United States Patent

[11] 3,537,598

[72] Inventor **Timothy R. Moody**
7600 High Meadow Apt. 45, Houston, Texas 77042

[21] Appl. No. **665,821**
[22] Filed **Sept. 6, 1967**
[45] Patented **Nov. 3, 1970**

[54] **SHOCK ABSORBER FOR RAILROAD ROLLING STOCK**
9 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** **213/8,** 213/43, 213/223
[51] **Int. Cl.** **B61g 9/02,** B61g 9/12, B61g 9/06
[50] **Field of Search** 213/8, 43, 223

[56] **References Cited**
UNITED STATES PATENTS

3,164,262	1/1965	Price et al.	213/8
3,173,552	3/1965	Zanow	213/43
3,220,561	11/1965	Blake	213/8
3,168,201	2/1965	Smith et al.	213/8

Primary Examiner—Drayton E. Hoffman
Attorney—Fidler and Bard

ABSTRACT: A hydraulic shock absorber for use in railroad cars and the like and adapted to absorb the impact occurring when one car is driven into another during the makeup of a train, and wherein the hydraulic cylinder and piston are arranged so that the impact causes the piston to be pulled through the cylinder during absorption of the impact.

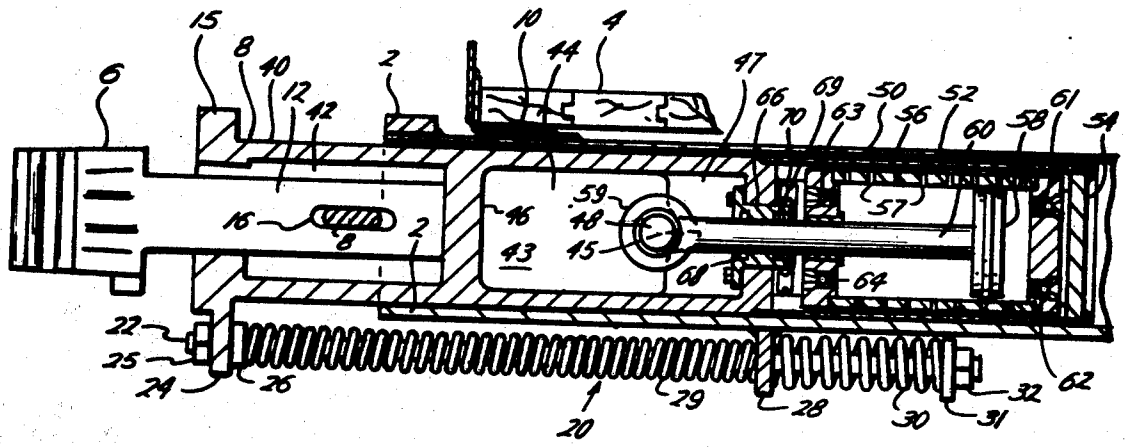


Fig. 1

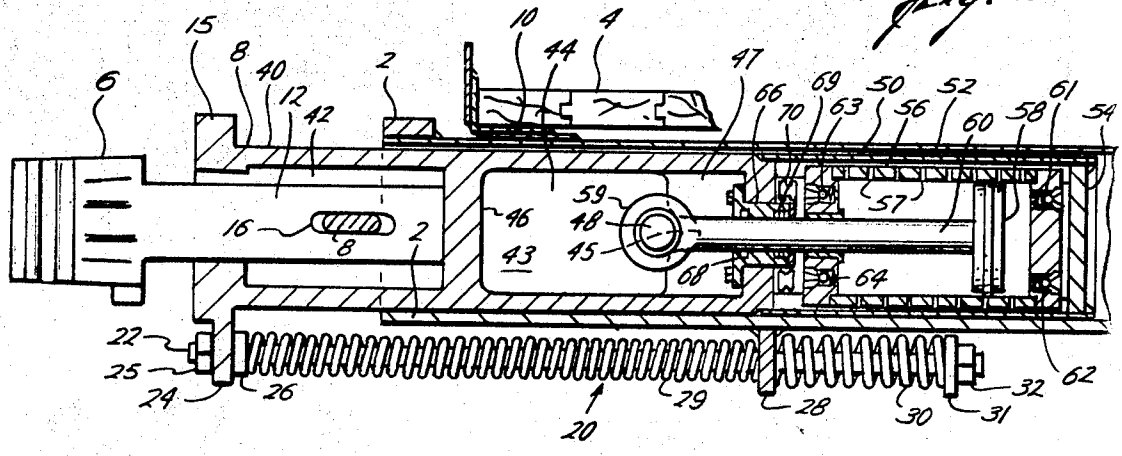


Fig. 2

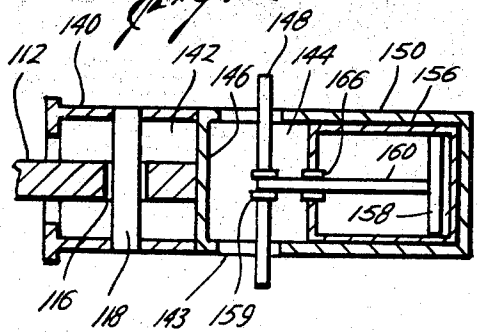


Fig. 3

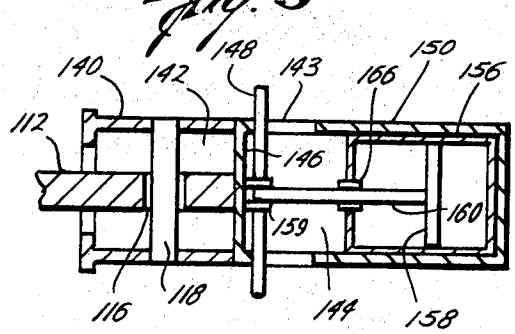


Fig. 4

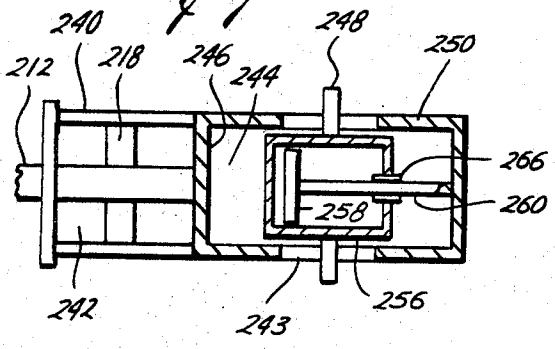
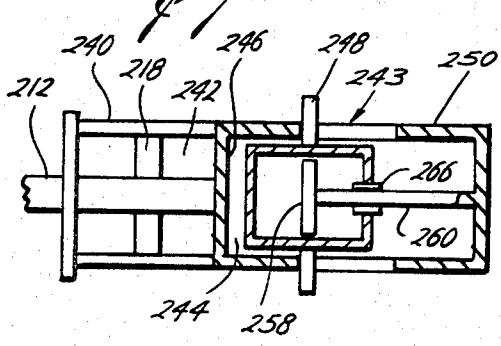


Fig. 5



Timothy R. Moody
INVENTOR

BY
Arnold, Roylance, Kruger & Dunkee
ATTORNEYS

SHOCK ABSORBER FOR RAILROAD ROLLING STOCK

BACKGROUND OF THE INVENTION

This invention relates to methods and apparatus for absorbing shock due to impact, and more particularly relates to shock absorption methods and apparatus for railroad rolling stock.

It is common railroad practice to shift cars from one location to another in the yard by simply bumping them from one location to another. Although this practice of "loose shunting", as it is called, permits a train to be assembled much more quickly than if the cars were pushed or pulled into position in a gentler manner, it is an inescapable fact that loose shunting subjects the cars and their contents to terrific shocks.

In order to absorb at least a substantial portion of the impact, elaborate and heavy-duty shock absorbers are incorporated with the couplers of each car and are usually slidably located in each end of the boxlike longitudinal strut or "sill" which constitutes the primary strength member of the car. For example, see U.S. Pat. No. 2,994,681, which depicts an illustrative embodiment of the type of shock absorption apparatus now commonly used in the railroad industry.

Although apparatus of the type depicted in the aforementioned U.S. Pat. No. 2,944,681 is fairly effective in protecting the cars and their contents from damage due to impacts, it is nevertheless also true that the shock absorbers themselves are often damaged when these impacts are directed at the receiving cars along force vectors which are nonparallel to the longitudinal axes of these cars. When this happens, the shock absorber assembly tends to move in the sill in the direction of the force vector rather than along the axis of the sill, and thus tends to bind in the sill rather than to slide freely therein.

In some instances, a binding shock absorber will fail to absorb the impact of the loose shunt, and the car and its contents will then receive the full force of the collision. Usually, however, the shock absorbers now in use will succeed in absorbing the force of the impact notwithstanding such misalignment, but the misalignment tends to place excessive stress on the internal parts of the absorber such as the bearings surrounding the hydraulic piston shafts.

It is well known in the industry that each such misaligned impact sharply reduces the useful life of the shock absorber, because it galls the piston shaft and damages the bearings and seals. This eventually causes loss of hydraulic fluid and operating failure of the absorber insofar as its ability to absorb shocks is concerned, and this in turn ultimately results in damage to the car and its contents unless the defective absorber is repaired or replaced.

These disadvantages of the prior art are overcome with the present invention, and novel methods and apparatus are provided for receiving and absorbing the force of a misaligned impact between two railroad cars or the like. It has been discovered that the primary reason that misaligned impacts tend to damage the shock absorbers of the prior art such as that depicted in the aforementioned U.S. Pat. No. 2,944,681, is because the hydraulic pistons in the prior art absorbers are arranged so as to be pushed from one end of the hydraulic cylinder to the other end, by the force of the impact. Thus, when the impact is delivered along a line other than the piston shaft axis, the piston head is driven out of alignment with the cylinder and the shaft tends to be driven out of alignment with the bearing or seal through which it rides. Furthermore, this misalignment of the piston with the cylinder, and the piston shaft with the bearing, becomes accentuated as the piston is driven towards the opposite end of the cylinder.

PREFERRED EMBODIMENT OF THE INVENTION

In the preferred embodiment of the present invention the piston and cylinder is rearranged so that an impact between two cars or the like operates to draw or pull the piston through the cylinder rather than to push it through as is done in the prior art shock absorbers. Since the misalignment of the piston with the cylinder tends to diminish as the piston is pulled through the cylinder, it will be apparent that in the present invention the ill effects of a misaligned impact will tend to be dissipated as the shock is absorbed, rather than being aggravated as in the case of the prior art shock absorbers.

These and other advantages and features of the present invention will be apparent from the following description, wherein reference is made to the FIGS. in the accompanying drawing.

In the Drawing:

FIG. 1 is a pictorial representation partly in cross section, of an illustrative embodiment of the present invention.

FIG. 2 is a functional representation of the basic components of an illustrative embodiment of the present invention, wherein said components are shown in a relaxed arrangement prior to receiving an impact.

FIG. 3 is a functional representation of the embodiment depicted in FIG. 2, wherein the components of the embodiment are in a compressed arrangement after receiving and absorbing an impact.

FIG. 4 is a functional representation of another embodiment of the present invention, wherein the components of such embodiment are shown in a relaxed arrangement prior to receiving an impact.

FIG. 5 is a functional representation of the embodiment depicted in FIG. 4, wherein the components of this alternative embodiment are depicted in a compressed arrangement after having received and absorbed an impact.

DETAILED DESCRIPTION

Referring now to FIG. 1, there may be seen a generalized representation of an illustrative embodiment of the present invention, wherein there is depicted a bottom view of the sill 2 of a railroad car or the like which functions as the main longitudinal strut or brace for the car, and which is usually located immediately below the bed or floor 4 of the car which rests on the sill 2 and on other lateral struts 10 as may be provided. As hereinbefore stated, the sill 2 is a boxlike member having a hollow rectangular cross section, and having open ends. The coupling 6 at each end of the car is interconnected with the shock absorber 8, and each shock absorber 8 is located within the sill 2 so that the coupling 6 projects out for connection with the coupling of an adjacent car (not depicted).

As may be seen, the coupler 6 is mounted at the extending end of the coupler shank 12 provided with an elongated keyway 16. A transverse key 18 is fitted through the keyway 16 to loosely connect the coupler shank 12 to the absorber 8. The coupler shank 12 may be seen to extend rearwardly into the housing 40 to abut a wall or bulkhead 46 therein, so that when an impact is received at the coupling 6, the force will drive the entire shock absorber 8 rearwardly into the sill 2.

It should be realized that the shock absorber 8 must be designed to absorb "stretch" (the pulling apart of the cars) which occurs during startup or acceleration of the locomotive. Thus, the depicted apparatus is preferably provided with one or more spring assemblies 20 mounted below the sill 2, and which may each be composed of a guide rod 22 attached at one end to a bracket 24 mounted on the lower side of the striker plate 15 by nuts 25 and 26, and slidably extending through a second bracket 28 mounted under the sill 2. A first spring 29 is preferably disposed about the guide rod 22 so as to be compressed between the brackets 24 and 28 when the coupler 6 receives an impact which drives it rearward into the sill 2. A second spring 30, which may be coiled oppositely to the first spring 29, may be disposed about the guide rod 22 and connected between the second bracket 28 and a washer 31 and retainer nut 32 at the other end of the rod 22. Thus, the first spring 29 acts to push the shock absorber 8 and coupling 6 forward out of the sill 2 after an impact has been received and absorbed, and the second spring 30 pulls the shock absorber 8 and coupling 6 back into the sill 2 after the "stretch"

created by startup of the train has been absorbed as will hereinafter be explained.

As may also be seen in FIG. 1, the absorber 8 is composed generally of a housing 40 which is divided into two open compartments 42 and 44 by an internal wall or bulkhead 46. The forward compartment encloses the coupler shank 12 and coupler key 18. The rear compartment 44 encloses a pin 48 which extends transversely through the sidewalls of the housing 40 and is fixedly attached to the sidewalls of the sill 2. Also mounted longitudinally in the rearward end of the second compartment 44 is a vertical bulkhead 47 having a curved recess 49 for accommodating the pin 48 for the purpose of limiting forward travel of the absorber 8 during the absorption of stretch of the train.

Attached to the rearward end of the housing 40 is a hydraulic section 50 composed of an outer housing 52 sealed at its forward end to the rearward end of the aforementioned housing 40, and sealed at its rearward end by an end plate 54. Inside the outer housing 52 of the hydraulic section 50 there may be provided an inner hydraulic cylinder 56 having a plurality of fluid ports 57 disposed about its circumference and along its length, and containing a piston 58 and piston shaft 60 preferably connected together by a ball and socket assembly 59. The pin 48 may be seen to be inserted through the ball and socket assembly 59 to fit into the recess 49. The cylinder 56 and outer housing 52 is filled with a suitable hydraulic fluid which passes from one side of the piston 58 to the other by way of the ports 57, and by way of the check valves 61—64, as the piston 58 shifts or is shifted with respect to the cylinder 56.

It will be noted that the piston shaft 60 is slidably encased in a suitable bearing and packing gland 66 having an O-ring 68 at its forward end and a plurality of packing rings 69 at its rearward end for preventing fluid escape along the surface of the piston shaft 60. An accumulator assembly 70 may also be provided for compensating for the movement of the piston shaft 60 in and out of what may be seen to be a closed hydraulic system.

As will be apparent with the form of the invention depicted in FIG. 1, it is the housing 52 and perforated hydraulic cylinder 56 which is movable relative to the sill 2, since the piston 58 and piston shaft 60 is fixedly positioned by the pin 48 relative to the sill 2. As depicted in FIG. 1, the apparatus is in its normal "relaxed" condition. When a rearwardly directed impact is received at the coupling 6, the force of the impact is transmitted by the coupling shank 12 to the bulkhead 42 to drive the housing 40 rearwardly into the sill 2, and the hydraulic section 50 will be pushed into the sill 2 in a rearward direction to shift the cylinder 56 rearward in the sill 2 and slidably about the piston 58 which is linked to the sidewalls of the sill 2 by the pin 48. The first spring 29 will also be compressed as hereinbefore described.

As the piston 58 is displaced towards the check valves 63 and 64, their shutoff members will be forced into their seats and fluid will tend to flow through the ports 57 into the low-pressure chamber between the outer housing 52 and the inner hydraulic cylinder 56. From there, the fluid is driven through the other two check valves 61 and 62 to the other or rearward side of the piston 58. It will be seen that during the initial rearward displacement of the cylinder 56, fluid will tend to flow into the cylinder 56 to the rearward side of the piston 58 only through the inwardly spring-loaded check valves 61 and 62. However, as the cylinder 56 is driven into the sill 2, an increasing number of ports 57 become opened to fluid flow into the expanding space between the check valves 61 and 62 and the rearward face of the piston 58. On the other hand, the number of ports 57 on the forward side of the piston 58 is correspondingly reduced.

It will be apparent that the primary resistance to the impact received by the coupling 6, is provided by the hydraulic pressure of the fluid on the piston 58, although the first spring 29 may tend to aid absorption of the impact as it is compressed about the guide rod 22 between the first bracket 24 and the second bracket 28. Furthermore, it will be apparent that in the apparatus depicted in FIG. 1, the impact on the coupling 6 tends effectively to "pull" the piston 58 along the cylinder 56, instead of "pushing" it as is the case with the prior art as exemplified by the apparatus depicted in U.S. Pat. No. 2,994,681, which issued to W. T. Blake on July 12, 1960. As will hereinafter be explained, if the impact is received by the coupling 6 and shock absorber 8 along a vector which is misaligned with the piston shaft 60, the misalignment will be smallest at the region of contact between the piston shaft 60 and the packing gland 66, and thus the damage which may otherwise occur to the packing gland 66 and piston shaft 60 (due to binding between these two components) will be minimized or eliminated.

After the impact has been absorbed as hereinbefore explained, the compressed first spring 29 will tend to expand and return the housing 40 and hydraulic section 50 forward to its normal location in the sill 2. Since the piston 58 is now effectively "pushed" through the cylinder 56 towards the rear check valves 61 and 62, which are now forced shut, the passage of hydraulic fluid through the ports 57 and the front check valves 63 and 64 to the front side of the piston 58, tends to slow the travel of bulkhead 47 toward the pin 48, to keep the shock absorber 8 from returning too abruptly.

As may be seen in FIG. 1, the piston 58 is located near but not at the rear end of the cylinder 56 when the apparatus is in its normal relaxed condition. The force of "stretch" is substantially less than the magnitude of the force of the impacts produced during shunting, and thus the piston 58 is not required to travel as far to absorb "stretch" as it does to absorb the usual shunting impact. In the case of "stretch", however, the cylinder 56 will be pulled forward and thus the piston 58 will tend to be "pushed" rearwardly. However, "stretch" is always longitudinally aligned, and thus there will never be any binding of the components during the absorption of stretch. After the stretch has been absorbed, the expanded second spring 30 will return the shock absorber 8 rearwardly into the sill 2 to its normal location therein.

As hereinbefore explained, it is the purpose of the vertical bulkhead 47 to limit forward travel of the cylinder 56 to prevent damage to the piston 58 during occasions of abnormal stretch. It may also be seen that rearward travel of the cylinder 56 is limited to the spacing between the forward end of the sill 2 and the flanged end 15 of the housing 40, so as to prevent damage to the piston 58, the cylinder 56, and the other components of the shock absorber 8 during the absorption of unusually heavy impacts.

Referring now to FIGS. 2 and 3, there may be seen functional representations, partly in cross section, of the basic components of the apparatus depicted in FIG. 1 and showing the relative positions of these components when the apparatus is in both a normal "relaxed" condition and the abnormal "-compressed" condition. More particularly, FIG. 2 represents the apparatus prior to receipt of an impact, and FIG. 3 represents the apparatus during receipt of an impact.

In FIGS. 2 and 3, there may be seen in cross section the coupler shank 112 extending into the forward compartment 142 of the housing 140. The key 118 is shown extending through the keyway 116 in the coupler shank 112 and fixed at each end to the sides of the housing 140 in the forward compartment 142.

Also shown in FIGS. 2 and 3 is the rear compartment 144, which is separated from the forward compartment 142 by the bulkhead 146 and containing a functional representation of a hydraulic cylinder 156, and a pin 148 anchored at each end to the sill 2 depicted in FIG. 1. A representation of a piston 158 and piston shaft 160 is also depicted, with the piston shaft 160 extending through the gland 166 and connected to the pin 148 by means of the ball and socket assembly 159.

As may be seen in FIG. 2, the piston 158 is located in the rearward end of the hydraulic cylinder 156 prior to impact. Upon receipt of an impact on the coupler 6, the housing 140 is driven into the sill 2 to push the cylinder 156 rearward relative to the piston 158. Since the piston 158 and piston shaft 160

are held stationary by the pin 148 which is connected to the sill 2, this will result in the piston 158 being "pulled" forward through the cylinder 156, as represented in FIG. 3. It will be noted that the pin 148 extends through relatively wide openings 143 in each side of the housing 140 which permit the housing 140 to move independently of the pin 148 to the extent of the width of these openings 143.

It should be noted that the piston shaft 160 is preferably positioned in the depicted apparatus parallel and preferably coincident with the longitudinal axis of the coupler shank 112 and the hydraulic cylinder 156. Accordingly, if the impact is received along an axis which is misaligned with the axis of the apparatus, the impact force vector will define an angle with the piston shaft 160 having a magnitude related to the degree of such misalignment, and will tend to reposition the piston shaft 160 in the cylinder 156. This, of course, creates a stress between the piston shaft 160 and the packing gland 166.

It will also be apparent from FIGS. 1—3, however, that the "effective" length of the piston shaft 160 (the portion of the piston shaft 160 between the gland 166 and the piston 158) is also a factor in the aforementioned angle. Since the effective length of the piston shaft 160 shortens as the impact is absorbed, the angle of misalignment is also decreased as the piston 158 is pulled through the cylinder 156 and the impact is absorbed. Accordingly, the stress which is created between the gland 166 and the piston shaft 160 is reduced as the piston 158 is pulled through the cylinder 156 and the impact is absorbed.

Referring now to FIGS. 4 and 5, there may be seen two functional representations of an alternate form of the present invention, wherein FIG. 4 depicts the apparatus in its normal relaxed condition prior to receiving an impact, and wherein FIG. 5 depicts the apparatus in its compressed condition during receipt and absorption of an impact. As may be seen, there is provided a housing 240, which is slidably movable in the sill 2 depicted in FIG. 1, and which is divided into a forward compartment 242 and a rear compartment 244 by a bulkhead 246. The coupler shank 212 is represented as extending into the forward compartment 242 to the bulkhead 246 to be anchored therein by the key 218 as hereinbefore described.

The rear compartment 244, which includes the hydraulic section 250, includes substantially the same components as appear in FIGS. 2—3. However, these components are somewhat rearranged as will hereinafter be apparent. In particular, the hydraulic cylinder 256 may be seen to be connected to the sill 2 (see FIG. 1) by the pin 244 which, in FIGS. 4 and 5, may be seen to be composed of two separate members mounted on opposite sides of the cylinder 256 and extending through the openings 243 in the sides of the housing 240. Additionally, the piston 258 is normally located in the forward end of cylinder 256, and the packing gland 266 is now located at the rear of the cylinder 256. Accordingly, the piston shaft 260 may be seen to extend rearwardly through the gland 266 and to be anchored by any suitable means to the rear of the housing 240.

As hereinbefore stated, FIG. 4 depicts the components of the apparatus in their relaxed condition prior to receipt of an impact (or after full recovery therefrom, of course). Accordingly, FIG. 5 shows how, upon receipt of an impact on the coupler 6 which is transmitted to the depicted apparatus by way of the coupler shank 212, the housing 240 is driven rearwardly into the sill 2. However, in the embodiment depicted in FIGS. 4 and 5, the cylinder 256 is held stationary by the pins 244 connected to the sill 2, and the housing 240 actually pulls the piston 258 and piston shaft 260 through the cylinder 256, instead of merely figuratively as in the embodiment depicted in FIGS. 1—3. In both embodiments, however, it will be apparent that the effective length of the piston shaft 260 is shortened during absorption of an impact, rather than lengthened as in the case of the prior art.

Other variations and modifications of the apparatus depicted and described herein may be made without significant departure from the concept of the present invention. Accordingly, it should be clearly understood that the forms of the invention described herein and depicted in the accompanying drawings, are intended to be exemplary only and are not intended as limitations on the scope of the invention.

I claim:

1. Shock absorbing apparatus for a railroad vehicle having a fixed longitudinal sill, said apparatus comprising:

a housing member;

means mounting said housing member in one end of said sill for axial sliding movement relative to the longitudinal axis of said sill;

a coupling shank member having one end extending generally longitudinally from said housing member and from said one end of said sill to receive buff impact forces, and having the other end interconnected with said housing for causing such sliding axial movement of said housing in response to such buff impact forces;

a fluid-filled hydraulic cylinder longitudinally disposed in said housing in general axial alignment with said coupling shank member, said cylinder having one closed end and provision in the other end for supporting a bearing means;

a fluid-tight bearing means supported in said other end of said cylinder and in general axial alignment with said coupling shank member;

a piston member slidably disposed axially in said cylinder and normally spaced from said bearing means;

a piston shaft member slidably disposed in a fluid-tight manner in said bearing means and having one end fixedly connected to said piston member; and

first and second means for mounting said cylinder and mounting the free end of said piston shaft member with respect to said sill and said housing to produce relative movement of said piston toward said bearing and to impose a tensile force upon said piston shaft member in response to relative movements between said sill and said housing resulting from buff impact forces.

2. Apparatus as described in claim 1, wherein said coupling shank member is interconnected to transmit any received buff force to said housing, cylinder, piston member and piston shaft member, and wherein said piston shaft member is interconnected with said piston member and said bearing means in general axial alignment with said cylinder and said housing.

3. Apparatus as described in claim 2, wherein said housing is slidably movable in said sill and about said cylinder in response to said buff force received by said coupling shank member.

4. Apparatus as described in claim 3, said apparatus further including anchoring means for holding said cylinder substantially stationary in said sill upon the receipt of said buff force by said coupling shank member.

5. Apparatus as described in claim 4, wherein said housing is provided with at least one lateral opening adjacent said cylinder, and wherein said anchoring means for holding said cylinder in said sill includes at least one pin member extending through said lateral opening in said housing and fixedly attached at one end to said cylinder and at the other end to said sill.

6. Apparatus as described in claim 5, wherein said piston shaft member is connected at one end to said piston member and at the other end to said housing to pull said piston member through said cylinder toward said bearing means in response to said buff force by said coupling shank member.

7. Apparatus as described in claim 2, wherein said cylinder is fixedly positioned in said housing, and wherein said piston shaft member is fixedly positioned relative to said sill.

8. Apparatus as described in claim 7, wherein said housing is provided with at least one lateral opening, and wherein said apparatus further includes anchoring means extending through said lateral opening and securing said piston member and piston shaft member against movement longitudinally of said sill.

9. Apparatus as described in claim 8, wherein said cylinder and housing are arranged to draw said bearing means slidably

along said piston shaft member toward said piston member in response to said receipt of said buff force by said coupling shank member.