevent substantial lateral deflection thereof.

6. A railway cushioning apparatus comprising:

cylinder means having well means including

side wall means,

first end wall means, and

second end wall means,

said first and second end wall means being connected with and spaced longitudinally of said side wall means;

mounting means operable to secure said cylinder means in generally fixed position within a railway car sill;

piston means slidably disposed within said cylinder means and including,

piston body means telescopingly mounted within

said side wall means of said cylinder means, and piston rod means telescopingly projecting through each of said first and second end wall means of said cylinder means;

interior impedance zone means located within said cylinder means, said impedance zone means containing liquid, and being operable to impede movement of said piston body means relative to said side wall means of said cylinder means, with said piston body means in combination with said cylinder side wall means defining buff and draft ends of said impedance zone means located on longitudinally opposite sides of said telescopingly mounted piston body means;

generally annular return flow passage means comprising a continuous chamber surrounding said first and second end wall means and side wall means of said cylinder means by generally encircling at least said side wall means and at least portions of said first and second end wall means of said cylinder means and operable to receive fluid expelled from said impedance zone means in response to movement of said piston body means relative to said cylinder side wall means;

generally fluid-tight housing means comprising generally mutually sealed side and end wall portions operable to house said cylinder means and return flow passage means, with the chamber of said return flow passage means being disposed between said housing means and said cylinder means;

socketed coupling means operable to interconnect said piston rod means and a drawbar of a railway car;

said socketed coupling means including

enlarged head means carried by said piston rod means,

yoke means operable to be connected with said drawbar, and

socket means defined by said yoke means and operable to support said enlarged head means in socketed relation with said yoke means;

port means in said cylinder means disposed at said buff and draft ends of said cylinder means and providing communication between said buff and draft ends of said interior impedance zone means of said cylinder means and said continuous chamber and operable to impede a flow of fluid out of said impedance zone means in response to buff and draft force induced movement of said piston body means relative to said cylinder side wall means;

relatively high capacity check valve means carried by said cylinder means and operable to permit a flow of fluid from said continuous chamber into at least one of said buff and draft ends of said impedance zone means of said cylinder means; and

relief valve means operable to relieve pressure in said at least one of said buff and draft ends of said impedance zone means and carried by said cylinder means;

said relief valve means and said relatively high capacity check valve means each including passage means defining a continuation of said at least one of said buff and draft ends of said interior impedance zone means;

scavenging means including

generally annular fitment means telescopingly receiving a portion of said piston rod means,

generally annular scavenging passage means carried by said fitment means, generally encircling said piston rod means, and operable to receive fluid passing between said fitment means and said portion of said piston rod means,

first transverse passage means extending through said fitment means generally outwardly of an axis of reciprocation of said piston rod means and communicating with said generally annular scavenging passage means, and

second passage means defining a continuation of said return flow passage means, and providing communication between said first transverse passage means and a portion of said return flow passage means generally adjacent one of said first and second end wall means;

said relief valve means and said check valve means each including valve seat means and valve means valvingly cooperable with said valve seat means, with each said valve seat means and valve means being contained inside said cylinder means and housed within a continuation of said impedance zone means which is contained within body means of said wall means of said wall means of said cylinder means;

said cylinder means including

compression limiting means operable to prevent the transmission of excessive compressive forces through said relatively lower pressure containing outer side wall means when said piston means and cylinder means are in a full buff condition;

stabilizing means operable to telescopingly receive said socketed coupling means; and

antideflection means operable to engage said stabilizing means and prevent substantial lateral deflection thereof.

7. A railway cushioning apparatus comprising:

cylinder means having well means including

side wall means,

first end wall means, and

second end wall means,

said first and second end wall means being connected with and spaced longitudinally of said side wall means;

mounting means operable to secure said cylinder means in generally fixed position within a railway car sill;

piston means slidably disposed within said cylinder means and including,

piston body means telescopingly mounted within said side wall means of said cylinder means, and

piston rod means telescopingly projecting through each of said first and second end wall means of said cylinder means;

interior impedance zone means located within said cylinder means, said impedance zone means containing liquid, and being operable to impede movement of said piston body means relative to said side wall means of said cylinder means, with said piston body means in combination with said cylinder side wall means defining buff and draft ends of said impedance zone means located on longitudinally opposite sides of said telescopingly mounted piston body means;

generally annular return flow passage means comprising a continuous chamber surrounding said first and second end wall means and side wall means of

said cylinder means by generally encircling at least said side wall means and at least portions of said first and second end wall means of said cylinder means and operable to receive fluid expelled from said impedance zone means in response to movement of said piston body means relative to said cylinder side wall means;

generally fluid-tight housing means comprising generally mutually sealed side and end wall portions operable to house said cylinder means and return flow passage means, with the chamber of said return flow passage means being disposed between said housing means and said cylinder means;

socketed coupling means operable to interconnect said piston rod means and a drawbar of a railway car;

said socketed coupling means including

enlarged head means carried by said piston rod means,

yoke means operable to be connected with said drawbar, and

socket means defined by said yoke means and operable to support said enlarged head means in socketed relation with said yoke means;

port means in said cylinder means disposed at said buff and draft ends of said cylinder means and providing communication between said buff and draft ends of said interior impedance zone means of said cylinder means and said continuous chamber and operable to impede a flow of fluid out of said impedance zone means in response to buff and draft force induced movement of said piston body means relative to said cylinder side wall means;

relatively high capacity check valve means carried by said cylinder means and operable to permit a flow of fluid from said continuous chamber into at least one of said buff and draft ends of said impedance zone means of said cylinder means; and

relief valve means operable to relieve pressure in said at least one of said buff an draft ends of said impedance zone means and carried by said cylinder means;

said relief valve means and said relatively high capacity check valve means each including passage means defining a continuation of said at least one of said buff and draft ends of interior impedance zone means;

scavenging means including

generally annular fitment means telescopingly receiving a portion of said piston rod means,

generally annular scavenging passage means carried by said fitment means, generally encircling said piston rod means, and operable to receive fluid passing between said fitment means and said portion of said piston rod means,

first transverse passage means extending through said fitment means generally outwardly of an axis of reciprocation of said piston rod means and communicating with said generally annular scavenging passage means, and

second passage means defining a continuation of said return flow passage means, and providing communication between said first transverse passage means and a portion of said return flow passage means generally adjacent one of said first and second end wall means; and

said relief valve means and said check valve means each including valve seat means and valve means valvingly cooperable with said valve seat means, with each said valve seat means and valve means being contained inside said cylinder means and housed within a continuation of said impedance zone means which is contained within body means of said wall means of said cylinder means;

stabilizing housing means connected with said cylinder means;

said stabilizing housing means including connection stabilizing means telescopingly receiving said socket means and stabilizing said socket means against lateral deflection caused by buff force acting on said piston means;

said yoke means being operable to abuttingly engage a draft end of said cylinder means in response to said buff force acting on said piston means;

draft means connected with said yoke means;

first stop means operable within a sill means within which said cylinder means is positioned to engage said cylinder means and prevent buff force induced movement of said cylinder means and said stabilizing housing means;

second stop means operable within said sill means to be spaced from said cylinder means and engage said stabilizing housing means and prevent draft movement of said cylinder means and said stabilizing housing means; and

antideflection means operable within said sill means to prevent substantial lateral deflection of said stabilizing housing means, said antideflection means extending between said stabilizing housing means and said sill means at a location spaced from said cylinder means and located between a draft extremity of said cylinder means and a coupling portion of said draft means.

8. A railway cushioning apparatus as described in claim 7 wherein:

said apparatus includes:

compression limiting means operable to prevent the transmission of excessive compressive forces through said housing means when said piston means and cylinder means are in a full buff condition.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,752,329 Dated August 14, 1973

Inventor(s) Orum E. Seay, Robert Q. Shelton

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

In column 7, line 3, delete "appreciated" (first occurrence) and insert in its place -- will --.

In column 13, line 55, delete "scavening" and insert in its place -- scavenging --.

In column 15, line 52, delete "indiced" and insert in its place -- induced --.

In column 19, line 40, delete "an" and insert in its place -- and --.

Signed and sealed this 2nd day of April 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.