A recoil and adjuster mechanism comprises a gas recoil spring and a hydraulic adjuster link operatively connected to an idler wheel.
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 often 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 accommodate 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 jour- nalled in a yoke 18 which is slidable mounted on frame 20 of the vehicle. A recoil and track adjuster mechanism 22 is mounted on the frame 20 by means of a trunion 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 26. 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 released. 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 accommodate 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 accommodating 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:
a. an idler wheel for engaging said track;
b. housing means for fixedly mounting said vehicle; said housing means comprising a first cylinder having an open end and a closed end and stop means disposed between said ends;
c. 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;
d. a plunger extending into said open end of said second cylinder and operatively connected to said idler wheel;
e. 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;
f. one end of said second cylinder defining stop means between said cylinders to stop said free piston after some travel toward said plunger;
g. an incompressible hydraulic fluid disposed in said cylinders between said piston and said plunger and freely movable 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,
h. 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-
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5. 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 diam-
eter smaller than said first cylinder coaxially dis-
posed 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 reciprocally disposed in said first cylin-
der 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 cylin-
ders to thereby define a differential coupling be-
tween 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 re-
moved when said shield is in the shielding position;
and,
safety venting means comprising conduit means com-
municating 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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6. 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 diam-
eter smaller than said first cylinder coaxially dis-
posed 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 reciprocally disposed in said first cylin-
der 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 cylin-
ders to thereby define a differential coupling be-
tween 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 re-
moved when said shield is in the shielding position;
and,
safety venting means comprising conduit means com-
municating 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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