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(54) TRACK TENSIONING AND RECOIL APPARATUS FOR A TRACKED VEHICLE

(71) We, CATERPILLAR TRACTOR CO., a corporation organised and existing under the laws of the State of California, United States of America, of 100 N.E. Adams Street, Peoria, State of Illinois 61602, United States of America, do hereby declare the invention, for which we pray that a Patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to track tensioning and recoil apparatus for a tracked vehicle.

In track-type vehicles, it is well known to provide for movement of a front idler toward and away from a rear drive member so that (i) the track entrained thereabout may be properly tensioned between the front idler and the rear drive member and/or (ii) recoil of the front idler may be allowed. In a conventionally designed vehicle, recoil is allowed by means of a resilient spring which is compressed at the same rate of movement as the actual recoil movement of the front idler toward the rear rotatable member. (See, for example, U.S. Patent No. 2,887,342). While such systems are generally effective, it is to be noted that, because spring compression movement is equal to recoil movement, a relatively large, stiff spring must be used (i.e., if spring travel could be designed as greater than the corresponding amount of recoil movement, a smaller, less stiff, and consequently less expensive spring, with greater impact load recoil capacity, could be used).

Examples of systems which achieved different rates of movement are shown in U.S. Patent Nos. 3,493,124, 3,574,418 and 3,539,229. However, the device of U.S. Patent No. 3,493,124 achieves less spring compression than the corresponding recoil movement, so that, for good performance, a very stiff, heavy spring would have to be used in this place, which is exactly the opposite of applicants' aims.

The devices of U.S. Patent Nos. 3,574,418

and 3,539,229 do indeed provide greater spring movement than the corresponding recoil movement. However, the device of U.S. Patent No. 3,574,418 achieves this by the use of an annular piston, which requires sealing on both the inner and outer surfaces thereof, and in addition may be subject to sealing problems, as it is possible for such a piston, of relatively large diameter, to become slightly skewed. (The device of U.S. Patent No. 3,493,124, in incorporating an annular piston, can suffer from this problem). And the device of U.S. Patent No. 3,539,229 includes a wall with a valve therein preventing compression of the spring until a certain, predetermined pressure on the valve is achieved.

In addition to these problems and complications, it must also be kept in mind that safety and convenience of assembly and disassembly are always problematical, as the spring or springs incorporated are generally quite large in capacity and can easily cause injury to workmen.

According to the invention, there is provided track tensioning and recoil apparatus for a tracked vehicle having first and second members movable relatively toward and away from each other, comprising cylinder means adapted to be connected to the first member and to be movable therewith and comprising a first cylindrical portion and a second cylindrical portion of greater cross-sectional area than the first cylindrical portion and in continuous open communication with the first cylindrical portion, a first piston slidably disposed within the first cylindrical portion of the cylinder means, a second piston adapted to be connected to the second member and to be movable therewith relative to the first member and cylinder means, the second piston being slidably disposed within the second cylindrical portion of the cylinder means so that the first and second pistons and the cylinder means define a closed chamber, reaction means connected to the



cylinder means for movement therewith, and compressible and extensible resilient means disposed between the reaction means and first piston to urge them apart, said chamber serving in use to receive substantially incompressible fluid so that the amount of movement of the first piston relative to the cylinder means in use is greater than the corresponding amount of movement of the second piston relative to the cylinder means, whereby, upon relative movement of the first and second members toward each other, the amount of compressing movement of the resilient means is greater than the corresponding amount of relative movement of the first and second members toward each other.

An embodiment of the invention will now be described by way of example and with reference to the accompanying drawings, in which:

Fig. 1 is a side elevation of a vehicle incorporating track tensioning and recoil apparatus according to the invention; and

Fig. 2 is a sectional side elevation of the track tensioning and recoil apparatus of Fig. 1.

Shown generally in Fig. 1 is a track-type vehicle 10 having track assemblies on either side thereof, one of which is shown at 12. Such track assembly 12 includes a track frame 14 made up of a first, or front track frame portion 16, and a second, or rear track frame portion 18. The track frame portion 16 includes a tubular body 20, and the track portion 18 includes a tubular body 22. The tubular body 20 includes extended portion 24 (Fig. 2), which is disposed within the tubular body 22, and is slidably mounted therein on a bearing 26. Rotatable members 28, 30 (Fig. 1), in this embodiment idlers, are mounted to the track frame portions 16, 18 respectively as shown. Upon sliding of the tubular body 20 inwardly and outwardly of the tubular body 22, the track frame portions 16, 18 are movable relatively toward and away from each other. Thus, the idlers 28, 30, upon such sliding movement, are movable therewith relatively toward and away from each other.

A drive sprocket 32 is associated with the vehicle 10 as shown, and conventional drive means (not shown) for this drive sprocket 32 are included. A track 34 is entrained about the idlers 28, 30 and is in driven engagement with the drive sprocket 32.

As shown in Fig. 2, a sleeve member 36 is fixed to a smaller diameter sleeve member 38 by means of bolts 40. These sleeve members 36, 38 together form cylinder means 42 which are fixed to extended portion 24 of tubular body 20 by means of bolts 44. Such cylinder means 42 comprise a first cylindrical portion 46, formed by sleeve member 38, and a second cylindrical portion

48, formed by sleeve member 36, of greater cross-sectional area than the cylindrical portion 46, and in continuous open communication with the cylindrical portion 46. Such cylinder means 42, it will be seen, are movable with the track frame portion 16, fixed to the tubular body 20.

The cylindrical portion 48 has formed on the outer surface thereof longitudinal splines 50. Inwardly of the tubular body 22 and toward the rear (left) thereof is a tube 52 fixed to the tubular body 22 by means of a ring 54. Such tube 52 has formed on the inner surface thereof longitudinal splines 56 in engagement with the splines 50. Through such splines 50, 56, the tubular bodies 20, 22, and thus the front and rear idlers 28, 30 are kept in alignment.

A piston 58 is sized to fit within the cylindrical portion 46, and includes seal means 60 thereabout and in engagement with the inner surface of the cylindrical portion 46. Such piston 58 contains no opening, such as for a valve, and thus defines a continuous cross-sectional surface which substantially completely fills in the cross-sectional area of the cylindrical portion 46. A piston 62 is fixed to tube 52 by means of a shaft 64 and is thus associated with the track frame portion 18 to move therewith relative to the track frame portion 16. The piston 62 defines an internal cavity 66 which, along with piston 58, and the cylinder means 42, defines a closed chamber 68.

A spacer 70 is disposed within cylindrical portion 46 and contacts piston 58. A sleeve 72 is in contact with spacer 70 and has a flange member 74, a tubular portion 76, and a flange member 78 extending outwardly of the tubular portion 76 and outwardly of the flange member 74, as shown. A plate 80 is fixed within tubular body 20. A compressible and extensible helical spring 82 is disposed between the flange member 74 and plate 80, and is in contact with such flange member 74 and plate 80. A compressible and extensible helical spring 84 is disposed between flange member 78 and the plate 80, and is in contact with such flange member 78 and plate 80. It will be seen that extended portion 24 of tubular body 20 actually makes up a casing which houses the helical springs 82, 84 and the sleeve 72, including flange members 74, 78. A guide 86 fixed to tubular portion 76 both contains spring 82 and serves as a positive stop for plate 80. As will be seen, the plate 80 acts as force reaction means.

A supply fitting 88 and a relief fitting 90 are mounted to piston 62 and communicate with chamber 68. Access to fittings 88, 90 is provided by an aperture 92 in tube 52, which may be reached by removing a cover plate 94 on a service port 96 fixed to tubular body 22. Substantially incompressible fluid, such

as grease, is supplied through fitting 88 to expand and fill out chamber 68. Such pressurized fluid moves the pistons 58 and 62 apart, moving the piston 62 outward of the cylinder means 42. Such movement, of course, moves the tubular bodies 20, 22 (and track frame portions 16, 18) apart, to in turn move idlers 28, 30 apart to tension the track 34. With the chamber 68 filled with incompressible fluid, it will be seen that upon movement of piston 62 relative to cylinder means 42, the amount of movement of piston 58 relative to cylinder means 42 is greater than the corresponding movement of piston 62 relative to the cylinder means 42. This is because of the different cross-sectional areas of cylindrical portions 46 and 48, i.e., any incompressible fluid which is to be formed from cylindrical portion 48 must move into cylindrical portion 46. Since the fluid is substantially incompressible, a certain volume leaving cylindrical portion 48 must enter cylindrical portion 46. With cylindrical portion 46 being of smaller cross-section than cylindrical portion 48, this displaced volume must be taken up by greater movement of piston 58.

It will be seen that, upon movement of the track frame portions 16, 18 relatively toward each other, (i.e., the recoil condition) piston 62 is moved relatively rightwardly (Fig. 2) a certain distance, and piston 58 is forced rightwardly by the incompressible fluid a greater amount relatively rightwardly than such movement of the piston 62. Consequently, the compressing movement of the helical springs 82, 84 is greater than the corresponding amount of relative movement of the track frame portions 16, 18 toward each other. This feature allows the use of recoil springs 82, 84 which are less stiff than usual, since more of their recoil travel is utilized for a given track frame recoil movement. Consequently, relatively great impact load recoil capacity is provided.

It is to be noted that the outer edge of the flange member 78 is in intimate relation with the inner surface of the casing 24. Retainer means 98 are associated with the inner surface of the casing 24 and are positioned to contact such flange member 78. The retainer means 98 comprise a plurality of retaining ring segments 100 seatable in an annular groove 102 defined by the inner surface of the casing 24. Such segments 100 limit the movement of the flange members 74, 78 under the urging of the springs 82, 84.

The retainer means provides an important safety and assembly advantage. The helical springs 82, 84 may be preassembled by inserting them into casing 24 and placing sleeve member 72 and attached guide 86 over the exposed ends thereof. The sleeve member 72 is then loaded to compress springs 82, 84 to the normal preloaded

operating position shown in Fig. 2. The segments 100 are then inserted in groove 102, to thereby retain the sleeve member 72 and springs 82, 84. Maximum effectiveness and safety are afforded by the spring assembly by having an annular shoulder 78' on flange 78 to positively retain ring segments 100 and by providing an abutting contact between segments 100 and on extending ring portion 36' on sleeve member 36. Through such an abutting contact, supplemental retaining support is provided in withstanding the high loads and impact forces of the spring driving recoiling functions. This assembly may then be installed, removed, or serviced as a unit independently of the track frame 14.

Thus it may be seen that the invention provides a track tensioning and recoil apparatus for a tracked vehicle, incorporating recoil spring means and which in use provides greater spring movement than the actual recoil movement. The apparatus is safe and convenient for handling, assembly and disassembly and allows proper and convenient tensioning of a track and free and proper recoil action.

WHAT WE CLAIM IS:—

1. Track tensioning and recoil apparatus for a tracked vehicle having first and second members movable relatively toward and away from each other, comprising cylinder means adapted to be connected to the first member and to be movable therewith and comprising a first cylindrical portion and a second cylindrical portion of greater cross-sectional area than the first cylindrical portion and in continuous open communication with the first cylindrical portion, a first piston slidably disposed within the first cylindrical portion of the cylinder means, a second piston adapted to be connected to the second member and to be movable therewith relative to the first member and cylinder means, the second piston being slidably disposed within the second cylindrical portion of the cylinder means so that the first and second pistons and the cylinder means define a closed chamber, reaction means connected to the cylinder means for movement therewith, and compressible and extensible resilient means disposed between the reaction means and first piston to urge them apart, said chamber serving in use to receive substantially incompressible fluid so that the amount of movement of the first piston relative to the cylinder means in use is greater than the corresponding amount of movement of the second piston relative to the cylinder means, whereby, upon relative movement of the first and second members toward each other, the amount of compressing movement of the resilient means is greater than the corresponding amount of



as grease, is supplied through fitting 88 to expand and fill out chamber 68. Such pressurized fluid moves the pistons 58 and 62 apart, moving the piston 62 outward of the cylinder means 42. Such movement, of course, moves the tubular bodies 20, 22 (and track frame portions 16, 18) apart, to in turn move idlers 28, 30 apart to tension the track 34. With the chamber 68 filled with incompressible fluid, it will be seen that upon movement of piston 62 relative to cylinder means 42, the amount of movement of piston 58 relative to cylinder means 42 is greater than the corresponding movement of piston 62 relative to the cylinder means 42. This is because of the different cross-sectional areas of cylindrical portions 46 and 48, i.e., any incompressible fluid which is to be formed from cylindrical portion 48 must move into cylindrical portion 46. Since the fluid is substantially incompressible, a certain volume leaving cylindrical portion 48 must enter cylindrical portion 46. With cylindrical portion 46 being of smaller cross-section than cylindrical portion 48, this displaced volume must be taken up by greater movement of piston 58.

It will be seen that, upon movement of the track frame portions 16, 18 relatively toward each other, (i.e., the recoil condition) piston 62 is moved relatively rightwardly (Fig. 2) a certain distance, and piston 58 is forced rightwardly by the incompressible fluid a greater amount relatively rightwardly than such movement of the piston 62. Consequently, the compressing movement of the helical springs 82, 84 is greater than the corresponding amount of relative movement of the track frame portions 16, 18 toward each other. This feature allows the use of recoil springs 82, 84 which are less stiff than usual, since more of their recoil travel is utilized for a given track frame recoil movement. Consequently, relatively great impact load recoil capacity is provided.

It is to be noted that the outer edge of the flange member 78 is in intimate relation with the inner surface of the casing 24. Retainer means 98 are associated with the inner surface of the casing 24 and are positioned to contact such flange member 78. The retainer means 98 comprise a plurality of retaining ring segments 100 seatable in an annular groove 102 defined by the inner surface of the casing 24. Such segments 100 limit the movement of the flange members 74, 78 under the urging of the springs 82, 84.

The retainer means provides an important safety and assembly advantage. The helical springs 82, 84 may be preassembled by inserting them into casing 24 and placing sleeve member 72 and attached guide 86 over the exposed ends thereof. The sleeve member 72 is then loaded to compress springs 82, 84 to the normal preloaded

operating position shown in Fig. 2. The segments 100 are then inserted in groove 102, to thereby retain the sleeve member 72 and springs 82, 84. Maximum effectiveness and safety are afforded by the spring assembly by having an annular shoulder 78' on flange 78 to positively retain ring segments 100 and by providing an abutting contact between segments 100 and on extending ring portion 36' on sleeve member 36. Through such an abutting contact, supplemental retaining support is provided in withstanding the high loads and impact forces of the spring driving recoiling functions. This assembly may then be installed, removed, or serviced as a unit independently of the track frame 14.

Thus it may be seen that the invention provides a track tensioning and recoil apparatus for a tracked vehicle, incorporating recoil spring means and which in use provides greater spring movement than the actual recoil movement. The apparatus is safe and convenient for handling, assembly and disassembly and allows proper and convenient tensioning of a track and free and proper recoil action.

WHAT WE CLAIM IS:—

1. Track tensioning and recoil apparatus for a tracked vehicle having first and second members movable relatively toward and away from each other, comprising cylinder means adapted to be connected to the first member and to be movable therewith and comprising a first cylindrical portion and a second cylindrical portion of greater cross-sectional area than the first cylindrical portion and in continuous open communication with the first cylindrical portion, a first piston slidably disposed within the first cylindrical portion of the cylinder means, a second piston adapted to be connected to the second member and to be movable therewith relative to the first member and cylinder means, the second piston being slidably disposed within the second cylindrical portion of the cylinder means so that the first and second pistons and the cylinder means define a closed chamber, reaction means connected to the cylinder means for movement therewith, and compressible and extensible resilient means disposed between the reaction means and first piston to urge them apart, said chamber serving in use to receive substantially incompressible fluid so that the amount of movement of the first piston relative to the cylinder means in use is greater than the corresponding amount of movement of the second piston relative to the cylinder means, whereby, upon relative movement of the first and second members toward each other, the amount of compressing movement of the resilient means is greater than the corresponding amount of



relative movement of the first and second members toward each other.

2. Apparatus as claimed in claim 1 wherein the resilient means comprise helical springs.

3. Apparatus as claimed in claim 2 and further comprising a first flange member operatively connected to the first piston, and a second flange member connected to the first flange member and extending outwardly of the first flange member, and wherein the helical springs comprise a first helical spring disposed between the first flange member and the reaction means, and in contact with the first flange member, and a second helical spring disposed between the second flange member and the reaction means, and in contact with the second flange member.

4. Apparatus as claimed in claim 3 comprising a casing surrounding the first and second helical springs and first and second flange members, with the outer edge of the second flange member in intimate sliding relation with the inner surface of the casing, the cylinder means being fixed to said casing.

5. Apparatus as claimed in claim 4 and further comprising retainer means operatively associated with the inner surface of the casing and positioned to contact the second flange member upon urging thereof by the first and second helical springs, to limit movement of the first and second flange members under such urging of the first and second helical springs.

6. Apparatus as claimed in claim 5 wherein the retainer means comprise a plurality of retaining members seatable in an annular groove defined by the inner surface of the casing.

7. Apparatus as claimed in claim 4, 5, or 6 including a first tubular body, and a second tubular body, and wherein the casing comprises an extended portion of said first tubular body, the first tubular body being

disposed within the second tubular body and slidable inwardly and outwardly thereof.

8. Apparatus as claimed in claim 7 wherein the reaction means comprise a plate fixed within the first tubular body and contacting the first and second helical springs.

9. Track tensioning and recoil apparatus substantially as hereinbefore described with reference to the accompanying drawings.

10. A vehicle having a track frame comprising first and second track frame portions movable relatively toward and away from each other, and apparatus as claimed in any preceding claim and wherein said first and second members comprise first and second rotatable members respectively mounted to the first and second track frame portions and movable relatively toward and away from each other upon relative movement of the first and second track frame portions, and further including a track disposed around the first and second rotatable members.

11. A vehicle as claimed in claim 10 including apparatus as claimed in claim 7 or 8 wherein said first and second track frame portions comprise said first and second tubular bodies.

12. A vehicle as claimed in claim 10 or 11 wherein the first and second rotatable members comprise idlers.

13. A vehicle as claimed in claim 10, 11 or 12 and further comprising means for selectively introducing pressurized fluid into the chamber to move the second piston relatively outwardly of the cylinder means, to in turn move the first and second track frame portions relatively apart, in turn moving the rotatable members apart to tension the track.

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