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Integrated damper ride height system

Abstract

An integrated ride height system is provided wherein the system is configured couple to a vehicle. The system includes a coilover shock absorber and a hydraulic preload cylinder coupled to a shock body of the coilover shock absorber. The hydraulic preload cylinder engages an end of a coil spring of the coilover shock absorber. The system includes a reservoir coupled to the shock absorber allowing hydraulic fluid to flow between the reservoir and the coilover shock absorber. The system includes a reversible pump coupled between the hydraulic preload cylinder and the reservoir, wherein the pump operates to pump hydraulic fluid from the reservoir to the hydraulic preload cylinder to extend the hydraulic preload cylinder to increase ride height of the vehicle and operates to pump hydraulic fluid from the hydraulic preload cylinder to the reservoir to retract the hydraulic preload cylinder to decrease ride height of the vehicle.

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Background/Summary

BACKGROUND OF THE INVENTION

Technical Field

(1) This invention relates generally to a ride height system and more particularly to an integrated ride height system.

State of the Art

(2) In operation of a vehicle, adjusting ride height can be desirable for vehicle performance, payload adjustment, and ground clearance. Conventional systems typically use external pump systems. These external pumps require additional valve control manifolds and long hydraulic hose lines that can be complex and costly to implement. There does not exist a fully integrated system to adjust ride height of a vehicle.

(3) Accordingly, there is a need for an integrated ride height system that is a fully integrated system that includes a pump mounted to the shock to move a hydraulic preload cylinder to adjust ride height.

SUMMARY OF THE INVENTION

(4) An embodiment includes an integrated ride height system configured couple to a vehicle, the system comprising: a coilover shock absorber; a hydraulic preload cylinder coupled to a shock body of the coilover shock absorber, wherein the hydraulic preload cylinder engages an end of a coil spring of the coilover shock absorber; a reservoir coupled to the shock absorber allowing hydraulic fluid to flow between the reservoir and the coilover shock absorber; and a reversible pump coupled between the hydraulic preload cylinder and the reservoir, wherein the pump operates to pump hydraulic fluid from the reservoir to the hydraulic preload cylinder to extend the hydraulic preload cylinder to increase ride height of the vehicle and operates to pump hydraulic fluid from the hydraulic preload cylinder to the reservoir to retract the hydraulic preload cylinder to decrease

ride height of the vehicle.
(5) Another embodiment includes a method of using an integrated ride height system, the method comprising: coupling an integrated ride height system to a vehicle, the system comprising: a coilover shock absorber; a hydraulic preload cylinder coupled to a shock body of the coilover shock absorber, wherein the hydraulic preload cylinder engages an end of a coil spring of the coilover shock absorber; a reservoir coupled to the shock absorber allowing hydraulic fluid to flow between the reservoir and the coilover shock absorber; and a reversible pump coupled between the hydraulic preload cylinder and the reservoir; activating the reversible pump in a first direction to pump hydraulic fluid from the reservoir to the hydraulic preload cylinder to increase ride height of the vehicle; and activating the reversible pump in a second direction to pump hydraulic fluid from the hydraulic preload cylinder to the reservoir to decrease ride height of the vehicle.
(6) The foregoing and other features and advantages of the present invention will be apparent from the following more detailed description of the particular embodiments of the invention, as illustrated in the accompanying drawings.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) A more complete understanding of the present invention may be derived by referring to the detailed description and claims when considered in connection with the Figures, wherein like reference numbers refer to similar items throughout the Figures, and:
(2) FIG. **1** is a diagrammatic view of an integrated ride height system according to an embodiment;
(3) FIG. **2** is a diagrammatic view of an integrated ride height system with an optional base valve according to an embodiment;
(4) FIG. **3** is a diagrammatic view of an integrated ride height system with an optional hydraulic manifold according to an embodiment;
(5) FIG. **4** is a diagrammatic view of an integrated ride height system with an optional position sensor, control module and so forth according to an embodiment; and
(6) FIG. **5** is a diagrammatic view of an integrated ride height system with an options base valve, hydraulic manifold, position sensor, control module and so forth according to an embodiment.
DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION
(7) As discussed above, embodiments of the present invention relate to an integrated ride height system that is a fully integrated system that includes a pump mounted to the shock to move a hydraulic preload cylinder to adjust ride height.
(8) Referring to FIG. **1**, an embodiment of an integrated ride height system **10** comprising a coilover shock absorber **12**, a hydraulic preload cylinder **20** coupled to the shock absorber **12**, a reservoir **30** coupled to the shock absorber **12**, and a pump **24** coupled between the reservoir **30** and the hydraulic preload cylinder **20**. The coilover shock absorber **12** comprises a shock body **14**, a piston **15** coupled to a piston shaft **16** and operable within the shock body **14** and a coil spring **18** operatively coupled around the shock body **14**. The hydraulic preload cylinder **20** further comprises a preload body **22** and a cylinder member **23** operatively coupled within the preload body **22**. The hydraulic preload cylinder **20** may be coaxial with the shock body **12** and coupled around the shock body **12**, with an end of cylinder member **23** engaging an end of the coil spring **18**. The reservoir **30** may be coupled to the shock absorber **12** in a conventional manner allowing the flow of hydraulic fluid between the shock body **14** and the reservoir **30** during operation of the shock absorber **12** while a vehicle (not shown) operates with the shock absorber **12** coupled thereto. The pump **24** may be coupled between the reservoir **30** and the hydraulic preload body **22** of the hydraulic preload cylinder **20**. The system **10** requires no additional valves, hoses, check systems, and so forth.

(9) The integrated ride height system **10** operates to adjust the ride height of the vehicle to which the system **10** is coupled. In embodiments, the pump **24** is a bidirectional pump or a reversible pump. To increase the ride height of the vehicle, the pump **24** operates in a first direction to pump hydraulic fluid from the reservoir **30** to the hydraulic preload body **22** that extends the hydraulic preload cylinder **20** out of the preload body **22** (extended position), wherein the preload cylinder **20** engaging the coil spring **18** increases preloading of the coil spring **18** and thereby increase the ride height of the vehicle. To decrease the ride height of the vehicle, the pump **24** operates in a second direction to pump hydraulic fluid from the hydraulic preload body **22** to the reservoir **30** to retract the hydraulic preload cylinder **20** into the preload body **22** (retracted position), wherein the preload cylinder **20** engaging the coil spring **18** reduces the preloading and reduces the ride height of the vehicle. It is understood that in operation, multiple integrate ride height systems **10** may be employed for each wheel of the vehicle.
(10) Referring further to the drawings, FIG. **2** depicts an integrated ride height system **10** as described with regard to FIG. **1** above and further comprises an optional base valve **40**. The base valve **40** may be coupled between the shock body **14** and the reservoir **30** and operates as a typical base valve to control pressure build up and operate a pressure relief for the shock absorber **12** during operation.
(11) Referring further to FIG. **3**, depicted is an integrated ride height system **10** as described with regard to FIG. **1** above and further comprising an optional hydraulic manifold **42**. The hydraulic manifold **42** may be coupled between the preload body **22** and the pump **24**, with an additional fluid coupling from the hydraulic manifold **42** to the reservoir **30** that bypasses the pump **24**. In operation, the hydraulic manifold **42** may comprise valving to rapidly dump pressure from the preload body **22** that bypasses the reversible pump **24** and flows hydraulic fluid directly from the preload body **22**, through the hydraulic manifold **42** and into the reservoir **30**. The valving of the hydraulic manifold **42** further allows for operation of the pump **24** to pump hydraulic fluid between the reservoir **30** and the preload body **22** through the hydraulic manifold in order to the increase and decrease the ride height of the vehicle.
(12) Referring additionally to FIG. **4**, depicted is an integrated ride height system **10** as described with regard to FIG. **1** above and further comprising an optional position sensor **44**. The position sensor **44** may be coupled to the pump **24**, wherein the position sensor **44** may determine a ride height of the vehicle and the pump **24** automatically operates to adjust the ride height based on input from the position sensor **44**. In embodiments, an optional control module **46** may be coupled to the position sensor **44** and the pump **24**, wherein the control module **46** operates to control pump **24** based on input from the position sensor **44**. An option battery **48** may be incorporated to power the control module **46** or to provide back-up power to the control module **46**. Additional components may be included as indicated in box **50** with optional external power, communications (including wireless communications), control systems, sensor feedback, etc.
(13) Another embodiment includes a method of using an integrated ride height system **10**. The method comprises coupling an integrated ride height system **10** to a vehicle; activating the reversible pump in a first direction to pump hydraulic fluid from the reservoir to the hydraulic preload cylinder to increase ride height of the vehicle; and activating the reversible pump in a second direction to pump hydraulic fluid from the hydraulic preload cylinder to the reservoir to decrease ride height of the vehicle.
(14) The embodiments and examples set forth herein were presented in order to best explain the present invention and its practical application and to thereby enable those of ordinary skill in the art to make and use the invention. However, those of ordinary skill in the art will recognize that the foregoing description and examples have been presented for the purposes of illustration and example only. The description as set forth is not intended to be exhaustive or to limit the invention to the precise form disclosed. Many modifications and variations are possible in light of the teachings above without departing from the spirit and scope of the forthcoming claims.

Claims

1. An integrated ride height system configured couple to a vehicle, the system comprising: a coilover shock absorber; a hydraulic preload cylinder coupled to a shock body of the coilover shock absorber, wherein the hydraulic preload cylinder engages an end of a coil spring of the coilover shock absorber; a reservoir coupled to the shock absorber allowing hydraulic fluid to flow between the reservoir and the coilover shock absorber; and a reversible pump coupled between the hydraulic preload cylinder and the reservoir, wherein the pump operates to pump hydraulic fluid from the reservoir to the hydraulic preload cylinder to extend the hydraulic preload cylinder to increase ride height of the vehicle and operates to pump hydraulic fluid from the hydraulic preload cylinder to the reservoir to retract the hydraulic preload cylinder to decrease ride height of the vehicle.
2. The system of claim 1, wherein the coilover shock absorber comprises the shock body, a piston coupled to a piston shaft and operable within the shock body, and the coil spring operatively coupled around the shock body.
3. The system of claim 1, wherein the hydraulic preload cylinder comprises a preload body and a cylinder member operatively coupled within the preload body.
4. The system of claim 3, wherein the hydraulic preload cylinder is coaxial with and coupled around the shock body with an end of cylinder member engaging the end of the coil spring.
5. The system of claim 1, further comprising a base valve coupled between the shock body and the reservoir.
6. The system of claim 1, further comprising a hydraulic manifold coupled between the preload body and the pump, and an additional fluid coupling extending from the hydraulic manifold to the reservoir that bypasses the pump.
7. The system of claim 6, wherein the hydraulic manifold comprises valving to rapidly dump pressure from the preload body that bypasses the pump and flows hydraulic fluid directly from the preload body through the hydraulic manifold and into the reservoir.
8. The system of claim 1, further comprising a position sensor coupled to the pump and a control module coupled to the position sensor and the pump, wherein the control module operates to automatically control the pump based on input from the position sensor.
9. A method of using an integrated ride height system, the method comprising: coupling an integrated ride height system to a vehicle, the system comprising: a coilover shock absorber; a hydraulic preload cylinder coupled to a shock body of the coilover shock absorber, wherein the hydraulic preload cylinder engages an end of a coil spring of the coilover shock absorber; a reservoir coupled to the shock absorber allowing hydraulic fluid to flow between the reservoir and the coilover shock absorber; and a reversible pump coupled between the hydraulic preload cylinder and the reservoir; activating the reversible pump in a first direction to pump hydraulic fluid from the reservoir to the hydraulic preload cylinder to increase ride height of the vehicle; and activating the reversible pump in a second direction to pump hydraulic fluid from the hydraulic preload cylinder to the reservoir to decrease ride height of the vehicle.
10. The method of claim 9, wherein the hydraulic preload cylinder comprises a preload body and a cylinder member operatively coupled within the preload body.
11. The method of claim 10, wherein the hydraulic preload cylinder is coaxial with and coupled around the shock body with an end of cylinder member engaging the end of the coil spring.
12. The method of claim 11, wherein activating the reversible pump in the first direction to pump hydraulic fluid from the reservoir to the hydraulic preload cylinder to increase ride height of the vehicle comprises pumping hydraulic fluid into the preload body and extending the cylinder member out of the preload body to increase preload of the coil spring.
13. The method of claim 11, activating the reversible pump in a second direction to pump hydraulic

fluid from the hydraulic preload cylinder to the reservoir to decrease ride height of the vehicle comprises pumping hydraulic fluid from the preload body to the reservoir and retracting the cylinder member into the preload body to decrease preload of the coil spring.