ABSTRACT OF THE DISCLOSURE

A railway car draft rigging of a type having its inward end anchored to a point longitudinally inward of the car body whereby the cushioning unit thereof undergoes compression or extension as the car coupler attached thereto moves toward and away from the anchor point in response to buff and draft forces, respectively. By this invention, crosshead structure is incorporated into the draft rigging between the cushioning unit and the coupler for interception of lateral force components imposed on the draft rigging which otherwise would reach the cushioning unit.

Description

This invention relates particularly to shock absorbing devices comprising a piston and cylinder assembly used, e.g., on railway vehicles to cushion such vehicles from high forces exerted thereon by adjacent vehicles.

In such devices, seals between relatively moving parts are always necessary for liquid retention. Because of the heavy duty nature of railway use and the great need to have railway vehicles free to travel great miles over an interchange railway system without servicing, the sealing structure must be constructed with great durability and freedom from repair. One approach to this problem is to construct the shock absorbing mechanism as a whole in such a manner as to subject the sealing structure to sliding contact with parts which undergo merely linear sliding motions which are free of lateral forces to all extent possible.

However, railway vehicles are subject continually to pulling and pushing forces which are in more or less angular relation with their longitudinal axes, thereby producing lateral force components which must be absorbed in some manner by respective draft riggings of the vehicles.

Lateral force components are produced also in draft rigging which comprises a resilient system for maintaining longitudinal alignment of the coupler with its associated vehicle since the alignment restoring mechanism produces a torque force in the draft rigging equal and opposite to that exerted on the coupler.

Hence, a primary object of the invention is to provide a shock-absorbing mechanism, particularly one incorporating a cushioning unit, such as a hydraulic cylinder piston type device adapted for use in railway vehicle draft rigging, in which the cushioning unit is virtually subjected to only linear forces directed along its axis of longitudinal compression or extension.

Another object is to provide apparatus in accordance with foregoing objects having the capability to return an angularly misaligned railway car coupler to longitudinal alignment with a vertical longitudinal plane of the associated car.

These objects and others apparent from the following description are accomplished in apparatus comprising an elongate housing, such as a railway car center sill; a longitudinally compressible and extendable cushioning unit; anchor mechanism at one end of the unit for securing the unit to the housing in universally pivotal relationship; and a crosshead member having slidable guide relation with the housing, universally pivotral relation with the longitudinally opposite end of the cushioning unit, and universal-pivot relation with an end portion of a force-imposing implement, such as a car coupler.

In a preferred embodiment, the crosshead member includes a casing and other components housed therein including a follower, an abutment block, and resilient means which separate the follower and the block. In functioning as a shock absorber, the resilient means has the further function of maintaining the follower in engagement with an end portion of the unit and maintaining the block in engagement with the implement received within the opposite end of the casing. This is an arrangement especially useful in conjunction with a car coupler structurally related to the abutment block to effect couple alignment correction.

In the drawing with respect to which this invention is described:

FIG. 1 is a fragmentary plan view, partially in section, of a draft rigging and portions of car structure and a coupler connected therewith;

FIG. 2 is a fragmentary side elevation, partially in section, of the draft rigging of FIG. 1 and associated coupler and car structure;

FIG. 3 is a perspective view of a casing forming a portion of a crosshead for connecting a cushioning unit and the coupler as shown in FIGS. 1 and 2;

FIG. 4 is a diagrammatic view of elevation of the draft rigging of FIGS. 1 and 2 illustrating a hydraulic unit with the piston thereof disposed within a cylinder at neutral position;

FIG. 5 is a fragmentary elevation partially in longitudinal cross section illustrating draft rigging incorporating modified crosshead structure; and

FIG. 6 is a fragmentary plan view with parts in section showing primarily the crosshead structure of FIG. 5.

In FIGS. 1, 2, and 4, a draft rigging is shown received in a center sill 4 rearwardly of striker structure 8 mounted on the sill at the end of the car. The draft rigging comprises cushioning means, such as a hydraulic unit 7, a crosshead 8, and a spring 9 acting between the housing 12 and the casing 14 of the crosshead to return the draft rigging to a neutral condition from a buff condition. A spring unit 15 is fixed to the casing 14 for resiliently engaging a vertical abutment 13 to return the draft rigging, if the plunger 16 of the unit is moved rearwardly within the casing of the unit, to a neutral position from a partially or fully pulled-forward position.

The cushioning unit 7 is fixed within the sill 4 in the longitudinal sense by an anchor assembly which, as shown, comprises slotted stops 17 welded or otherwise fixed to the sliding sill and vertically grooved along respective faces which face inwardly of the center sill to receive flanges 18 of a bowl or cup-shaped retainer 18. The retainer has a central aperture 19 through which projects a stud 21 forming a substantially cylindrical extension of the cushioning unit housing 12. The stud 21 is concentric with respect to an annular spherically concave end surface 22 of the casing 12 surrounding the base of the stud. A nut 23 of circular periphery is supported on the end portion of the stud 21 in threaded relation therewith.

Thus, the casing 12 is held in fixed longitudinal relation with the sill 4 but has limited universal freedom of pivotal movement therefrom because of (1) an annular clearance between the stud 21 and retainer 18, and (2) the approximate spherical concentricity of the end surface 22 and the convex nut surface 25 with the convex surface 26 and the concave surface 27, respectively, of the retainer. For the purposes of this invention, i.e., the elimination of lateral forces on the unit 7 and the subjection thereof to purely longitudinal forces, it is essential that the cushioning unit 7 be capable of free universal angular movements relative to its rear anchor.
To facilitate the installation and removal of the entire draft rigging as a unit, the grooves of the stops 17 in which the retainer flanges 18a are received open downwardly with respect to the center sill 4. The center sill is shown is of conventional inverted U-shape construction and is open along its bottom side before installation of the draft rigging. The draft rigging may be assembled and the crosshead connected with the associated coupler 30 by a pin 31, and the resulting assembly lifted into the position within the sill as shown in FIGS. 1 and 2. The draft rigging as assembled includes the retainer 18 which during assembly slides upward along the vertical grooves of the stops 17. If preferred, the coupler may be connected with the crosshead after the assembled cushioning unit and crosshead are in place.

While the assembled draft rigging is supported in this position by jacks or other means based externally of the car, retaining plates 34 and 35 are secured to the lower horizontal flanges 37 and 38 of the center sill. The plate 34 entraps the retainer 18 within the grooves of the stops 17 and thus supports the rear end of the draft gear assembly within the center sill. As an alternative construction, not shown, the retainer may be permanently fixed or integralized with stops functioning as do the stops 17. If this alternative structure is provided, the draft rigging with the nut 23 removed from the step 21 is installed by guiding the stud 21 through the aperture 19 and applying and adjusting the nut 23 to operative position shown in FIGS. 1 and 2.

The plate 35 has a central longitudinal slot 39 through which project two pairs of downwardly extending lugs 41, 42. An elongate lug 43 integral with the outer casing 45 of the spring unit 15 is received between each pair of lugs 41, 42 and bolted thereto. In attaching the plate 35 to the sill 4 it is necessary to have the spring unit 35 detached from the lugs 41, 42 and 43 of the crosshead casing 14. As the present draft rigging is designed to undergo both shortening and extension with respect to the neutral condition as illustrated in FIGS. 1, 2, and 4, and such extension or shortening is translated directly into linear movement of the cross head 8, the slot 39 has a length accommodating the travel of the lugs 41 and 42 in the desired ranges of travel for maximum "buff" or "pull" strokes possible in the travel of the crosshead 8.

As a structural feature which contributes to the establishment of a neutral condition of the draft rigging, the parent vehicle provides the abutment or stop 13 in fixed relation with the center sill 4. In the present embodiment, the abutment 47 consists of a downwardly extending reinforced web of the plate 35 although, alternatively, it may also be made an integral rear portion of the striker structure 5.

In the diagrammatic view of FIG. 4, the cushioning unit 7 is depicted as a cylinder and piston assembly in which a piston 48 is stopped at its neutral position intermediate between the ends of the cylinder 49 which permits travel of the piston through a predominant portion of the length of the cylinder toward the end 51 in "buff" operation, and a much shorter range of travel toward the end 52 in "pull" or "draft" operation. Neutral condition of the draft rigging is established by equilibrium in the opposed forces derived from the spring unit 15 and the spring 9 and any other spring acting in parallel therewith. That is to say, the spring unit 15 contains one or more springs, such as spring 55, having greater resistance to compression than the spring 9 when the couple is forward of its neutral position. The spring 55 engages a seat 56 fixed within the casing 45 and a seat 57 fixed to the plunger 16 but movable within the casing 45 to allow retraction of the plunger inwardly of the casing in a direction to allude the left as viewed in FIG. 2.

Consequently, when the piston 48 of the cushioning unit is pushed inwardly of the cylinder, the spring unit 15 is carried away from its stop 13 but the crosshead and the spring unit will be returned by the spring 9 to neutral position established as the front end of the plunger 16 engages the stop 13 and subjects the spring 55 to a minor amount of compression deformation. "Pull" forces, when sufficient, cause movement of the crosshead forwardly within the center sill accompanied by hydraulic expansion as the piston 48 moves forward within its cylinder and compression of the spring 55 of the spring unit 15 as the plunger 16 is forced rearward within the casing 45. As the "pull" force subsides, the spring 55 which is now more resistant to compression than the spring 9, causes the plunger 16 to act on the stop 47 and return the crosshead to its neutral position.

Considering now an essential feature of the invention, i.e., the structural arrangement for rendering a cushioning unit, such as the presently disclosed cylinder, piston, and piston-rod assembly, free of destructive lateral force on the crosshead with a swivel connection at its rear end as already described. Thus, an important net effect of interposing a crosshead between a coupler and a cushioning unit as taught herein, is to eliminate such lateral forces as would cause greater than normal wear between the piston and the cylinder and between the piston-rod and the sealing structure of the cylinder.

Proceeding now to features of the crosshead, the casing 14 has a rear portion 60 of diameter and depth suitable for receiving such a portion of the length of spring 9 as to provide substantial lateral support for the spring against buckling and to provide a seat for the spring at surface 61. The casing 14 has an aperture at 62 concentric with the longitudinal axis of the piston-rod 58 of sufficient diameter to provide a clearance for the piston-rod. The casing also has a convex front facing seat 63 also concentric with the piston-rod axis for receiving a spherically convex surface 64 of a nut 65 in threaded relation with a threaded end portion of the piston-rod. The nut and the end surfaces of the piston-rod 58 have concentric spherical concave front facing surfaces 67, respectively, which together are complementary with a rear facing convex surface 69 of the follower 70 housed within the casing and seated on an annular shoulder 71 thereof.

In addition to the follower 70 and the casing 14, the crosshead further comprises an abutment block 74 and a pair of resilient pads 75, 76 of which each comprises a steel plate and a flat pillow of rubber bonded thereto. When the crosshead is assembled, the pads engage each other longitudinally. The rubber block has a front facing spherically convex surface 78 which engages, and is complementary with, a rear facing convex coupler butt surface 79, typical of the standard F-type coupler, as identified by the Association of American Railroads. The coupler butt shown is also typical of
the alignment control provided by the standard F-type coupler in the provision of alignment shoulders 81, 82, adapted to engage forward facing shoulders 83, 84, respectively, of the abutment block 74 upon slight angling of the coupler 30 relative to the longitudinal axis of the draft rigging.

When the crosshead is in its neutral condition, free of any substantial buffing forces as illustrated, the resilient pads 75, 76 are in a condition of initial compression, establishing a condition of tightness of relatively movable parts throughout the crosshead. The pads 75, 76 in combination with other structure impart to the crosshead two important functions:

(1) Return of the coupler from an angled position to a virtually longitudinally aligned position, and

(2) Ability to absorb impacting forces in buffing operation. To enable buffing force absorption, the pin 31 must be free to move relative to the casing 14. For this purpose, the casing has upper and lower holes 86, 87 elongated along a central vertical longitudinal plane of the casing for receiving the crosshead 80. The elongation of these holes enables the pin 31 to move rearwardly within these holes to the degree that the pads 75, 76 are compressed. Under other conditions, the pads, through the bearing block 74 and the butt portion of the coupler 30, maintain the pin against the front rear-facing surfaces within the holes 86, 87.

Another structural feature incident to the present invention is the disposition of stops within the center sill and a conformation of the crosshead casing 14 which renders the crosshead cooperative with the stops and definitive of the range of movement permitted the crosshead during buff and draft operation of the draft rigging. Provision of such stopping system enables the cushioning unit to be constructed more economically and simply without massive construction within the unit itself for protection against forces which exceed the force absorption capacity of the cushioning unit. Performance of the draft rigging beyond the cushioning ability of the cushioning unit gives rise to a need for structure known in the industry as "over solid stops." Hence, the top wall 90 of the casing has an intermediate, narrow section providing front-facing shoulders 91, 92 in longitudinally spaced relation with rear-facing shoulders 93 and 94 engageable with stops 96 and 97 disposed inwardly from opposite side walls of the center sill laterally adjacent respective side walls traversable by the casing shoulders just named. The front-facing shoulders are spaced at a predetermined distance with respective rear-facing shoulders to (1) allow disposition of the stops 96, 97 therebetween and to (2) provide the desired buffing range between the front-facing shoulders and the stops, and (3) the desired draft range between the stops and the front-facing shoulders. The spacing between the shoulders thus equals these two ranges plus the width of the shoulders. The bottom wall of the casing has a width equal to the crosshead casing because of the need for adequate bearing area of this wall with the plate 35 which supports the crosshead throughout the buff and draft ranges of travel. Since the plate 35 is cut out to a large extent underneath the crosshead to provide a slot of adequate width and length for movement of the lugs 41 and 42 which project through, the bearing area is obtained through contact of lateral marginal portions of the bottom wall 98 with portions of the plate 35 extending along opposite sides of the central slot therein. The top wall 90 is laterally indented to accommodate the stops in order that (1) the stops may be longer in the vertical direction, and (2) that the top wall does not interfere with raising of the crosshead into its operating position when assembling the draft rigging.

FIGS. 5 and 6 illustrate an amplified embodiment of the invention wherein a crosshead 100 of shorter design than the crosshead 8 is incorporated in the draft rigging for service under conditions in which the coupler alignment control is not required. In this design, an abutment block 101 has been substituted for the follower 70, the resilient pads 75, 76 and the abutment block 74 and the crosshead 100 is disposed between the piston rod surface 67 and the rear spherical end surface 79 of the coupler 30. The bearing block is provided with partially spherical surfaces 103 and 104 complementary in sphericity to the surfaces 67 and 79, respectively. The top and bottom apertures in the casing 105 of the crosshead 100 are elongated in the longitudinal direction of the draft rigging to provide clearance at 107 and 108 assuring good contact of the coupler surface 79 with the bearing block 101 during buff operation. However, as the bearing block 101 has some clearance within the casing 105 in the longitudinal direction of the draft gear, buffing force is normally transmitted from the coupler through the bearing block to the piston rod 58 with the casing 105 in substantial floating relation with the elements just named. This is done to offset any adverse tolerances of the components which could preclude insertion of the coupler pin. The casing is subjected to any lateral forces which are a component of the total buffing force imposed by the coupler. In draft, the casing is subjected fully to the tensile forces transmitted from the coupler to the piston rod.

Although shorter, the crosshead 100 functions in a manner similar to the earlier described crosshead 8 to receive laterally directed forces from the coupler and dissipate them against the side walls of the center sill rather than to transmit them to the piston rod of the hydraulic cylinder. Similarly to the earlier described embodiment, the piston rod terminates and the coupler butt have spaced pivot centers located within the crosshead 100. The surfaces 67 and 103 of the piston rod and bearing block in opposed concentric bearing relation are concentric to a pivotal center located approximately at point 110 within the bearing block. Pivoting of the coupler 30 takes place approximately at a point 111 located midway along the axis of the pin 31. Because of the spacing of the pivotal points 111 and 110, the coupler is unable to transmit any appreciable portion of lateral force components directly to the piston rod 58. This principle of construction enhances or amplifies the basic benefit of the invention derived from providing a crosshead in the generic sense without regard to the above described pivotal points, i.e., the benefits derived from merely pivotal relation of the cushioning unit with the crosshead and the rear anchor of the unit on the car frame accompanied by pivotal relation of the coupler with the crosshead.

The crosshead 100 is readily connected with the coupler and the piston rod by first placing the crosshead casing with the piston rod end portion extended through the opening 112. Then, the nut 65 is inserted through a side opening 114 of the casing 105 and turned onto the piston rod end in threaded relationship therewith. Thereafter the bearing block is inserted into the casing 105 and positioned in approximately seated relation with the shoulder surface 115. Thereafter the coupler butt of coupler 30 is inserted through the front open-end of the casing to establish registry of its pin opening with those of the casing, wherein the pin 31 may be inserted into the position shown by FIGS. 5 and 6.

The assembly of the cushioning unit 7, the crosshead 100, and the coupler 30 may be installed in a center sill as described with respect to the earlier embodiment herein. What is claimed is:

1. In draft rigging for a railway car wherein a cushioning unit thereof may be isolated from lateral forces incident to buffing a signal transmitted thereto from a coupler thereof:
   (A) a car frame defining a housing disposed with its front end in an end portion of the car, the housing extending inwardly and rearwardly longitudinally of the car;
7. A cushioning unit comprising:

(A) a cushioning unit having front and rear relatively movable portions arranged generally along a longitudinal axis aligned lengthwise of the car, said unit being contained in the housing;

(C) a crosshead member disposed within the housing in guide relation therewith and forwardly of said unit;

(D) means for pivotally connecting said rear portion to the housing;

(E) means for pivotally connecting said front portion to said member;

(F) a coupler disposed forwardly of the member with the Shank thereof extending rearwardly into the member; and

(G) means for pivotally connecting the coupler Shank to said member.

2. In draft rigging according to claim 1 wherein:
said means connecting the unit and the member is spaced longitudinally within said member from said means connecting the coupler Shank and the member.

3. In draft rigging according to claim 2 wherein:

the connecting means of the coupler and the member includes means defining a range of movement for said coupler relative to the member lengthwise of said axis; and

said rigging comprises a resilient means disposed within the member between the rear extremitiy of the coupler and the forward extremity of the front unit portion, said resilient means being maintained in a state of initial compression as a minimum by both of said connecting means associated with the member.

4. In draft rigging according to claim 2 wherein:

(A) said member has a rearwardly transversely apertured wall;

(B) said front portion of the unit has a forwardly extending stem extending through said wall, and an enlarged head concentric to, and fixed to, a front portion of the stem with an annular surface thereof in juxtaposition with the front side of said wall;

(C) a movable follower is housed by the member against the front side of the head;

(D) a movable abutment block is housed by the member against the rear end of the said Shank;

(E) said connecting means of the coupler to the member includes means defining a range of movement of the coupler relative to the member; and

(F) said resilient means is disposed between the follower and the abutment block urging the coupler and connecting means associated therewith toward the forward extremity of said range.

5. A draft rigging according to claim 4 wherein:

(A) said Shank has a spherically convex rear end surface flanked by generally flat rear-facing shoulder surfaces at opposite sides of a vertical plane containing said axis; and

(B) said abutment block has a spherically concave surface engaging, and in approximately complementary relation with, said convex Shank surface, and shoulder surfaces in opposed relation with said Shank shoulder surfaces for urging the coupler toward a position of alignment with said axis.

6. In a draft rigging according to claim 2 comprising:

resilient means for urging said unit into a neutral condition from which the unit is longitudinally expansible and contractable under tension or compression forces, respectively; said pivotal means connecting the rear unit portion maintaining said rearmost portion in fixed longitudinal relation with the housing.

7. Draft rigging in accordance with claim 6 comprising:

(A) a rearward-facing abutment in fixed exterior relation with the housing;

(B) said resilient means comprising a first means reacting between said rear unit portion and said member to return the unit to said neutral condition from a more contracted condition, and a second means attached to said member and disposed exteriorly of the housing in longitudinal rearward alignment with said abutment for engaging the abutment at said neutral condition, said second means being resiliently yieldable thereagainst as said unit assumes a more extended condition than said neutral condition.

8. Draft rigging in accordance with claim 2 wherein:

(A) said member has exterior vertically extending shoulders facing forwardly within said housing;

(B) said housing has interior rearward-facing stops spaced forwardly, at neutral position, relative to said housing shoulders, and said stops and said shoulders are engageable for limiting forward movement of the member.

9. In draft rigging in accordance with claim 8 wherein:

said member has a pair of rearward-facing shoulders and the sides of the member are recessed transversely inwardly and forwardly from the forward facing shoulders to said rearward-facing shoulders, each of said stops is disposed between a pair of opposed shoulders, and the opposed shoulders are spaced for a distance equal to the desired working range of said unit plus a distance between front and rear member engaging surfaces of said stops.

10. In draft rigging in accordance with claim 4 wherein:

the member defines a forward-facing seating surface in radial spaced relation with said head, and the follower defines a rearward-facing seating surface adapted complementary to said seating surface of the member when said head is seated against said wall in said seated position, Said head being just out of contact with said follower.

11. In draft rigging according to claim 5 wherein:

(A) the cushioning unit is a double-acting hydraulic snubber;

(B) said rearward portion provides a front-facing spring seat and said member provides a rear-facing spring seat, both concentric to said front stem;

(C) said cushioning unit includes a coil spring received between said spring seats;

(D) said follower and said member define opposed engageable seats maintaining the end surface of the front stem and an opposed rear-facing follower surface at contacting to slight clearance relationship at said neutral condition; and

(E) said rigging includes:

(1) a rear-facing abutment disposed in underneat forward fixed relation with the housing, and

(2) a cushion device fixedly supported by the member underneath the housing rearwardly of the abutment for engaging said abutment at said neutral condition, said spring and said device opposing each other in a state of equal initial compression to establish said neutral condition.

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DRAYTON E. HOFFMAN, Primary Examiner.
UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,400,834

Andrey L. Zanow

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

Column 8, line 19, "an" should read -- are --.

Signed and sealed this 16th day of December 1969.

(SEAL)
Attest:
Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents