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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : **B60S 9/04**	**A1**	**(11) International Publication Number:** **WO 96/33894** **(43) International Publication Date:** 31 October 1996 (31.10.96)

(21) International Application Number: PCT/US95/05313

(22) International Filing Date: 28 April 1995 (28.04.95)

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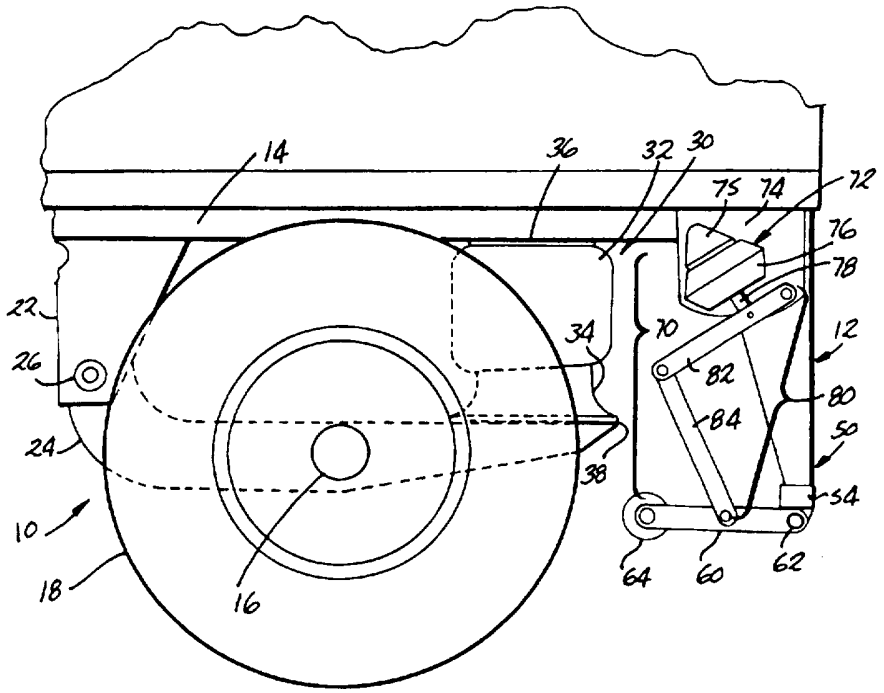
(81) Designated States: AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LT, LU, LV, MD, MG, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TT, UA, UG, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.

(54) Title: DEVICE FOR MAINTAINING THE HEIGHT OF A VEHICLE CHASSIS



(57) Abstract

A device (12) for keeping the chassis height of a trailer constant comprises a rotatable member (60) mounted to the trailer frame (14, 50) and adapted to be movable between a retracted position and an extended position. In the retracted position, the axle (16) and wheel (18) of the trailer are free to move within the limits of the suspension. In the extended position, the rotatable member (60) limits the relative movement between the trailer frame (14) and the suspension to limit creep of the trailer.

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DEVICE FOR MAINTAINING THE HEIGHT OF A VEHICLE CHASSIS

BACKGROUND OF THE INVENTION

Field of the Invention

The invention relates to an anti-creep device for use in stabilizing a trailer to retard the forward and downward movement of the trailer upon loading, loss of air spring pressure or other events causing a change in axle to frame relationship, and more specifically to a device for limiting the relative downward movement of the vehicle frame with respect to the axle of the trailer suspension during loading or other "stationary" times to limit the creep of the trailer from a loading dock or parked position.

Description of the Prior Art

In the loading of a trailer, the trailer is typically backed up against a dock by the tractor. The operator then lowers the front dolly legs on the trailer until they touch the ground and removes the tractor. In storage situations the tractor may or may not be connected to the trailer. Many trailers have trailing arm suspensions with air springs to control the relative position of the frame with respect to an axle and also to cushion the relative movement of the axle toward the frame due to bumps in the road. Although the air spring is pressurized by the tractor's air compressor during transport and stationary times, the air compressor is normally off during loading operation.

As the trailer is loaded, the force from the weight of the goods loaded into the trailer and the loading equipment, such as a forklift or a handcar, lowers the rear portion of the frame rail with respect to the axle. Because the compressor is off during the loading operation, the air pressure in the air spring is not adjusted to compensate for the increased load. While the rear portion of the trailer frame moves downwardly, the front portion of the trailer frame is substantially fixed at the height of the dolly and the trailer frame effectively rotates about the contact point of the dolly with the ground. The downward movement of the rear portion of the trailer frame results in the pivotable movement of the pivotal connection between the trailer frame and the trailing arm. This pivotable movement results in the slight rotation of the trailing arm

wheel to move the trailer forward away from the dock. In other words, the trailer tends to move away from the loading dock. This movement is referred to as "creep." Creep of the trailer can create hazards for loading of the trailers.

U.S. Patent No. 5,333,645, issued August 2, 1994, discloses an apparatus for overcoming this problem by providing a dump valve to exhaust air from the air spring when the trailer door is opened. The trailer thus bottoms out on the suspension before loading begins and cannot creep away from the dock. Whereas this system has worked well to prevent creep, not all vehicles are equipped with this system, or cannot use such a system. Also, when some air suspensions are lowered to their lowest position, the trailer floor is much lower than the dock, which prevents safe entry with the loading equipment.

Therefore, there is a significant need to reduce or eliminate creep associated with a trailer during loading. The anti-creep solution must also be simple, reliable and inexpensive if it is to be commercially viable. Further, the anti-creep solution must also not interfere with the normal function of the trailing arm suspension during normal operation thereof.

SUMMARY OF INVENTION

The invention relates to an anti-creep device that solves the creep problem associated with trailers during loading by movably mounting a column to the trailer for movement between a retracted position and an extended position. When the column is in the retracted position, the trailer is free to move vertically on the suspension without interference from the column. In the extended position, the column substantially prevents the relative movement of the trailer with respect to the suspension to substantially eliminate the creep of the trailer during loading. Advantageously, the invention is not dependent on a particular type of vehicle suspension.

The support column is preferably adapted to be mounted to an underride guard of the trailer and is movable between the retracted position and the extended position by an actuator assembly adapted to be mounted to the trailer. The actuator assembly is connected to the support column by a linkage assembly having a first portion connected to the support column and a second portion operatively connected to the actuator, whereby when the anti-creep device is

mounted to the underride guard of a trailer, and upon actuation of the actuator, the support column will be moved to the extended position thereby to minimize the creep of a trailer due to changes in load while stationary.

The support column is preferably adapted to mount to a cross bar of the underride guard. A wheel can be mounted to a second end of the support column and is adapted to contact the ground when the support column is in the extended position.

The actuator assembly preferably comprises an air-operated actuator with a housing adapted to be pivotally mounted to the trailer and an arm extending from the housing for reciprocal movement with respect thereto. The arm is mounted to the support column whereby the reciprocal movement of the arm moves the support column between the extended and retracted positions.

The linkage can comprise first and second links with the first link having one end adapted to be pivotally mounted to the trailer and a second end mounted to a first end of the second link. The second link has a second end, which is pivotally mounted to the support column to thereby connect the actuator to the support column. The first and second links can be a bar and/or a cable.

In one embodiment of the invention, the support column comprises a tube with one end adapted to mount to the trailer and a leg that is movably mounted within the tube for reciprocal movement therewith in response to the actuator assembly, whereby the actuator assembly moves the leg between a first position in which it is substantially within the tube to retract the support column and a second position in which the leg projects from the tube to move the support column to the extended position. The support column can further comprise a ratchet for locking the position of the leg with respect to the tube. The ratchet comprises a plurality of teeth formed in the leg and a pawl pivotally mounted to the tube and adapted to engage the teeth.

In another embodiment of the invention, the support column comprises a first tube having one end adapted to be pivotally mounted to the vehicle and another end, which is at least partially closed by a first plate having a first aperture. The support column further comprises a second tube having one end abutting the first plate and being at least partially closed by a second plate

having a second aperture. A spring extends through the first and second apertures of the tubes to elastically connect the tubes. The spring can have a positioning pin, which is positioned in the first and second apertures when the first plate is abutting and flush with the second plate.

In another embodiment, the invention relates to a trailer vehicle having an underride guard and an anti-creep device mounted to the underride guard.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described with reference to the drawings wherein:

FIG. 1 is a side elevational view of an anti-creep device according to the invention in a raised position and mounted to a vehicle having a trailing arm suspension;

FIG. 2 illustrates the anti-creep device of FIG. 1 in a lowered position;

FIG. 3 illustrates an alternative mounting for the anti-creep device of FIG. 1;

FIG. 4 is a side elevational view of a second embodiment of an anti-creep device according to the invention in a raised position and mounted to a vehicle with a trailing arm suspension;

FIG. 5 illustrates the anti-creep device of FIG. 4 in a lowered position;

FIG. 6 is a side elevational view of a third embodiment of the anti-creep device according to the invention in a lowered position and attached to a vehicle with a trailing arm suspension;

FIG. 7 is an enlarged view of a portion of the anti-creep device of FIG 6; and

FIG. 8 illustrates the third embodiment of the anti-creep device according to the invention with an alternative spring construction.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 illustrates a trailing arm suspension 10 in combination with an anti-creep device 12 according to the invention. The trailing arm suspension 10 is mounted to a longitudinal frame 14 of a trailer frame and supports an axle 16 to which wheels 18 are mounted on opposite ends of the axle 16. In a typical

trailer application, two trailing arms are used to mount the axle 16 to the frame 14. The trailing arms are mounted on opposite sides of the frame rail and support opposing ends of the axle 16. Only one of the trailing arms will be described in detail.

The trailing arm suspension 10 comprises a hanger bracket 22 fixedly mounted to the frame 14 and to which is rotatably mounted a trailing arm 24 by means of a bushed connection 26 at the forward end of the trailing arm 24. The rearward end of the trailing arm 24 mounts at a lower end thereof an air spring 30, which is connected to the frame 14 at its upper end. The air spring 30 resiliently resists upward movement of the trailing arm 24 with respect to the frame and comprises an air bag 32 mounted to the frame 14 by a mounting plate 36 and a piston 34 mounted to a platform 38 on the trailing edge of the trailing arm 24. As the trailing arm 24 rotates, the piston 34 is urged into the air bag 32 to resiliently retard movement of the trailing arm 24 toward the frame 14.

Referring to FIGS. 1-3, positioned longitudinally behind the trailing arm suspension is an underride guard 50 comprising a pair of laterally spaced, vertically extending braces 52, each having one end mounted, preferably by welding, to a cross beam (not shown) of the vehicle frame. The other end of each brace 52 mounts a horizontally oriented and laterally extending cross bar 54, which is welded thereto. The underride guard 50 prevents a vehicle following the trailer from driving underneath the frame 14 and contacting the wheels 18. The underride guard also is used in combination with restraining devices to link/lock a trailer to a loading dock.

As illustrated, a typical trailer with underride guard 50 requires two opposing anti-creep devices 12, each mounted near the braces 52. The anti-creep devices 12 are identical, except for their location and, thus, only one of the anti-creep devices 12 is described here in detail.

Referring to FIGS. 1 and 2, the anti-creep device 12 comprises a support column 60 whose upper end is pivotally mounted to the cross bar 54 by a pivot pin 62. Alternatively, the support column 60 can be mounted in any suitable manner, such as by a hinge. The lower end of the support column 60 pivotally

mounts a wheel 64, which is adjacent the ground when the support column is in the lowered position as illustrated in FIG. 2.

The anti-creep device 12 further comprises an actuator assembly 70 for moving the support column 60 between an extended position (FIG. 2) and a retracted position (FIG. 1). The actuator assembly 70 includes an air operated actuator 72, which is secured to a mounting plate 74 through an L-shaped bracket 75, which in turn is fixedly mounted to the frame 14 by welding or other suitable fasteners. The air-operated actuator 72 comprises a housing 76 connected to a pressurized air source (not shown) and from which extends an arm 78, which reciprocally moves with respect to the housing 76 in response to the application and exhaustion of pressurized air from the housing 76. A spring (not shown) is mounted within the housing 76 and biases the arm 78 to an extended position when the air is exhausted from the actuator 72. Therefore, when pressurized air is applied to the actuator 72, the pressurized air overcomes the force of the spring and retracts the arm 78.

The actuator assembly 70 further comprises a linkage 80 having a first link 82 and a second link 84. The first link 82 is pivotally connected at one end to the mounting plate 74 and pivotally connected at the other end to one end of the second link 84. The other end of the second link 84 is pivotally connected to the support column 60. The arm 78 of the air operated actuator 72 is pivotally connected to the first link 82 between the ends of the first link 82.

When the arm 78 is extended from the housing 76 by the exhaustion of pressurized air, the linkage 80 is rotated to move the support column 60 to the extended position as illustrated in FIG. 2. When the arm 78 is retracted into the housing 76 upon the application of pressurized air to the air-operated actuator 72, the linkage 80 is moved to retract the support column 60 to the retracted position as illustrated in FIG. 1. In the extended position, the wheel 64 is adjacent or in contact with the ground. If the wheel 64 is not in contact with the ground, as the trailer is loaded, the weight of the material being loaded on the trailer will lower the frame 14 with respect to the ground, resulting in the contact of the wheel 64 on the ground. When the wheel 64 is in contact with the ground, the frame 14 is prevented from creeping downwardly.

When the vehicle is completely loaded, the air system of the trailer is pressurized and initially fills the air spring 30 with pressurized air to raise the frame 14 with respect to the ground. Simultaneously, the air-operated actuator 72 receives pressurized air and the arm 78 is retracted to move the support column 60 to the retracted position.

FIG. 3 illustrates an alternative mounting for the first embodiment of anti-creep device 12. The alternative mounting incorporates the same components as the anti-creep device 12. The only difference between the anti-creep device illustrated in FIGS. 1-2 and 3 is that the mounting plate 74 is mounted perpendicularly with respect to the frame 14 instead of longitudinally with respect to the frame 14. Thus, all the components of the anti-creep device 12 are rotated 90 degrees. The 90 degree rotation results in the support column 60 rotating in a plane parallel to the longitudinal access of the cross bar 54, instead of a plane perpendicular to the longitudinal access of the cross bar 54 as illustrated in FIGS. 1 and 2.

FIGS. 4 and 5 illustrate a second embodiment 100 of the anti-creep device according to the invention. The second embodiment is shown mounted to a vehicle with an identical trailing arm suspension and underride guard as shown in the first embodiment. Therefore, like parts are identified by like numerals. The second embodiment comprises a support column or ratcheting leg assembly 102 and an actuator assembly 104. The ratcheting leg assembly comprises a tube 106 having one end mounted to the frame 14 and the other end mounted to the cross bar 54. A pulley 108 is rotatably mounted within the hollow interior of the tube 106 and supports a line 110, which functions as a link to connect the support column to the actuator assembly. A leg 112 is also positioned within the hollow interior of the tube 106. One end of the leg 112 is secured to the line 110 and the other end of the leg 112 pivotally mounts a wheel 114.

A ratchet is formed by a plurality of teeth 116 on one side of the leg 112 and an U-shaped pawl 120 pivotally mounted to the exterior of the tube 106 by a pivot pin 122. The pawl 120 comprises elongated portions 124 extending along the side of the tube 106. The lower end of the elongated portion 124 extends beyond the opened lower end of the tube 106. A flange 126 extends

laterally between the elongated portions 124 and extends laterally a sufficient distance to engage the teeth 116 of the leg 112. An air cylinder 132 is pivotally mounted at one end to the exterior of the tube 106 and pivotally mounted at another end to the upper end of the elongated portion 124. The pawl 120 is rotated by an air cylinder 132, which is connected to the vehicle's source of pressurized air (not shown).

The actuator assembly 104 comprises a mounting bracket 140 welded to the frame 14. A link 142 is pivotally mounted at one end to the mounting bracket 140. The line 110 is secured to the other end of the link 142. An air cylinder 144 is pivotally mounted to the frame 14, at one end, and pivotally mounted to the link, at another end. The air cylinder 144, like the air cylinder 132, is fluidly connected to the vehicle pressurized air source (not shown).

In operation, when the air source of the vehicle is pressurized, such as during normal driving conditions, air cylinders 132 are retracted. As the air cylinder 132 is retracted, the link 120 is pivoted away from the teeth 116 of the leg 112. The air cylinder 144 is extended to pivot the link 142 downwardly to lift and retain the leg 112 within the hollow interior of the tube 106 as is seen in FIG. 4.

When the vehicle is stopped and the trailer is backed against a loading dock, the pressurized air source for the trailer is exhausted and the air cylinder 132 is extended and air cylinder 144 is retracted. Upon the retraction of the air cylinder 144, the link 142 is moved upwardly to lower the leg 112 from within the hollow interior of the tube 106. As the leg 112 is lowered, the pawl 120 is pivoted toward the leg 112 by the extension of the air cylinder 132. The flange 126 of the pawl 120 abuts the teeth 116 and rides along their surface. The leg 112 is free to move downwardly as the flange 112 ratches with respect to the teeth 116. When the pressurized air source is exhausted, the loading of the trailer will cause the frame rail to move downwardly until the flange 126 abuts one of the teeth 116 to prevent further downward movement of the frame rail and the subsequent creeping of the trailer away from the dock.

When the loading of the trailer is completed, the air system of the trailer is pressurized, the air spring is filled to lift the frame 14 with respect to the ground and relieve the pawl 120 and the leg 112 from bearing the weight of the

loaded trailer. Simultaneously, the air cylinder 132 is retracted and air cylinder 144 is extended to pivot the flange 126 of pawl 120 out of engagement with the teeth 116 to lift the leg 112 into the interior of the tube 106.

FIGS. 6 and 7 illustrate a third embodiment 200 of the anti-creep device according to the invention. The third embodiment 200 is illustrated being mounted to a trailer with a trailing arm suspension and an underride guard as shown in the first embodiment. Therefore, like parts will be identified by like numerals. The anti-creep device 200 is a breakaway anti-creep device so that if the trailer is moved when the anti-creep device is in the lowered position (FIG. 6), the movement of the trailer will not damage the anti-creep device.

The anti-creep device 200 comprises an actuator assembly 202 that actuates a support column 204 between an extended position and a retracted position. The support column prohibits the downward movement of the trailer with respect to the ground. The actuator assembly 202 includes a mounting plate 210, which pivotally mounts an air-operated actuator 212. The actuator 212 comprises a housing 214, which is pivotally mounted to the mounting plate 210 by a pivot pin 216. Extending from the housing 214 is an arm 218.

The support column 204 includes a first support member or tube 222 and a second support member or tube 224. Both the first support member 222 and the second support member 224 are preferably cylindrical tubes having a hollow interior. Looking now more closely at the first support member 222, it can be seen that the upper end of the first support member 222 is pivotally mounted to the cross bar 54 of the underride guard 50 by a pivot pin 226. The lower end of the first member 222 is closed by a circular plate 228 having an opening 230. A spring 232 is positioned in the hollow interior of the first member 222 and has one end attached to the interior of the first member 222 by a pin 234. The other end of the first spring 232 is mounted to a positioning pin 236, which extends through the opening 230. An arm mounting plate 240 is secured to the exterior of the first member 222 and to which the arm 218 is pivotally connected by a pin 242.

The second member 224 is closed at its upper end by a circular plate 248, which has an upstanding annular flange 250 that defines a circular recess 252 in which is received the circular plate 228 of the first member 222. The plate 248

of the second member 224 has a centrally located opening 254 that is axially aligned with the opening 230 of the circular plate 228. In cross section, the opening 254 is stepped having a greater diameter portion 256 of substantially the same diameter as the positioning pin 236 and a reduced diameter portion 258 of a diameter less than the diameter of the positioning pin 236 to prevent the positioning pin 236 from moving within the hollow interior of the second support member 224. The bottom of the second member 224 is sealed by a circular base plate 262 within the hollow interior of the second member 224, a spring 264, much like spring 232, is mounted by a pin 266 at one end and affixed to the positioning pin 236 at another end.

As illustrated in FIG. 7, when the vehicle is in the normal operation mode, the air system of the trailer is supplied with pressurized air and the arm 218 is retracted into the housing 214 of the actuator 212 to pivot and retain the support column 204 in the retracted position. When the trailer is backed against a loading dock for loading, the air system of the trailer is exhausted and the arm 218 is extended from the housing 214 of the actuator 212 to move the support column 204 to the extended position as illustrated in FIG. 6.

While the support column 204 is in the extended position, if the trailer is moved away from the dock, the first member 222 will break away from the second member 224. The circular plate 228 of the first member 222 will tend to lift upwardly out of the circular recess 252 while maintaining the positioning pin 236 substantially within the opening 230. As the circular plate 228 lifts out of the circular recess 252, the first and second members 222, 224, respectively, can fold with respect to each other to effectively reduce the link of the support column 224. However, the first and second members 222, 224 remain connected by the springs 232 and 264 whereby upon completion of the movement of the trailer, the springs 232, 264 will realign the first and second members 222, 224.

FIG. 8 illustrates a simplified alternative construction for the spring of support column 204, which eliminates the dual springs 232 and 264 connected by positioning pin 236. In the simplified construction, the circular plates 228, 248 have coaxial apertures 270, 272, respectively. The apertures 270, 272 have substantially equal and constant diameters through which a single spring 274 passes. One end of the spring is mounted to the interior of the first support

member 222 and the other end is mounted to the second support member 224. In all other aspects, the simplified construction of FIG. 8 is identical to FIG. 7.

Although the anti-creep device according to the invention is illustrated in combination with a trailing arm suspension, it should be evident that, advantageously, the anti-creep device operates independently of the type of suspension because it is not part of the suspension or utilize portions of the suspension. Thus, the anti-creep device can be used on any vehicle with an underride guard regardless of the type of suspension. The independence of the anti-creep device from the suspension is a significant advantage over previous anti-creep devices because it can be mounted to any trailer with an underride guard as original equipment or as retro-fit.

While particular embodiments of the invention have been shown, it will be understood, of course, that the invention is not limited thereto since modifications may be made by those skilled in the art, particularly in light of the foregoing teachings. Reasonable variation and modification are possible within the scope of the foregoing disclosure of the invention without departing from the spirit of the invention.

CLAIMS

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. An anti-creep device adapted to mount to an underride guard of a trailer, the anti-creep device comprising:

a support column adapted to be movably mounted to the trailer for movement between a retracted position which would permit downward motion of the trailer relative to grade, and an extended position which would restrain downward motion of the trailer relative to grade;

an actuator adapted to be mounted to the trailer; and

a linkage assembly having a first portion connected to the support column and a second portion operatively connected to the actuator, the first and second portions being movably joined together to link the actuator to the support column;

whereby when the anti-creep device is mounted to an underride guard on a trailer, and upon actuation of the actuator, the support column will be moved to the extended position thereby to minimize the creep of a trailer due to changes in load while stationary.

2. An anti-creep device according to claim 1 wherein the support column further comprises a wheel mounted to a second end thereof and the wheel is adapted to contact the ground when the support column is in the extended position.

3. An anti-creep device according to claim 1 wherein the actuator has a housing adapted to be pivotably mounted to the trailer and an arm extending from the actuator housing for reciprocal movement with respect to the housing.

4. An anti-creep device according to claim 3 wherein the actuator is an fluid-operated actuator.

5. An anti-creep device according to claim 3 wherein the actuator is an air-operated actuator.

6. An anti-creep device according to claim 1 wherein the linkage assembly further comprises first and second links, the first link has a first end adapted to be pivotally mounted to the trailer and a second end pivotally mounted to a first end of the second link, the second link has a second end pivotally mounted to the support column, and the actuator is pivotally mounted to the first link between the first and second ends thereof.

7. An anti-creep device according to claim 6 wherein one of the first and second links is a cable.

8. An anti-creep device according to claim 7 wherein the other of the first and second links is a bar.

9. An anti-creep device according to claim 1 wherein the support column comprises:

a tube having a proximal end adapted to mount to the trailer and an open distal end;

a leg which is movably mounted within the tube for reciprocal movement therewith in response to the actuator assembly;

whereby the actuator assembly moves the leg between a first position in which it is substantially within the tube to retract the support column and a second position in which the leg projects from the tube to move the support column to an extended position.

10. An anti-creep device according to claim 9 wherein the actuator has a housing adapted to be pivotally mounted to the trailer and an arm extending from the actuator housing for reciprocal movement with respect to the housing.

11. An anti-creep device according to claim 10 wherein the linkage assembly further comprises first and second links, the first link has a first end

adapted to be pivotally mounted to the trailer and a second end pivotally mounted to a first end of the second link, the second link has a second end pivotally mounted to the support column, and the arm is pivotally mounted to the first link between the first and second ends thereof.

12. An anti-creep device according to claim 10 wherein the support column further comprising a ratchet for locking the position of the leg with respect to the tube, the ratchet comprising a plurality of teeth formed in the leg and a pawl pivotally mounted to the tube and adapted to engage the teeth.

13. An anti-creep device according to claim 12 wherein the ratchet further comprises an fluid actuator for pivoting the pawl into and out of engagement with the teeth and the fluid actuator comprising a housing pivotally mounted to the tube and an arm extending from the housing and pivotally mounted to the pawl.

14. An anti-creep device according to claim 13 wherein the leg further comprises a wheel pivotally mounted thereto.

15. An anti-creep device according to claim 1 wherein the support column comprises:

a first tube having a proximal end and a distal end, the proximal end adapted to be pivotally mounted to the vehicle and the distal end being at least partially closed by a first plate having a first aperture;

a second tube having a proximal end and a distal end, the proximal end of the second tube abutting the first plate and being at least partially closed by a second plate having a second aperture and abutting the distal end of the first tube; and

a spring extending through the first and second apertures and having first and second ends, one end of which is mounted to the first tube and the other end of which is mounted to the second tube, wherein the spring elastically connects the first and second tubes.

16. An anti-creep device according to claim 15 wherein the spring further comprises a positioning pin connecting a first portion of the spring to a second portion of the spring and the positioning pin is positioned in the first and second apertures when the first plate is abutting and flush with the second plate.

17. An anti-creep device according to claim 15 wherein the actuator assembly further comprises an actuator having a housing adapted to be pivotally mounted to the trailer and an arm extending from the actuator housing for reciprocal movement with respect to the housing.

18. An anti-creep device according to claim 15 wherein the linkage assembly further comprises a first link rigidly mounted to the support column and the actuator is pivotally mounted to the first link.

19. An anti-creep device according to claim 18 wherein the first link is a plate mounted to the first tube.

20. In a trailer having an underride guard, the improvement comprising:

an anti-creep device mounted to the underride guard, the anti-creep device including a support column movably mounted to the trailer for movement between a retracted position which would permit downward motion of the trailer relative to grade, and an extended position which would restrain downward motion of the trailer relative to grade;

an actuator mounted to the trailer; and

a linkage assembly having a first portion connected to the support column and a second portion operatively connected to the actuator, the first and second portions being movably joined together to link the actuator to the support column;

whereby upon actuation of the actuator, the support column will be moved to the extended position thereby to minimize the creep of the trailer due to changes in load while the trailer is stationary.

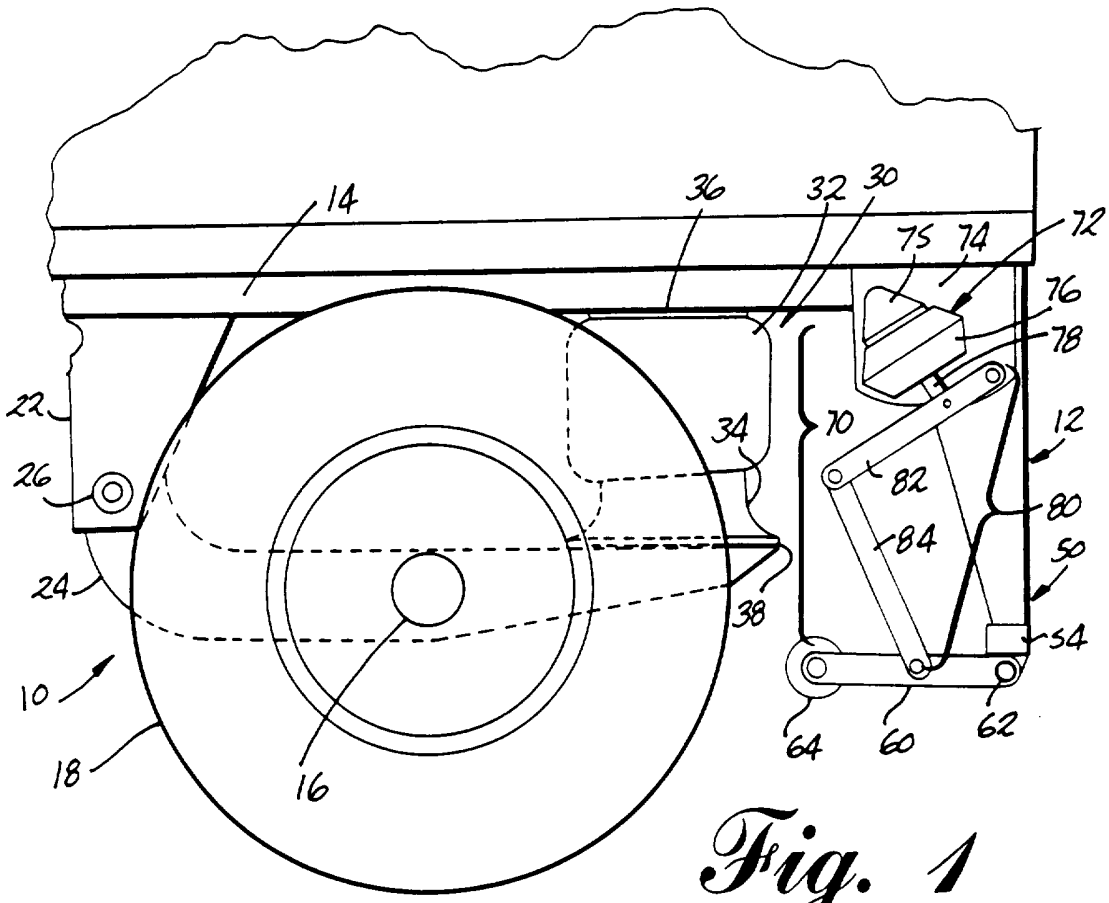
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Fig. 1

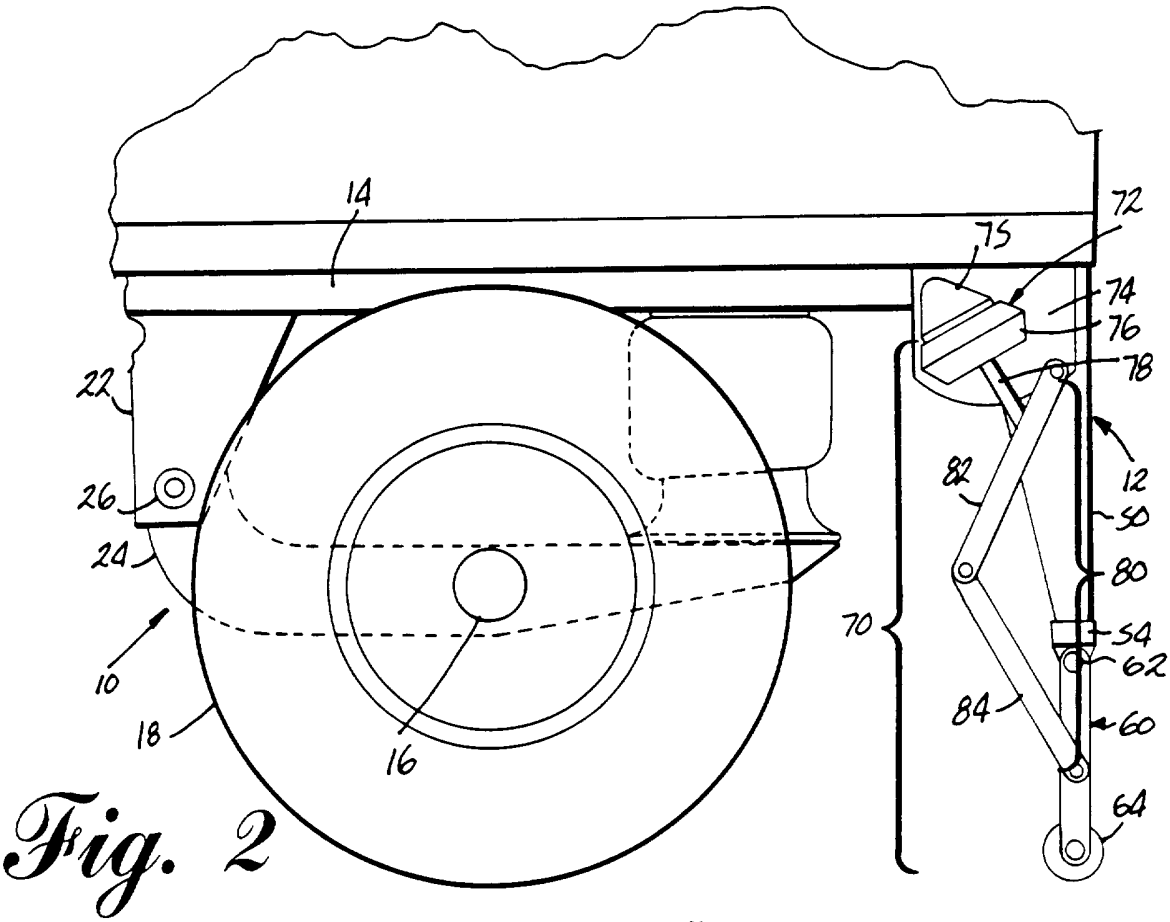
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Fig. 2

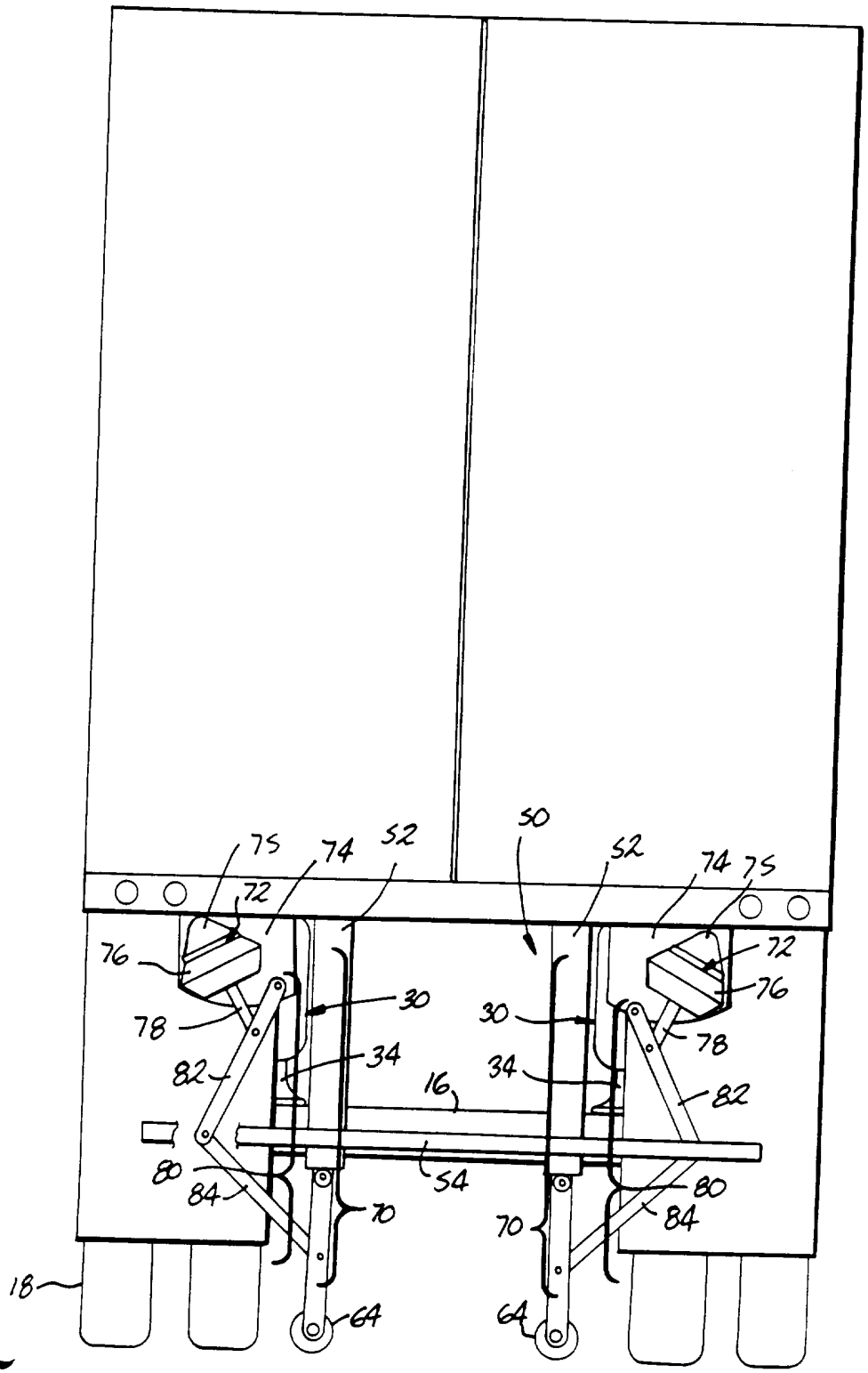
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Fig. 3

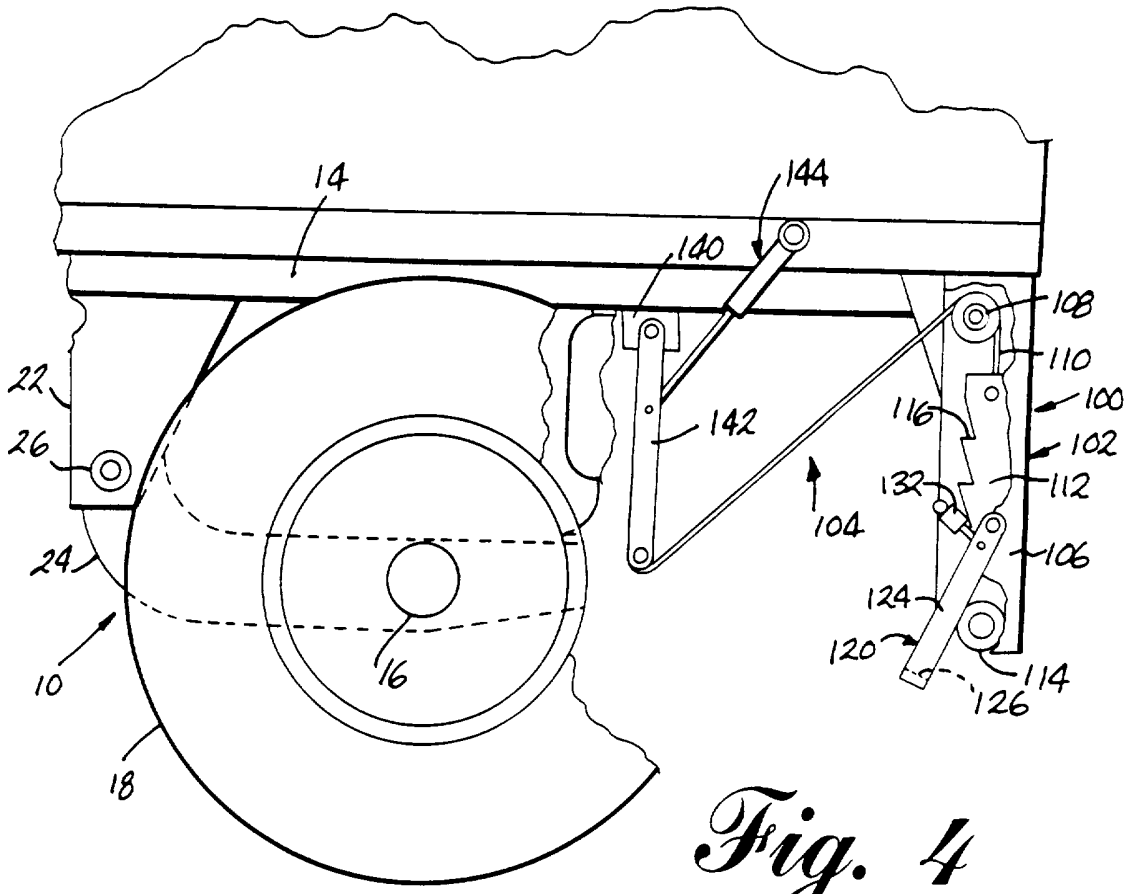
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Fig. 4

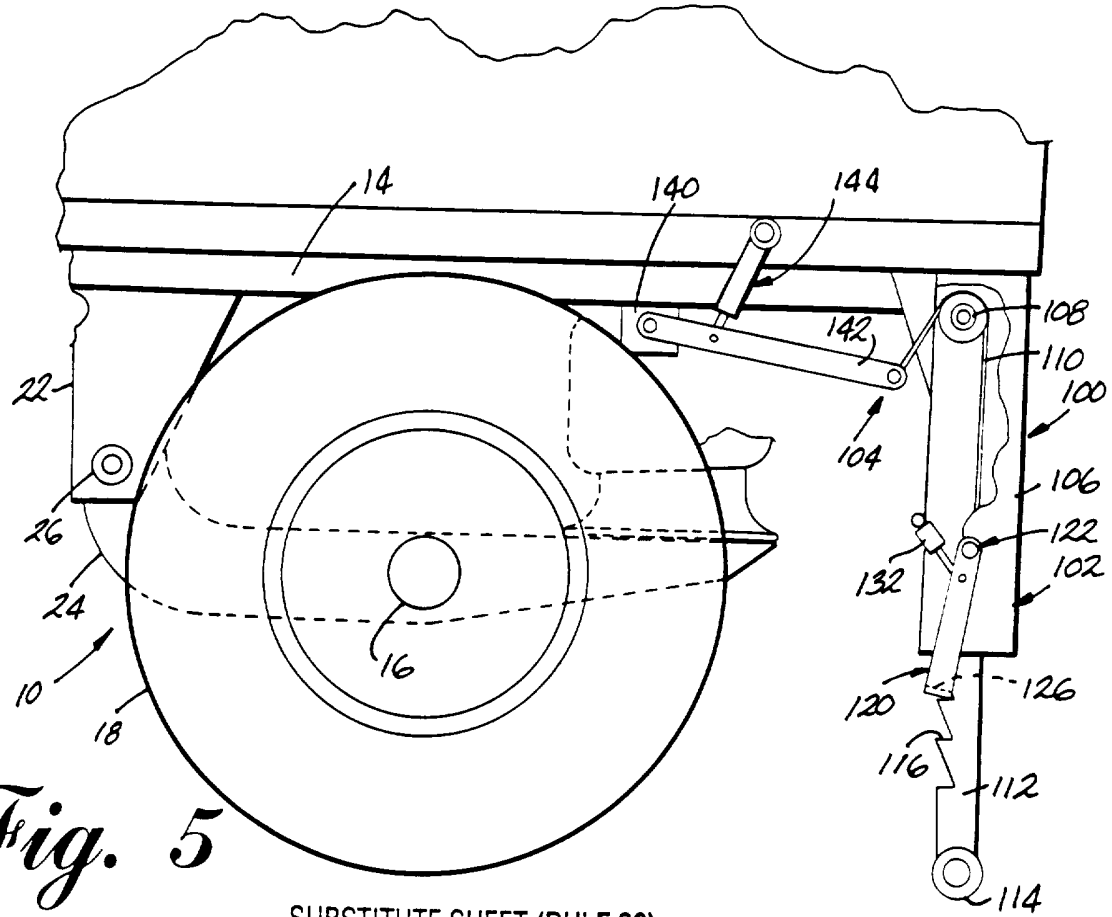
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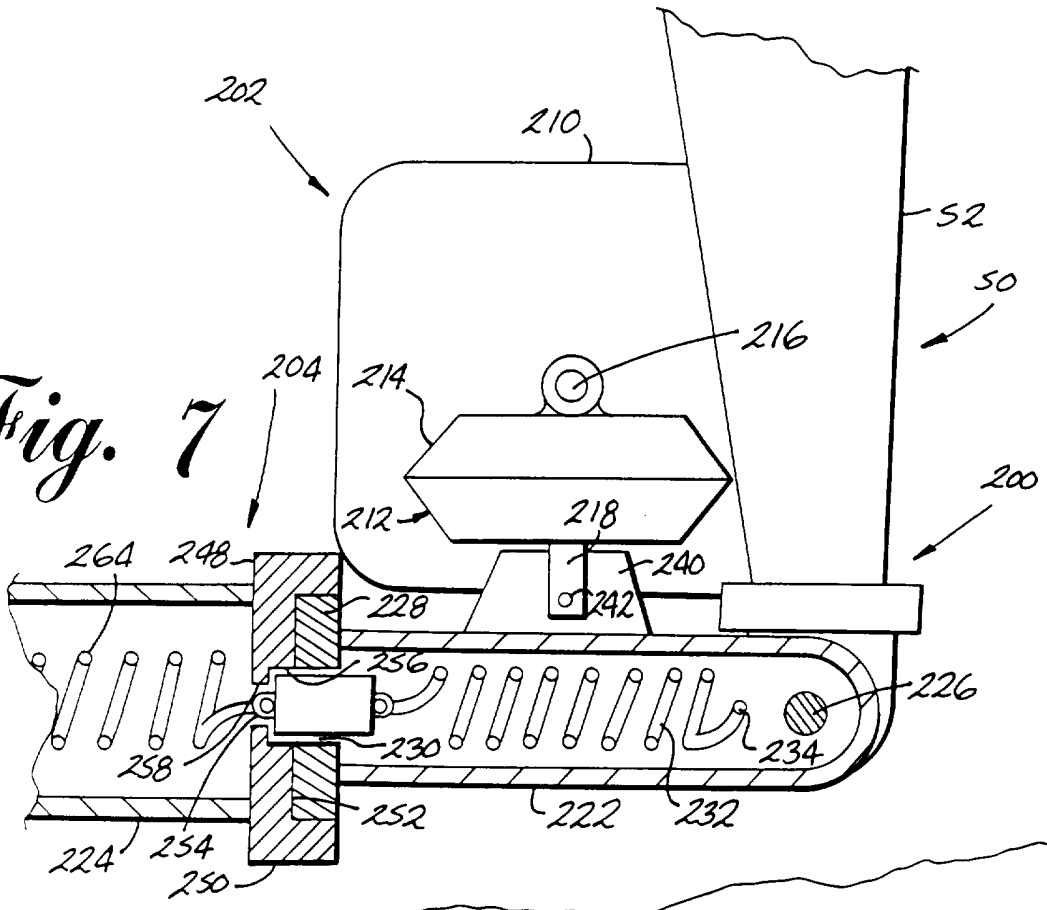
Fig. 5

Fig. 7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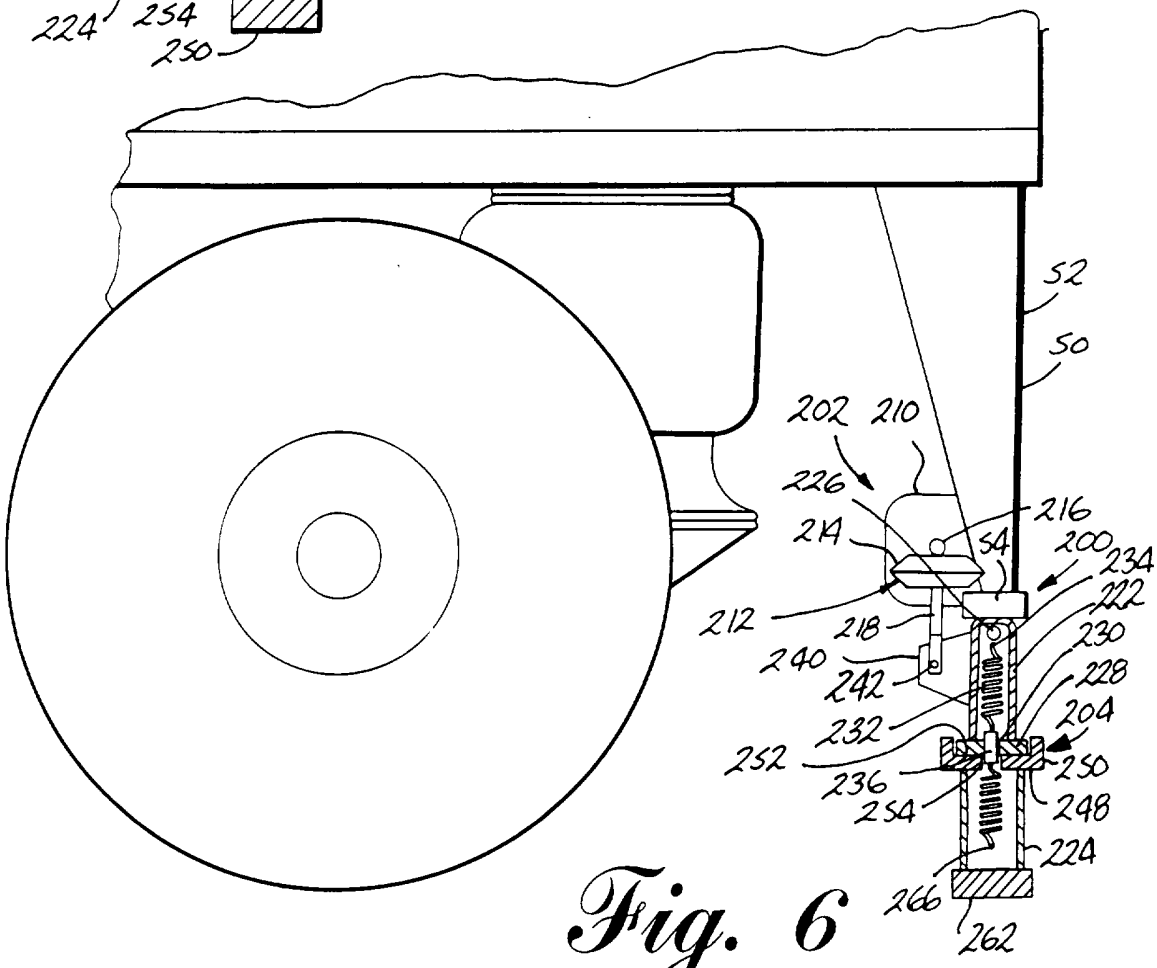
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Fig. 6

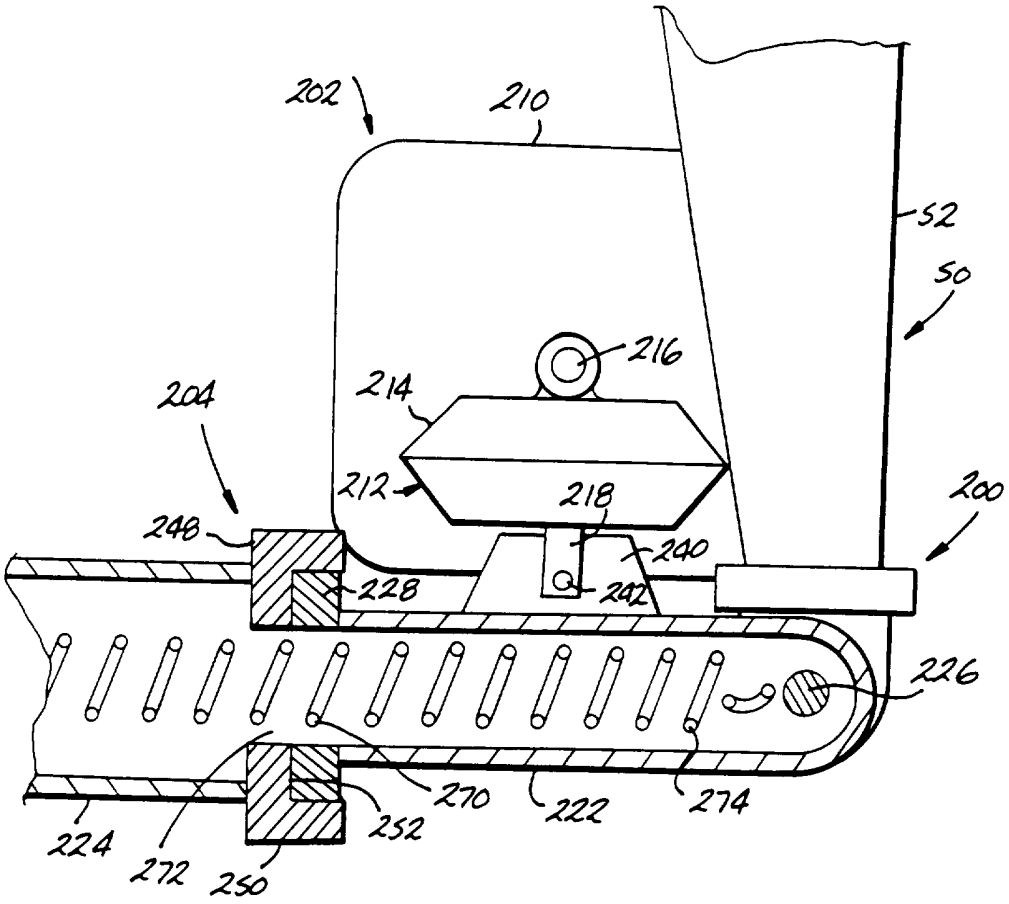
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Fig. 8

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 95/05313

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B60S9/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B60S B60R B60G B60P

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE,A,23 09 554 (KOCKUM INDUSTRI AB) 5 September 1974 see claims; figures 1,2 see page 1, line 20 - page 2, line 3 see page 2, line 12 - page 3, line 24	1,3-5,20
A	FR,A,2 588 807 (MARTIN) 24 April 1987 see abstract; figure 1 see page 1, line 24 - line 33	1,20
A	EP,A,0 567 189 (CAMPISA SRL) 27 October 1993 see abstract; claims 1,8; figures 1,3 see column 1, line 1 - line 6 see column 3, line 12 - line 28 see column 4,. line 25 - line 55	1-4,14, 20

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"&" document member of the same patent family

1

Date of the actual completion of the international search	Date of mailing of the international search report
19 December 1995	21. 12. 95
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016	Authorized officer Westland, P

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

Int ional Application No
PCT/US 95/05313

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-A-2309554	05-09-74	NONE	
FR-A-2588807	24-04-87	NONE	
EP-A-0567189	27-10-93	NONE	