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				Utility Model H1-113644 (JP, U)
			(56) Citations	Utility Model S60-24688 (JP, U)

(54) Title of the Device: Hydraulic Shock Absorber Damping Force Adjustment Mechanism

(57) Scope of Claims of the Utility Model

[Claim 1] A hydraulic shock absorber damping force adjustment mechanism for adjusting compression-side damping force and extension-side damping force by coaxially inserting two adjusting rods into a hollow rod attached to a piston in contact with the inner circumferential surface of a cylinder and sliding each of these adjustment rods in the axial direction, wherein a single slider is provided, movable in the radial direction and driven by a single motor at the back end of each adjustment rod, and two sloped surfaces of differing angles are formed on this slider, with the back end of one of the adjustment rods contacting one of the sloped surfaces, and the back end of the other adjustment rod contacting the other sloped surface, such that the amount of displacement of the two adjustment rods differs according to the rotation of the motor.

[Claim 2] The hydraulic shock absorber damping force adjustment mechanism of Claim 1, wherein one of the adjustment rods adjusts the surface area of a hollow rod bypass oil passage opening using a needle portion furnished at the tip [thereof], and the other adjustment rod adjusts the blow[out] load of a pressure-side valve disposed in an oil passage within a piston at the tip portion; whereby of the two slider sloped surfaces, one of the adjustment rod back end portions contacts the more gently sloped surface [thereof] than does the other adjustment rod back end portion.

[Detailed Description of the Device]

(Industrial Field of Application)

The present device pertains to a damping force adjustment mechanism for adjusting the damping force of a hydraulic shock absorber.

(Prior Art)

In a hydraulic shock absorber used in a vehicle rear damper such as that described in Unexamined Patent Application H1-113644, for example, an adjuster is provided, whereby a piston sliding on the inner circumferential surface of a cylinder is installed on the end of a hollow rod inserted into [a] cylinder on the inner circumferential surface of which the piston slides; a compression-side oil passage and an extension-side oil passage are formed in this piston; a valve is provided to open and close these compression-side and extension-side oil passages, and a valve pressing member contacting the rear surface of the compression-side valve and a spring seat are [each] installed on [the] piston so as to be movable up or down; a spring is interposed between this valve pushing member and a spring seat; a push pipe is also retractably inserted into the hollow rod, and a push rod, at the tip of which a needle is formed, is retractably inserted into the interior of this push pipe; the tip portion of the push pipe is made to contact the spring seat; the push rod needle is made to face a bypass oil passage communicating between a lower oil chamber and an upper oil chamber formed inside the piston; in addition, the back end portion of the push pipe bifurcates to contact a first slider forming a tapered surface, and the back end portion of the push rod contacts a second slider forming a tapered surface inserted into the bifurcated portion of the push pipe; the first and second sliders are mated so as to be mutually slidable, forming an adjuster for separately sliding these first and second sliders.

(Problem the Device Seeks to Solve)

In the damping force adjustment mechanism described above, the damping force can be adjusted so that the compression-side and extension-side have differing damping forces, but separate adjustments must be made to adjust the compression-side and extension-side damping forces.

(Means for Solving the Problem)

To solve the problem above, Claim 1 of the device provides a single slider, movable in the radial direction and driven by a single motor at the back end of each adjustment rod; two sloped surfaces with differing angles are formed on this slider, with the back end of one of the adjustment rods in contact with one of the sloped surfaces, and the back end of the other adjustment rod in contact with the other sloped surface, such that the amount of displacement of the two adjustment rods differs with the rotation of the motor.

In Claim 2, one adjustment rod adjusts the surface area of a bypass oil passage opening on a hollow rod with a needle portion provided at the tip, and the other adjustment rod adjusts the blow[out] load on a pressure-side valve provided on an oil passage in the piston at the tip portion; one of the adjustment rod back end portions contacts the more gently sloped surface [thereof] than does the other adjustment rod back end portion.

(Operation)

By moving the slider, the compression-side damping force and the extension-side damping force can be simultaneously [adjusted], and the adjustment range of the extension-side damping force made smaller than the adjustment range of the compression-side damping force.

(Embodiments)

Below we explain the present device based on the attached drawings.

Fig. 1 is a cross section of a hydraulic shock absorber comprising the damping force adjustment mechanism of the device; Fig. 2 is an expanded cross section of the piston portion of that shock absorber; Fig. 3 is an expanded plan view cross section of the moving mechanism portion of that mechanism; Fig. 4 is a front view cross section of that moving mechanism portion; Fig. 5 is a side view cross section of that moving mechanism portion.

A hollow rod 7 is inserted from the top into cylinder 1 via rod guide 3, oil seal 4, retainer 5, and rebound rubber 6; a piston 10 sliding on the inner circumferential surface of cylinder 1 is attached to the lower end of this hollow rod 7; upper oil chamber S1 and lower oil chamber S2 are defined within this cylinder 1, and a compression-side oil passage 11 and extension-side oil passage 12 are formed on this piston 10; compression-side valve 13, comprising multiple disk valves for opening and closing compression-side oil passage 11, is installed on the top surface side of piston 10, and extension-side valve 14, comprising multiple disk valves for opening and closing extension-side oil passage 12, is installed on the bottom surface side of piston 10.

A valve stopper 16 contacting the back surface of compression-side valve 13 at the upper side of piston 10 is affixed and installed on hollow rod 7 by a pin 17; a seat plate 18 contacting the rear surface of disk valve 13a, which contacts the seating surface of piston 10 inside compression-side valve 13 [*original shows "10" – presumed typo*], is slidably inserted on the bottom end outer circumferential surface of this valve stopper 16; an oil hole 18a is formed in this seat plate 18; a spring seat 19 is slidably inserted on the top end outer circumferential surface of valve stopper 16, and an adjusting lever 22, which passes through long hole 20 formed on valve stopper 16 and long hole 21 formed on hollow rod 7, engages spring seat 19; furthermore a spring 23 for blow[out] load adjustment is interposed between seat plate 18 and spring seat 19;

the pressing force of disk valve 13a on seat plate 18 is changed by moving spring seat 19 up or down, [causing] the compression-side valve 13 open pressure to change.

Thus in order to build in a mechanism for changing the compression-side valve 13 blow[out] point, a rod end is installed on the tip portion of hollow rod 7 and a piston is affixed to this rod end; however this may produce friction when the piston slides due to machining errors such as eccentricity between the hollow rod and the rod end, whereas machining and assembly errors and piston friction are reduced by integrating the hollow rod and the rod end into a single piece, as in the present device.

Also, a bypass oil passage 26 is formed on hollow rod 7, respectively directed to upper oil chamber S1 through long holes 21, 20, and to lower oil chamber S2 through valve seat 25.

A push pipe 31, being a control rod, is retractably inserted into hollow rod 7; the tip portion of this push pipe 31 contacts adjusting lever 22; a push rod end 33 is retractably inserted via a collar 32 onto the back end of push pipe 31, and push rod 34, which is a control rod, is retractably inserted into this push pipe 31, collar 32, and push rod end 33; a needle 35 is formed on the tip portion of this push rod 34, and this needle 35 is directed toward valve seat 25.

An O-ring 37 and backup ring 36, which slide on the inner circumferential surface of hollow rod 7, are inserted on the outer circumferential surface of push rod end 33; an O-ring 38 contacting the outer circumferential surface of push rod 34 is inserted into the inner circumferential surface of push rod end 33, and a spring 39 for biasing push rod 34 in the retracting direction is interposed between the back end portion of push rod end 33 and the push rod 34; in addition, a bifurcated portion 41 is formed at the back end portion of push rod end 33.

An upper bracket 42 is screwed onto the top end of hollow rod 7; a slider 43 is inserted so as to be radially movable within this upper bracket 42, and two sloped surfaces (tapered surfaces) 44, 45 are formed on this slider 43 so that tapered surface 44 is positioned on both sides of tapered surface 45 with tapered surface 45 at the center; the forked portion 41 on push rod end 33 is made to contact tapered surface 44, and the back end portion of push rod 34 contacts tapered surface 45.

A motor with damping mechanism 47 is attached within upper bracket 42; a gear 48 is affixed to the rotary shaft of this motor 47; a gear 49 meshing with gear 48 is provided, and a feed axle 50 is affixed to this gear 49; this feed axle 50 is engaged with slider 43, and the movable element 52 of a stroke sensor 51 comprising a potentiometer, which is a means for detecting the amount of motion (amount of deflection) thereof is attached to slider 43; this stroke sensor 51 is attached to upper bracket 42. This stroke sensor 51 converts the amount of the slider 43 deflection to a voltage and outputs [same].

A volume [control] (variable resistor) is then disposed at a position operable from a driver's seat, not shown; by manipulating this volume [control], the current

flowing to motor 47 changes, which changes the rotary speed of motor 47; a display panel matched in advance to the slider 43 deflection and to the output voltage of stroke sensor 51 is placed in a position visible from the driver's seat.

A collar 55 is inserted onto the bottom end outer circumferential surface of upper bracket 42, a jack cylinder 56 is installed onto the outer circumferential surface of this collar 55, and a jack piston 57 is slidably inserted into this jack cylinder 56; a spring seat 58 is received at the bottom end surface of this jack piston 57, and a suspension spring 60 is interposed between this spring seat 58 and a spring seat 59 installed on the bottom end outer circumferential surface of this jack piston 57; in addition, the top end of a dust cover 61 is attached to the bottom end outer circumferential surface of jack cylinder 56.

A collar 62 is installed on the bottom end inside cylinder 1; a free piston 63 is slidably inserted on the inner circumferential surface of cylinder 1 under this collar 62, and a lower bracket 64 is attached at the bottom portion cylinder 1.

Below we explain the operation of a hydraulic shock absorber constituted as described above.

First, when hollow rod 7 is lowered in the compression step, hydraulic oil in lower oil chamber S2 passes through the compression-side oil passage 11 in piston 10, pushing up compression-side valve 13 against the pressing force of seat plate 18 and flowing into upper oil chamber S1 to produce a damping force; when this happens, free piston 63 drops to absorb a hydraulic oil amount equal to the volume penetrated by hollow rod 7. When hollow rod 7 rises in the extension step, hydraulic oil in upper oil chamber S1 passes through extension-side oil passage 12 in piston 10, pushing down the extension-side valve 14 and flowing into lower oil chamber S2 to produce a damping force; at this time an amount of hydraulic oil equal to the volume of the hollow rod 7 retraction is compensated by the rise of free piston 63.

Then, in the compression step, adjusting lever 22 is moved up or down to move spring seat 19 up or down, thereby changing the biasing force from spring 23 on seat plate 18, which changes the pressing force on disk valve 13a from seat plate 18, so that in response the open pressure force on compression-side valve 13 changes, thereby changing the compression-side damping force. In the extension step, a portion of the hydraulic oil in upper oil chamber S1 flows from the opening between valve seat 25 and needle 35 through bypass oil passage 26 and long holes 21 and 20, bypassing the extension-side oil passage 12 and flowing into lower oil chamber S2, so that the advancement or retraction of needle 35 changes the amount of the opening between [the needle?] and the valve seat 25, such that the extension-side damping force changes.

Rotationally driving motor 47 rotates feed axle 50 via gears 48, 49, therefore slider 43 moves in the radial direction, and push rod end 33, which contacts slider 43 tapered surface 44 at its back end, and push rod 34, which contacts tapered surface 45

at its back end, advance or retract; the advancement or retraction of push rod end 33 causes adjusting lever 22 to rise or fall via collar 32 and push pipe 31, changing the compression-side damping force, and the advancement or retraction of push rod 34 causes needle 35 to advance or retract so that the extension-side damping force changes, permitting the compression-side damping force and extension-side damping force to be implemented by the movement of a single slider 43.

When this occurs, manipulating a volume [control] while observing a display panel correlated in advance to the displacement of slider 43 and the output voltage of stroke sensor 51 enables the driver's seat to control the rotary speed of motor 47 and adjust the damping force by moving slider 43 to a desired position; by thus detecting the position of slider 43, the positions of push rod end 33 and push rod 34 can be estimated, and damping force can be continuously adjusted by controlling the rotation of motor 47 so that slider 43 comes to a desired position.

(Effect of the Device)

As explained above, the hydraulic shock absorber damping force adjustment mechanism of Claim 1 disposes a single slider, movable in the radial direction and driven by a single motor at the back end side of each adjustment rod; two sloped surfaces of differing angles are formed on this slider; the back end of one of the adjustment rods contacts one of the sloped surfaces and the back end of the other adjustment rod contacts the other sloped surface, such that the amount of displacement of the two adjustment rods differs with the rotation of the motor, therefore there is no need to increase the number of motors or sliders, and the apparatus can be made compact without added complexity, making it advantageous in both weight and cost.

The hydraulic shock absorber damping force adjustment mechanism of Claim 2 uses one adjustment rod to adjust the bypass oil passage opening surface area of a hollow rod at the needle portion provided at the tip [thereof], and uses the other adjustment rod to adjust the blow[out] load of a pressure-side valve disposed in an oil passage inside a piston at the tip portion [thereof]; the back end of one of the adjustment rods is made to contact the more gently sloped surface of the two sloped surfaces of the slider relative to the back end of the other adjustment rod, therefore the adjustment range at the needle portion can be made smaller than the adjustment range of the pressure-side valve blow[out] load, and fine adjustment amounts can be achieved at the needle portion.

[Brief Explanation of Drawings]

Fig. 1 is a cross section of a hydraulic shock absorber comprising the damping force adjustment mechanism of the device; Fig. 2 is an expanded cross section of the piston portion of that shock absorber; Fig. 3 is an expanded plan view cross section of the moving mechanism portion of that mechanism; Fig. 4 is a front view cross section of

that moving mechanism portion; Fig. 5 is a side view cross section of that moving mechanism portion.

In the drawings, 1 is a cylinder, 7 is a hollow rod, 10 is a piston, 11 is a compression-side oil passage (oil passage), 12 is an extension-side oil passage, 13 is a compression-side valve (pressure-side valve), 14 is an extension-side valve, 16 is a valve stopper, 18 is a seat plate, 19 is a spring seat, 22 is an adjusting lever, 23 is a spring, 25 is a valve seat, 26 is a bypass oil passage, 31 is a push pipe (adjustment rod), 32 is a collar, 33 is a push rod end, 34 is a push rod (adjustment rod), 35 is a needle, 43 is a slider, 44, 45 are tapered surfaces (sloped surfaces), 47 is a motor.

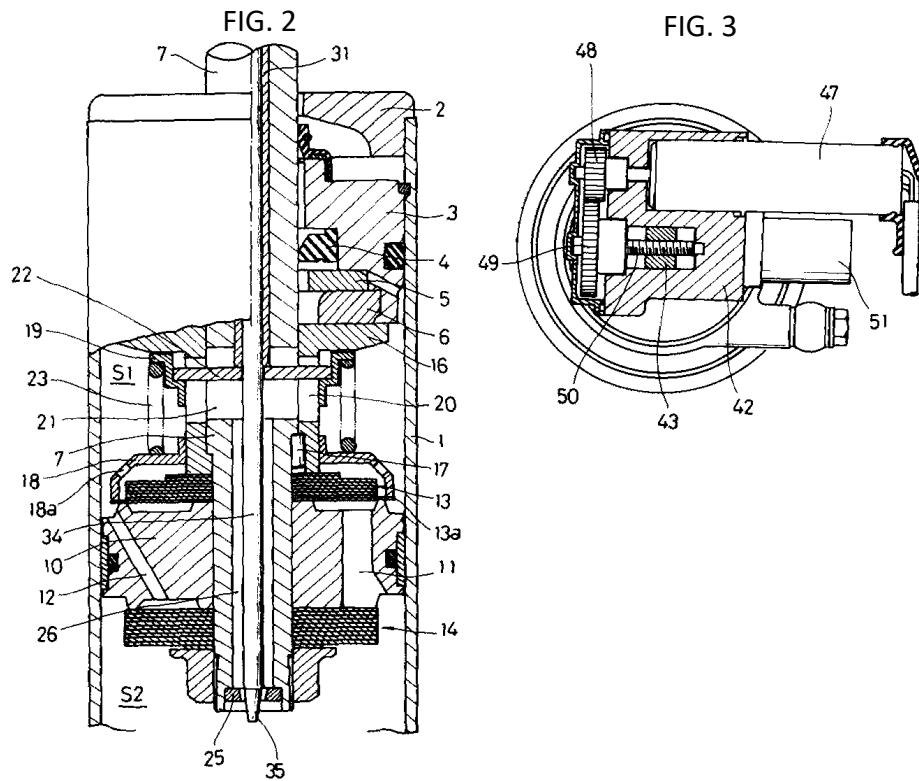


FIG. 1

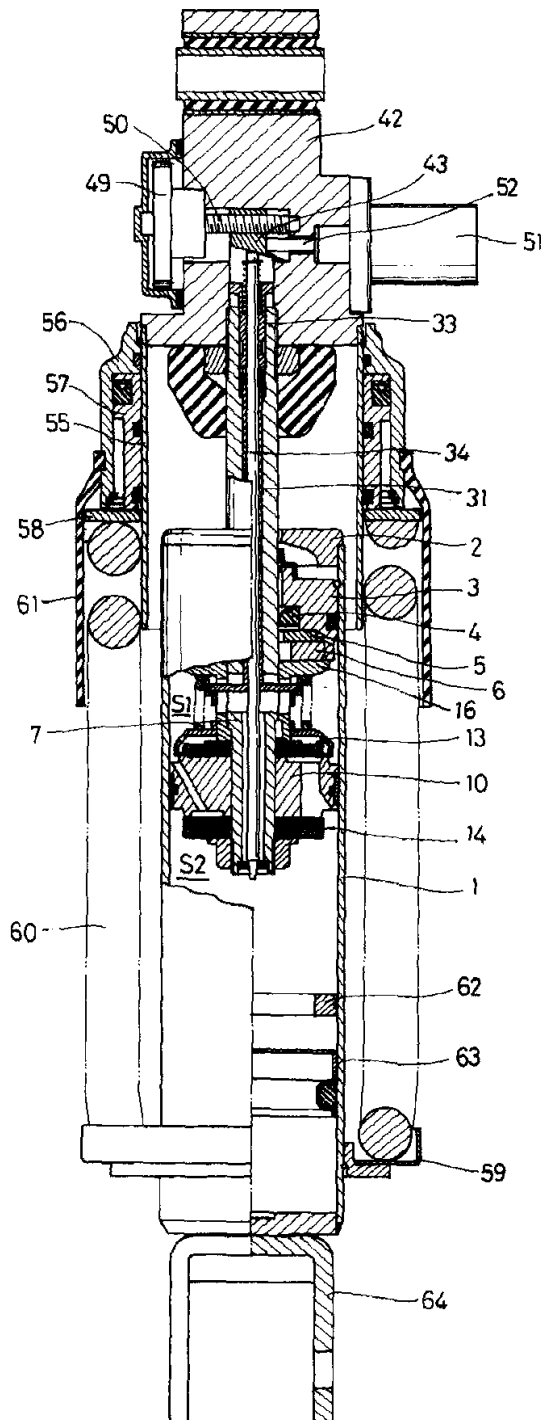


FIG. 5

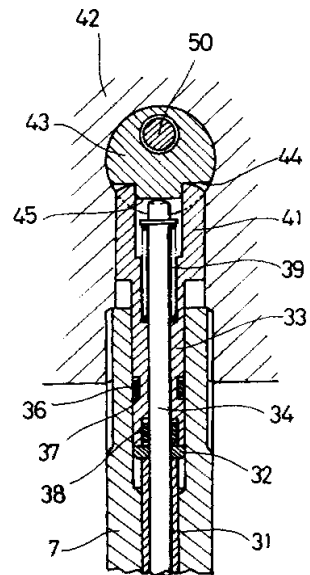
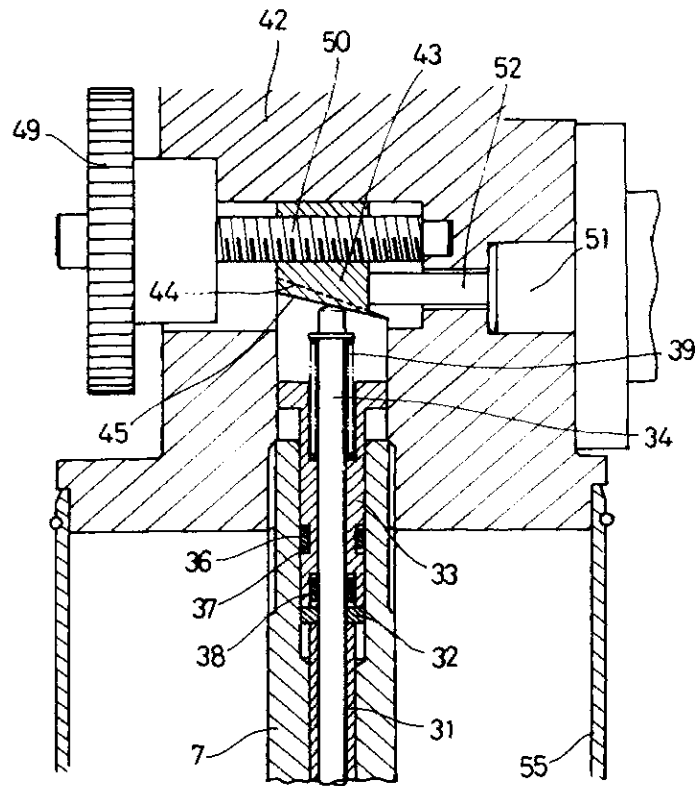


FIG. 4



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CERTIFICATION OF TRANSLATION

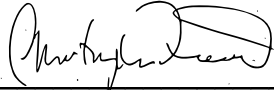
I, Christopher L. Field, residing at 52 Sherman Bridge Rd., Wayland MA, 01778, United States of America, declare and state as follows:

I am well acquainted with the English and Japanese languages. I have translated numerous Japanese documents of legal and/or technical content into English. I am fully accredited by the American Translators Association (ATA) for Japanese to English translation, and my ATA certification number is 423514.

I have personally translated the attached document, entitled "JP Utility Model 2516279Y2" from Japanese into English. I hereby certify that the English translation of the attached documents is an accurate translation to the best of my knowledge and ability.

I further declare that all statements made herein of my own knowledge are true, that all statements made on information and belief are believed to be true, and that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Executed at Wayland, Massachusetts, 22 December, 2023

Signed, _____

Christopher Field

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