A housed draft gear for railway vehicles having friction and rubber cushioning units arranged in tandem in an open-fronted cavity of uniform cross section in a housing and held in assembled relation in the cavity, the friction and rubber cushioning units being of improved construction.

9 Claims, 4 Drawing Figures
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HOUSED DRAFT GEAR

In U.S. Pat. No. 3,491,898 to Suckow assigned to the present assignees, there was disclosed an improved housed draft gear. In this draft gear, the relatively complex housing of a conventional housed draft gear was replaced by a housing having a front-opening cavity of uniform, preferably rectangular cross section. The draft gear had a rear, preferably polyurethane rubber cushioning unit and a front friction cushioning unit, which with other housed parts, were all insertable into the housing's cavity through the latter's open front end. Preferably ported at the sides only for observation of the rubber cushioning unit, the housing had adequate strength at the rear with a rear wall of reduced thickness compared to previous gears, correspondingly increasing the space available for the rubber cushioning unit in the cavity.

The preferred friction unit included a central wedge serving as a plunger for the draft gear and friction shoes wedged laterally by the plunger into frictional engagement with the housing. The friction unit was compact and only occupied a small part of the cavity with both wedge and shoes projecting therefrom for maximizing the space available for the rubber cushioning unit. A releasable interlock between the wedge and the shoes and the housing held the several components of the draft gear in assembled relation and permitted their ready assembly and disassembly.

In the above construction, the rubber pads or mats are O-shaped with a central tunnel portion. After extensive testing, it was found that this mat design provided too little lateral restraint wherein the mat was squeezed out from the spring and spacer plates. Further, the pad has an inability to recover properly after being squeezed out, and the condition became progressively worse, lowering the capacity of the gear to the point where it could not pass the A.A.R. 2-year check test as presently called for in Specification M-901-E.

The fact that the mats or pads did not have the necessary lateral restraint coupled with a variation in the surface condition of the spacer pads and the increased compression ratio caused nonuniform distortion of the mats under load so that the spring and spacer plates were subjected to uneven pressures to the extent that they became bent. The bending of the plates was also aggravated by column instability which caused plates to drag against the inside of the housing while under a high lateral load during compression of the gear.

Another shortcoming of the above design was in the forward internal follower which had an opening for the wedge guide lugs. The rubber pad adjacent thereto extended into the opening and became damaged.

Accordingly, it is an object of the present invention to provide a housed draft gear having improved construction for the rubber spring assembly, spacer plates and friction unit.

The foregoing and other objects and features of the invention will appear hereinafter in the detailed description, be particularly pointed out in the appended claims and be illustrated in the accompanying drawings, in which:

FIG. 1 is a plan view in working position of a preferred embodiment of the housed draft gear of the present invention, with portions broken away and shown in section to more clearly illustrate certain of the details of construction;

FIG. 2 is a side elevational view in working position of the draft gear of FIG. 1, again with portions broken away and shown in section to more clearly illustrate certain of the details of construction;

FIG. 3 is a vertical sectional view taken along lines 3-3 of FIG. 2; and

FIG. 4 is a side elevational view of the wedge of the friction unit of the draft gear of FIG. 1.

In accordance with the present invention, there is provided improvements in the housed draft gear described above. The rubber pads in each spring unit are characterized by having opposed horizontal and vertical surfaces and a central tunnel portion. A vertical strap member connects the horizontal surfaces and is integral therewith. The strap member substantially bisects the tunnel portion. This provides lateral restraint and recovery means after compression.

Preferably, the opposed vertical surfaces are convex and the opposed horizontal surfaces are concave. This prevents the mats from protruding over the edges of the spring plates under load, thus removing a further hindrance to full recovery of the mat on the removal of the load.

Additionally, the spacer plates dividing each spring consisting of a spring plate sandwiched by a pair of rubber pads or mats are of a thickness greater than and of a cross-section slightly larger than the spring plates.

Also, modifications have been made in the forward follower and its relationship and cooperation with the friction shoes of the friction unit.

Referencing now in detail to the drawings in which like reference characters designate like parts, the improved friction rubber draft gear of the present invention is intended to fit into a draft gear pocket in a centrsill of a railway vehicle for cushioning buffing and draft forces between the adjoining coupler (not shown) and the sill and is readily adaptable to fit either the 24 ¼ in. or the 36 in. pocket upon which the A.A.R. has now standardized. While that for the longer pocket will have greater travel and capacity, the adaptations of the improved draft gear for both standard pockets will be basically the same. It therefore will suffice for an understanding of the invention to direct the description primarily to the illustrated embodiment in which the improved draft gear has been adapted to fit into a 24 ¼ in. pocket and have a travel of about 3 ¼ in.

The improved draft gear is comprised of a housing 1, which usually will be of box-shape and have therein a longitudinal extending cavity 2 open at the front and closed at the rear by the housing's rear wall 3. The cavity 2 in cross section is uniform or the same throughout its length and if, as preferred, the cross section is rectangular, will be bounded at the sides by longitudinally extending top and bottom walls 4 and side walls 5 forming the several sides of the housing.

Disposed in the cavity 2 and inserted therefore in the cavity's open front end 6, are a rear rubber cushions unit 7 and a front friction cushioning unit 8, which are arranged in tandem and act in series in cushioning the buffing and draft or longitudinal forces between the centrsill and the coupler. Acting, as well, as a return spring for returning itself and the friction unit 8 to normal position on release from a longitudinal force, the preferred rear cushioning unit 7 is formed of a plurality of rubber springs 9 arranged in tandem longitudinally of the cavity 2 and separated longitudinally from each other by spacer plates 10, each spring being
formed of a pair of rubber pads 11 sandwiching and joined or connected through an intervening spring plate 12.

The rear unit 7 is contained longitudinally by and acts between the rear wall 3 and a front spring follower plate 13 separating the rear and front units. While the longitudinal alignment so provided might be adequate, the length of the rear unit, even in the 24 % in. pocket version, is such as to render some intermediate guidance desirable. Accordingly, the rear unit 7 is divided longitudinally by spacer plates 10 interposed between each spring 9 which constitute a spring plate 12 having a rubber pad 11 secured on each side. The spacer plates 10 are thicker than the spring plates 12 to provide both stabilization of the column and protection of the individual spring plates 12. The spring plates 12 are slightly smaller in cross section than the spacer plates so that they are prevented from contacting the sides of the housing and being bent during compression.

While the term “rubber” is used herein to differentiate the rear unit 7 from the front unit 8 and the material of which the pads 11 are made is rubber-like in being elastic and flowing under compression, the preferred material is rubber only in that general sense and, instead of natural or synthetic rubber, is the elastomer known popularly as “polyurethane rubber.” This preference is dictated in the main by the increased capacity derivable from the higher compression modulus and greater elasticity at high hardness of polyurethane rubber than natural and synthetic rubber and, among polyurethane rubbers, those having a durometer hardness (as measured on the Shore A scale) of around 100 now appear to be the most suitable.

The friction cushioning unit 8, upon which the improved draft gear depends mainly for adequate capacity at initial or low travel, has as its preferred components a single center wedge 17, centered transversely on the housing 1, and a plurality of side wedges or friction shoes 18. For the preferred pair of friction shoes 18, the wedge 17 is generally of arrowhead shape in plan and rectangular on any cross section (as shown in FIG. 4) with a forwardly projecting shank 19 at the front and a plural or double wedge, rearwardly tapering head 20 at the rear, the latter having on opposite sides flat, vertically extending, horizontally oblique and rearwardly converging wedging faces 21 on opposite sides of and at equal angles to the longitudinal centerplane of the gear. In their turn, the preferred friction shoes 18 are generally right triangular with vertical extending flat sides, of which the inner are wedging surfaces or faces 22 corresponding in obliquity and rearward convergence to and each bearing against just one of the wedging faces 21 on the center wedge 17. The surfaces 21 of the wedge 17, or the surface 22 of the friction shoes 18, should be or are preferably crowned to accommodate angular displacement of the wedge 17. The other, right angularly related sides of the friction shoes 18 are outer or friction surfaces 23 and rear bearing surfaces 24, disposed parallel to and bearing against, respectively, the planar and parallel inner side surfaces 25 of the side walls 5 laterally bounding the cavity 2 and the front of the spring follower 13. Both the wedge 17 and friction shoes 18 preferably normally project forwardly from the front end 6 of the cavity 2 beyond the front end 26 of the housing 1 and in the illustrated embodiment the wedge or, more precisely, combined wedge and plunger or wedge-plunger has a flat front face 27 adapted to bear against the rear of a conventional front follower block 28, although, if desired the wedge and block can be integral. Telescopable into the housing 1 from its normal forwardly projecting position, under buffing and draft forces applied in the usual manner to the limit of travel imposed by contact of the normally forwardly spaced front follower block 28 with the front end 26 of the housing 1, the friction cushioning unit 8 divides the applied longitudinal force into lateral and longitudinal components by the wedging action of the wedge-plunger 17 on the friction shoes 18 and uses the lateral component for constantly wedging or urging the outer side or friction surfaces 23 of the shoes into frictional engagement with the sides 25 of the cavity 2 on which they slide longitudinally in the course of the gear's travel. At the same time, the friction unit transmits the longitudinal component of the applied force through the rear bearing surfaces 24 of the shoes and the intervening front spring follower 13 to the rubber cushioning unit 7. As they move, the several parts of the draft gear housed in the housing 1 all move in substantially rectilinear paths, the wedge 17 and friction shoes 18 of the friction unit 8 as a result of the parallelism of the inner sides 25 of the side walls 5 of the housing over at least the areas thereof slidably engaged by the shoes. During such movement, longitudinal movement of the wedge relative to the shoes and lateral movement of the latter relative to the housing is limited to that required to compensate for or take up any wear produced by the friction engendered between the shoes and housing.

The friction unit capacity is dependent upon the spring capacity so that as the gear is compressed and the rubber spring resistance is increased, the friction component also increases, essentially in proportion. The capacity of the rubber cushioning unit is derived from the high compression modulus of the urethane material. The internal friction which is best kept low, and the frictional resistance of the shoes and the plates account for a percentage of the absorbed capacity, or the energy lost due to its conversion to heat.

The internal friction or hysteresis of the elastomer itself is best kept low because it is then less sensitive to dynamic deformation and, therefore, produces lower reaction levels for a given energy input. In other words, if the rubber has high internal friction it is then more velocity-sensitive and produces higher reaction force levels for a given input at a given velocity.

On the other hand, the friction developed by the high spring force levels, due to the high compression modulus, is not velocity-sensitive to anywhere near the same degree and, therefore, does not produce inordinately high reaction force levels and this helps to obtain high cushioning capacity at low reaction levels. On the contrary, the capacity of the rubber cushioning unit 7, derived from the internal frictional resistance of the pads 11 and the frictional resistance to their lateral flow along the adjoining surfaces of the spacer and spring plates 10 and 12, rear wall 3 and intermediate and front spring followers 16 and 13, progressively increases with increase in the compression or telescoping of the draft gear. This increase is greater and the ultimate capacity at full travel higher than with a conventional rubber cushion, if, as preferred, the pads are made of polyurethane rubber.

An important factor in the capacity of the gear also is the greater than usual number of rubber springs 9 it
can have in its rubber cushioning unit 7, within the limited length of the draft gear pocket, because of the compactness of the friction cushioning unit 8 and consequently relative small space normally required therefor in and to a lesser degree the relative thinness of the rear wall 3. With regard to that thinness, the nondependence of the gear on a wedging action of the housing on its friction unit and the uniform cross section of the cavity 2 enabling the housed parts to be inserted thereinto through the cavity's open front end 6, enable the side walls 4 and 5 of the housing to be uninterupted or unapertured, save, desirably, for ports 29, conveniently in the top and bottom walls 4, for observing the condition of the rubber cushioning unit. This minimum aperturing, by giving the housing more than usual strength despite its relative simplicity, permits reduction not only in the thickness of the rear wall 3 but also in that of the side walls 4 and 5 by weight-reducing depressions 30 formed in their outsides rearwardly of the portion of the housing at the front which is exposed to lateral forces from the friction cushioning unit 8.

The insertibility of the housed parts of the draft gear into the housing 1 through the open front end 6 of the cavity 2 does not stem solely from the uniform cross section of the cavity 2 and, instead, depends in part on the way in which the draft gear is held in assembled relation. In the preferred draft gear the several parts are so held by a releasable interlock pin 31 passing through the upper and lower surfaces of the housing and engages grooves 37 in the wedge-plunger. The wedge-plunger 17 is locked against relative forward movement and also retains the friction shoes 18 against relative forward movement to the housing 1.

Each friction shoe 18 preferably has a guide lug 43 extending rearwardly beyond its rear bearing surface 24 as a rearward extension of its outer friction surface 23 and fitting in an outwardly opening groove 44 in the adjoining side portion of the front spring follower 13 for limiting the relative transverse movement therebetween, as an aid in maintaining the desired longitudinal alignment between the friction and rubber cushioning units.

Referring to FIG. 3, one side of the preferred spring 9 is shown. The mat 11 is generally of FIG. 8 configuration; that is, the opposed vertical sides 33 are convex and the opposed horizontal sides 34 are concave. Substantially bisecting the tunnel portion 35 is an integral strap 36 which provides lateral restraint of the mat under load. Also, the spring plate 12 contains apertures 14 through which the two sides of the mat 11 are joined by mechanical bonds formed in the molding process. The spacer plates 10, end wall 3 and the internal follower 13 have depressions 15 which correspond in diameter and location to the holes of apertures 14 in the spring plate 12 to provide additional retention and alignment which gives the column some degree of stability.

While identical in the foregoing respects, the preferred adaptations of the improved draft gear for 24 % and 36 in. standard pockets will vary in two main respects, one, travel, and the other, the number of rubber springs 9 in their rubber cushioning units 7. In either adaptation, the rubber cushioning unit normally will be precompressed or under initial compression to escape the low gradient at the beginning in the compression-capacity curve of such a unit, and, depending on its length, this precompression does have a definite bearing on its practical further compression. The travel of the adaptation of the gear for a 24 % pocket ordinarily will be around 3 ¼ in. and at that travel tests have indicated the gear to have a capacity of about 51,000 ft. lbs. at 710,000 lbs. reaction, far in excess of the minimum capacity required by the applicable A.A.R. specification. With the greater length of its rubber cushioning unit, the adaptation for the 36 in. pocket would pass by a large margin.

From the above description it will be apparent that there has been provided an improved housed friction-rubber draft gear which is readily adaptable to fit either of the present A.A.R. standard draft gear pockets and in either adaptation will more than meet the specifications required for A.A.R. approval.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A housed draft gear comprising a housing, a cavity in and extending longitudinally of said housing and bounded laterally by side wall means thereof, said cavity being closed at the rear and opening at the front onto a front end of said housing, rubber and friction cushioning units in tandem in said cavity and insertible thereinto through said open front thereof, said rubber unit comprising a plurality of rubber pads having convex opposed vertical surfaces and concave opposed horizontal surfaces being disposed rearwardly and yieldably resisting rearward movement of said friction unit, said friction unit being movable longitudinally in and normally projecting forwardly from said housing and under external longitudinal forces telescoping into and frictionally engaging said side wall means of said housing and compressing said rubber unit, and said cavity being of uniform cross section over at least the area of said wall means engaged by said friction unit, and means for normally locking said friction unit and therethrough said rubber unit in said housing.

2. A housed draft gear according to claim 1 in which the rubber units comprise a pair of rubber pads sandwiching an intervening spring plate, each pair being separated by a spacer plate.

3. A housed draft gear according to claim 2 in which the spring plates are slightly smaller in cross section than the spacer plates wherein said rubber unit comprises a plurality of pairs of rubber pads separated by a spring plate, and said rubber pads are characterized by having a central tunnel portion, comprising a vertical strap member connecting the horizontal surfaces and being integral therewith, said strap member substantially bisecting the tunnel portion.

4. A housed draft gear according to claim 1 wherein the means releasably locking the friction unit to the housing is a pin means passing through the housing and engaging a groove in wedge-plunger of the friction unit, in absence whereof the cavity is unrestricted for free insertion and removal of the friction and rubber units.

5. A housed draft gear according to claim 1 wherein the cavity is of uniform cross section throughout the length thereof, the friction unit includes friction shoe means frictionally engaging the side wall means of the housing, and wedge means normally projecting forwardly from the housing and responsive to an external longitudinal force for wedging said shoe means against and along the side wall means and through said shoe means compressing the rubber unit by respectively lateral and longitudinal components of said force.
6. A housed draft gear according to claim 5 wherein contact between the wedge means and the shoe means and between the shoe means and the wall means is surface contact, and the shoe means are urged laterally against the wall means solely by the wedging action of the wedge means.

7. A housed draft gear according to claim 5, including a front spring follower interposed between the rubber and friction units and engaged at the front by the rear bearing surfaces of the shoes.

8. A housed draft gear according to claim 5 wherein the shoe means normally project forwardly from the housing.

9. A housed draft gear according to claim 1 wherein the rubber pads are polyurethane rubber pads of about 100 durometer hardness as measured on the Shore A scale.