March 20, 1962 B. E. PETERSON 3,025,974

RUBBER DRAFT GEAR

Filed Feb. 2, 1960 4 Sheets-Sheet 1

Fig. 1

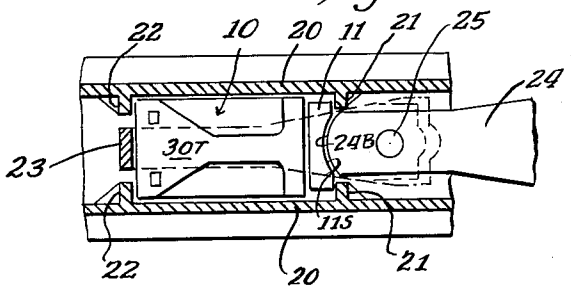


Fig. 2.

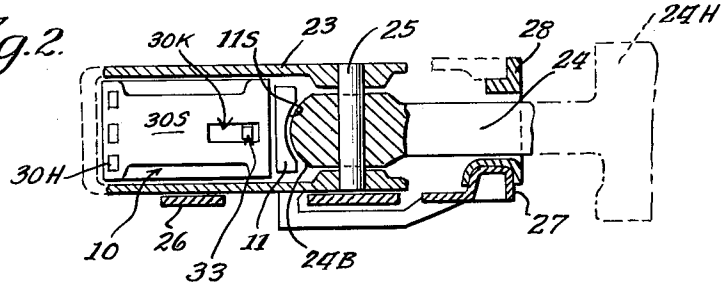
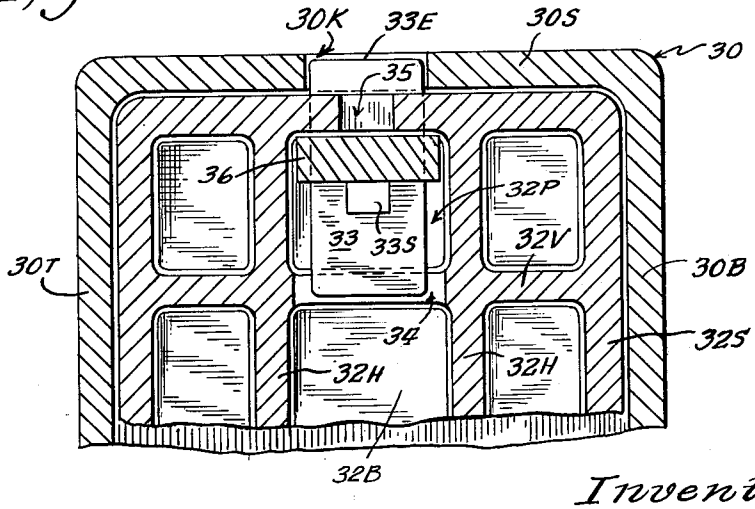


Fig. 4.



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RUBBER DRAFT GEAR

Filed Feb. 2, 1960 4 Sheets-Sheet 2

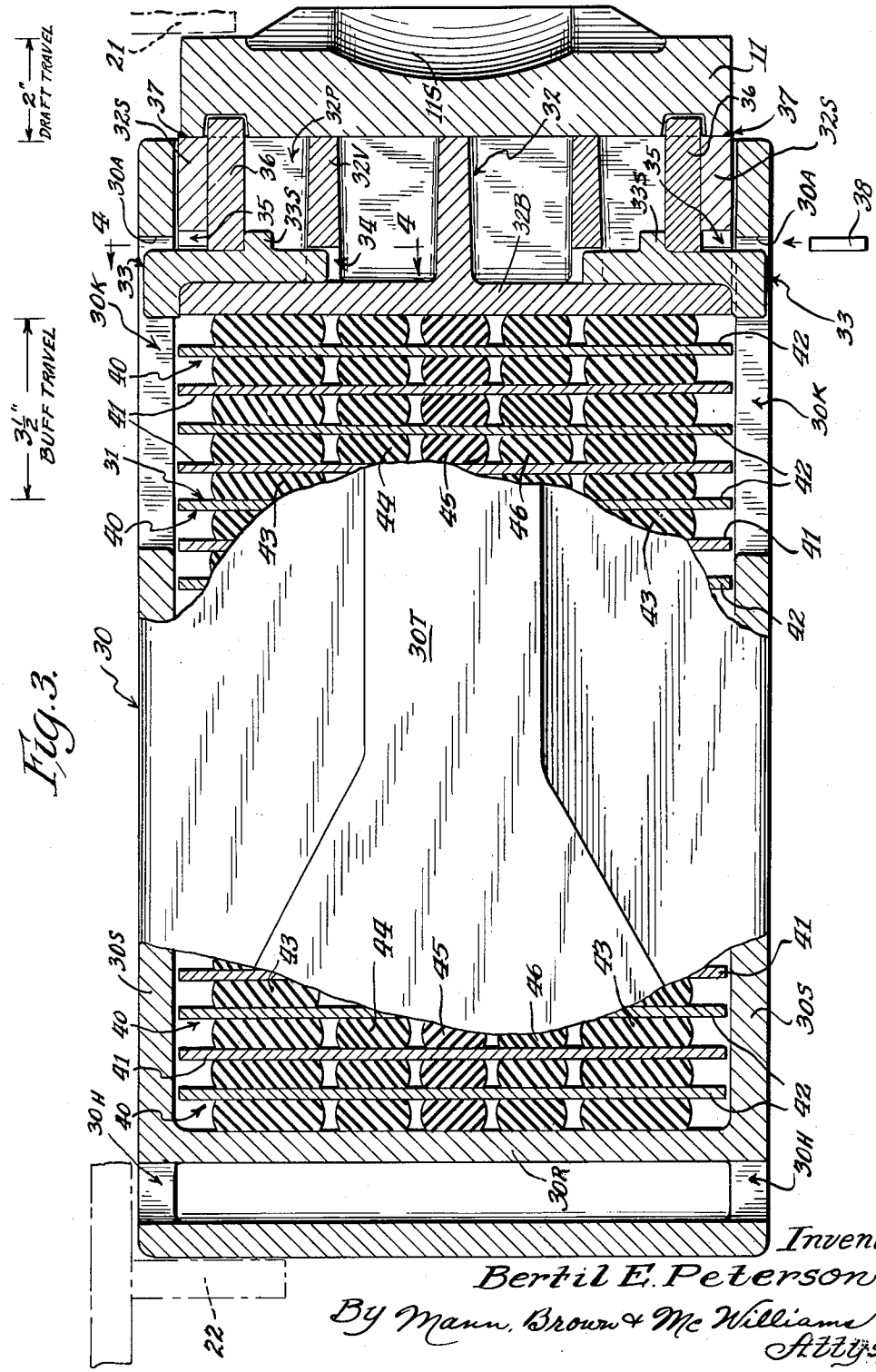

Fig. 3.

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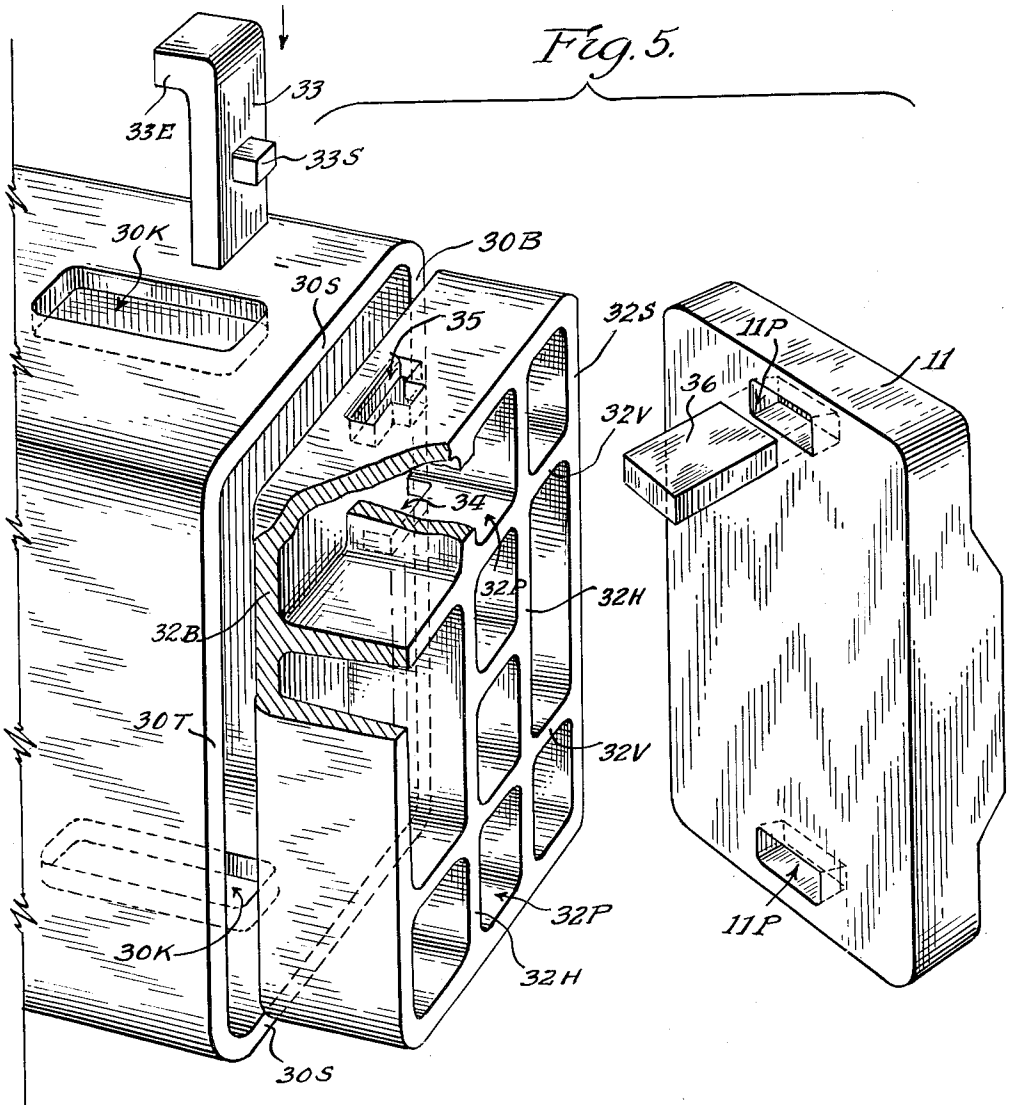
March 20, 1962 B. E. PETERSON 3,025,974

RUBBER DRAFT GEAR

Filed Feb. 2, 1960 4 Sheets-Sheet 3

Fig. 5.



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RUBBER DRAFT GEAR

Filed Feb. 2, 1960 4 Sheets-Sheet 4

Fig. 6.

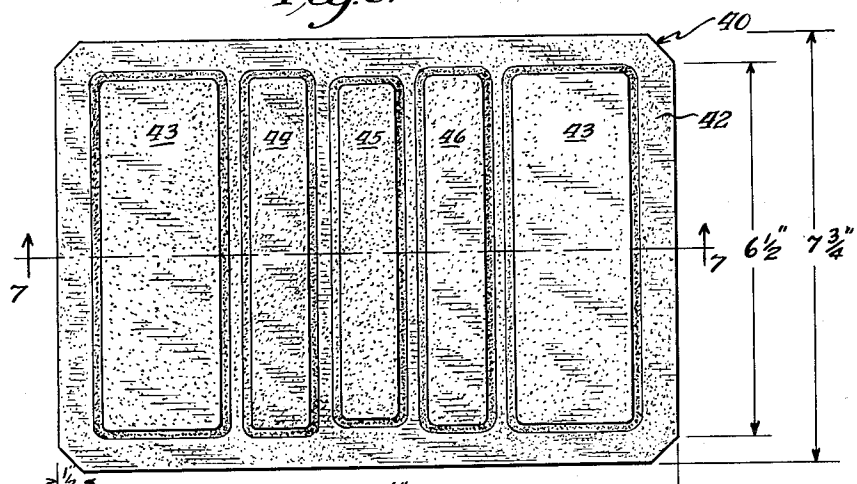
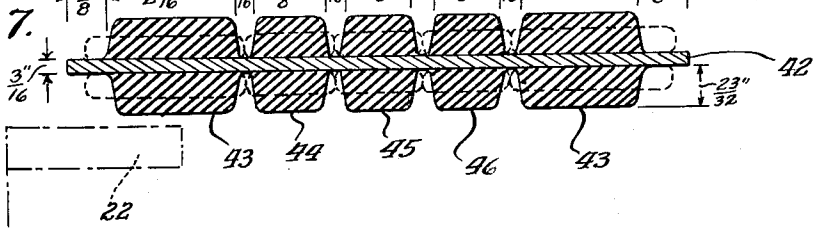


Fig. 7.



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3,025,974

RUBBER DRAFT GEAR

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Filed Feb. 2, 1960, Ser. No. 6,305
9 Claims. (Cl. 213—40)

This invention relates to draft gears and, more particularly, is concerned with draft gears having a cushioning mechanism of the rubber spring type and having an improved retaining or locking mechanism for holding the cushioning mechanism under a predetermined compression.

The principal object of the present invention is to provide a rubber draft gear in which the rubber spring units of the cushioning mechanism produce high energy absorption to develop a maximum of capacity with a minimum of reaction.

Another object is to provide an improved rubber spring arrangement having a rubber bar arrangement that encourages transmission of the applied forces in a direct line to the rear lugs to relieve the rear follower of objectionable bowing.

Still another object is to provide a cushioning arrangement wherein the rubber end bars are of greater size than the intermediate bars and are fixed on their mounting plates at points located transversely inwardly of the extremities of the plate to resist transverse outward flow of the rubber beyond the plate edges during severe compression loads.

A further object of the invention is to provide an improved rubber draft gear arrangement having retaining keys for locking the gear in assembled relation for ease in handling, shipping and installation thereof.

Another object is to provide an arrangement wherein the retaining key operates in a slot in the lengthwise extending side wall structure of the gear casing so that the open end of the gear casing may be of full size to accommodate rubber spring units of maximum transverse dimensions.

Generally speaking, the draft gear arrangement of this invention comprises a gear casing having an open end of full size to receive an aligned stack of rubber spring units therein, with a plunger being movable through the open end of the casing to compress the rubber spring units therein. The casing has lengthwise extending elongated slots opening through its side wall structure and the plunger has transversely opening passages for registry with the casing slots to receive retaining keys which project into the slots to hold the gear assembly under a predetermined initial compression.

This locking arrangement accommodates rubber spring units having maximum transverse dimensions and the arrangement of the rubber bars of each of the spring units minimizes the stress applied to the portions of the rear follower that are located between and free of contact with the rear stops of the car frame to thereby release the required strength and thickness of the rear follower and correspondingly increase the mounting space available for the cushioning mechanism itself. The novel arrangement of the rubber bars develops an intense rubber scrubbing action for achieving maximum capacity with a minimum of reaction.

Other objects and advantages will become apparent during the course of the following description.

In the accompanying drawings forming a part of this specification and in which like numerals are employed to designate like parts throughout the same:

FIG. 1 is a reduced horizontal section through familiar parts of a railway freight car showing the draft gear

mounted in a draft gear pocket in association with the coupler yoke of the draft gear rigging;

FIG. 2 is a vertical sectional view of the draft gear mounting arrangement of FIG. 1;

FIG. 3 is a horizontal sectional view through the draft gear better illustrating its construction;

FIG. 4 is a fragmentary sectional view taken along the line 4—4 of FIG. 3;

FIG. 5 is an exploded perspective view of the draft gear casing, a plunger, front follower, and retaining key, better illustrating the construction and assembly of these parts;

FIG. 6 is an elevational view illustrating the arrangement of the rubber bars of each rubber spring unit; and

FIG. 7 is a sectional view through the rubber spring unit shown in FIG. 6.

Referring now to FIGS. 1 and 2, for purposes of illustrative disclosure, the draft gear of this invention, which is designated generally at **10**, is shown mounted in a draft gear pocket in association with the familiar surroundings of center sills **20**, front and rear draft gear lugs or stops **21** and **22**, respectively, and a yoke **23** having its arms connected to a coupler **24** by a swivel pin **25**, with the yoke **23** being shown slideably supported upon a carrier plate **26** and with the coupler **24** being slideably supported on a coupler carrier iron **27**. The coupler **24** has its horn **24H** in predetermined spaced relation from a striking casting **28**. These parts are conventional and are so familiar that no specific description is deemed necessary.

It may be noted that the arrangement illustrated for purposes of disclosure includes a well-known type F coupler having a sperical butt **24B**, and the front follower **11** of the gear is correspondingly provided with a complementary spherical seat **11S**. It will become apparent that the gear may be employed with other coupler yoke arrangements known to those familiar with this art.

The draft gear **10**, as best shown in FIGS. 3, 4 and 5, comprises a hollow casing **30** open at its front end, a rubber spring cushioning mechanism **31** disposed within the casing, a plunger **32** movable through the open end of the casing to compress the cushioning mechanism therewithin, and retaining keys **33** engageable between the casing and the plunger for locking the plunger within the casing with the cushioning mechanism under predetermined compression therebetween.

The draft gear casing **30** is an oblong, generally rectangularly shaped, hollow cast steel body having top, bottom and side walls designated, respectively, **30T**, **30B**, and **30S**, and interconnected by an integral rear wall **30R**, which functions as a rear follower in that its opposite rear edge portions abut the rear lugs **22**. The rear wall **30R** is of hollow-cored construction and has drain holes **30H** opening transversely through its opposite edges. As is best seen in FIG. 5, the open front end of the casing may be termed "full size" in that it is of the same cross-sectional dimension as the remainder of the casing body and it has no inwardly projecting corner shoulders or other abutments and it therefore accommodates a cushioning mechanism of maximum transverse dimensions. A key opening **30K** elongated in the lengthwise direction of the casing is provided in each side wall **30S** adjacent to the open end of the casing to provide abutments **30A** facing generally towards the rear end of the casing. The elongated key openings **30K** in the side walls **30S** of the casing are made sufficiently longer than the full closure travel provided by the cushioning mechanism to provide free movement for the retaining keys which operate in these openings.

The plunger **32** is a hollow casting having a flat, transverse base plate **32B** that is engageable with the front end of the cushioning mechanism, with reinforcement

wall structure upstanding from this base plate and comprising an outer surrounding wall 32S interconnected by horizontal webs 32H and vertical webs 32V to define a number of pockets opening through the outer end of the plunger. Each of the vertical webs 32V is provided with a rectangular slot 34 at a point thereof that is adjacent to the transverse base plate 32B and that is approximately midway of their height. The surrounding wall portions of the plunger that are adjacent and parallel to the web slots are each provided with a generally T-shaped slot 35 that registers with the adjacent web slot to define key passages opening through opposite sides of the plunger for registry with the key openings 30K formed in the casing.

To lock the plunger within the casing against the expansive action of the cushioning mechanism, the plunger is moved inwardly of the casing sufficiently to bring the full height of the T-slots 35 into registry with the front ends of the key openings 30K. The retaining key is then inserted laterally through the side wall 30S of the casing and into the retaining key passage.

Each key has its outer end bent over, as indicated at 33E, to provide locating abutment with the edge of the transverse base plate of the plunger, and in this position the outer end of the key projects into the opening 30K for lengthwise engagement against the rearwardly facing casing abutment 30A. Each retaining key also includes an integral shoulder 33S projecting toward the open end of the casing and arranged for location approximately centrally within the bottom of one of the plunger pockets that is indicated at 32P. A locking bar 36 is provided for fixing each retaining key in place. The locking bar is inserted into the plunger pocket 32P after the retaining key is properly positioned therein, with the bar being fitted between the surrounding wall 32S and the retaining key shoulder 33S to block escape of the key.

In the preferred practice of the invention, the locking bars 36 are made long enough to project beyond the outer end of the plunger casting and the front follower 11 is recessed at its opposite sides to provide pockets 11P for receiving the projecting ends of the locking bars. After the front follower has been positioned over the locking bars 36 and brought into flush engagement with the outer end of the plunger, it may be tack-welded to the surrounding wall 32S at a number of points, as indicated at 37, to hold the parts in assembled relation.

It will be apparent that the front follower must move through the open end of the casing to compress the cushioning mechanism, and since the tack welds are subject to fracture during normal use of the gear, the projecting ends of the locking bars 36 are given a snug fit within the pockets 11P of the front followers so that these bars may themselves retain the follower in properly centered relation with respect to the open end of the casing.

This locking arrangement requires no transversely inwardly extending projections on the open end of the casing 30 and thus allows maximum utilization of the space within the casing. The retaining keys 33 are readily inserted through the side walls after the plunger 32 has been moved inwardly into the casing sufficiently to permit its retaining key passages to move behind the abutments 30A. The locking bars 36, which maintain the front follower in proper alignment, are in turn trapped between the follower and the plunger to positively prevent escape of the retaining keys.

It is conventional to foreshorten draft gears to facilitate their insertion into the draft gear pocket, and the present gear arrangement readily accommodates an aluminum shim or other spacer 38 (see FIG. 3) that may be located between the retaining key and the casing abutments 30A.

Tests show that the present gear arrangement provides exceptionally high capacity with a relatively low reaction. The locking arrangement contributes to this in that it leaves the full cross section of the casing available for mounting of the cushioning mechanism. The cushioning mechanism has novel rubber spring units which, as designated generally at 40, are intercalated with a series of steel spacer plates 41 to provide an aligned stack of spring units and spacer plates spaced apart in the lengthwise direction of the casing. Each spring unit 40 comprises a mounting plate 42 that extends transversely of the axis of the stack and identical groups of compressible rubber bars fixed to each of the opposed transversely extending faces of the mounting plate.

FIGS. 6 and 7 show a typical rubber spring unit of this invention in its free or uncompressed condition and the dimensions of the bars and of the plate itself are applied to these figures for completeness of the disclosure. The rubber bars are vulcanized directly to the plate and preferably have a durometer on the order of 77. Actually, in forming the rubber bars on the plates, the entire surface of the plates becomes coated; and since this coating has no particular effect upon the gear operation, it is simpler to leave it than to remove it.

As is illustrated in FIG. 7, it is presently preferred that all of the bars be of the same height, but it will be apparent that the outer or end bars 43 may be made higher or lower than the intermediate bars 44, 45 and 46 for achieving various nuances in the cushioning characteristics.

As will be apparent from an inspection of the dimensions on FIGS. 6 and 7, the mass of rubber in the two end bars 43, taken collectively, is greater than the mass of rubber in the three intermediate bars 44, 45 and 46, taken collectively; and this arrangement permits the large end bars to transmit the majority of the applied forces in a direct line to the rear lugs 22.

The concentration of these applied forces at the parts of the rear follower that actually contact the rear lugs avoids the development of excessive bending or bowing forces on the center regions of the rear follower. Thus the strength requirements for the rear wall 30R of the casing are considerably reduced and the rear wall may be of correspondingly less thickness. This saving in space is, in turn, made available for increasing the size and hence the capacity of the rubber cushioning unit.

The larger sized end bars have the additional advantage that they develop a better anchorage to the mounting plate. They are located in transversely, inwardly offset relation to the extremities of this mounting plate, and their firmer anchorage resists excessive outward flow thereof so that the arrangement effectively avoids the undesirable situation of the rubber bars actually coming into contact with the side wall of the casing during severe compression conditions.

The ends bars 43, as indicated by the dimensioning, have their outer edges located about 5/8" from the outer edge of the mounting plate. This dimension is somewhat greater than has been employed in the prior art; and this increased lateral offset, in conjunction with the better anchorage of the large end bars, permits them to resist the laterally directed expansive action of the intermediate bars sufficiently to avoid the objectionable scoring of the rubber which results when the rubber is permitted to flow beyond the edges of the mounting plate. The centermost one of the intermediate bars is also offset vertically approximately 1/8" more than the remaining bars since this centermost bar is subjected to the greatest pinching action and has a somewhat greater tendency to flow vertically than do the adjacent bars.

While it is important that the end bars be offset inwardly, the offset dimension which is permissible is limited by the fact that the end bar arrangement must also serve to concentrate the majority of the applied forces directly in line with the rear lugs. This requires that the location of the end bars overlap the location of the rear lugs, and this relationship is illustrated in FIG. 7.

The distorted shape of the bars is illustrated in dotted lines in FIG. 7, and it will be noted that the extent of overlapping of the locations of the end bars and the rear lugs increases substantially as the bars are compressed. At the point of full compression, the requirement for concentration of the forces in direct line with the rear lugs is most critical, and it is at this time that the greatest overlapping exists.

In the illustrated arrangement, three intermediate rubber bars are shown. There is a practical limit on the number of intermediate bars that may be employed. If as many as six or seven intermediate bars are used, so many air spaces exist that the gear has an excessively soft start and has a significantly reduced ultimate capacity. On the other hand, some air space in this intermediate section is quite important for providing the necessary clearances for accommodating flow of the rubber bars under compression. As the rubber bars distort transversely under compression, they scrub against the bare steel of the adjacent spacer plate, and this scrubbing action provides the energy absorption that permits the gear to develop high capacity with a minimum of reaction.

As indicated in FIG. 3, the rubber draft gear design illustrated herein is capable of developing 3½" of travel under buff loading and is arranged to provide 2" of draft travel; and for use in the United States, the front and rear followers may each be offset forwardly a corresponding distance to provide the necessary clearance between the coupler horn and the striking plate **28**. This technique is illustrated in the Campbell Patent 2,728,465, issued December 27, 1955, the disclosure of which, to the extent it is not inconsistent herewith, is specifically incorporated by reference.

The foregoing description and the drawings are given merely to explain and illustrate the invention and the manner in which it may be performed, and the invention is not to be limited thereto, except insofar as the appended claims are so limited since those skilled in the art who have this disclosure before them will be able to make modifications and variations therein without departing from the scope and spirit of the invention.

I claim:

1. A draft gear comprising a casing open at one end and having lengthwise wall structure provided with key openings elongated in the lengthwise direction of said casing and spaced peripherally thereabout adjacent said open end to provide abutments facing towards the other end of said casing, a cushioning mechanism disposed in said casing for expansion and compression lengthwise thereof, a plunger movable lengthwise in said open end of the casing to compress the cushioning mechanism, said plunger having a transverse base plate at the end thereof adjacent said cushioning mechanism and wall structure upstanding from said base plate and having transversely extending key passages opening therethrough at points spaced peripherally thereabout for registry with said key openings when said cushioning mechanism is under predetermined compression between said casing and said plunger, and separate retaining keys insertable transversely through each of said key openings and into said passages for engagement with said plunger to move with said plunger and engageable with said abutments to lock the plunger within the casing under said predetermined compression.

2. A draft gear comprising a casing open at one end and having lengthwise wall structure provided with key openings elongated in the lengthwise direction of said casing and spaced peripherally thereabout adjacent said open end to provide abutments facing towards the other end of said casing, a cushioning mechanism disposed in said casing for expansion and compression lengthwise thereof, a plunger movable lengthwise in said open end of the casing to compress the cushioning mechanism, said plunger having a transverse base plate at the end thereof adjacent said cushioning mechanism and wall structure upstanding from said base plate and having key-receiving passageway means opening transversely therethrough at points spaced peripherally thereabout for registry with said key openings when said cushioning mechanism is under predetermined compression between said casing and said plunger, and retaining key means insertable transeversely through said key openings and into said passageway means for engagement with said plunger to move with said plunger, said retaining key means projecting into said openings for engagement with said abutments to lock the plunger within the casing under said predetermined compression.

3. A draft gear comprising a casing open at one end and having lengthwise wall structure provided with key openings elongated in the lengthwise direction of said casing and spaced peripherally thereabout adjacent said open end to provide abutments facing towards the other end of said casing, a cushioning mechanism disposed in said casing for expansion and compression lengthwise thereof, a plunger movable lengthwise in said open end of the casing to compress the cushioning mechanism, said plunger having a transverse base plate at the end thereof adjacent said cushioning mechanism and wall structure upstanding from said base plate and having key-receiving passageway means opening transversely therethrough at points spaced peripherally thereabout for registry with said key openings when said cushioning mechanism is under predetermined compression between said casing and said plunger and having pocket means opening lengthwise through said open end of the casing, retaining key means insertable transversely through said key openings and into said passageway means to move with said plunger, said retaining key means projecting into said openings for engagement with said abutments to lock the plunger within the casing under said predetermined compression, said retaining key means having transversely facing abutment structure located adjacent the inner end of said pocket means, and locking bar means insertable lengthwise into said pocket means to engage said abutment structure for fixing said retaining key means within said plunger in position to engage said abutments.

4. A draft gear comprising a casing open at one end and having lengthwise wall structure provided with key openings elongated in the lengthwise direction of said casing and spaced peripherally thereabout adjacent said open end to provide abutments facing towards the other end of said casing, a cushioning mechanism disposed in said casing for expansion and compression lengthwise thereof, a plunger movable lengthwise in said open end of the casing to compress the cushioning mechanism, said plunger having a transverse base plate at the end thereof adjacent said cushioning mechanism and wall structure upstanding from said base plate and having key-receiving passageway means opening transversely therethrough for registry with said key openings when said cushioning mechanism is under predetermined compression between said casing and said plunger and having pocket means opening lengthwise through said open end of the casing, retaining key means insertable transversely through said key openings and into said passageway means to move wtih said plunger, said retaining key means projecting into said openings for engagement with said abutments to lock the plunger within the casing under said predetermined compression, said retaining key means having transversely facing abutment structure located adjacent the inner end of said pocket means, and locking bar means insertable lengthwise into said pocket means to engage said abutment structure for fixing said retaining key means within said plunger, said locking bar means projecting lengthwise beyond the outer end of said pocket means, and a follower in abutting engagement with said plunger for movement therewith through said open end of the casing and having socket means opening length-

wise towards said plunger for receiving said locking bar means, with said follower restraining said locking bar means against lengthwise movement relative to said plunger and with said locking bar means supporting said follower against transverse movement relative to said plunger and in registry with said open end of the casing.

5. A draft gear comprising a casing open at one end and having lengthwise wall structure provided with key openings elongated in the lengthwise direction of said casing and spaced peripherally thereabout adjacent said open end to provide abutment surfaces facing towards the other end of said casing, a cushioning mechanism disposed in said casing for expansion and compression lengthwise thereof, a plunger casting movable through said open end of the casing to compress the cushioning mechanism, said casting having a transverse base plate at the end thereof adjacent said cushioning mechanism and integral wall structure upstanding from said base plate, said wall structure having transversely extending key passages opening therethrough at points spaced peripherally thereabout and at regions in the casing adjacent and at least partially rearwardly of said abutment surfaces, and separate retaining keys insertable transversely through each of said key openings and into said passages for engagement with said casting to move with said casting and to engage said abutment surfaces to lock the casting within the casing under a predetermined compression.

6. A draft gear comprising a casing open at one end and having lengthwise wall structure provided with transversely aligned key openings elongated in the lengthwise direction of said casing and located in opposed portions of said wall structure adjacent said open end to provide abutments facing towards the other end of said casing, a cushioning mechanism disposed in said casing for expansion and compression lengthwise thereof, a plunger movable lengthwise in said open end of the casing to compress the cushioning mechanism, said plunger having an abutment plate at the end thereof adjacent said cushioning mechanism and wall structure upstanding from said abutment plate and having key-receiving passageway means opening through opposite sides thereof for registry with said aligned openings when said cushioning mechanism is under compression between said casing and said plunger, and retaining key means insertable transversely through said aligned key openings and into said passageway means to move with said plunger, said retaining key means projecting into said aligned openings for engagement with said abutments to lock the plunger within the casing under a predetermined compression of said cushioning mechanism.

7. In a draft rigging that includes a draft gear mounted in a draft pocket of a railway car frame, said frame having stops extending transversely along opposite rear edges of said pocket, said gear comprising a casing with rear follower means having opposite edge portions overlying said rear stops for abutment thereagainst, a cushioning mechanism within said casing for compression lengthwise therein, and front follower means movable lengthwise into said open end of the casing for compressing said cushioning mechanism therein, said cushioning mechanism comprising an aligned stack of intercalated spring units and spacer plates spaced apart in the lengthwise direction of said casing, each spring unit having a mounting plate extending transversely of said axis and provided with a group of compressible rubber bars affixed to each of its transversely extending faces, each mounting plate and spacer plate having corresponding opposite edge portions in alignment with said rear stops in the lengthwise direction of said casing, each group of bars having end bars offset transversely inwardly from and extending substantially parallel to the outermost edges of said edge portions of its mounting plate, with each end bar, in its free uncompressed state, having a substantial portion of the body thereof overlying the corresponding one of said edge portions, and a number of bars intermediate said end bars, said end bars collectively comprising a greater mass of rubber than said intermediate bars.

8. In a draft rigging that includes a draft gear mounted in a draft pocket of a railway car frame, said frame having stops extending transversely along opposite rear edges of said pocket, said gear comprising a hollow casing having an integral rear follower that has its opposite edge portions overlying said rear stops for abutment thereagainst, said casing having a mounting chamber of substantially rectangular transverse cross-sectional configuration opening substantially full size through its front end, said casing having a key opening extending transversely therethrough adjacent said front end to provide a rearwardly facing abutment adjacent its forward end, a cushioning mechanism within said mounting chamber and compressible lengthwise therein, said cushioning mechanism comprising an aligned stack of intercalated spring units and spacer plates spaced apart in the lengthwise direction of said casing, each spring unit having a transversely extending mounting plate having a group of compressible rubber bars affixed to each of its transversely extending faces, each mounting plate and spacer plate substantially spanning the transverse cross-sectional configuration of said chamber and having corresponding opposite edge portions in alignment with said rear stops in the lengthwise direction of said casing, each group of bars having end bars extending in the same transverse direction as said stops and being located at a position offset transversely inwardly from the outermost extremities of said edge portions of its mounting plate and a number of bars intermediate said end bars, said end bars collectively comprising a greater mass of rubber than said intermediate bars and each end bar having, when said gear is under substantially full compression, a major portion of the body thereof overlying the corresponding one of said edge portions and said intermediate bars collectively overlying substantially the entire center surface of their mounting plate when said gear is under substantially full compression, front follower means movable lengthwise through the open front end of said casing for compressing said cushioning mechanism against said rear follower, said front follower means having a key passage opening transversely therethrough for registry with said key opening when said cushioning mechanism is under predetermined compression between said front follower means and said rear follower, and retaining key means projecting through said key passage into said key opening for engagement with said rearwardly facing abutment of said casing to lock said front follower means within the front end of said casing.

9. In a draft rigging that includes a draft gear mounted in a draft pocket of a railway car frame, said frame having stops extending transversely along opposite rear edges of said pocket, said gear including rear follower means having opposite edge portions overlying said rear stops for abutment thereagainst and a cushioning mechanism compressible lengthwise of said pocket to react through said edge portions of the rear follower means and against said stops, said cushioning mechanism having an aligned stack of spring units spaced apart in the lengthwise direction of said pocket; the improvement wherein each spring unit has a mounting plate extending transversely of said pocket and provided with a group of compressible rubber bars on one of its transversely extending faces, said mounting plate having transversely spaced apart opposite edge portions in alignment with said rear stops in the lengthwise direction of said pocket, each group of bars having end bars offset transversely inwardly from and extending substantially parallel to the outermost edges of said edge portions of its mounting plate and a number

of bars intermediate said end bars, said end bars collectively comprising a greater mass of rubber than said intermediate bars and each end bar having, in its free, uncompressed state, a substantial portion of the body thereof overlying the corresponding one of said edge portions.

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