March 16, 1965 A. L. ZANOW 3,173,552

HYDRAULIC DRAFT RIGGING

Filed May 17, 1963 2 Sheets-Sheet 1

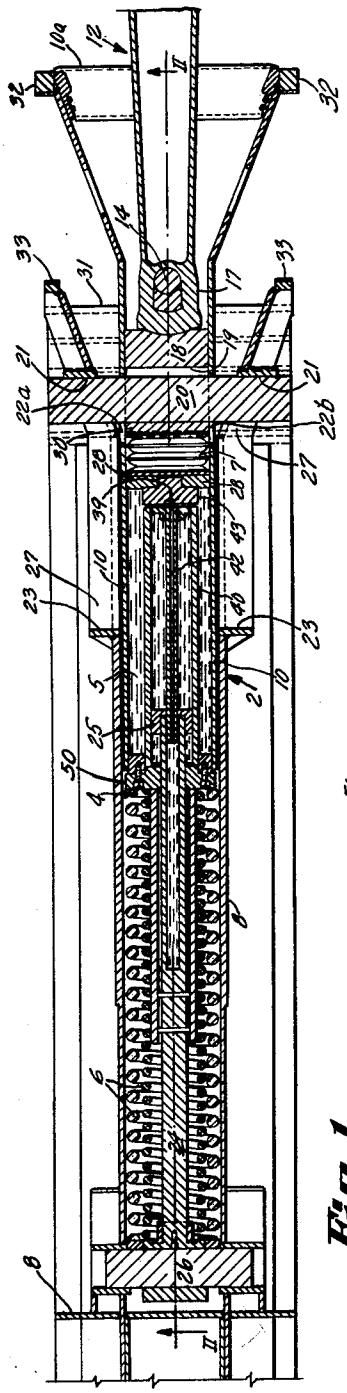


Fig. 1

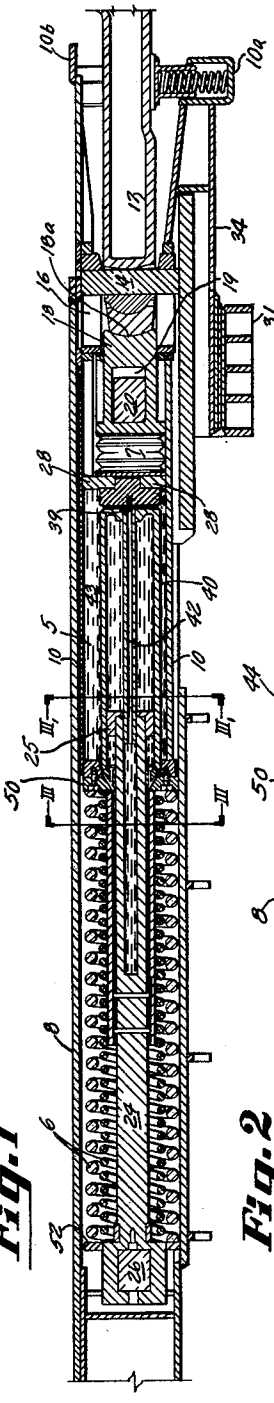


Fig. 2

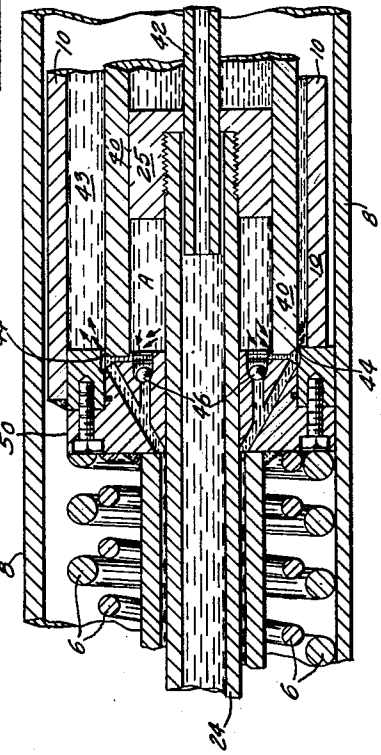


Fig. 3

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HYDRAULIC DRAFT RIGGING

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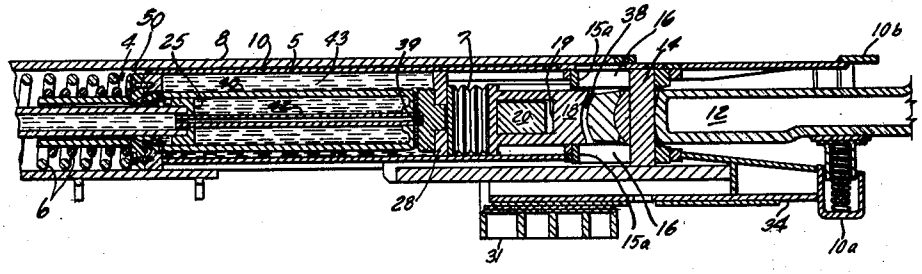


Fig. 4

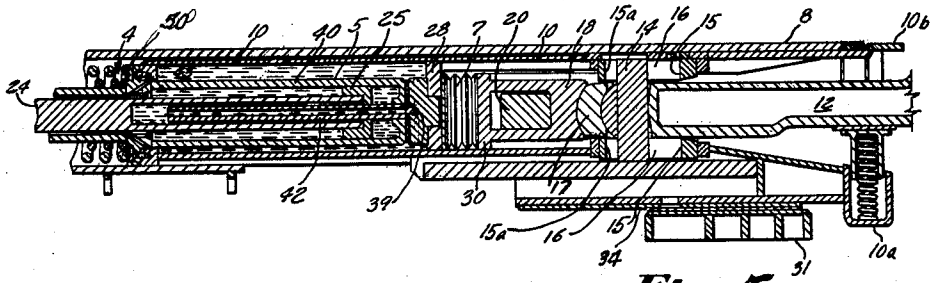


Fig. 5

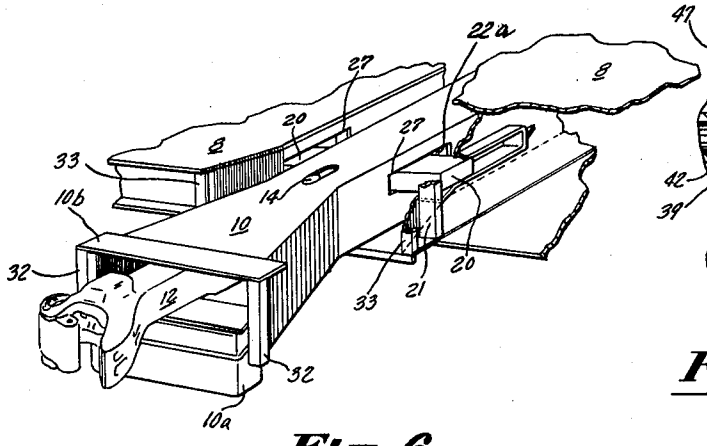


Fig. 6

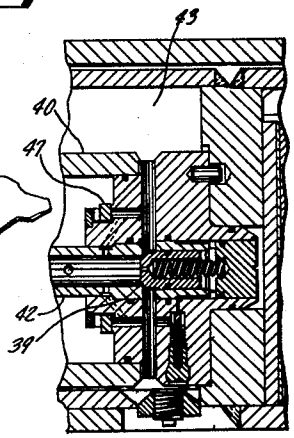


Fig. 7

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HYDRAULIC DRAFT RIGGING

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12 Claims. (Cl. 213—43)

This invention relates to an improved draft and buff mechanism for railway vehicles. The mechanism herein disclosed permits the best features of a hydraulic cushioning unit and a resilient cushioning unit to be combined in a single draft and buff mechanism.

Recent developments in the railway field have led to the conclusion that the conventional friction type draft gear and the conventional rubber type draft gear hitherto widely employed do not provide the most effective cushioning under the wide range of conditions encountered by the typical railway vehicle. Hydraulic cushioning of railway vehicles is a relatively recent development in the field that provides selected desirable features. The invention herein disclosed permits the best features of the widely-used rubber and spring type gears to be combined with the newer hydraulic gear and incorporated into a single draft gear mechanism.

It is, therefore, the primary object of this invention to provide a draft gear mechanism combining the best features of hydraulic and resilient cushioning units into a single draft gear mechanism.

It is another object of this invention is to provide a draft gear mechanism having cushioning elements that function in series when subjected to buff forces and in parallel when subjected to draft forces.

A further object is to provide draft rigging capable of extended hydraulically cushioned travel in a direction for absorbing buff forces but substantially shorter and more softly cushioned travel in the direction for absorbing draft forces.

Another object is to effect the foregoing object through the use of hydraulic snubbing in cushioning draft forces.

In brief, the invention resides in a draft rigging wherein a draft gear comprises two resilient cushioning elements and a hydraulic snubbing device interrelated with a coupler and the sill structure of a railway vehicle to (1) place the hydraulic device in series additive force relation with one of the resilient elements and in parallel additive force relation with the other element during application of buff forces to the coupler; and (2) when draft forces are applied to the coupler, tending to pull portions of the rigging forwardly out of a neutral position, to place the one resilient element in parallel additive force relation, and the other resilient element in parallel subtractive force relation with the hydraulic device.

As a brief structural recital, the draft rigging comprises a housing preferably elongate in its front to rear longitudinal direction arranged in longitudinally coextensive relation with sill structure of a vehicle, such as its center sill. The rigging also has a front cushioning unit and a rear cushioning unit received by the housing. The housing has a longitudinally intermediate partition which separates the cushioning units. Preferably, the rear unit consists of a hydraulic device having a cylinder fixed to the housing, a piston reciprocable therein, and a piston rod connecting the piston to an anchor fixed to the sill rearwardly of the housing. The rear unit further comprises a resilient cushioning element standing, e.g., between the rear end of the cylinder and a forward facing surface of the anchor.

Two-member thrust means, such as a coupler and a follower disposed between the front cushioning unit and the rear shank end of the coupler, extends inwardly of the front end of the housing to transmit buffing forces into the front unit and thence into the rear unit, the anchor, and the center sill.

Both the sill and the housing have rearwardly-facing stops preferably located in respective front portions thereof. The rigging further comprises first detent means, such as a key, adapted to engage the rear facing stops above the sill and the housing, and extending transversely of the rigging in abutting relation, at neutral condition of the rigging, with the rear-facing sill stop and a forward-facing surface of the rear member of the thrust means, i.e., the follower. Consequently, the spring or resilient element of the rear unit urges the housing forwardly until the key engages the sill stops. If the spring has sufficient strength, the front resilient element is compressed slightly at neutral position to dispose the housing slightly forwardly with respect to a position assumed if the resilient element is not compressed, thereby disposing its rearward-facing stops out of contact with the key but with the key seated against the rear-facing sill stops.

In the preferred construction requiring a front resilient unit of greater resistance to compression than the rear resilient element, the thrust means is consequently normally positioned forwardly relative to the partition in the housing against the above-mentioned housing stops by engagement therewith, e.g., second detent means carried by the coupler, such as protruding portions of a pin which connects the coupler shank in slip connection with the housing. Hence, the position of the housing relative to the sill is established in the first instance by the position of the key relative to the housing under compulsion of the front cushioning unit, then secondarily, in the positioning of the housing relative to the fixed sill by positioning the key against the sill stops under the weaker force exerted on the housing by the rear cushioning element. This arrangement is slack-free and typical of the neutral condition of the rigging.

In the drawing in respect to which the invention is described below:

FIG. 1 is a plan view in section of the draft mechanism in a neutral condition;

FIG. 2 is a vertical section taken along line II—II of FIG. 1;

FIG. 3 is an enlarged view of the midportion of the mechanism generally included between lines III—III and III_1—III_1 in FIG. 2;

FIG. 4 is a fragmentary vertical longitudinal section of the draft mechanism when subjected to draft forces;

FIG. 5 is a fragmentary vertical section of the draft mechanism when subjected to buff forces;

FIG. 6 is a fragmentary perspective view of the draft mechanism mounted in the center sill of a railway vehicle; and

FIG. 7 is a fragmentary enlarged elevation of a cylinder head and valve structure shown in less detail in the previous figures.

Referring to FIG. 1, the rigging **2** has a rear cushioning unit **4** comprising a hydraulic device **5** and resilient means, i.e., the springs **6**, and a front resilient unit **7**. The mechanism is slidably disposed within the center sill **8** of a railway vehicle. The hydraulic device **5** is enclosed in a housing **10** which projects forwardly to also enclose the front cushioning unit **7**. A car coupler **12** is operatively connected to the forward end of the housing by means of a connecting pin **14** having upper and lower end portions which function with pin stops **15** at the forward ends of upper and lower slots **16** as detent means. The connecting pin is movable within the slots **16** in the housing. The housing **10** comprises a forward bell-shaped portion, i.e., that portion which extends and flares forwardly from the pin stop **15** to form a lower carrier iron receptacle **10***a* and an upper transverse shoulder member **10***b*. This member is spaced from the front end of the sill **8** at the

neutral position of the rigging. At full length of travel of the housing **10** relative to the sill this member may be used as a stop in conjunction with the front surface of the sill. The bell-shape of the front portion of the housing permits vertical and lateral angling freedom of the coupler shank relative to the housing.

The slots **16** provides a range of movement of the pin **14** equal substantially to the longitudinal compression of the cushion **7**. These slots terminate frontwardly in fixed stops **15** fixed to the casing; rearwardly they terminate in stops **15***a*.

Disposed between the butt end of the coupler shank **17** and the front unit **7** is a follower **18** providing a seat **18***a* for the coupler butt end surface. The follower **18** has a transverse opening **19** in which is received a key **20** which normally functions as a detent means reacting through the follower **18** between the cushion **7** and rearwardly facing stops **21** fixed in the center sill **8** as forward extremities of slots **27** therein through which the key **20** passes. It is to be noted that the key **20** also extends outwardly of the housing **10** through slots **22***a* and **22***b* in the side walls of the housing. These slots are of sufficient length to permit movement of the key **20** relative to the housing throughout the compression range of the front cushioning unit **7**. The coupler shank **17** and the follower **18** function as a thrust means acting on the cushion **7** in buff operation although the shank and the follower are adapted to separate when the draft rigging is subjected to draft force of sufficient magnitude to compress the cushion beyond its state of compression at neutral condition of the draft rigging.

As this invention is directed especially to draft riggings providing long cushioning travel, e.g., 24 inches or more, the slot **27** allows a full range of inward and outward movement of the housing relative to the sill **8**. The slots **27** terminate rearwardly in abutments **23** which may be used as emergency stops. However, primary facilities for stopping the housing **10** in moving rearwardly of the sill **8** comprise side abutments **32** as lateral extremities of the housing, and front facing sill or striker abutments **33** in longitudinal alignment with the side abutments.

Travels of the magnitude desired are achieved essentially in the length of the hydraulic device **5**. Of suitable length is a piston member or rod **24** of the hydraulic device **5** attached to the center sill by means of an anchor or key **26**. Slack between key **26**, rod **24**, and the sill **8** is preferably a minimum. Fixed to the forward extremity of the rod **24** is a piston **25**. Thus, there are two points of attachment of the cushioning assembly carried by the housing **10** to the center sill, the first by means of a key **20** near the butt end of the coupler, and the second at the rear of the mechanism where the piston rod **24** is secured to the center sill by means of the key **26**. Additional vertical support for the housing **10** is obtained by an inverted saddle **31** attached to the sill adjacent to its front end. The saddle **31** passes transversely under a guide member **34** of the housing attached to and extending rearwardly from the receptacle **10***a*.

As shown in FIGS. 1, 2, 4, and 5, the housing **10** comprises a partition, i.e. a wall **28** which separates the hydraulic device **5** and the resilient unit **7**. The wall **28** is an integral part of the housing **10** and serves as a rearward support or stop for the resilient unit **7**. When the coupler is subjected to buff forces, the coupler and pin **14** move rearwardly against the follower **18** which by compressing the front cushioning unit **7** moves relative to the housing **10**. The buffing force is then transmitted through the wall **28** into the hydraulic unit **4** and the springs **6** which share in parallel relationship of the buff load transmitted thereto through the housing. An important feature is that during the initial stages of any buff blow, when the force levels are relatively low, only the resilient unit **7** offers any cushioning to the coupler. Relative movement of the cylinder and the piston is prevented through prevention of passage of any liquid from the cylinder at low force levels. Liquid does not pass from the cylinder because the valves internally of the hydraulic device do not open at low force levels. Thus, the hydraulic device remains immobilized and rearward movement of the housing **10** is prevented.

As the buffing force increases, the rearwardly disposed hydraulic device **5** comes into operation to cushion the coupler. The housing **10** is unable to move rearwardly until a preselected force level is attained. The preselected force level is determined by means, such as a relief valve **39**, which may be of customary design and located within the hydraulic unit.

Referring to FIG. 3, the hydraulic device **5** has an inner cylinder **40** with a metering tube **42** fixed concentrically therein. The piston **25** and the piston rod **4** have a common axial bore in coaxial relation with the metering tube whereby the tube is accommodated within the bore, in accordance with movements of the housing **10** relative to the piston and piston rod. During compression of the unit resulting from a buff force being applied to the coupler, the outer housing **10** with the metering tube **42** moves rearwardly relative to the fixed piston **24** to force fluid from the inner cylinder into the reservoir **43** formed between housing **10** and the wall of inner cylinder **40**. It is necessary for the fluid within the cylinder to pass through the tube **42** to reach the reservoir. The relief valve **39**, located at the forward end of the metering tube, precludes fluid from passing into the outer container until a predetermined force level has been attained. Hence, if the valve is set for a pressure, e.g., of 5,000 pounds per square inch (p.s.i.), the hydraulic unit will not function until a pressure of 5,000 p.s.i. is applied to the valve. The valve **39** thereby requires the front resilient unit **7** to provide cushioning for all buff forces that will produce a pressure of less than 5,000 p.s.i. on the relief valve. The valve **39** may be provided as a "dump valve" in accordance with conventional designs. That is to say, that once open it remains open until pressures substantially below actuating pressures are obtained in the cylinder.

The valve **39** controls the flow of fluid from the tube into the reservoir or outer container, but not in reverse. Thus, the relief valve **39** is an important feature when it is desired to avoid utilization of the hydraulic device at the lower buffing force levels. The rate of compression of the hydraulic device after its actuation is determined by the configuration of the orifice made by bore of the piston **25** and the outer surface of the tube **42** during closure. In buff, the hydraulic device also prevents the springs of the rear unit from coming into play since compression thereof is dependent on movement of the housing **10**.

Thus, in buff, the forward resilient unit **7** is the first to come into operation because of the purposely restricted functioning of the hydraulic device. Then the hydraulic device and the springs **6** come into operation. Hence, the two units function in series to provide cushioning at different force levels. Normally, the buff forces on a couple far exceed the draft forces. By providing cushioning from a resilient unit at the lower force levels, and providing a hydraulic device for the higher force levels, the combined features of both units are available in a single draft gear mechanism. It is to be noted in buff, that while the forces resisting coupler movement by the hydraulic device **5** and the springs **6** are parallel, these forces considered together are in series relation with that which is derived from the front unit **7**.

In draft, the mechanism provides cushioning to the coupler by actuating the cushioning units in parallel. However, it is to be noted that the springs **6** of the rear unit are now acting oppositely with respect to the front unit **7** and the hydraulic device **5**. While force contributed by the springs **6** is parallel to that contributed by the unit **7** and the device **5**, such force must be subtracted from the sum contributed by the front unit **7** and the device **5**. The coupler being operatively connected to the housing **10** will pull the housing forwardly under draft.

The resilient unit 7, under draft, will be compressed between wall 28 and key 20. The key 20, which passes through slot 27 in center sill 8, is lodged in the forward end of the slots 27 against the sill stops 21. As the forward unit 7 is compressed between the key 20 and the wall 28, the coupler 12 separates from the follower 18 to develop a gap 38. At the same time, the hydraulic device is extended through some of the cushioned travel as hereinafter described remaining to the piston 25 within the cylinder 40; simultaneously the springs 6 are expanding and neutralize some of the cushioning force derived from the device 5 and the front unit 7. A comparison of FIG. 4 with FIGS. 1 and 2 which illustrate the rigging at neutral condition, shows in FIG. 4 that the draft rigging has undergone substantially all of the short stroke movement available to the housing 10 in moving forwardly relative to the piston 25 and the sill 10 under conditions of draft.

In draft, the hydraulic device 5 functions differently from that in buff. Referring to FIG. 3, which is an enlarged view of that portion of FIG. 2 in brackets, there is shown that portion of the device 5 that provides cushioning when subjected to draft forces. The housing 10, in draft, is pulled forwardly by the coupler in contrast to being driven rearwardly when subjected to buff forces. The piston 25 is anchored to the center sill structure by means of key 26 and the piston rod 24 and thereby held stationary. When draft forces are applied to the mechanism, the portion of the fluid in the cylinder 40 marked "A" is forced outwardly in metered fashion, as indicated by the arrows indicating fluid flow, through an orifice 44 in cylinder 40 into the reservoir 43. It should be noted that at the same instant that the hydraulic unit operates as a result of draft forces being applied to the coupler, the resilient unit 7 is also being compressed. Thus, both the hydraulic and cushioning units are functioning simultaneously in draft. Under the buff conditions, ball check valve 46 opens to permit fluid to flow from the reservoir into the cylinder to the rear of the piston 25. In draft, or in returning the draft gear to neutral condition from a buffed condition, the metering tube 42 is not used to control the rate of piston movement as it is in buff. In returning to neutral condition from a buffed condition, the housing 10 moves forwardly and liquid flows relatively freely from the reservoir 43 into the cylinder forwardly of the piston through openings subject to restriction under buffing action by a ring-type check valve 47.

The hydraulic unit is maintained in an extended position by means of the springs 6. These springs keep the housing 10 forwardly in its neutral position in equilibrium with an opposing force provided by the front unit 7. The forward end of the spring is in abutting engagement with wall 50 of the housing, and the rearward end of the spring is in abutting engagement with wall 52 on the rearward portion of the piston member. The spring is extended slightly because of forward movement of the housing from neutral position when the mechanism is subjected to draft forces. It is when the mechanism is subjected to buff loads that actuate the hydraulic unit that the spring is greatly compressed. The spring not only serves to restore the hydraulic unit to its extended position, but provides resistance to compression resulting from draft and buff forces being applied to the mechanism.

One of the distinctive features of the mechanism herein described is that the housing 10 encloses the two cushioning units and is attached to the automatic coupler. Another feature is that the housing, which functions in a manner similar to a yoke, is an integral part of one cushioning unit and provides a housing for the unit.

What has been disclosed herein is a unique draft gear mechanism that combines the best features of hydraulic and resilient draft units into a single draft gear mechanism. The mechanism not only provides improved cushioning for the associated vehicle, but provides great flexibility in the selection of suitable units. The cushioning provided by the hydraulic unit may be readily adjusted to meet unusual service conditions, and the forwardly disposed resilient unit may be easily replaced.

The terms and expressions which have been employed are used as terms of description and not of limitation and there is no intention of excluding such equivalents of the invention described, or of the portions thereof, as fall within the scope of the claims.

What is claimed is:

1. Draft rigging for a railway vehicle comprising:
(A) a housing having a front-to-rear longitudinal direction and a fixed longitudinally intermediate partition;
(B) a sill in external longitudinally coextensive relation with the housing;
(C) a front cushioning unit and a rear cushioning unit, both resistant to contraction, received by said housing at frontward and rearward sides, respectively, of the partition;
(D) thrust means disposed frontwardly of the housing, comprising front and rear longitudinally separable members, and movable rearwardly against the front unit;
(E) anchor means connected to said sill rearwardly of the housing with respect to which the housing is movable rearwardly to compress the rear unit;
(F) rearward-facing stop means on said sill;
(G) detent means engageable in abutting relation with a forward-facing surface of said rear member and engaging said surface and said stop means in the neutral condition of the rigging;
(H) second detent means carried by said front member; and
(I) rearward-facing stop means mounted on the housing in frontward engageable relation with the second detent means;
(J) said front cushioning unit having greater resistance to compression than said rear cushion, at said neutral condition, to maintain the second detent means against said stopping means on the housing.

2. The draft rigging of claim 1 comprising:
energy-absorbing means reacting between the housing and the sill in movements of the housing relative to the sill forwardly from its position in said neutral condition.

3. The draft rigging of claim 1 wherein:
the rear cushioning unit comprises a double-acting hydraulic device for snubbing movements of the housing relative to the sill in both directions from its position at said neutral condition.

4. The draft rigging of claim 1 wherein the rear cushioning unit comprises:
(1) a hydraulic device having a cylinder fixed to said housing, a piston, and a piston rod fixed to said rear thrust means; and
(2) a compression spring reacting between the housing and the anchor means in parallel force relation with said device.

5. The draft rigging of claim 1 wherein the rear cushioning unit comprises:
(1) a double-acting hydraulic device having a cylinder fixed to said housing, a piston disposed internally intermediately of the ends of the cylinder at said neutral condition affording hydraulically snubbed movement of the housing in either longitudinal direction relative to the sill, a piston rod fixed to said anchor means, and a compression spring surrounding said piston rod and reacting with opposed surfaces of the cylinder and the anchor means to urge said device to an extended condition;
said spring being in parallel additive force relation with said device and the spring and the device in combination, and being in series additive force relation with the front cushioning

unit during rearward movements of the entire front thrust means relative to the sill; and

said spring being in parallel subtractive force relation with said device and the front cushioning unit during movements of said front member and the housing forwardly of said neutral condition.

6. The draft rigging of claim 1, wherein the rear cushioning unit comprises:

(1) a hydraulic device having a cylinder fixed to said housing, a piston, and a piston rod fixed to the rear thrust means; and

(2) a compression spring reacting between the housing and the anchor means in parallel-force relation with said device;

said hydraulic device having pressure sensitive valve means disposed for opening upon a predetermined pressure within said cylinder developed in movements of the housing in a rearward direction.

7. A draft rigging for a railway vehicle comprising:

(A) a housing having a front-to-rear longitudinal direction, a fixed longitudinally intermediate partition, and a rearward-facing stop;

(B) a sill fixed in said vehicle in external longitudinally coextensive relation with the housing, the sill having a rearward-facing stop;

(C) anchor means connected to the sill rearwardly of the housing;

(D) a rear cushioning unit comprising:

(1) a hydraulic device having a cylinder fixed in the housing at the rear of the partition, a piston slidably received in the cylinder, and a piston rod connecting the piston with the anchor means; and

(2) a spring concentric to the piston rod bearing on the rear end of the cylinder and a forward-facing surface of the anchor means;

(E) a front cushioning unit located forwardly of the partition;

(F) a car coupler having a head and a shank extending rearwardly therefrom into said housing;

(G) means for connecting the coupler shank to the housing normally engaging said housing stop to limit forward movement of the coupler relative to the housing, said connecting means allowing rearward movement of the coupler upon longitudinal compression of said front unit;

(H) a follower disposed between said front unit and the rear end of the shank in separable relation with the latter; and

(I) a key extending transversely of said longitudinal direction in normally abutting relation with a forward-facing surface of the follower and said sill stop; and

said front unit being substantially more resistant to compression than said spring to maintain said connecting means, said follower, said coupler shank, and said housing stop in substantially slack-free relationship at the neutral and draft conditions of the rigging.

8. The draft rigging of claim 7 wherein:

said device has a liquid reservoir in communication with said cylinder, and said housing has an external wall surrounding said cylinder in spaced relation therewith to provide said reservoir.

9. The draft rigging of claim 8 wherein:

said device comprises pressure-relief valve means maintaining said device and said spring inoperative as shock absorbing media during application of rearward buff forces on the front unit while the pressure within said cylinder remains below said predetermined pressure; and

liquid metering means in communication with the pressure relief means for restricting the discharge of liquid passing therethrough from the cylinder.

10. The draft rigging of claim 7 wherein:

the housing comprises a front bell-shaped portion flaring forwardly from said housing stop, said front portion terminating forwardly and downwardly in a carrier iron receptacle.

11. The draft rigging of claim 10 wherein:

said housing terminates forwardly and laterally as side abutments in longitudinal, usually-spaced alignment with respect to lateral striker abutments of said sill, said side abutments adapted to cooperate with said striker abutments in stopping rearward movement of the housing relative to the sill.

12. The draft rigging of claim 10 wherein:

said housing comprises a guide member extending horizontally rearwardly from said receptacle; and

the rigging comprises an inverted saddle attached to a front end portion of the sill and extending under said guide member.

No references cited.