Aug. 9, 1960 A. L. ZANOW 2,948,413

DRAFT GEAR

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Fig. 1

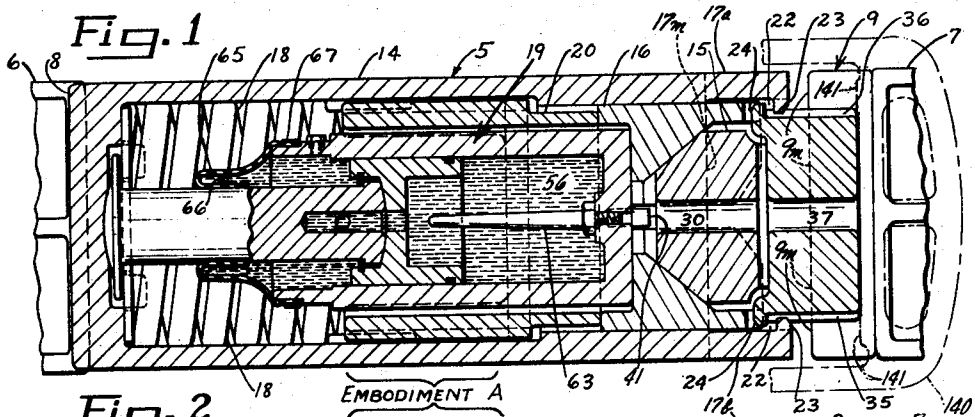


Fig. 2

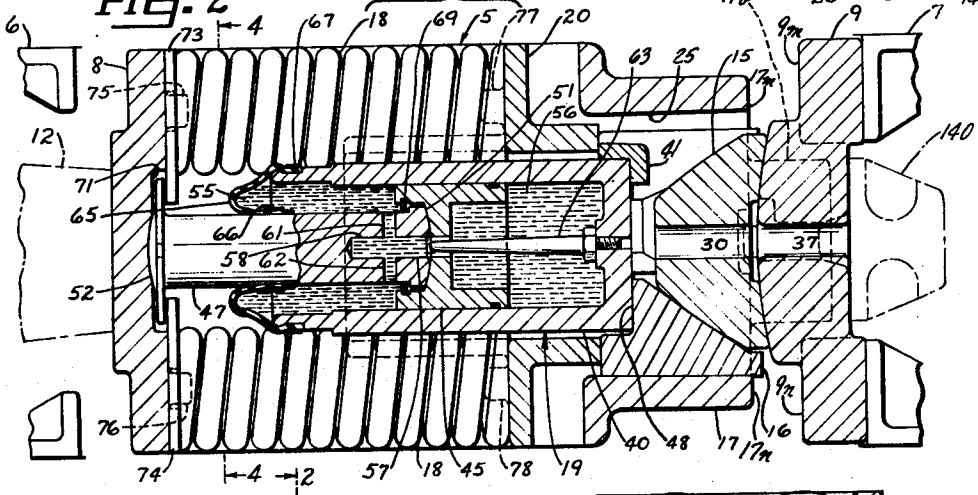


Fig. 3

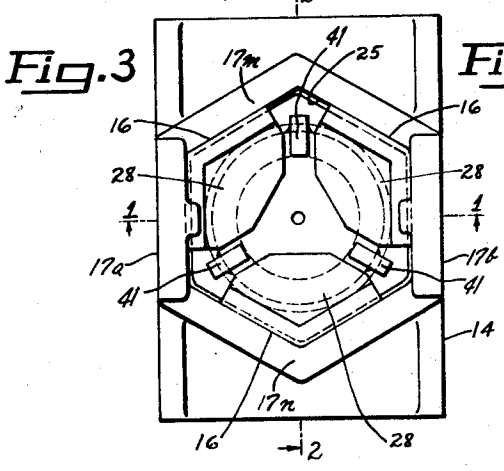
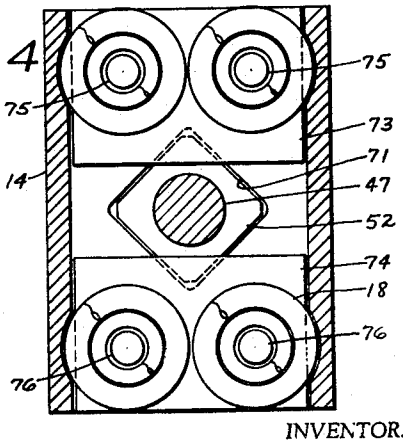


Fig. 4



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Fig. 5

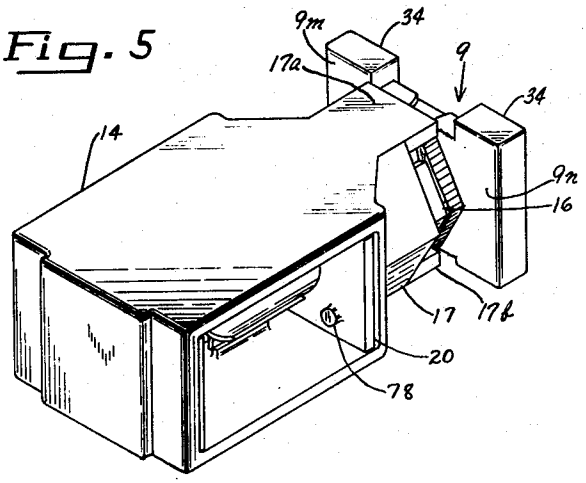


Fig. 6

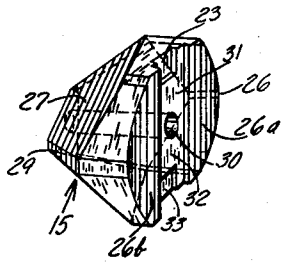


Fig. 7

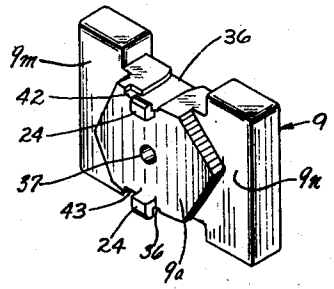


Fig. 8

EMBODIMENT B

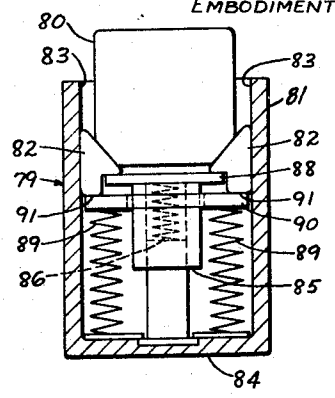


Fig. 9

EMBODIMENT C

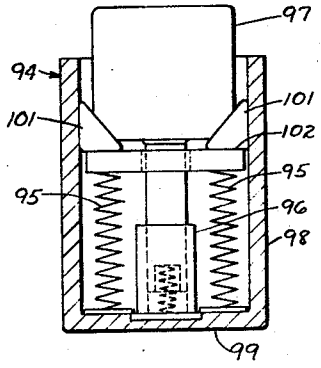


Fig. 10

EMBODIMENT D

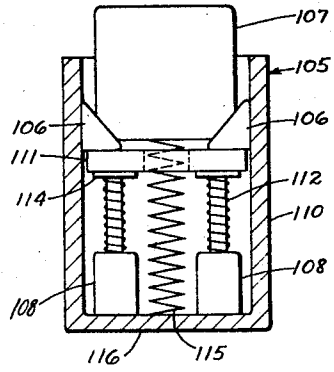
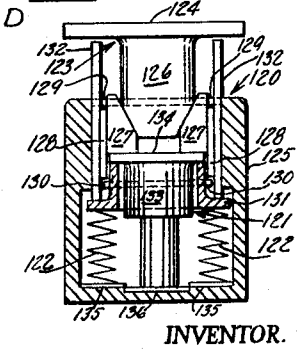


Fig. 11

EMBODIMENT E



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2,948,413

DRAFT GEAR

Andrey L. Zanow, Cleveland, Ohio, assignor to National Malleable and Steel Castings Company, Cleveland, Ohio, a corporation of Ohio

Filed Apr. 14, 1958, Ser. No. 728,350

20 Claims. (Cl. 213—43)

The present invention is concerned particularly with improved railway draft gears that are essentially shock absorbing devices adapted to cushion the longitudinal shocks or impacts occuring during train action or switching operation in the marshaling yards.

The impact-cushioning ability of the draft gear is approximately equivalent to the amount of energy that it can absorb during a closure movement of the gear. A severe limitation in this respect is the maximum permissible draft gear travel resulting from the maximum draft gear pocket length imposed by the car construction standards of the Association of American Railroads. A further limitation on the draft gear cushioning capacity is the car underframe strength, since this determines the maximum desirable or permissible coupler force that can be expended on the draft gear.

A draft gear having 100 percent efficiency from the standpoint of cushioning capacity for forces within a given maximum allowable magnitude, would be one which exerted a constant and uniform resistive force equal to the applied force throughout the travel of the draft gear and disappeared instantaneously at the end of the stroke, with the draft gear returning to its original uncompressed state without any appreciable rebound force. Such operation would be illustrated by a force-displacement diagram providing a nearly rectangular force-travel curve, with the area enclosed by the curve representing the energy absorbed by the draft gear.

Resilient type draft gears function efficiently as cushioning devices but have the disadvantage of returning a major part of the energy which was initially applied to the draft gear by recoil to the train or cars. While spring gears cushion effectively under impact loads and are suitable for some types of service, they have little energy absorption capacity and are thus unsuitable for types of service wherein protection is also needed against recoil forces.

Conventional friction draft gears are capable of greater energy absorption but, as they are in general actuated by a spring placed under compression during the contraction of the gear, their operation takes on the general characteristics of a spring-type gear. In the typical friction type draft gear, the anti-compression force exerted by the basic resilient means, is multiplied several times by the operation of a friction mechanism which commonly consists of a wedge and shoe clutch assembly interposed between one of the followers and one or more longitudinal friction surfaces fixed with respect to the other follower.

An advantage of the friction draft gear is the ability of this device to dissipate a substantial fraction of impact energy as frictional energy which is not returned to the train system in draft by recoil.

A friction gear may be regarded as having a friction system actuated by an internal force, such as that provided by an interiorly disposed spring and an external force tending to compress the draft gear longitudinally. The energy-absorptive capacity of the gear is dependent upon the frictional effect produced by multiplication of the internal force into a frictional resistive force which provides a predominant portion of the force opposing the external or coupler force. Hence, the output or force-resistant capacity of the gear is a function of the input or internal force, as provided by an internal spring, and the multiplication effect of the clutch mechanism. The invention is described and defined hereinbelow with respect to this general viewpoint.

A primary object of this invention is to provide a shock-absorbing device adapted for railway draft gear use of high energy-absorbing capacity.

Another object is to provide a draft gear in accordance with the foregoing object, capable of automatic recovery to a shock-absorbing condition.

Still another object is to provide a shock absorbing device in accordance with the foregoing objects capable of absorbing impact forces at low initial resistance which may be increased rapidly with relative travel of parts of the device to attain the maximum resistive force during the initial portion of the travel and maintain such force for the remainder of the travel.

It is also an object to provide a draft gear whose overall resistive force increases when the impact speed is increased, yet also offers enough resistance against sustained static forces which occur during prolonged train hauls.

A further object is to provide draft gear mechanism which may be easily adjusted and/or modified to produce any type of behavior desired as exemplified by force-travel diagram illustrating a cycle consisting of a compression stroke and an expansion stroke of a draft gear.

In brief, the present invention is embodied in a shock absorbing mechanism or draft gear comprising a casing or other member capable of providing a longitudinal frictional surface having a follower fixed therewith at one end of the casing; a second follower in relatively movable relation adjacent the other end of the casing and adapted for reciprocal movements in the end-to-end direction of the casing; and an assembly for multiplying a force applied between the followers for resisting movement thereof toward each other into a much longer force for opposing an equally large force applied externally to the draft gear to produce movement of one follower toward the other.

The invention is essentially characterized by this assembly which comprises a resilient device, a compressible hydraulic device, and a force-multiplying friction system in interposed operative relation with at least one of said devices and the second follower adapting it for transmission of an internal activating force. The devices extend lengthwise of the draft gear in collateral relationship and are disposed between said followers to resist movement of one follower toward the other. The friction system is also operatively disposed between the second follower mentioned above and the casing in sliding engagement with the latter and is responsive to the forces imposed thereon by the followers in movements toward each other in a direction lateral to such forces to generate substantially greater frictional force between the casing and the friction means than the smaller force applied from the first-named follower. The resilient device is positioned during operation between the followers in a condition of compression. This device is interconnected with the hydraulic device for urging the draft gear and the hydraulic device into a longitudinally extended condition adapting the followers for engagement with forward and rear stops of the draft gear pocket.

In one preferred embodiment, an activating force applied internally of the draft gear from the first follower may comprise parallel forces transmitted through the hydraulic mechanism and the resilient device disposed in parallel arrangement between the first follower and the

friction means. In optional embodiments, either the resilient device or the hydraulic device may by-pass the friction means and be disposed for the direct transmission of its force from the first follower to the second follower, with the other one of such devices being interposed between the first follower and the friction means.

In the drawing with respect to which the invention is described in greater detail:

Fig. 1 is a longitudinal section taken along line 1—1 of Fig. 3 illustrating a draft gear in its expanded condition in accordance with one embodiment of the invention;

Fig. 2 is a longitudinal section taken along line 2—2 of Fig. 3, illustrating the gear of Fig. 1 in a compressed condition;

Fig. 3 is a rear end view, with parts removed, of the gear of Figs. 1 and 2;

Fig. 4 is a cross-section of the gear of Figs. 1 to 3, along line 4—4 of Fig. 2;

Fig. 5 is a perspective view of the draft gear of Figs. 1 to 4, showing the springs and the hydraulic unit for actuating the clutch friction mechanism removed;

Fig. 6 is a perspective view of a wedge member in the friction system of the draft gear shown in the foregoing figures;

Fig. 7 is a perspective view of a movable follower member of the previous figures;

Fig. 8 is a diagrammatic view of another embodiment of the invention;

Fig. 9 is a diagrammatic view of an additional embodiment;

Fig. 10 is a diagrammatic view of still another embodiment; and

Fig. 11 is a diagrammatic view of an embodiment employing a multiple-plate clutch system.

Embodiment A of the invention first to be described is illustrated in Figs. 1 to 5 in the form of a railway draft gear **5** positioned between stop lugs **6** and **7** within the center sill of a car frame. Fig. 1 illustrates the gear **5** in its expanded or neutral condition, wherein the front follower **8** and the rear follower **9** engage the front stop **6** and rear stop **7**, respectively. Fig. 2 is another longitudinal section of the gear as viewed in a plane normal to the plane of section **1** illustrating the gear **5** in a partly reacted or compressed condition, such as would result from a buff force applied to the front follower **8** by the butt-end **12** of a coupler shown partly in dot-dash.

Essential major components of the gear **5**, in addition to the followers already named, are (*a*) a casing **14** providing the rear follower **8**, (*b*) a friction clutch assembly comprising a wedge **15** for engaging three shoes **16** which in turn engage the interior hexagonally swedged rear portion **17** of the casing **14**, (*c*) a resilient device in the form of four springs **18**, (*d*) a hydraulic device in the form of an oil-dampened cylinder-piston assembly **19** disposed in collateral relation between the followers with the springs **18** within the casing **14**, and (*e*) a longitudinally movable bearing member **20** in interposed engaged relation with the shoes **16** and the springs **18**. The bearing member in this embodimetn has the dual function (1) of transmitting expansion forces of the springs to the forward surfaces of the shoes, moving in a longitudinal direction with the shoes **16** during operation of clutch mechanism, and (2) returning the cylinder-piston assembly **19** to an extended condition after a compression stroke of the draft gear.

The rear follower and clutch mechanism

The clutch mechanism comprising the shoes **16** and the wedge **15** are supported in the rear hexagonal end-portion of the housing or casing **14** with the draft gear as a whole under an initial state of compression, as provided by the confinement thereof between the forward and rear stop plates **6** and **7**. The initial state of compression is such as to provide gaps **22** at opposite sides of the follower **9** between the lugs **23** on top and bottom legs **17***a* and **17***b*, respectively, at the extreme rear end of the casing and lugs **24** at the forward end of the rear follower. The gaps **22** also provide means for the gear to expand in an oversized draft gear pocket. When the draft gear is removed from the car pocket, gaps **22** disappear and the lugs **23** and **24** engage as a result of residual compression in the springs **18**.

As shown in Fig. 3, each shoe **16** engages two adjacent inner side surfaces of the hexagonal rear portion **17** of the casing. The outer periphery, as well as the inner periphery, of this casing portion **17** is shown hexagonal. As may also be seen from Figs. 1–3, the inner hexagonal surface **25** tapers to a slightly smaller periphery in the forward direction of the gear **5** to exert a squeezing action on the clutch mechanism as it moves forwardly within the casing.

The wedge **15**, as shown in Fig. 6, resembles a six-sided column with part of its length tapered toward one end to form a three-sided truncated pyramid. The small front end surface provided by the pyramidal portion is generally perpendicular to the longitudinal axis of the gear in the normal position of the wedge within the gear. The three primary faces **27** of the pyramidal portion are disposed 120° apart about the axis and incline forwardly inwardly toward the axis. In the normal position of the wedge within the gear **5**, the pyramidal surfaces **27** are in opposed relation with faces **28** of the shoes **16** which also incline forwardly toward the axis of the gear. The faces **27** of the wedge are separated by three relatively narrow pyramidal surfaces **29** which take a similar inclination toward the axis of the wedge.

Other construction features of the wedge **15** to be noted are (1) a hole **30** extending through the wedge co-axially with its axis and normally in co-axial relation with the axis of the gear; (2) a shallow channel-way **31** having a bottom surface **32** and separating the surface **26** into portions **26***a* and **26***b*; (3) recesses **33** at opposite ends of the channel-way **31** extending forwardly from the surface **32** to accommodate the lugs **24** of the rear follower **9**, and (4) a concavity in the surface **26** extending transversely of the channel-way **31**.

The forward surface of the follower **9** is complementarily convex in respect to the concavity of surface **26** (surface portions **26***a* and **26***b*) of the wedge **15**, thereby providing one of the structural features of the gear **5** by which the various portions of the gear are self-aligning with respect to twisting or misaligning forces to which the gear as a whole may be subjected by its pocket stops, the yoke, or a coupler butt. The surface **26** of the wedge is divided by the channel-way **31** so that operation of the gear in buff will not subject the rear follower **9** to excessive bending stress that would otherwise be imposed on its central portion by a load applied to the shoulders **34**. Provision of the channel-way **31** permits such a load to be divided between the surface portions **26***a* and **26***b* and concentrated at points along the forward surface **9***a* of the rear follower substantially to each side of its axis.

The rear follower **9** is provided with grooves **35** and **36** extending in the longitudinal direction of the gear. These grooves are longitudinally traversed by the lugs **23** of the casing during movement of the follower **9** relative to the casing. The follower **9** has a central opening **37** extending generally along the axis of the gear in registry with the opening **30** of the wedge to permit access to the cylinder **40** of the hydraulic device during assembly of the gear. By initially lacing the rear follower **9** and the wedge **15** onto a push-rod and then using the push-rod to force the cylinder **40** forwardly to compress the springs **18**, the rear follower and the various components of the clutch mechanism may be assembled into operative relationship, or disassembled by a reverse procedure.

To facilitate the interlocking of the rear follower 9 with the rear hexagonal portion 17 of the casing, the follower is provided with recesses 42 and 43 contiguous with the ends of grooves 35 and 36 at the ends thereof adjacent the lugs 24. The recesses 42 and 43, in effect, enlarge the end portions of the grooves whereby, during an assembling operation, the follower 9 may be shifted out of longitudinal alignment with the axis of the gear to permit maneuvering of the lugs 23 of the casing through the recesses 42 and 43 into position within the grooves 35 and 36 behind the lugs 24.

In preparing the gear 5 for installation within the gear pocket of a railway car, the follower 9 may be forced further inwardly of the casing 14 than shown in Fig. 1 to increase the size of the gaps 22. A plug is then inserted into each of the enlarged gaps 22 to hold the follower in its position relative to the casing thereby obtained. The gear, when adjusted in this manner, may be easily inserted into the car pocket. The plugs (not shown) will then drop out of the gaps 22 upon application of a substantial buff force.

The hydraulic device

In the cylinder-piston assembly 19, the cylinder 40 is movable longitudinally within, and relatively to, the casing 14 while engaged with all three shoes 16 along respective forward facing surfaces 48 thereof. Three right-angle lugs 41 are secured, as by welding, to the cylinder 40 along its rearward peripheral corner. The forward end surface of the lugs engages the bearing ring 20 whereby the hydraulic device 19 is expanded to the neutral position of Fig. 1 by expansion of the springs 18 after release of a gear-compressing load. The position of the piston 45 is fixed longitudinally with respect to the casing by a piston rod 47 anchored in the forward follower portion 8 of the casing 14. The piston rod 47 has rounded and enlarged end portions 51 and 52 engaging complementary seats in the piston 45 and the forward follower 8, respectively. Preferably, the end portions of the piston rod and their respective seats are formed with the same degree of spheroidity to permit proper bearing engagement between the piston rod ends and their respective seats during toggle action of the piston rod. By this arrangement, the draft gear is provided with another one of those construction features hereinbefore mentioned, i.e., self-alignment of various portions in response to unbalanced forces acting on the gear as a whole.

During longitudinal extension and contraction of the hydraulic device 19 in the normal operation of the gear, liquid flows back-and-forth between the chambers 55 and 56 through a passageway system comprising a bore 57 passing axially through the piston 45, and a co-axial bore 58 in the piston rod 47, and bores 61 and 62 extending radially from the bore 58 to the periphery of the piston rod. As shown, an elongate plug 63 is attached to the rear wall of the cylinder 40 and extends forwardly in co-axial relation with the bores or passageways 57 and 58. The plug 63 is provided for the purpose of entering the intercommunicating passageway system to restrict the flow of oil from the chamber 56, chamber 55 during a final substantial portion of the compression stroke of the gear, thereby maintaining a desired dampening action of the hydraulic device 19 as the gear approaches its maximum travel in compression. The return flow from chamber 55 into chamber 56 may be facilitated to a functional advantage by means not shown here, such as a one-way valve well known in the art. The chamber 55 is enclosed by a forward tubular portion of the cylinder 40, the forward end portion of the piston 45, the peripheral surface of the piston rod 47, and a sleeve 65 secured to the piston rod at 66 and to the outside of the cylinder 40 at 67. The chamber 56 is formed by the rearward inner surface of the cylinder 40 and the transverse wall portion of the piston 45. The end portion 51 of the piston rod is trapped adjacent its seat in the piston 45 by a snap-ring 69.

To protect the sleeve 65 from being twisted and possibly ruptured, the piston rod 47 is prevented from turning within the casing 14. For this purpose, the end portion 52 of the rod is formed with a square periphery and the recess 71 into which it fits with a substantially square periphery. The rod portion 52 is trapped within the recess 71 by a pair of thin plates 73 and 74 which overlap the rearward surface of the rod portion 52, as shown in Fig. 4. The plates 73 and 74 are apertured to fit over centering bosses 75 and 76 and are held firmly in place by the springs 18.

The resilient device

In the embodiment described in Figs. 1–7, the resilient device comprises four springs 18, held in parallel alignment with the longitudinal axis of the gear by four bosses (see bosses 75 and 76) on the rear surface of the forward follower 8 and four bosses (see bosses 77 and 78) on the forward surface of the bearing member 20. The bearing member 20, of course, transmits any compressive force to which the springs are subjected to the shoes 16. The springs 18 just described are exemplary of any equivalent resilient system such as one differing in number or the arrangement of the springs, or one utilizing rubber or other elastic material capable of loading the shoes 16 with a resilient resistive force applied from the forward follower 8.

Principle of operation of embodiment A

In the draft gear 5, the full resistive load of springs 18 (resilient device) and the hydraulic piston-cylinder assembly 19 (the hydraulic device) is applied to the shoes 16 to activate the clutch mechanism. The shoes have one set of forward-facing surfaces for engaging the rear end surface of the cylinder 40; they have another set of rearward-facing surfaces offset in a forward direction from the first set, for engaging the bearing member 20. The invention is obviously not limited to any particular arrangement for transmitting the resistive load to the resilient device and the hydraulic device to the clutch mechanism.

The springs serve two purposes: (*a*) to provide a resistive load for activating the clutch mechanism in relative movements of the followers toward each other, and (*b*) to return the hydraulic device and the other parts of the draft gear to positions which characterize the extended neutral condition of the gear. The latter function of the springs is perhaps most important in the present invention because of the unique versatility in the performance of the gear that may be obtained by use of the hydraulic device as the primary actuating means of the clutch mechanism. In one respect, the hydraulic device is similar to the clutch mechanism in that it is an energy-absorbing means rather than an energy-storing means such as the springs or other resilient system. Hence, in the many applications it is desirable to utilize the cumulative 100 percent energy-absorption capacity provided by the series arrangement of the clutch mechanism and the hydraulic device. In this instance, the resistive capacity of the springs applied to the shoes is relatively small as compared to that offered by the hydraulic device 19.

In ways well-known to the hydraulic shock-absorbing art, the transfer of fluid from one chamber of the shock-absorbing hydraulic device to its other chamber may be controlled in any pattern desired by known methods of valving and porting, etc. These advantages of a hydraulic shock-absorbing mechanism are utilized in the present invention to obtain greatly magnified effects through the use of the hydraulic device for actuating a clutch mechanism. In this manner, the clutch mechanism may be controlled in any manner desired throughout the full travel of the draft gear to escape the charac-

teristic performance patterns of combination spring and friction clutch mechanisms.

The gear of embodiment A is adapted for effecting buff strokes and draft strokes differing in length. It will be apparent from an inspection of Figs. 1 to 7, particularly Fig. 1 which shows the gear in neutral position, that (1) in buff, the casing arms 17*a* and 17*b* may move past the sides of rear follower 9 as the casing is driven rearwardly by the coupler butt 12 until the shoulder surfaces 9*m* and 9*n* of the follower engage the end surfaces 17*m* and 17*n*, respectively, of the casing; and (2) in draft the rear follower 9 will be pulled forwardly by the yoke 140 until the transverse rear portion of the yoke at 141 engages the rear end surfaces of the arms 17*a* and 17*b*.

As the distance at the neutral position of the gear, between follower surfaces 9*m*, 9*n*, and the casing surfaces 19*m*, 19*n* is somewhat greater than the distance between the yoke surface at 141 and the ends of the arms 17*a*, 17*b*, the gear may consequently undergo greater shortening in buff operation than in draft.

Embodiment B

Fig. 8 is a diagrammatic illustration of a draft gear 79 having the same principle of operation as the gear of embodiment A, differing from embodiment A primarily in the spring return provided for the hydraulic device.

The gear of embodiment B comprises a follower 80 longitudinally movable with respect to a casing 81 and having an integral wedge portion for engaging shoes 82 which in turn engage longitudinal surfaces 83 of the casing 81. Disposed between the shoes 82 and the rear follower portion 84 of the casing 81 is a hydraulic shock absorber 85 having an internal spring 86 for expanding the device 85 to maintain the abutment plate portion 88 thereof in contact with the shoes 82 during return or expansion strokes of the gear. After energy-absorption strokes of the clutch mechanism inwardly of the casing 81, during which the movement of the mechanism is resisted by the hydraulic device 85 and springs 89, the mechanism is returned by expansion of the springs against a bearing plate 90 which in turn engages surfaces 91 of the shoes 82 facing inwardly of the casing. As shown, surfaces 91 are longitudinally offset from those engaged by the plate portion 88. Obvious from Fig. 8 is the fact that the springs 89 and the hydraulic device 85, including its spring 86, coact in collateral relationship to oppose movement of one follower toward the other.

Embodiment C

Fig. 9 diagrammatically illustrates a gear in which a resilient device, such as springs 95, engages and actuates the clutch mechanism, and the hydraulic device 96 bypasses the clutch mechanism to directly engage and react between the followers of the gear. That is to say, one end of the device 96 bears directly on the inward end of the follower 97 in relatively movable relation with the casing 98 and its integral follower 99.

In the operation of the draft gear 94, the resistive force of the hydraulic device 96 is not multiplied by the clutch mechanism and hence may be a relatively high capacity shock absorber as compared with previously described embodiments. The clutch mechanism of the gear operates to multiply the force exerted by the springs 95 in resisting compression. This type of gear calls for springs which are sufficiently resistant to compression to provide desired reaction of the clutch mechanism with the casing 98, and a heavier hydraulic shock-absorbing system. The pressure of the springs is transmitted to the shoes 101 by a bearing ring 102. The springs 95 and the hydraulic device coact in collateral relationship to resist the movement of one follower toward the other.

Embodiment D

Fig. 10 illustrates a gear 105 in which the clutch mechanism, comprising shoes 106 and a wedge potrion of the follower 107 is actuated solely by one or more hydraulic devices such as device 108. The force provided by the device 108 in resisting movement of the follower 107 and the clutch system inwardly of the casing 110 is transmitted by a bearing ring 111 to the shoes 106. Each of the devices 108 is provided with a spring 112 disposed externally of its piston portion and seating at one end against its enlarged piston end 114 and the cylinder portion at the other end. In this manner, the hydraulic device is expanded without being returned by a portion of the casing or the clutch mechanism.

A resilient force, resisting the movement of the follower 107 inwardly of the casing 110 is provided by resilient means, such as a spring 115, which stands between the follower 107 and the integral follower 116 of the casing 110. By acting directly on the followers, the spring 115 by-passes the clutch mechanism and hence exerts no effect thereon. However, the spring 115 and the hydraulic device are arranged in collateral relationship between the followers 107 and 116 and coact to resist movement of one toward the other.

Embodiment E

Fig. 11 diagrammatically illustrates an additional draft gear 120 having a friction clutch of the multiple-plate type activated in accordance with this invention by a hydraulic shock-absorbing device 121 and a spring system comprising the compression springs 122. As shown, a member 123 comprises a follower 124 and a wedge integrally connected therewith. The member 123 is movable lengthwise of, and relatively to, the casing 125. When the gear 120 is subjected to longitudinal compression in absorbing buff or draft forces, the wedge 126 urges the shoes 127 in opposite directions against the plates 128. The latter are trapped within the casing 125 with respect to the longitudinal direction of the gear between an overhanging lip 129 and a ridge 130 extending inwardly from the casing wall; a corresponding ridge and lip are provided on the opposite wall (not shown). The friction system further comprises a pair of plates 132 which are engaged along their outer ends and driven inwardly of the casing 125 by the follower 124 during buff and draft strokes. The plates are returned by a bearing member 131 which engages their inner ends. The plates 132 are slightly shorter than distance between the follower 124 and the surface of bearing member engaged by the plates to provide clearance or end play for the plates.

Integral with the cylinder 133 of the hydraulic device 121 is a base plate 134 which, on its one side, maintains continuous engagement with the inner end surfaces of the shoes 127, and on the other side with the bearing member 131 as the result of pressure originating in the springs 122. Hence, both the springs and the hydraulic device resist movements of the shoes 127 inwardly of the casing and thereby activate the friction clutch in a manner to multiply their combined resistance into a relatively large frictional force resisting the movement of the follower 124 toward the casing 125. The springs stand on retaining plates 135 which overlap the head portion 136 of the piston of the device 121 whereby the piston is held fixed longitudinally with respect to the integral follower portion 137 of the casing. Of course, the springs 122 and the hydraulic device 133 are positioned in collateral relationship between the followers 124 and 137 and coact to resist movement of one follower toward the other.

Similarly to embodiments C and D, the arrangement in embodiment E could be modified so as to make either the hydraulic device or the springs to by-pass the friction clutch.

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

What is claimed is:

1. In a railway draft gear: a casing and a first follower fixed therewith at one end of the casing; a second follower in relatively movable adjacent relation with the other end of the casing and adapted for reciprocal movements in the end-to-end direction of the casing; and means for transmitting a force from the first follower to the second follower comprising: a resilient device and a compressible hydraulic device extending collaterally in said direction and disposed between said followers for resisting movement of one follower toward the other, and a force-multiplying friction means in interposed operative relation with one of said devices and the second follower for transmission of said force through said friction means; said friction means being operatively disposed between the second follower and the casing for sliding engagement with the casing, said friction means being responsive to said force in a direction lateral with respect to said direction to generate frictional force between the casing and the friction means; said resilient device being positioned during operation between said followers in a condition of compression and interconnected with the hydraulic device for urging the draft gear and the hydraulic device into a longitudinally extended condition adapting the followers for engagement with forward and rearward stops of a draft gear pocket.

2. The draft gear of claim 1 wherein: the friction means is operatively interposed between both devices and the second follower, and the devices are arranged in parallel relation between the first follower and said means.

3. The draft gear of claim 1 wherein: the friction means and the resilient device are interposed in series relationship between the followers and the combination of said means and the resilient device is in parallel relation with the hydraulic device between said followers.

4. The draft gear of claim 1 wherein: the friction means and the hydraulic device are interposed in series relationship between the followers; and the combination of said means and the hydraulic device is in parallel relation with a second resilient device between said followers.

5. The draft gear of claim 1 wherein: the force-multiplying friction means comprises a multiple-shoe and wedge-type clutch supported with the shoes in engagement with the inner side surfaces of an open end portion of the casing and with a longitudinally-facing surface of each shoe in connected following relation with one of said devices; the wedge being associated in following relation with said second follower.

6. The draft gear of claim 5 wherein: the wedge and the second follower are separable and have opposed complementary concave-convex surfaces facing in opposite longitudinal directions of the gear along which the follower and the wedge are engaged.

7. The draft gear of claim 5 wherein: a pair of opposite sides of the open-end portion of the casing are extended to provide longitudinal arms; guide-and-stop means is provided interconnecting the arms and the second follower for limited travel of said follower relative to the casing in its longitudinal direction.

8. The draft gear of claim 7 wherein: a pair of opposite sides of the open-end portion the casing are extended to provide longitudinal arms; the end of each arm has a short lug extending toward the end of the other arm; and the second follower has a groove on each of one pair of opposite sides, said grooves being parallel and aligned in the longitudinal direction of the draft gear and disposed for receiving said lugs; said follower providing stop means at the ends of the grooves nearer the wedge to limit movement of said follower away from the casing.

9. In a railway draft gear: a casing providing an interior friction surface extending generally in the end-to-end direction of the casing, and having a first follower in fixed relation with said friction surface and extending across one end of the casing, the other end being open; a second follower in movable adjacent relation with said open end adapted for reciprocal movement in said end-to-end direction; wedge means comprising a wedge element in interposed relation with said friction surface and a side surface of the second follower, one of said surfaces and the surface of the element engaged therewith extending inwardly of the casing away from said open end and at an inclination with respect to said end-to-end direction away from the casing portion providing said friction surface whereby said means frictionally impedes movement of one follower toward the other; and a resilient device and a compressible hydraulic device extending collaterally in said direction and positioned between said followers for opposing movement of one follower toward the other; said wedge means being operatively interposed between one of the devices and the second follower; said resilient device being positioned during operation between said followers in a condition of compression and interconnected with the hydraulic device for urging the draft gear and the hydraulic device into a longitudinally extended condition adapting the followers for engagement with forward and rear stops of a draft gear pocket.

10. In a railway draft gear: a casing providing a first follower fixed therewith and enclosing one end of the casing, the other end of the casing being open; a second follower in movable adjacent relation with said open end and adapted for reciprocal movement in the end-to-end direction of the casing; force multiplying friction means in operative interposed relation with a generally longitudinal surface of the casing and a surface of the second follower; a resilient device and a compressible hydraulic device extending collaterally in said direction and in interposed operative relation with said followers for opposing said relative movements of the followers, said friction means being operatively interposed between the devices and the second follower; said friction means acting in a lateral direction against said longitudinal surface in response to forces imposed thereon in opposite longitudinal directions of the casing by the second follower and said devices to increase frictional forces between the friction means and the casing whereby relative movements of the followers toward each other are impeded; said resilient device being positioned during operation between said followers in a condition of compression and interconnected with the hydraulic device for urging the draft gear and the hydraulic device into a longitudinally extended position adapting the followers for engagement with the forward and rear stops of a draft gear pocket.

11. The draft gear of claim 1 comprising: a bearing member interposed between said friction means and said device and in operative connection therewith.

12. The draft gear of claim 5 comprising: a bearing member interposed directly between said longitudinally-facing surfaces of the shoes and said one device for the direct transmission therebetween of forces for activating the friction means.

13. The draft gear of claim 1 wherein: said other end of the casing is hollow and has an open end; and said friction means comprises: one set of plates in alternate frictionally engaged relation with a second set of plates, means for holding one set of plates in fixed position with respect to the length of the casing, means connecting the other set of plates with the second follower for movement lengthwise of the casing, and wedge means connected with the second follower for urging the plates in a lateral direction relative to said direction into tighter engagement; and a bearing member directly interposed

between said one device and the said second set of plates.

14. The draft gear of claim 13 wherein: the bearing member is engaged on the side thereof facing toward the first follower by the resilient device and urged thereby toward said open end; said second set of plates and a portion of the hydraulic device adapted for movement with said second set being connected with the bearing member for positive return by said member from a compressed condition of the draft gear to an expanded condition thereof.

15. The draft gear of claim 5 comprising a plurality of springs in addition to said resilient means, arranged externally of the hydraulic device; the shoes have two sets of surfaces facing toward the first follower, one set engaging the hydraulic device and the other set engaging one side of a bearing member; said member being engaged on its other side, and biased toward said open end, by said springs.

16. The draft gear of claim 15 comprising: means connected with a portion of the hydraulic device adapted for movement longitudinally of the casing with the shoes; said means aligned with respect to the member to be engaged thereby for returning the hydraulic device from a compressed to an extended condition.

17. The draft gear of claim 5 comprising: a bearing member engaging the surfaces of the shoes which face toward the first follower; a plurality of springs normally under compression between the member and the first follower; said hydraulic device being operatively disposed between the wedge and the first follower and includes said resilient device.

18. The draft gear of claim 5 wherein: the hydraulic device includes spring return means and is operatively disposed between the first follower and the shoes for bias of the shoes and the first follower in opposite directions; and said resilient device is operatively disposed between the first follower and the wedge for bias of said follower and the wedge in said directions.

19. The draft gear of claim 1 wherein: said hydraulic device has one end engaging the first follower, its other end engaging the friction means, and comprises: a cylinder, a piston reciprocally supported therein; a piston rod having one end in engagement with a complementary seat therefor in the piston, and the other end disposed outside the cylinder and providing one of said ends of the device; a flexible sleeve for enclosing a region surrounding a portion of the rod with one end of the sleeve in sealed relation with the rod and the other end in sealed relation with the cylinder; and duct means leading through the piston and the rod for transferring a fluid between said region and an interior region of the cylinder; said gear providing a complementary seat for said last-named end of the rod.

20. The draft gear of claim 19 wherein: said rod ends are convexly spherical and said seats are correspondingly concave; and said last-named rod end and seat therefor have substantially complementary non-circular peripheries.

No references cited.