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Inventor(s) Shaffer; Samuel

Shock adjuster

Abstract

Described herein is a shock adjuster comprising a remote pulley, a pulley shaft, wherein the pulley shaft is coupled to the remote pulley at a first end, wherein the pulley shaft is coupled to an air spring cam shaft at a second end, an air spring needle, wherein the position of the air spring needle is determined by the position of the air spring cam shaft, wherein an air spring shim is engageable with the air spring needle, an open mode adjuster, a compression cam shaft, wherein the compression cam shaft is coupled to the open mode adjuster, a compression needle, wherein the position of the compression needle is determined by the position of the compression cam shaft, and a shim, wherein the shim is coupled to the compression needle, wherein the shim is fit to open or close at least a main port in a piston.

Inventors: **Shaffer; Samuel (Ben Lomond, CA)**

Applicant: **Fox Factory, Inc.** (Duluth, GA)

Family ID: **1000006968903**

Assignee: **Fox Factory, Inc. (Duluth, GA)**

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References Cited

U.S. PATENT DOCUMENTS

Patent No.	Issued Date	Patentee Name	U.S. Cl.	CPC
2003255	12/1934	Duff	384/417	E21B 1/02
7147207	12/2005	Jordan et al.	N/A	N/A
8356829	12/2012	Shirai	N/A	N/A
8622180	12/2013	Wootten et al.	N/A	N/A
9273746	12/2015	Chen et al.	N/A	N/A
9593736	12/2016	Jordan et al.	N/A	N/A
10578179	12/2019	Laird	N/A	N/A
11041537	12/2020	Yablon et al.	N/A	N/A
2011/0012317	12/2010	Mouri	280/5.519	F16F 9/56

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS (PROVISIONAL) (1) This application claims priority to and benefit of U.S. Provisional Patent Application No. 63/255,790 filed on Oct. 14, 2021, entitled “SHOCK ADJUSTER” by Sam Shaffer, and assigned to the assignee of the present application, the disclosure of which is hereby incorporated by reference in its entirety.

BACKGROUND ART
(1) Shock absorbers commonly have features that allow users to adjust the settings for damping and rebound, or when the shock is being compressed and when it is returning to its full length. Air spring shocks typically have a chamber for damping, and a chamber for rebound. Adjusting these settings can be inconvenient for a user.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) The accompanying drawings, which are incorporated in and form a part of this specification, illustrate embodiments of the present technology and, together with the description, serve to explain the principles of the present technology.
(2) FIG. **1** shows a cross section view of an air spring shock in a first open mode.
(3) FIG. **2** shows a perspective view of the piston in a first open mode.
(4) FIG. **3** shows a front external perspective view of remote pulley and open mode adjuster in a first open mode.
(5) FIG. **4** shows a rear external perspective view of remote pulley and open mode adjuster in a

second open mode.
(6) FIG. **5** shows a perspective view of remote pulley.
(7) FIG. **6** shows a perspective view of open mode adjuster.
(8) FIG. **7** shows a perspective view of remote pulley, open mode adjuster, and the cam shafts coupled to each.
(9) FIG. **8** shows a cross section view of an air spring shock in a second open mode.
(10) FIG. **9** shows a perspective view of the piston in a second open mode.
(11) FIG. **10** shows a front external perspective view of remote pulley and open mode adjuster in a second open mode.
(12) FIG. **11** shows a cross section view of an air spring shock in a third open mode.
(13) FIG. **12** shows a perspective view of the piston in a third open mode.
(14) FIG. **13** shows a front external perspective view of remote pulley and open mode adjuster in a third open mode.
(15) FIG. **14** shows a cross section view of an air spring shock in a middle mode.
(16) FIG. **15** shows a perspective view of the piston in a middle mode.
(17) FIG. **16** shows a front external perspective view of remote pulley and open mode adjuster in a middle mode.
(18) FIG. **17** shows a cross section view of an air spring shock in a closed mode.
(19) FIG. **18** shows a perspective view of the piston in a closed mode.
(20) FIG. **19** shows a front external perspective view of remote pulley and open mode adjuster in a closed mode.
(21) FIG. **20** shows a close-up cross section view of the body cap end of the air spring shock in a second open mode.
(22) FIG. **21** shows an alternate close-up cross section view of the body cap end of an air spring shock in a second open mode.

DETAILED DESCRIPTION OF THE EMBODIMENTS

(23) The detailed description set forth below in connection with the appended drawings is intended as a description of various embodiments of the present invention and is not intended to represent the only embodiments in which the present invention is to be practiced. Each embodiment described in this disclosure is provided merely as an example or illustration of the present invention, and should not necessarily be construed as preferred or advantageous over other embodiments. In some instances, well known methods, procedures, and objects have not been described in detail as not to unnecessarily obscure aspects of the present disclosure.
(24) Shock absorbers (e.g., dampers) are used in numerous different vehicles and configurations to absorb some or all of a movement that is received at a first portion of a vehicle before it is transmitted to a second portion of the vehicle. For example, when a wheel hits a pothole, the encounter will cause an impact force on the wheel. However, by utilizing suspension components including one or more dampers, the impact force can be significantly reduced or even absorbed completely before it is transmitted to a person on a seat of the vehicle.
(25) Conventional damping components provide a constant damping rate during compression or extension through the entire length of the stroke. Other conventional damping components provide mechanisms for varying the damping rate. Further, in the world of bicycles, damping components are most prevalently mechanical. As various types of recreational and sporting vehicles continue to become more technologically advanced, what is needed in the art are improved techniques for varying the damping rate.
(26) Typical shock absorbers consist of at least a cylinder with an inner diameter, a rod movably disposed within the cylinder, and a main damping piston coupled to the rod. The main damping piston is configured to divide the cylinder into a compression chamber and a rebound chamber.
(27) Such shock absorbers may be monotube, or two concentric cylinders. The main damping piston may be vented or solid. Internal bypasses or external bypasses may also be present. Some

shock absorbers have an external reservoir with a bladder or floating piston.
(28) For additional detail and description of a shock absorber/damper, see, as an example, U.S. Pat. No. 10,576,803 the content of which is incorporated by reference herein, in its entirety. For additional detail and description of position-sensitive shock absorber/damper, see, as an example, U.S. Pat. No. 6,296,092 the content of which is incorporated by reference herein, in its entirety.
(29) Air spring shocks are another common type of shock, where an air chamber is utilized for rebound control instead of a coil over spring. For additional detail and description of air spring shock absorber/damper, see, as an example, U.S. Pat. No. 8,869,959 the content of which is incorporated by reference herein, in its entirety.
(30) It should be understood that while an air spring shock is shown in the example embodiments, other types of suspension systems (e.g., coil over), are able to utilize the embodiments described herein. It should be understood that within the detailed description, relative terms such as “top”, “left”, “right”, “lower”, etc., are used for the sake of clarity and are not intended to be limiting features.
(31) Some embodiments have the benefit of allowing a shock absorber to have both a remote adjustment feature, as well as a pre positionable adjustment feature. In some embodiments, the unique features include the remote adjustment feature being able to affect the pre positionable adjustment feature, without the reverse being true. This allows for a user to have a broader range of adjustments they can make, as well as have remote access to the bigger adjustments while riding a bike or vehicle.
(32) Previous inventions struggled to combine remote adjustment features and pre positionable adjustment features into a single mechanism, especially in a simple and intuitive manner that some embodiments achieve.
(33) Another draw back of previous inventions was the complexity of their designs, as well as some aspects such as adjustments in one direction being more difficult to make than in the other (for example, it would be harder for a user to make the damping stiffer than it would be to make it softer).
(34) FIG. **1** shows a cross section view of an air spring shock **100** in a first open mode. Also included are remote pulley **102**, open mode adjuster **104**, compression cam shaft **106**, compression cam surface **108**, compression needle **110**, adjuster spring **112**, shim **114**, piston **116**, main port **118**, central port **120**, pin **122**, pulley shaft **126**, air spring cam shaft **128**, air spring cam surface **130**, air spring needle **132**, torsional spring **134**, and spring retainer **136**.
(35) In some embodiments, air spring shock is comprised of a damping cylinder **172** and an air spring cylinder **174**, where the damping cylinder **172** assists with damping and the air spring cylinder **174** assists with rebound. Within the damping cylinder **172** the piston **116** (sometimes referred to as main damping piston) is configured for operation and divides the damping cylinder **172** into a compression chamber **176** and a rebound chamber **178**. Furthermore, in this embodiment an internal floating piston (IFP) **180** divides the compression chamber **176** from the gas chamber **182**. The pressure within gas chamber **182** will affect the dampening rate of air spring shock **100**.
(36) In some embodiments, damping cylinder **172** telescopically compresses within the air spring cylinder **174**. In some embodiments, rod **184** extends through the air spring cylinder and part way into the damping cylinder such that when compression occurs rod **184** holds piston **116** in place as the damping cylinder **172** moves. In some embodiments, rod **184** is coupled to piston **116** on one end, and is coupled to body cap **160** on the other end. In some embodiments, rod **184** is hollow, such that compression needle **110** is located within rod **184**.
(37) As the shock **100** is compressed, the damping chamber **176** will decrease in volume and the rebound chamber **178** increases in volume as the working fluid within the damping chamber **176** flows into rebound chamber **178**. In some embodiments, compression shim stack **186** is used to manage fluid flow during a compression stroke and prevent flow during a rebound stroke. Similarly, rebound shim stack **190** is used to manage fluid flow during a rebound stroke and

prevent flow during a compression stroke.
(38) It should be understood that in some embodiments the remote pulley **102** may be in an open mode, a middle mode, or a closed mode, while in some embodiments, the position of the open mode adjuster **104** are referred to as a first mode, a second mode, and a third mode. For the sake of clarity and brevity, the combinations of the positions of the remote pulley **102** and the open mode adjuster **104** are referred to as: first open mode, second open mode, third open mode, middle mode, and closed mode. While these are the available modes shown in the figured embodiments, it should be understood that more or fewer modes may be utilized in some embodiments. Further, it should be understood that while the figured embodiments do not have multiple middle and closed mode combinations (unlike the open mode), some embodiments allow for similar combinations of the middle and closed modes.
(39) In some embodiments, a first open mode would be ideal for a smooth downhill terrain, where a user might want more compression damping or to reduce pedal bob. In some embodiments, the third open mode would be more ideal for rough terrain where a user still wants more damping than the middle and closed positions offer.
(40) In some embodiments, remote pulley **102** is used to make coarse adjustments to the damping of the air spring shock **100** (e.g., open, middle, and closed mode), while open mode adjuster **104** is used to make finer adjustments while the shock **100** is in an open mode (e.g., first, second, and third open mode). In some embodiments, the open mode adjuster **104** allows for compression setting adjustments to be made without affecting the settings of the remote pulley **102**.
(41) In some embodiments, open mode adjuster **104** is manually rotated to change the setting it is on. In some embodiments, open mode adjuster **104** has at least two settings. In the figured embodiments, open mode adjuster has three different possible settings. In some embodiments, open mode adjuster **104** is manually adjusted by a user pushing open mode adjuster **104** away from remote pulley **102** and rotating the open mode adjuster **104** to a new position, while the position of remote pulley **102** is unchanged due to open mode adjuster **104** disengaging. In some embodiments, adjuster spring **112** keeps the open mode adjuster **104** biased in a position against the remote pulley **102**.
(42) In some embodiments, open mode adjuster is coupled to the compression cam shaft **106**. As the compression cam shaft **106** is rotated with open mode adjuster **104**, compression cam surface **108** will push against compression needle **110**. In some embodiments, compression cam surface **108** has an inconsistent diameter such that the position of compression needle **110** will vary as the compression cam shaft **106** is rotated. The diameter of compression cam surface **108** can also be seen in at least FIG. **7**. In some embodiments, the profile of the compression needle **110** acts to change the fluid flow allowed through the central port **120** with the movement of the compression needle. In some embodiments, the position of the compression needle is determined by the position of the compression cam shaft. In some embodiments, central port **120** allows fluid flow through piston **116**. Similar to the main ports **118**, central port **120** is also closed off from fluid flow when shim **114** is fully closed.
(43) In some embodiments, compression needle **110** is coupled to shim **114**. Shim **114** alters the flow through the main ports **118** of piston **116** (sometimes referred to as main damping piston **114**). As the open mode adjuster **104** is switched between settings, leading to movement of the compression needle **110**, the distance between shim **114** and piston **116** will change. In some embodiments, the change in distance from the open mode adjuster **104** settings is small as the open mode adjuster **104** is for fine tuning. In some embodiments, none of the open mode adjuster settings will result in the shim **114** closing the main ports **118** of piston **116**. Main ports **118** can be seen more clearly in at least FIG. **2**. In some embodiments, shim **114** is fit to open or close a main port in a piston
(44) In some embodiments, movement of compression needle **110** will also restrict fluid flow through central port **120** due to a variance of the diameter of compression needle **110**.

(45) FIG. **2** shows a perspective view of the piston **116** in a first open mode. In some embodiments, such as that shown in at least FIG. **2**, main ports **118** are not circular and shim **114** is of an appropriate shape to cover main ports **118** and not the blow off valves **224**. In some embodiments the main ports **118** are of a shape similar to a kidney bean. In some embodiments, pin **122** is used to keep shim **114** from becoming misaligned with main ports **118**. In some embodiments, shim **114** is a tri load plate.

(46) In some embodiments, blow off valves **224** are not covered by shim **114**, and allow for fluid flow during a compression stroke even when shim **114** is in a closed position. In some embodiments, blow off valves **224** are located closer to the center of the piston **116** than the main ports **118**. In some embodiments, main ports **118** allow for a greater flow volume than the blow off valves **224**.

(47) Returning to FIG. **1**, remote pully **102** is operated remotely, for example by a lever on the handlebar of a bike. In some embodiments, the remote pully **102** is actuated by mechanisms such as a solenoid, a motor, or an electronic system, however it should be understood that the actuation method is not a limiting factor and that other systems may be utilized. In some embodiments, the rotation of remote pulley **102** causes open mode adjuster **104** to be rotated.

(48) In some embodiments, remote pulley **102** controls coarse adjustments to the damping of the air spring shock **100**. In some embodiments, remote pulley has three setting options of open, middle, and closed. At least FIG. **14** and FIG. **17** illustrate the middle and closed positions respectively.

(49) In some embodiments, pulley shaft **126** is coupled to remote pulley at a first end, and pulley shaft **126** is unaffected by the rotation of open mode adjuster **104**. Pulley shaft **126** is also coupled to the air spring cam shaft **128** at a second end, such that the rotation of pulley shaft **126** will rotate the air spring cam shaft **128**. With the rotation of air spring cam shaft **128**, air spring cam surface **130** will press against air spring needle **132** to alter the position of air spring needle **132**. In some embodiments, the position of the air spring needle **132** is determined by the position of the air spring cam shaft **128**.

(50) Torsional spring **134** is used to bias air spring cam shaft **128** to an open or closed position depending on the settings when installed. Torsional spring **134** is held in place between the air spring cam surface **130** and spring retainer **136**. As remote pulley **102** is rotated, torsional spring **134** is either wound or unwound depending on the direction rotated.

(51) Adjustments to the air spring via the remote pulley **102** will be discussed in further detail with FIG. **14** and FIG. **17**.

(52) FIG. **3** shows a front external perspective view of remote pulley **102** and open mode adjuster **104** in a first open mode.

(53) FIG. **4** shows a rear external perspective view of remote pulley **102** and open mode adjuster **104** in a second open mode. From this view, open mode adjuster **104** can be seen to fit into one of several slots **438** on remote pulley **102**.

(54) FIG. **5** shows a perspective view of remote pulley **102**. In this view, slots **438** can be better seen as well as the recess which the open mode adjuster **104** conforms to.

(55) FIG. **6** shows a perspective view of open mode adjuster **104**. Here, indicator **640** can be clearly seen. In some embodiments, indicator **640** aligns with the slots **438** of the remote pulley **102**, as well as indicate to a user which setting the open mode adjuster **104** is currently in.

(56) FIG. **7** shows a perspective view of remote pulley **102**, open mode adjuster **104**, and the cam shafts coupled to each. More specifically, compression cam shaft **106** along with compression cam surface **108** are coupled to the open mode adjuster **104**, while pulley shaft **126**, air spring cam shaft **128**, air spring cam surface **130**, and spring retainer **136** are coupled to the remote pulley **102**.

(57) FIG. **8** shows a cross section view of an air spring shock **100** in a second open mode. Here, the open mode adjuster is in the second position (when compared to at least FIG. **1**), and the compression needle **110** and shim **114** are seen to be slightly further to the right (when compared to

at least FIG. **1**).
(58) FIG. **9** shows a perspective view of the piston **116** in a second open mode. Here, shim **114** can be seen to be closer to the piston **116** when compared to at least FIG. **2**.
(59) FIG. **10** shows a front external perspective view of remote pulley **102** and open mode adjuster **104** in a second open mode.
(60) In some embodiments, rotation of the open mode adjuster **104** to a second open mode results in decreasing the distance between shim **114** and piston **116** as well as narrowing the fluid flow path in the central port **120**. These changes result in increasing the damping of the air spring shock **100** when compared to the first open mode shown in at least FIG. **1**.
(61) FIG. **11** shows a cross section view of an air spring shock **100** in a third open mode. Here, the open mode adjuster is in the third position (when compared to at least FIG. **1**), and the compression needle **110** and shim **114** are seen to be slightly further to the right (when compared to at least FIG. **8**).
(62) FIG. **12** shows a perspective view of the piston **116** in a third open mode. Here, shim **114** can be seen to be closer to the piston **116** when compared to at least FIG. **9**.
(63) FIG. **13** shows a front external perspective view of remote pulley **102** and open mode adjuster **104** in a third open mode.
(64) In some embodiments, rotation of the open mode adjuster **104** to a third open mode results in further decreasing the distance between shim **114** and piston **116** as well as narrowing the fluid flow path in the central port **120**. These changes result in increasing the damping of the air spring shock **100** when compared to the first and second open mode shown in at least FIG. **1** and FIG. **8**.
(65) FIG. **14** shows a cross section view of an air spring shock **100** in a middle mode. Also included are the primary chamber **1442**, auxiliary chamber **1444**, air valve **1446**, spacer **1448**, air spring shim **1452**, and ports **1454**.
(66) In some embodiments, middle mode is an adjustment made through the remote pulley **102**. In some embodiments, compression needle **110** and shim **114** are moved farther to the right than any of the open mode settings to where flow through piston **116** and central port **120** is accordingly more restricted. In some embodiments, the variable profile of compression needle **110** within the central port **120** is what allows the fluid flow rate to vary.
(67) In some embodiments, remote pulley **102** is able to affect the compression damping due to the open mode adjuster **104** being rotated along with the remote pulley **102** as it is keyed into slots **438**. In some embodiments, when the open mode adjuster **104** is adjusted independently of the remote pulley **102** the rotation angles between settings is considered small (for example, 15-degree increments). However, when the remote pulley is adjusted the rotation angles between settings is comparatively large (for example, 60-degree increments). Because of this, the compression cam shaft **106** will also have a larger rotation angle when the remote pulley **102** is used, and in turn the compression needle **110** will move a larger distance than when the open mode adjuster **104** is used. In some embodiments, changing the setting the open mode adjuster is in while the remote pulley is in a middle or closed mode will not noticeably affect the position of the compression needle **110**. In other words, in some embodiments the adjustment of the open mode adjuster is only effective during one of the settings of the remote pulley. In such embodiments, the open mode adjuster **104** will not noticeably affect the position of compression needle **110** due to the influence of the remote pulley **102** position being much larger than the influence of the open mode adjuster.
(68) In some embodiments, the remote pulley **102** also makes adjustments to the rebound rate of the air spring. In some embodiments, the air spring is comprised of the primary chamber **1442** and the auxiliary chamber **1444**. Air valve **1446** separates the primary chamber **1442** and the auxiliary chamber **1444**. In some embodiments, spacer **1448** is used to adjust the volume of the auxiliary chamber **1444**.
(69) In some embodiments, remote pulley **102** is coupled to pulley shaft **126**, which in turn is coupled to air spring cam shaft **128**. Air spring cam surface **130** is used to influence the position of

the air spring needle **132**. Similar to compression needle **110**, air spring needle **132** is coupled to an air spring shim **1452** that is used to control air flow through ports **1454** in air valve **1446**.

(70) In some embodiments, the ports in air valve **1446** are unobstructed by air spring shim **1452**, but in both middle mode and closed mode (as seen in at least FIG. **17**), the ports in air valve **1446** are closed by shim **1452**. In some embodiments, there are more settings where the ports **1454** remain open. In some embodiments, the air spring shim **1452** is used to close off an auxiliary chamber **1444** from a primary chamber **1442**.

(71) When ports **1454** are closed, the primary chamber **1442** volume is completely separate from the auxiliary chamber **1444** volume. During this time, the primary chamber **1442** will have a greatly reduced volume than when fluidly connected to the auxiliary chamber **1444** but the pressure within the primary chamber **1442** is unchanged. Opening the ports **1454** will allow the primary chamber **1442** to regain a maximum volume, and will still remain at a constant pressure.

(72) In some embodiments, if the shock is pressurized, then the auxiliary chamber **1444** will be pressurized too. In some embodiments, the pressure within the primary and auxiliary chambers **1442**, **1444** can be adjusted through a valve (shown in at least FIG. **16**, valve **1658**). In some embodiments, valve **1658** is connected to auxiliary chamber **1444**. It should be understood that the opening of valve **1658** into the auxiliary chamber **1444** is present in this embodiment, but is on a different plane than the cross section view shows.

(73) FIG. **15** shows a perspective view of the piston **116** in a middle mode. Here, shim **114** can be seen to be closer to the piston **116** when compared to at least FIG. **12**.

(74) FIG. **16** shows a front external perspective view of remote pulley **102** and open mode adjuster **104** in a middle mode. In some embodiments, the movement of remote pulley **102** does not affect the position of the open mode adjuster **104** relative to the remote pulley **102**. In other words, if the open mode adjuster **104** is keyed into the second slot of the remote pulley **102** then the open mode adjuster **104** will remain in the second slot despite rotational movement of the remote pulley **102**.

(75) FIG. **17** shows a cross section view of an air spring shock **100** in a closed mode. In some embodiments, closed mode entails both the main ports **118** of the piston **116** and the ports **1454** of air valve **1446** being closed off by their respective shims. Also included are ledge **1756**, and stopper **1750**.

(76) In some embodiments, compression cam surface is shaped in such a way that it is disengaged from compression needle **110** during the closed mode setting. This disengagement allows for assurance that the compression cam surface is not causing a gap to prevent the shims **114** from completely sealing the main ports **118**. In some embodiments, compression needle **110** is biased towards a closed position. In some embodiments, a spring is used to bias compression needle **110**. In some embodiments, geometry is used to retain compression needle **110** to a specific range of movement.

(77) In some embodiments, in order to limit the distance over which remote pulley **102** can be rotated stopper **1750** is placed such that a ledge **1756** will come into contact with stopper **1750** at the extremities of allowed rotation. Ledge **1756** acts to limit the rotational movement of the pulley shaft and the remote pulley.

(78) FIG. **18** shows a perspective view of the piston **116** in a closed mode. Here, shim **114** is fully closed to obstruct fluid flow through the main ports **118** during a compression stroke. Shims **114** will still bend during a rebound stroke to allow fluid to flow through main ports **118**. Blow off valves **224** are still open to allow limited fluid flow during a compression stroke.

(79) FIG. **19** shows a front external perspective view of remote pulley **102** and open mode adjuster **104** in a closed mode.

(80) FIG. **20** shows a close-up cross section view of the body cap **2060** end of the air spring shock **100** in a second open mode. Also included are body cap **2060**, wave spring **2062**, rebound adjuster **2064**, rebound screws **2066**, and pulley screw **2068**.

(81) In some embodiments, wave spring **2062** is used to bias air spring shim **1452** towards a closed

position during assembly. In some embodiments, air spring shim **1452** is held against the air spring needle **132** via fluid pressure after assembly is complete (in other words during operation). In some embodiments, at least the primary chamber **1442** and the auxiliary chamber **1444** are filled with a gas such as air, nitrogen, or other suitable gases. In some embodiments, pulley screw **1066** is used to couple the remote pulley **102** and the pulley shaft **126**. In some embodiments, pulley shaft **126** is contoured where it meets with the air spring cam shaft **128** such that the rotation of pulley shaft **126** also rotates the air spring cam shaft **128**.
(82) In some embodiments, rebound adjuster **2064** and rebound screws **2066** are used to control rebound settings. in some embodiments, the rebound adjustment is independent of the settings controlled by remote pulley **102** and open mode adjuster **104**.
(83) FIG. **21** shows an alternate close-up cross section view of the body cap **2160** end of an air spring shock in a second open mode.
(84) In this embodiment, stopper **1750** is not present to limit the rotational freedom of the pulley shaft **2126** and remote pulley **2102**. Instead, hard stop **2170** is formed in body cap **2160** and acts directly against the remote pulley **2102**. Also in this embodiment, air spring cam shaft **2128** is extended to compensate for the lack of a stopper feature on pulley shaft **2126**.
(85) It should be understood that while a needle and its surrounding architecture is not shown in FIG. **21**, this is for the sake of simplicity and such features are still included in this embodiment.
(86) The foregoing Description of Embodiments is not intended to be exhaustive or to limit the embodiments to the precise form described. Instead, example embodiments in this Description of Embodiments have been presented in order to enable persons of skill in the art to make and use embodiments of the described subject matter. Moreover, various embodiments have been described in various combinations. However, any two or more embodiments can be combined. Although some embodiments have been described in a language specific to structural features and/or methodological acts, it is to be understood that the subject matter defined in the appended claims is not necessarily limited to the specific features or acts described above. Rather, the specific features and acts described above are disclosed by way of illustration and as example forms of implementing the claims and their equivalents.

Claims

1. A shock adjuster comprising: a remote pulley; a pulley shaft, wherein the pulley shaft is coupled to the remote pulley at a first end, wherein the pulley shaft is coupled to an air spring cam shaft at a second end; an air spring needle, wherein the position of the air spring needle is determined by the position of the air spring cam shaft, wherein an air spring shim is engageable with the air spring needle; an open mode adjuster; a compression cam shaft, wherein the compression cam shaft is coupled to the open mode adjuster; a compression needle, wherein the position of the compression needle is determined by the position of the compression cam shaft; and a shim, wherein the shim is coupled to the compression needle, wherein the shim is fit to open or close at least a main port in a piston.
2. The shock adjuster of claim 1 wherein, the open mode adjuster allows for compression setting adjustments to be made without affecting the settings of the remote pulley.
3. The shock adjuster of claim 1 wherein, changing the setting of the remote pulley also moves the open mode adjuster.
4. The shock adjuster of claim 1 wherein, the pulley shaft has a ledge that acts to limit the rotational movement of the pulley shaft and the remote pulley.
5. The shock adjuster of claim 1 wherein, the shim is of an appropriate shape to cover the main ports and not a blow off valve.
6. The shock adjuster of claim 1 wherein, the profile of the compression needle acts to change the fluid flow allowed through a central port with the movement of the compression needle.

7. The shock adjuster of claim 1 wherein, fluid pressure is used to bias the air spring shim towards a closed position.
8. The shock adjuster of claim 1 wherein, the air spring shim is used to close off an auxiliary chamber from a primary chamber.
9. The shock adjuster of claim 1 wherein, the adjustment of the open mode adjuster is only effective during one of the settings of the remote pulley.
10. The shock adjuster of claim 1 wherein, the remote pulley is actuated remotely.
11. The shock adjuster of claim 1 wherein, the open mode adjuster is manually operated.
12. A shock adjuster comprising: a remote pulley; a pulley shaft, wherein the pulley shaft is coupled to the remote pulley at a first end, wherein the pulley shaft is coupled to an air spring cam shaft at a second end; an air spring needle, wherein the position of the air spring needle is determined by the position of the air spring cam shaft, wherein an air spring shim is engageable with the air spring needle; an open mode adjuster, wherein the open mode adjuster allows for compression setting adjustments to be made without affecting the settings of the remote pulley, wherein changing the setting of the remote pulley also moves the open mode adjuster; a compression cam shaft, wherein the compression cam shaft is coupled to the open mode adjuster; a compression needle, wherein the position of the compression needle is determined by the position of the compression cam shaft; and a shim, wherein the shim is coupled to the compression needle, wherein the shim is fit to open or close at least a main port in a piston.
13. The shock adjuster of claim 12 wherein, the pulley shaft has a ledge that acts to limit the rotational movement of the pulley shaft and the remote pulley.
14. The shock adjuster of claim 12 wherein, the shim is of an appropriate shape to cover the main ports and not a blow off valve.
15. The shock adjuster of claim 12 wherein, the profile of the compression needle acts to change the fluid flow allowed through a central port with the movement of the compression needle.
16. The shock adjuster of claim 12 wherein, fluid pressure is used to bias the air spring shim towards a closed position.
17. The shock adjuster of claim 12 wherein, the air spring shim is used to close off an auxiliary chamber from a primary chamber.
18. The shock adjuster of claim 12 wherein, the adjustment of the open mode adjuster is only effective during one of the settings of the remote pulley.
19. A shock absorber comprising: a damping cylinder, the cylinder telescopically coupled with an air spring cylinder; a rod, wherein the rod extends through the air spring cylinder and part way into the damping cylinder, wherein the rod is hollow; a main damping piston, the main damping piston coupled to the rod and configured for operation within the damping cylinder, the main damping piston configured to divide the damping cylinder into a compression chamber and a rebound chamber; and a shock adjuster, the shock adjuster comprising: a remote pulley; a pulley shaft, wherein the pulley shaft is coupled to the remote pulley at a first end, wherein the pulley shaft is coupled to an air spring cam shaft at a second end; an air spring needle, wherein the position of the air spring needle is determined by the position of the air spring cam shaft, wherein an air spring shim is engageable with the air spring needle; an open mode adjuster; a compression cam shaft, wherein the compression cam shaft is coupled to the open mode adjuster; a compression needle, wherein the position of the compression needle is determined by the position of the compression cam shaft, wherein the compression needle is in the center of the rod; and a shim, wherein the shim is coupled to the compression needle, wherein the shim is fit to open or close at least a main port in the main damping piston.
20. The shock absorber of claim 19 wherein, the open mode adjuster allows for compression setting adjustments to be made without affecting the settings of the remote pulley.