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Kaufman et al.

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[54] **RECOIL MECHANISM WITH GAS RECOIL SPRING AND A HYDRAULIC TRACK ADJUSTER**

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[51] **Int. Cl.** **B62d 55/30**

[58] **Field of Search** 305/10, 22, 31; 91/181; 92/134

[56] **References Cited**

UNITED STATES PATENTS

2,837,378	6/1958	Williams	305/10
3,267,677	8/1966	Bollar	92/134
3,337,208	8/1967	Johansson	305/10
3,692,368	9/1972	Alexander	305/10

FOREIGN PATENTS OR APPLICATIONS

1,125,778	3/1962	Germany	305/10
1,158,379	11/1963	Germany	305/10
1,923,732	11/1970	Germany	305/10
1,142,324	2/1969	Great Britain	92/134

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[57] **ABSTRACT**

A recoil and adjuster mechanism comprises a gas recoil spring and a hydraulic adjuster link operatively connected to an idler wheel.

2 Claims, 2 Drawing Figures

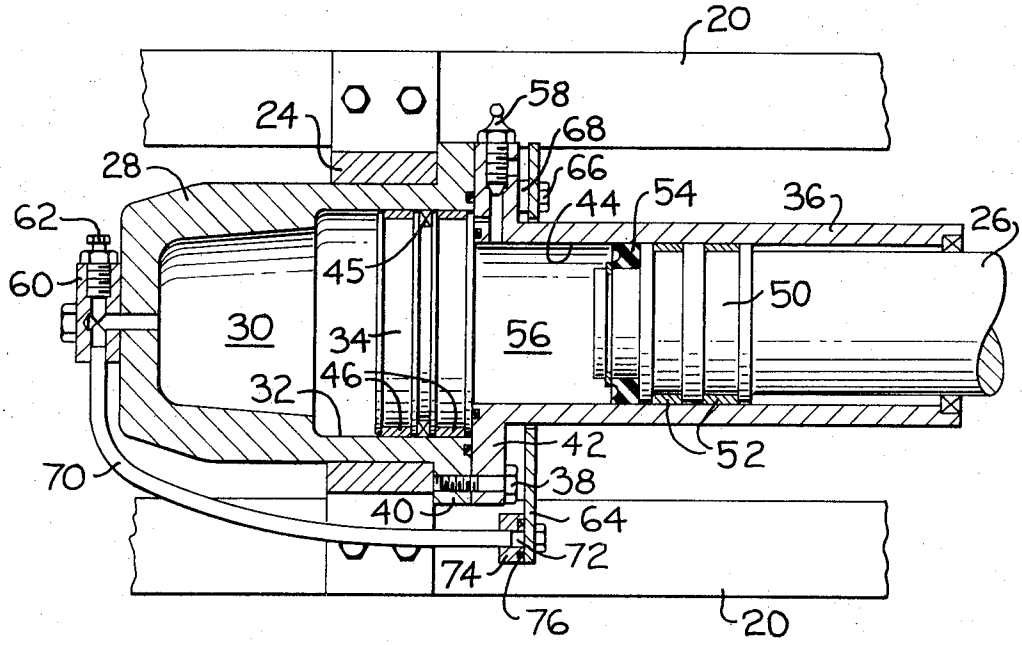


Fig. 1.

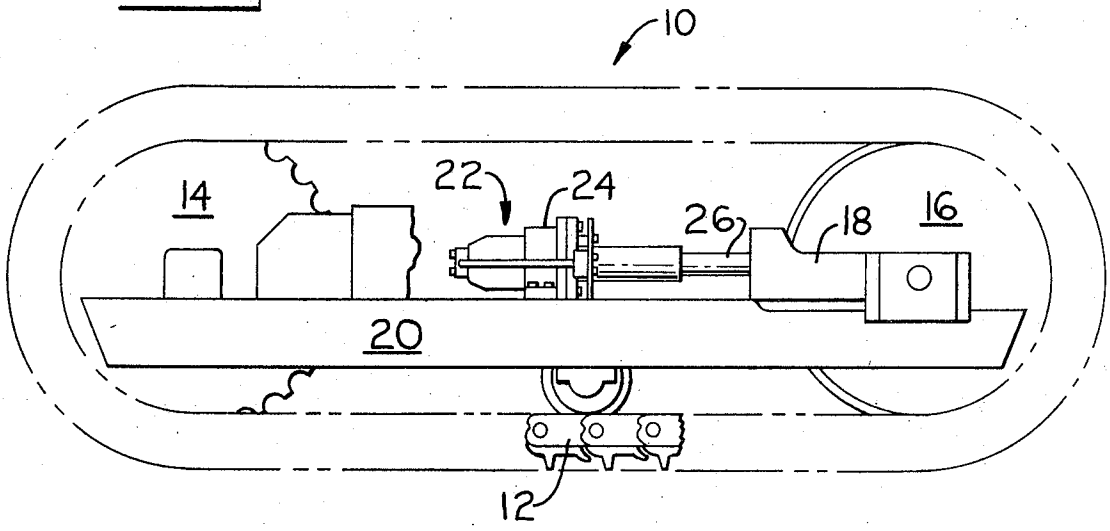
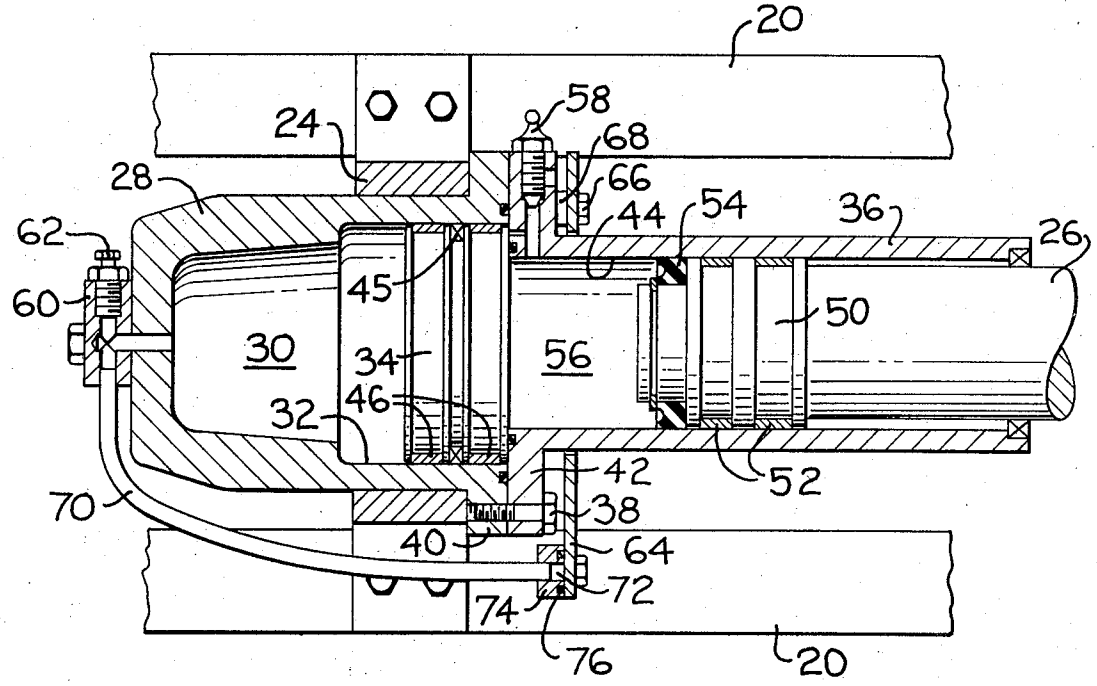


Fig. 2.



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RECOIL MECHANISM WITH GAS RECOIL SPRING AND A HYDRAULIC TRACK ADJUSTER

BACKGROUND OF THE INVENTION

This invention relates to a new and improved recoil and adjuster system for endless tracks, chains, belts and the like. More particularly, the invention is directed to a novel means for combining a gas accumulator and a hydraulic adjuster mechanism for an idler wheel for endless chains, tracks, belts and the like.

One particular application of recoil mechanisms and adjusters which is in particular need of improvement is the application to crawler-type vehicles. When operating in rough terrain, crawler-type, earth-working vehicles experience sudden impact loading which can cause severe damage to the track components unless means are provided to absorb track recoil and cushion the system. In addition, normal wear on the rollers, idler wheel and other components will decrease the tension in the track and will ofen result in the need for adjustment while in the field.

In the past, compression coil springs have been utilized in combination with a movable idler wheel as track recoil means. While the mechanical spring system has been somewhat successful in absorbing recoil, it has proved to be an extremely difficult system to adjust or repair particularly while in the field. The springs, sometimes preloaded to a force of approximately forty tons, require special tools for adjustment and present a hazard if the energy therein is accidentally released during maintenance.

Another type of recoil means utilizes a piston and a compressed gas cylinder or accumulator in place of the aforementioned mechanical spring and also uses an incompressible fluid system to provide adjustment of track tension. Such a system is shown in U.S. Pat. No. 2,837,380 to Mazzarins.

While the gas accumulator recoil system shown by Mazzarins is effective, it is susceptible to excessive gas pressure for large recoil, or in the alternative an excessive large gas cylinder in order to maintain a reasonable gas pressure. In addition, different size vehicles would require different size recoil units.

This invention is principally directed to a gas accumulator recoil system and track adjusting system wherein the piston provides for a differential recoil force.

The primary object of this invention is to provide a gas accumulator track recoil system which utilizes a hydraulic adjusting means to provide a differential movement connection to maintain reasonable recoil forces over a long range of recoil movement.

Another object of this invention is to provide a track recoil and adjuster system which can be readily installed and adjusted in the field.

Still another object of this invention is to provide a combination hydraulic track tension adjuster and recoil means which is sealed from foreign objects and, therefore, not susceptible to jamming.

Yet another object of this invention is to provide a gas accumulator track recoil arrangement which is readily adapted to use in conjunction with standard track adjusting apparatus.

A further object of the present invention is to provide a recoil and adjuster mechanism whereby adjustment of track tension does not affect gas spring preload.

A still further object of the present invention is to provide a recoil mechanism wherein spring rate can be changed simply by changing gas pressure to thereby accomodate different size vehicles.

Other objects and advantages of the present invention will become apparent from the following description and claims. The accompanying drawings show by way of illustration the preferred embodiments of the present invention and the principles thereof which are considered to be the best mode contemplated for utilizing these embodiments. It is recognized that other embodiments of the invention utilizing the same or equivalent principles may be used and structural changes may become apparent to those skilled in the art from the following description when read in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an elevational view of a crawler vehicle track showing the recoil and track adjuster mechanism of the present invention in operative position; and

FIG. **2** is a top view partially in section of the recoil and adjuster mechanism of FIG. **1.**

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Referring now to the drawings and specifically to FIG. **1**, there is illustrated a track assembly **10** for a crawler-type vehicle which assembly comprises a track **12** suitably trained about a drive sprocket **14** and an idler wheel **16.** The idler wheel **16** is rotatably journaled in a yoke **18** which is slidably mounted on frame **20** of the vehicle. A recoil and track adjuster mechanism **22** is mounted on the frame **20** by means of a trunnion **24** and operatively connected such as by means of a rod or link **26** to the yoke **18.** The accumulator comprises a housing **28** having a gas chamber **30** formed therein in communication with a cylindrical bore **32** in which is reciprocably mounted a free piston **34.** An open-ended cylinder **36** is secured as by means of bolts **38** and flanges **40** and **42** to the open end of housing **28.** This arrangement provides communication between cylindrical bore **32** of housing **28** and cylindrical bore **44** of housing **36.** The piston **34** is provided with a suitable sealing ring **45** to prevent the escape of gases from chamber **30** past the piston and wear rings **46** to prevent wear to the bore **32.**

The connecting rod **26** is provided with a piston **50** and wear rings **52** to prevent wear to the bore **44** and a suitable sealing ring **54** to prevent the escape of hydraulic fluid from chamber **56** past the piston **50.** The chamber **56** formed between the piston **50** and piston **34** is provided with a suitable means such as a fitting **58** for introducing fluid therein. Any suitable hydraulic fluid may be utilized for this purpose. However, a fluid having a high viscosity such as a grease is generally preferred in order to reduce the tendency for leaking. This hydraulic fluid contained in chamber **56** constitutes, in effect, a hydraulic coupling between the link member **26** and the recoil mechanism comprising the piston **34** and a compressible gas contained in chamber **30.**

A suitable fitting **60** including a valve **62** is provided for introducing a suitable compressible fluid into chamber **30** to urge the piston **34** to the right. This compressible fluid may preferably be a gas such as nitrogen.

Once the recoil mechanism and adjuster mechanism has been assembled, the chamber **30** may be charged

with a gas at a suitable pressure to match the requirements of the vehicle on which the unit is installed. After the unit has been installed on the vehicle as shown in FIG. **1**, the piston **34** will be biased by means of pressurized gas in chamber **30** to the right against the end of the open-ended cylinder **36.** Hydraulic fluid is then introduced in through fitting **58** into chamber **56** and thereby bias the piston **50** and rod **26** to the right forcing the yoke **18** and sprocket or idler wheel **16** to the right to apply tension to the track **12.** When track link or pin wear occurs, additional grease may be added to the chamber **56** to adjust for proper tension.

In operation, when forces are applied to idler **16** to force it against the recoil mechanism as by the lodging of rocks or other material between the tracks and idler wheel, the idler will move toward the recoil mechanism forcing the piston **50** into chamber **56.** The incompressible fluid in chamber **56** will force piston **34** to the left against the compressible fluid in chamber **30** until the force on the idler **16** is relaxed. The pressure in chamber **30** will then bias the piston **34** and the piston **50** to the right forcing the idler back into proper position and tension with respect to the track **12.**

The different sizes of the cylinder **32** and cylinder **44** results in the hydraulic connection between the piston **34** and the piston **50** being a differential connection.

This differential connection results due to the greater diameter of the cylinder **32** being able to accommodate a greater movement of the piston **50** for a given movement of the piston **34.** In other words, hydraulic fluid from chamber **56** when forced into the greater diameter bore **32** will result in the piston **34** moving a shorter distance to the left than the piston **50.** This movement, of course, will also vary for the stroke of piston **34.** This differential movement between piston **34** and piston **50** may be modified by selecting the diameters for the different cylindrical bores to accommodate the desired differential ratio.

The differential ratio could be selected to accommodate different size vehicles. However, an advantage of the present invention is that a given size unit may be adaptable to accomodate the requirements of different size vehicles. Because of the differential connection or coupling between the two pistons, the short stroke of the piston **34** compresses the gas less than if the piston were attached directly to the plunger **26.** For example, for a design having a two-to-one ratio, the idler and recoil plunger recoils three inches, the piston **34** would travel only 1½ inches and in the extended position a precharge of 1,400 psi into chamber **30** would provide 14,000 pounds of preload. Upon full recoil of the plunger and piston, the gas is compressed to 2,240 psi and provides a maximum recoil force of 22,400 pounds. On the other hand, if the recoil rod **26** were attached directly to the recoil piston **34** as is taught by the prior art, 3 inches of recoil would result in 3 inches of rearward movement of the piston **34.** To obtain 14,000 pounds of preload, the precharge would have to be lowered to 700 psi and the pressure would increase to a maximum of 2,800 psi which would result in a 56,000 maximum recoil force. Conversely, if this arrangement were designed to obtain an equivalent preload and recoil force as provided with the present design, the volume of the gas chamber would have to be twice as much. Thus, the present invention provides a mechanism having smaller overall dimensions for accomodating a given preload and recoil force.

The hydraulic adjuster of the present invention is incorporated as an integral part of the recoil mechanism such that adding hydraulic fluid for adjustment purposes does not affect the gas spring preload. The nonrestricted direct coupling between the two pistons in the present invention permits a direct recoil mechanism response to shock and loading in the track mechanism.

As a safety feature, in order to prevent the possibility of the bolts **38** from being removed while the chamber **30** is charged with gas, a ring **64** is secured to flange **42** by means of bolts **66** with spacers **68** provided to provide clearance for the heads of bolts **38.** A safety venting attachment comprising a conduit **70** communicates by means of a passageway and fitting **60** with the chamber **30.** The conduit **70** extends to communicate with a passage **72** in a flange **74** bolted to the back of ring **64.** Suitable seal **76** is provided for engagement with ring **64** to seal and close passageway **72** when ring **64** is in place. In order to separate the cylinder **36** from housing **28,** it is necessary to remove ring **64** in order to get to bolts **38.** Upon removal of rings **64,** the passage **72** becomes unblocked thus venting chamber **30** to atmosphere. This arrangement prevents removal of barrel or housing **36** while cylinder or piston **34** is preloaded.

From the foregoing description, it can be seen that I have provided a recoil and adjuster mechanism comprising a compressible fluid accumulator connected to a hydraulic adjusting mechanism by means of a differential coupling. While I have described my invention with respect to specific embodiments, it is to be understood that many changes and modifications may be made without departing from the spirit and scope of the present invention as defined in the appended claims.

What is claimed is:

1. A combination recoil and track adjusting means for a track laying vehicle, said means comprising:

an idler wheel for engaging said track;

housing means for fixedly mounting on said vehicle;

said housing means comprising a first cylinder having an open end and a closed end and stop means disposed between said ends;

a second cylinder having both ends open and a diameter smaller than said first cylinder coaxially disposed with and detachably secured to the open end of said first cylinder for direct open communication therebetween;

a plunger extending into said open end of said second cylinder and operatively connected to said idler wheel;

a free piston reciprocably disposed in said first cylinder between said plunger and engageable with said stop means to define a fixed minimum volume chamber at said closed end of said cylinder;

one end of said second cylinder defining stop means between said cylinders to stop said free piston after some travel toward said plunger;

an imcompressible hydraulic fluid disposed in said cylinders between said piston and said plunger and freely movably between said first and second cylinders to thereby define a differential coupling between said plunger and said piston so that said plunger moves greater than the corresponding movement of said free piston, and,

a compressible fluid disposed between said piston and said closed end of said first cylinder to provide increased resistance to movement of said free pis-

ton over its entire range of movement in response to force transmitted thereto from said plunger movement over a greater range of movement than said piston.

2. A combination recoil and track adjusting means for a track laying vehicle, said means comprising:

an idler wheel for engaging said track;

housing means for fixedly mounting on said vehicle;

said housing means comprising a first cylinder having an open end and in a closed end;

a second cylinder having both ends open and a diameter smaller than said first cylinder coaxially disposed with and detachably secured to the open end of said first cylinder;

a plunger extending into said open end of said second cylinder and operatively connected to said idler wheel;

a free piston reciprocably disposed in said first cylinder between said plunger and said closed end of said cylinder;

one end of said second cylinder defining stop means between said cylinders to stop said free piston after some travel toward said plunger;

an incompressible hydraulic fluid disposed in said cylinders between said piston and said plunger and freely movably between said first and second cylinders to thereby define a differential coupling between said plunger and said piston so that said plunger moves greater than the corresponding movement of said free piston;

a compressible fluid disposed between said piston and said closed end of said cylinder;

a plurality of bolts securing said cylinders together;

shield means detachably secured to said housing and covering said bolts so that said bolts cannot be removed when said shield is in the shielding position; and,

safety venting means comprising conduit means communicating with the closed end of said first cylinder and operative to vent said chamber when said shield is moved from said shielding position.

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