Feb. 17, 1970 J. M. PEPPERS 3,495,719

HYDRAULIC DRAFT UNIT FOR USE ON A RAILWAY VEHICLE

Filed April 2, 1968

FIG. 2

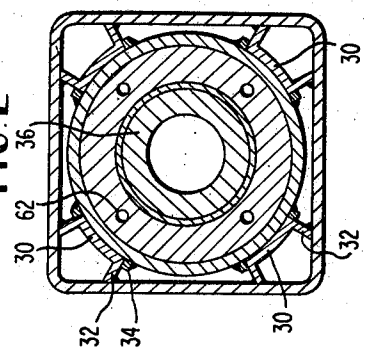


FIG. 1

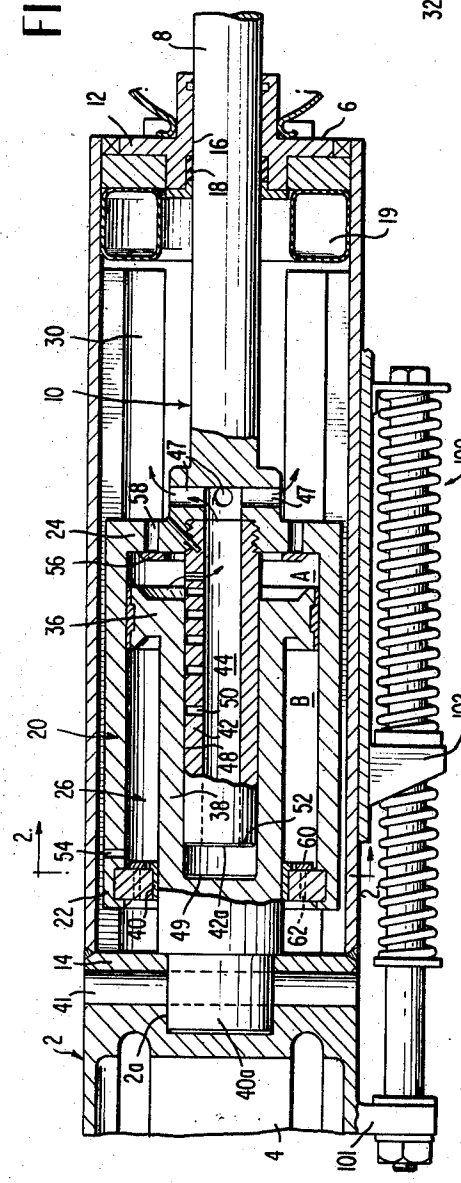


FIG. 4

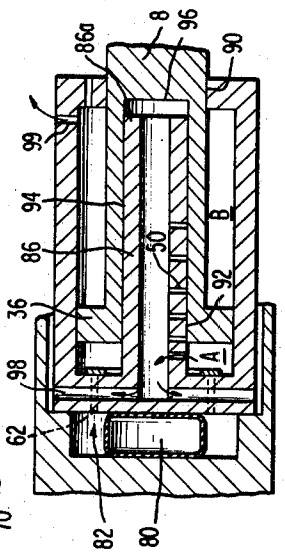
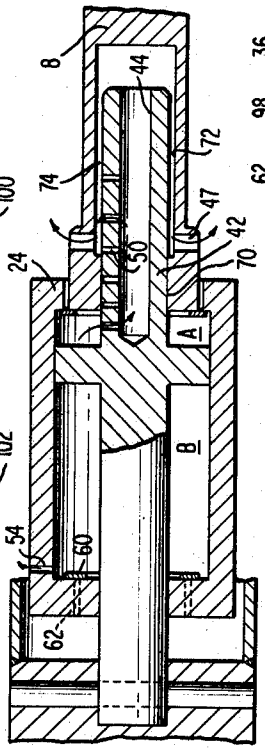


FIG. 3



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HYDRAULIC DRAFT UNIT FOR USE ON A RAILWAY VEHICLE

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U.S. Cl. 213—43 8 Claims

ABSTRACT OF THE DISCLOSURE

A hydraulic draft unit which is intended for use with a railway vehicle provided with a draft coupler. The draft unit includes an outer housing member having an enclosed, liquid filled main chamber. A rod member extends slidably and sealingly through an aperture in the housing, partially into the main chamber. One of the members is fixedly connected with the railway vehicle and the other of the members to the draft coupler. An inner housing, positioned within the main chamber, includes first and second end walls defining an enclosed, liquid filled, inner chamber. A piston means extends transversely across the inner chamber for axial sliding movement therealong. The piston means is fixedly connected with one of the members and the inner housing is fixedly connected with the other of the members. A control opening provided in either the piston means or one adjacent end wall of the inner housing, receives a control tube fixedly connected to the other of the piston means and the one end wall. The control tube includes longitudinally extending, first passage means placing the inner chamber in fluid communication with the interior of the control tube. The tube passage means is progressively blanked off by the piston means during relative motion thereof towards the one end wall. Second metering passage means are provided in the inner housing closely adjacent the other of the end walls. During buff motion, liquid is expelled from the inner chamber through a progressively diminishing area of the first metering passage means. Draft motion in an opposite direction causes liquid to be expelled from the inner chamber through the second metering passage.

BACKGROUND OF INVENTION

This invention relates to an hydraulic draft unit intended for use on a railway vehicle in order to provide impact cushioning of the vehicle during the application of buff and draft loads.

In transporting freight in railway vehicles, problems are encountered due to the buff and draft impact loads imposed on the vehicles during periods of retardation and acceleration respectively. In order to cushion the effects of these impact loads, various forms of hydraulic draft unit intended to provide hydraulic damping between each railway vehicle and its associated draft couplers during periods of acceleration and deceleration, are in common use.

It has been recognized that improved dissipation of railway car impact energy may be obtained by exponentially reducing the drainage area in hydraulic cushioning devices. A particularly efficient arrangement of this nature is featured in United States Seay Patent 3,301,410.

Because of the fundamentally different load-absorbing problems involved in buff and draft conditions, prior cushioning devices have not optimized their load-absorbing characteristics when operating in buff and draft. This lack of optimization in shock absorbing characteristics has resulted from utilizing the same fluid control channels, at least to some partial extent, in both buff and draft. While prior cushioning devices such as those featured in U.S. patent Zanow 3,173,552 have provided different porting arrangements for buff and draft energy absorption, these devices have failed to effectively utilize the separate flow paths by providing fundamentally diverse energy absorbing systems in each flow path, uniquely suited to the type of energy which fluid flowing through that flow path should absorb.

Another problem engendered by previously developed cushioning devices has been the longitudinal displacement of buff and draft energy absorbing flow paths as well as the axial displacement of centering springs from these paths. Such axial displacement, as evidenced by the Zanow unit, creates cushioning units of undesired axial lengths.

In short, the contributions of the prior inovators in the cushioning device art notwithstanding, there remains a need for an effective intermarriage of the concepts of completely independent buff and draft control, diverse treatment of buff and draft forces, effective handling of high pressure fluids so as to avoid external leakage, and minimization of the axial lengths of shock absorbing units.

SUMMARY OF INVENTION

It is therefore a general object of the invention to provide an hydraulic draft unit for a railway vehicle, intended to unify in a single unit, the desirable characteristics of a railway cushioning device, above noted.

It is a particular object of the invention to provide an hydraulic draft unit of the type providing independent fluid damping passages in buff and draft, wherein the degree of fluid restriction in buff is progressively increased as the buff load progressively increases.

It is a further object of the invention to provide an hydraulic draft unit which provides for a long stroke of the working members while at the same time providing a compact unit capable of installation on railway vehicles of restricted sill dimensions.

An hydraulic draft unit constructed in accordance with a preferred embodiment of the invention is intended for use on a railway vehicle provided with a draft coupler. The unit includes an outer housing member provided with an enclosed, longitudinally extending main chamber filled with hydraulic liquid. A longitudinally extending rod member extends slidably and sealingly through an aperture in the housing partially into the main chamber. One of the members is adapted for fixed connection to the railway vehicle and the other of the main member is adapted for fixed connection to the draft coupler. An inner housing positioned within the main chamber includes longitudinally spaced, opposed, first and second end walls and an enclosed inner chamber extending between the end walls filled with hydraulic liquid. Piston means extends transversely across the inner chamber, mounted for sliding sealing movement therealong. The piston means is fixedly connected with one of the members, and the inner housing is fixedly connected with the other of the members. A control opening is provided in one of the piston means and the first end wall of the inner housing. An axially extending hollow control tube is fixedly connected at one end thereof to the other of the piston means and the first end wall. The control tube extends slidably and sealingly through the control opening and includes longitudinally extending first metering passage means placing the inner chamber in fluid communication with the interior of the control tube. The first passage means is progressively blanked off by the piston means during relative motion thereof towards the one end wall. Communicating passage means places the interior of the control tube in fluid communication with the main chamber. Second metering passage means is provided in the inner housing closely adjacent the second end walls so as to provide fluid communication between the inner and the

main chambers. During buff motion of the rod member in one longitudinal direction relative to the outer housing member, hydraulic liquid is expelled from the inner chamber to the main chamber through a progressively diminishing area of the first metering passage means. During draft motion of the rod member, in an opposite longitudinal direction relative to the housing member, hydraulic liquid is expelled from the inner chamber to the main chamber through the second metering passage means.

THE DRAWINGS

An hydraulic draft unit constructed according to certain preferred embodiments of the invention, is illustrated in the accompanying drawings in which:

FIGURE 1 is a cross-sectional side view of an hydraulic draft unit, according to a first preferred embodiment of the invention;

FIGURE 2 is a cross-sectional, end view of a portion of the hydraulic draft unit shown in FIGURE 1 taken along the lines 2—2 therein;

FIGURE 3 is a simplified, cross-sectional view of a portion of an hydraulic draft unit according to a second embodiment of the invention; and

FIGURE 4 is a simplified, cross-sectional view of a portion of an hydraulic draft unit according to a third embodiment of the invention.

DETAILED DESCRIPTION

Referring to FIGURE 1, an hydraulic draft unit constructed according to a preferred embodiment of the invention is there shown. The draft unit is intended for use on a railway vehicle, such as for example a freight car, provided with a conventional draft coupler for connecting the vehicle to another adjacent vehicle.

The draft unit includes a longitudinally extending generally rectangular outer housing member **2** having forward and rearward ends **4** and **6** respectively. At its forward end, the outer housing **2** is connected to the draft coupler (not shown). Projecting slidably through the rear end **6** of the housing **2** is a longitudinally extending, circularly cross sectioned rod member **8**. Rod member **8** is fixedly connected to a sill portion of the railway car (not shown). The portions of the housing member **2** connected to the draft coupling and of the rod member **8** connected to the vehicle, may correspond to those disclosed in Blake U.S. Patent No. 2,944,681 and the relevant disclosures of that patent is deemed to be incorporated herein by reference.

Positioned within the housing **2** is a longitudinally extending, generally rectangularly cross sectioned, enclosed main chamber **10**. This chamber is filled with hydraulic fluid and extends between a first or rear end wall **12** and a forward or second end wall **14**. The rod member **8** passes through an aperture **16** in the end wall **12** into the main chamber **10** and is aligned axially with the center of this chamber. A suitable conventional seal unit **18** is connected with the housing wall **12** and extends sealingly about the rod member **8** adjacent the aperture **16**.

As the rod member **8** advances into the main chamber **10**, the internal free space therein is correspondingly reduced. To provide for the corresponding displacement of hydraulic fluid in the main chamber **10**, an annular, resilient gas filled flexible bag **19** is mounted in the main chamber adjacent the rear end wall **12**. The bag **19** undergoes limited resilient compression to provide space for hydraulic fluid displaced by the incoming rod member **8**.

The rod member **8** is connected at its forward end to an inner housing **20**. This housing comprises a longitudinally extending cylindrical body concentric with the rod member **8** and spaced from the adjacent interior surface of the main chamber **10**. The inner housing **20** is further provided with transversely extending, axially spaced, and mutually facing circular end walls **22** and **24**. An enclosed cylindrical inner chamber **26** filled with hydraulic liquid is provided internally of the inner housing **20**, extending longitudinally between the end walls. The inner housing **20** is of smaller external length than the internal length of the main chamber **10**, with the rear surface of the first end wall **24** fixedly secured to the rod member **8**.

During buff action, or impact imposed on the vehicle draft coupler, the housing **2** is moved rearwardly relative to the rod **8** (i.e. to the right as shown in FIGURE 1), causing the inner housing **20** to be moved in a forward direction through the main chamber **10**. Conversely, during the application of draft forces to the vehicle draft coupler, the inner housing **20** moves relatively rearwardly of the main chamber **10**.

To guide the inner housing **20** for centralized motion through the main chamber **10**, four longitudinally extending, peripherally spaced guide tracks **30** are provided. The guide tracks **30** (FIGURE 2) are fixedly connected by brackets **32** to the interior of the housing **2** within the main chamber **10** adjacent the corners thereof. Each track **30** slidingly and snuggly abuts the adjacent portions of the exterior of the inner housing **20**. To prevent rotation of the inner housing **20**, longitudinally extending, strip-like abutment stops **34** are secured to the exterior of the inner housing **20** in abutting and longitudinally slidable contact with the sides of the guiding tracks **30**.

Within the inner chamber **26** there is positioned a piston **36**. This piston extends transversely across the chamber, and is fitted in sliding contact with the interior wall of the inner housing **20**. The piston **36** is maintained in longitudinally fixed relation relative to the outer housing member **2** by a concentric shaft **38** of circular cross section. This shaft is fixedly secured to the forward face of the piston **36** and has an external diameter spaced from the interior of the housing **20** so as to define an annular space between the shaft **38** and housing **20**. The shaft **38** passes sealingly and slidably through an opening **40** in the forward or second end wall **22** of the inner housing and extends forwardly into fixed engagement with the forward end wall **14** of the outer housing **2**. At its extreme forward end the shaft **38** is provided with a projecting portion **40** fixedly secured to adjacent portions of the outer housing **2** by a conventional key **41**. Key **41** intersects housing aperture **2***a* to effect this securing of the shaft **40**.

It will be appreciated that during buff motion, the volume in the inner housing of the inner chamber A on the rearward side of the piston **36** (right side as viewed in FIGURE 1), is progressively diminished. To permit the liquid to be expelled from the piston side of the inner chamber at a controlled rate during buff, a control tube **42** is provided. The control tube **42** is fixedly and concentrically, connected to the forward interior surface of the rear end wall **24** of the inner housing. Tube **42** projects forwardly from wall **24** almost to the forward end wall **22**. The control tube **42** is of uniform external diameter and has an internal passage **44** which is open at its forward end **42***a*. At its rearward end, the internal passage **44** of the control tube communicates with two radially extending passages **46** in the rod **8** to place the interior of the control tube **42** in fluid communication with the main chamber **10**.

The control tube **42** extends slidably and sealingly through a control opening **46** provided in, and concentric with, the piston **36**. Additionally, a bore **48**, concentric with the control opening **46** for receiving the forward portion of the control tube **42**, is provided in the shaft **38**. The bore **48** in the shaft **38** includes a closed forward end **49** which prevents an egress of liquid from the bore **48** into the rod side B of the inner chamber. The end **52** of tube **48** is spaced from the bore end **49**, even in the full buff condition of the draft unit.

In operation, buff motion causing relative approaching motion between the piston **36** and the end wall **24** displaces liquid at high pressure from the inner chamber on

the piston side A thereof, through a plurality of axially spaced, radially extending, first passages **50**. These passages **50** extend radially through the wall of the control tube **42** and communicate with the passages **44** and **46** and the main chamber **10**. As the unit becomes progressively more compressed as the buff load increases, the piston **36** and shaft **38** progressively blank off the apertures **50** thus progressively diminishing the remaining area through which damping fluid may escape through the passages **44** and **46** to the main chamber. In this manner damping resistance is increased progressively with the increase in buff load to provide the desired degree of cushioning.

In a further aspect of the invention, the ports **50**, which are of equal area, are spaced exponentially along the control tube **42** with the maximum spacing adjacent the free forward end of the control tube **42** and the minimum spacing adjacent the end wall **24**. This exponential spacing, decreasing in the direction of buff movement of piston **36**, causes a more rapid rate of reduction of cross sectional area in the latter stages of unit compression. This tends to provide a uniform dissipation of impact energy as described in the United States Seay Patent 3,301,410.

During draft loading, an altogether different metering path is provided for liquid displaced from the inner chamber. For this purpose, a radially extending second metering passage **54** is provided in housing **20**. This passage **54** communicates with the inner and main chambers and is positioned closely adjacent the forward end wall **22** of the inner housing. During draft, the piston **36** and the forward end wall **22** of the inner housing undergo relative approaching motion to expel liquid from the rod side B of the piston **36**, outwardly through this second metering passage **54**. The second metering passage **54** remains of constant area, thus providing a different damping characteristic in draft from that experienced in buff to permit the absorbing of the lower level, train action, draft forces.

To provide for controlled refilling of the inner chamber **20** on the piston side A during draft motion, a conventional annular check valve **56** (shown in simplified form) is provided. This valve **56**, mounted on wall **24**, controls the flow of liquid through a plurality of ports **58** extending through this wall **24** of the housing **20**. The check valve **56** opens under fluid pressure during draft to admit liquid from the main chamber **10** to the piston side A of the inner chamber **20**.

Similarly to provide for refilling of the inner chamber rod side **8** during buff motion, another conventional check valve **60** (also shown simplified) is provided. This valve **60** controls the flow of liquid through a plurality of axially extending ports **62** in the forward end wall **22** of the inner housing from the main chamber **10** to the rod side of the inner chamber **26**, is provided. This check valve controlled refilling of the chamber **26**, is described, for example in the United States Seay Patent 3,301,410.

As shown in FIGURE 1, a resilient restoring mechanism **100** is secured to the forward underside of the coupling portion **101** of the outer housing **2**. This restoring mechanism extends back to an anchoring point **102** designed to be affixed to a sill portion of a railway car. This centering structure **101** and its mounting arrangement is described in detail in U.S. Abbott et al. Patent 3,233,747. As will thus be appreciated, this restoring mechanism axially overlaps the mutually overlapping buff and draft flow control paths of the FIGURE 1 structure. The mechanism would tend to restore the piston **36** to a "neutral" position, located axially intermediate port **54** and the leftmost port **50** of the FIGURE 1 illustration.

In a second embodiment of the invention shown in FIGURE 3, somewhat similar to the first preferred embodiment, the control tube **42** is fixedly and concentrically connected with the rear radial face of the piston **36** and extends rearwardly therefrom, i.e., to the right as illustrated. The control tube **42** passes sealingly and slidably through a control opening **70**, generally similar to the previously described control opening **46**, but provided in the rear end wall **24** of the inner housing. The control tube **42** also extends into a closed bore **72** extending axially rearwardly within the previously mentioned rod member **8**. The bore **72** is generally similar to the previously described bore **48** but is of greater internal diameter than the external diameter of the control tube **42**, to provide an axially extending annular passage **74** communicating with the previously mentioned cross communicating passages **46**. The control tube **42** includes the previously mentioned exponentially spaced radial passages **50** (most widely spaced adjacent the free, i.e., right most, end of the control tube). These passages, during buff, permit the controlled escape of liquid from the piston side A of the inner chamber through the passage **74**, **44** and **46** to the main chamber. As in the first embodiment, radial apertures **50** communicating with the interior of the inner chamber **20** are progressively blanked off. However, in the second embodiment now described, the blanking off is effected by passage of the control tube **42** through the radial end wall **24**.

A third embodiment of the invention illustrated in FIGURE 4 is generally similar to that previously described for the first embodiment except that the control tube is carried by wall **22** rather than by wall **24**.

In the third embodiment, however, the inner housing **20** is fixedly secured to the outer housing **2** within the main chamber **10**, with the forward end wall **22** of the inner housing abuttingly secured to the adjacent forward end wall **14** of the main outer housing **2**. A gas filled bag **80**, abutting a central portion of the forward face of the forward end wall **22** of the inner housing, is mounted in a recess **82** in the adjacent main outer housing **2**. An annular outer portion of the recess **82** surrounding the bag **80**, is filled with hydraulic liquid. Bag **80** here performs the function of unit **19** of the FIGURE 1 embodiment.

A control tube **86** similar to the previously described control tube **42** is fixedly and concentrically secured to the rear inner surface of the forward end wall **22** of the inner housing. Tube **86** projects rearwardly therefrom, almost to the forward end wall **24**. A plurality of the previously mentioned exponentially spaced first passages **50** are provided in the control tube **86** having their widest spacing adjacent the free end **86***a*.

The rod member **8** projects slidably and sealingly through a concentric opening **90** in the rear end wall **24** of the inner housing, with the forward end of the rod member **8** being fixedly secured to and carrying the piston **36**. A control opening **92** in the piston (similar to the previously mentioned control opening **46**) communicates with a rearwardly extending axial bore **94** in the rod member **80**, to receive the control tube **42**. A closed end **96** of the bore **94** is positioned rearwardly of the most extreme buff position of the rear end **86***a* of the control tube **86**. The check valve passage **62** in the forward end wall **22** communicates with the recess **82** which is, itself, placed in communication with the main chamber **10** by passages, not shown, but described for example in the aforesaid Seay Patent 3,301,410.

During buff loading, the rod member **8** causes the piston **36** to be moved forwardly within the inner chamber **20** so that hydraulic liquid on the piston side A is forced out through the axially spaced radial ports **50** in the control tube into the interior thereof, and from there into the main chamber through radially extending communicating passages **98** provided in the forward end wall **22**. These passages **98** are circumferentially displaced from the passages **62** in end wall **22**.

A second metering passage **99** (similar to the previously described second metering passage **54**) provides for controlled escape of fluid from the inner chamber during draft. Passage **99** is formed in the inner housing **20** adjacent the rear end wall **24**, as shown in FIGURE 3.

SUMMARY OF ADVANTAGES

It will be appreciated that in constructing an hydraulic draft unit for a railway vehicle according to the present invention, certain significant advantages are provided.

Particular advantages are afforded by the different buff and draft metering paths for liquid expelled from the inner chamber, which permits different damping characteristics to be provided by the hydraulic draft unit during buff and draft loads.

This permits optimum matching of the damping performance of the hydraulic draft unit against the different shock load characteristics of buff and draft impact loads. In this respect, the provision of the exponential metering passage system which is exponentially diminished in drainage as the buff load builds up, is of particular significance.

Also, the construction described, utilizing an inner housing and an outer housing with separate buff and draft metering passages for fluid expelled from the inner housing, permits an hydraulic draft unit having a reduced overall length with a maximized working stroke to be provided.

It will thus be recognized that through this invention there has been united, in a single unit, several highly advantageous operating characteristics of railway draft gear. In an axially compact format, independent buff and draft fluid flow control paths are provided. These flow paths are housed within a relatively low pressure fluid return path. Further, as has been shown, these two independent flow paths may be arranged so as to axially overlap and be disposed in substantially axial alignment with a restoring or centering mechanism. Where the draft flow path circumferentially envelops the buff flow path, leakage tendencies from the relatively high pressure draft flow path are curtailed.

Although the invention has been described with respect to certain preferred embodiments, it will be appreciated by those skilled in the art that additions, deletions, substitutions, modifications and other changes not specifically disclosed may be made.

I claim:

1. An hydraulic draft unit for use on a railway vehicle provided with a draft coupler, said hydraulic draft unit comprising:

an outer housing member including,

an enclosed, longitudinally extending, main chamber at least partially filled with hydraulic liquid;

a longitudinally extending rod member extending slidably and sealingly through an aperture in said housing partially into said main chamber, one of said members adapted for fixed connection to the railway vehicle and the other of said members adapted for fixed connection to the draft coupler;

an inner housing positioned within said main chamber including,

longitudinally spaced, opposed, first and second end walls,

an enclosed, inner chamber extending between said end walls filled with hydraulic liquid;

piston means extending transversely across said inner chamber mounted for sliding sealing movement therealong, with said piston means being fixedly connected with one of said members, and said inner housing being fixedly connected with the other of said members;

a control opening in one of,

said piston means, and

said first end wall of said inner housing;

a longitudinally extending hollow control tube fixedly connected at one end thereof with the other of said piston means and said first end wall;

said control tube extending slidably and sealingly through said control opening, said control tube further including,

longitudinally extending first metering passage means placing said inner chamber in fluid communication with the interior of said tube, said first metering passage means being progressively blanked off by said piston means during relative motion thereof towards said first end wall, and

communicating passage means placing the interior of said control tube in fluid communication with said main chamber; and

second metering passage means in said inner housing generally adjacent said second end wall and providing fluid communication between said inner and main chambers;

whereby during buff motion of said rod member in one longitudinal direction relative to said outer housing member, hydraulic liquid is expelled from said inner chamber to said main chamber through a progressively diminishing area of said first metering passage means, and whereby during draft motion of said rod member in an opposite longitudinal direction relative to said housing, hydraulic liquid is expelled from said inner chamber to said main chamber through said second metering passage means.

2. An hydraulic draft unit as defined in claim 1 wherein said first metering passage means includes:

a plurality of ports extending radially of said tube between the interior and exterior thereof, said ports being spaced axially along said tube in a generally exponential distribution, with the spacing between said ports decreasing in the direction of buff movement of said piston means.

3. An hydraulic draft as defined in claim 1 further including:

first check valve means in said inner housing for permitting relatively unrestricted flow of damping liquid from said main chamber into said inner chamber between said piston means and said first end wall of said inner housing only during draft motion of said piston means; and

second check valve means in said inner housing for permitting relatively unrestricted flow of damping liquid from said main chamber into said inner chamber between said piston means and said second end wall of said inner housing only during buff motion of said piston means.

4. An hydraulic draft unit as defined in claim 1 wherein:

said outer housing member further includes;

first and second, longitudinally spaced, opposed, outer housing end walls positioned at opposite ends of said main chamber with said main chamber being of greater length than said inner housing;

said aperture for slidably and sealingly receiving said rod member being positioned in said first end wall of said outer housing;

said rod member being fixedly connected with said first end wall of said inner housing on a side thereof remote from said inner chamber to cause longitudinal movement of said inner housing along said main chamber during said buff and draft motions; and

a longitudinally extending shaft is fixedly connected to said piston means on a side thereof remote from said rod member, said shaft extending slidably and sealingly through an opening in said second wall of said inner housing and having a remote end fixedly secured to said second end wall of said outer housing member.

5. An hydraulic draft unit as defined in claim 4 wherein:

said control tube is fixedly connected with said first end wall of said inner housing and extends longitudinally inwardly of said inner chamber; and

said control opening for slidably receiving said control tube is located in said piston means;

said shaft further includes;

a bore communicating with said control opening in said piston means and extending longitudinally into said shaft, said bore receiving said control tube, and

a closed inner end of said bore spaced axially from a free end of said tube.

6. An hydraulic draft unit as defined in claim 4 wherein:

said control tube is fixedly connected with said piston means and extends longitudinally toward and through said first end wall of said inner housing;

said control opening for slidably and sealingly receiving said control tube is positioned in said first end wall of said inner housing; and

said rod member further includes;

a bore communicating with said opening in said first end wall of said inner housing and extending longitudinally into said rod member, said bore receiving said control tube in radially spaced relation, and

a closed end of said bore spaced axially from a free end of said tube.

7. An hydraulic draft unit as defined in claim 1 wherein:

said outer housing member further includes;

first and second, mutually facing, longitudinally spaced, end walls position at opposite ends of said main chamber;

said aperature for slidingly and sealingly receiving said rod member is positioned in said first end wall of said outer housing;

said first end wall of said inner housing is fixedly connected with said outer housing closely adjacent said second end wall thereof;

said control tube is fixedly connected with said first end wall of said inner housing and extends longitudinally inwardly of said inner chamber, with said control opening being positioned in said piston means for slidably and sealingly receiving said control tube;

said rod member extends slidingly and sealingly through a second opening in said second end wall of said inner housing with said rod member being fixedly connected with said piston means on a side thereof remote from said first end wall of said inner housing, said rod member further including;

a longitudinally extending bore communicating with said opening in said piston means, with

said bore extending longitudinally into said rod member for receiving said control tube and,

a closed end of said bore spaced from a free end of said control tube.

8. An hydraulic draft unit for use on a railway vehicle provided with a draft coupler, said hydraulic draft unit comprising:

an outer housing member including,

an enclosed, longitudinally extending, main chamber at least partially filled with hydraulic liquid;

a longitudinally extending rod member extending slidably and sealingly through an aperture in said housing partially into said main chamber, one of said members adapted for fixed connection to the railway vehicle and the other of said members adapted for fixed connection to the draft coupler;

an inner housing positioned within said main chamber including,

longitudinally spaced, opposed, first and second end walls,

an enclosed, inner chamber extending between said end walls filled with hydraulic liquid;

piston means extending transversely across said inner chamber mounted for sliding sealing movement therealong, with said piston means being fixedly connected with one of said members, and said inner housing being fixedly connected with the other of said members;

a control opening in one of

said piston means, and

said first end wall of said inner housing;

a longitudinally extending hollow control tube fixedly connected at one end thereof with the other of said piston means and said first end wall;

said control tube extending slidably and sealingly through said control opening, said control tube further including,

longitudinally extending first metering passage means placing said inner chamber in fluid communication with the interior of said tube, said first metering passage means comprising a series of exponentially spaced ports, spaced longitudinally of said tube and operable to be progressively blanked off by said piston means during relative motion thereof towards said first end wall, and

communicating passage means placing the interior of said control tube in fluid communication with said main chamber;

second metering passage means in said inner housing generally adjacent said second end wall and providing fluid communication between said inner and main chambers;

whereby during buff motion of said rod member in one longitudinal direction relative to said outer housing member, hydraulic liquid is expelled from said inner chamber to said main chamber through a progressively diminishing area of said first metering passage means, and whereby during draft motion of said rod member in an opposite longitudinal direction relative to said housing, hydraulic liquid is expelled from said inner chamber to said main chamber through said second metering passage means;

first, buff controlling, fluid flow path means disposed in fluid communicating relationship with said first metering passage means;

second, draft controlling, fluid passage means disposed in fluid communicating relationship with said second metering passage means and disposed in at least partially axially overlapping relationship with said buff controlling flow path means and at least partially circumferentially enveloped by said buff controlling flow path means; and

spring means operable to yieldably maintain one of said members in a predetermined rest position in relation to the other of said members, said spring means being disposed in at least partially axially overlapping relationship with said buff and draft flow path means.

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DRAYTON E. HOFFMAN, Primary Examiner

U.S. Cl. X.R.

188—88; 213—8