Aug. 31, 1965 G. ALFIERI 3,203,449

SUPPLY AND EXHAUST VALVE WITH PISTON TYPE INLET

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FIG 1

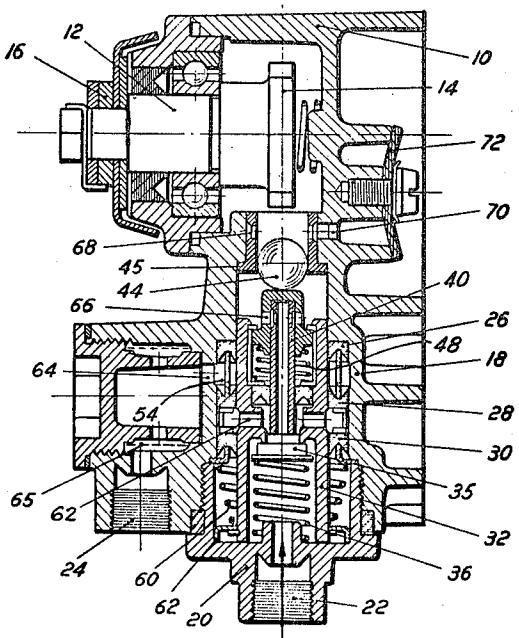
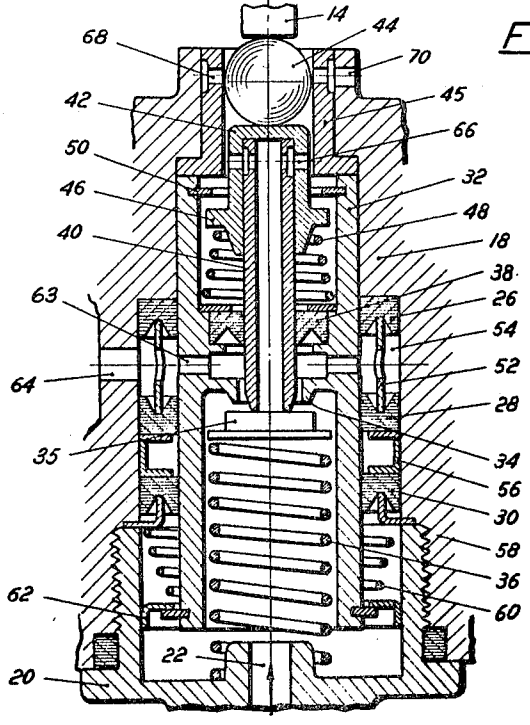


FIG 2



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SUPPLY AND EXHAUST VALVE WITH PISTON TYPE INLET

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7 Claims. (Cl. 137—627.5)

This invention relates to a servo-actuated levelling device for controlling pneumatic suspensions in vehicles, said device being adapted to keep the vehicle in the desired position when changes occur in the load carried by the vehicle itself.

Many types of servo actuated levellers are known wherein the operations are induced by the compressed air supply feeding the pneumatic suspension system. Said compressed air supply operates the movable assembly in the leveller governing communication between the pneumatic suspension and the chamber which houses the discharge valve. However, when the pneumatic section in the levellers is idle the mechanical section is not excluded, and parts of the leveller are constantly in motion during the vehicle run, such motion being responsive to the expansion and contraction to which the pneumatic suspension components are subjected.

This invention relates, further, to a servo-actuated device which remains in a position of rest while the leveller is inactive, except, obviously, for the leveller pin which is connected to the actuating lever or linkage.

Said levelling device has a cam actuated by the relative displacement between the wheel axle and vehicle chassis, and which actuate, through a drilled push rod, the inlet valve governing communication between the compressed air supply source and the pneumatic suspension. Said device includes a cylinder/piston assembly, whose movable element contains said inlet valve and drilled push rod, and the device also has means for cutting off the connection between the inlet valve and pneumatic suspension. The air supply for the assembly is governed by the leveller air supply means, so that when the leveller is operative the cylinder/piston assembly is also simultaneously supplied, and the movable element of the latter is also shifted to engage the drilled push rod with the leveller operating cam.

In one embodiment of the device the cylinder in the cylinder/piston assembly is housed in the leveller body while the relevant piston is movable and has side holes located in positions suitable to engage with the cylinder wall and the conduit leading to the pneumatic suspensions; said holes lead to a chamber defined by the inlet valve, which is located on the axis of said piston.

The invention will now be explained in the following description, taken in conjunction with the attached drawing showing, by way of example, a leveller device which forms the object of this invention.

In the drawings:

FIG. 1 is an axial cross sectional view of the leveller shown in its idle or inoperative position,

FIG. 2 shows the device on a larger scale and in a position in which the leveller is operative.

The leveller shown in the above illustrations has a hollow body 10, having secured to it a pin 12, through suitable supports. Said pin has, on the one side, a cam 14 and on the other side a lever 16, the free end of which is connected, in the usual known manner, to the vehicle axis.

Body 10 has a cylindrical chamber 18, forming a cylinder, said chamber being closed at one end by the plug 20. Said plug terminates with a fitting 22 to which

is connected, through a shut off valve (a solenoid valve, for example) not shown, the compressed air tank.

The body 10 has a second fitting 24 to which the vehicle pneumatic suspension is connected. A drilled piston 32, operates on the inside of cylinder 18 in air tight relation with the latter, through a set of three gaskets 26, 28 and 30. Said piston 32, has in its middle section, an annular seat 34 for a disk valve plug 35, making up the inlet valve of the leveller, said plug 35 being urged against the seat 34 by a spring 36.

The piston 32 houses a gasket 38 near its seat 34, and in which slides a hollow push rod 40. A cap 42 is secured to the upper end of push rod 40 and engages with the profile of cam 14 through a ball bearing 44. The cap 42 has a crown 46 which holds, on its upper side, one of the ends of a spring 48 acting on the push rod 40, and on its lower side engages a split ring 50 which is held by piston 32 and acts as a stop for the push rod itself.

The action of spring 48 engages crown 46 with the split ring 50 while the push rod 40, secured to cap 42 is kept away from valve 35. During operation of the device, ball bearing 44 is held by a bushing 45 which is secured to body 10, co-axially to piston 32.

Gaskets 26 and 28 are separated from each other by a drilled spacer 52 to form a chamber 54, while gaskets 82 and 30 are spaced by a U ring 56. The triple set of gaskets 26, 28 and 30 is held in the seat by a crown 58 which is locked between body 10 and plug 20. A coil spring 60 is inserted on the exterior of piston 32, one of the ends of said spring being held by a ring 62 secured to the lower end of the piston, and whose action tends to draw the piston and its relevant components downward. The seat 34 of valve 35 and gasket 38 form in piston 32 a chamber which communicates on the one side (through radial holes 63) with the previously mentioned chamber 54 and on the other side, with the atmosphere (through push rod 40), or with the reservoir connected (through valve 35) to fitting 22. Chamber 54 communicates through holes 64 and a filter 65 with fitting 24 above referred to.

The hollow push rod 40 and cap 42 communicate with the atmosphere through the radially tapped holes 66 which also establish a communication between said push rod and the hole in bushing 45, which has, in turn, radially tapped holes 68, opposite to holes 70 in body 10, and which complete communication with the atmosphere. In the embodiment shown, communication with the atmosphere is effected through a flexible protective diaphragm 72 which enables air discharge on the one side, and inhibits entry into the leveller of dust or foreign matter on the other side.

When the leveller is in a position of rest (as shown in FIGURE 1), it is evident that the tension of spring 60 acts upon piston 32 so as to keep it lowered and urged against plug 20.

The parts connected with piston 32 (i.e. valve 35, hollow push rod 40 and ball bearing 44) are positioned as shown in FIGURE 1, in which spring 36 is seen to urge valve 35 against its respective seat, and spring 48 engages crown 46 of cap 42 against ring 50.

Ball bearing 44 is therefore disengaged from cam 14 and any oscillations of the latter are not communicated to the levelling device, and as a result of which valve 35 is closed and no air communication takes place between fittings 22 and 24. On the other hand, in view of the position of piston 32, the latter closes communication between fitting 24 and holes 62, as a result of which the desired pressure can be maintained in the pneumatic suspension when a compressed air supply is admitted to fitting 22, the lower chamber of cylinder 18 is loaded or pressurized, and piston 32 is lifted in opposition to

the action of spring 60, until the said piston upper end stops against the flanged end of bushing 45.

During its stroke, piston 32 drags upward with it hollow push rod 40, valve 35 and ball bearing 44, and as a result of this action ball bearing 44 comes into engagement with the profile of cam 14. Depending on the cam section engaged, push rod 40 is shifted downward to a greater or lesser extent, to open or not the valve 35.

Simultaneously with the upward stroke of piston 32 the radial holes 62 in the latter are brought into communication with chamber 54 to establish a connection between fittings 22 and 24 (when valve 35 is open or away from its seat), through holes 62, chamber 54, hole 64 and filter 65.

When the load on the vehicle is normal, ball bearing 44 engages a section of cam 14 so as to bring hollow push rod 40 into engagement with the inlet valve 35 but without lifting this from its seat and so as to close the axial hole in push rod 40. Consequently, no air will flow to the pneumatic suspension, the pressure in which will remain unchanged.

On the other hand, when the vehicle load increases, or when pressure in the pneumatic suspension decreases, that is, if the distance of the vehicle chassis from ground level decreases, ball bearing 44 engages the profile of cam 14, causing push rod 40 to open inlet valve 35. In this manner, the air pressure from fitting 22 flows to fitting 24, thereby establishing or re-activating the required pressure in the pneumatic suspension, and causing the vehicle chassis to reach its normal level.

When the vehicle load decreases, with consequent increase of the chassis distance from ground level, ball bearing 44 engages a section of cam 14, keeping push rod 40 away from valve 35, which is urged against its seat. Consequently, fitting 24 is put in communication with the atmosphere through chamber 54, holes 62, push rod 40 and holes 66 and 70, thereby to discharge the air pressure into the pneumatic suspension.

The air supply to fitting 22 is interrupted following each levelling operation and as a result of which this fitting is put in communication with the atmosphere, thereby discharging the pressure from cylinder 18; the action of spring 60 on piston 32 returns the latter and parts connected thereto to a position of rest, in which the ball bearing 44 is kept away from the profile of cam 14. In this way, the elements which govern air flow are closed and not operative.

Having thus described and illustrated the invention, it will be apparent to those of ordinary skill in the art to which the invention pertains that modifications and changes may be made in the illustrated embodiments particularly in regard to the features concerning engagement and application; for example, piston 32 of the device may be returned to its position of rest by fluid pressure means rather than by spring 60. Said piston may also have conveniently sized active surfaces, so that the pressure prevailing in chamber 54 may conveniently act on said surfaces to return the piston to its position of rest.

I claim:

1. A device for controlling air flow between a source of air pressure and a pressurized system comprising a cylinder having an inlet adapted to be connected to said source and an outlet adapted to be connected to said system, a cam normally in neutral position, means for turning said cam in one direction from said neutral position and in the other direction from said neutral position, a hollow piston within said cylinder and providing therethrough an air passageway between said inlet and said outlet, said piston being in idle position in the absence of air pressure at said inlet but being movable from said idle position to an operative position in response to air pressure at said inlet, a valve within said piston normally blocking said passageway, and valve operating means operative to open said valve only when said piston is in operative position and said cam is turned in said one direction.

2. A device as set forth in claim 1 wherein said valve operating means includes a hollow push rod which is arranged to contact said valve at its one end to open the same when said cam is turned in said one direction, and which forms by its hollow interior a part of a passage connecting said outlet with the atmosphere when said cam is turned in said other direction.

3. A device as set forth in claim 2 in which said rod is normally engaged with said valve to close said passage and said valve is normally closed but wherein said rod is axially movable in response to turning of said cam in said other direction to disengage itself from said valve and open said passage through its hollow interior.

4. A device as set forth in claim 3 including a spring urging said push rod axially in a direction contrary to that in which it is operative for opening said valve.

5. A device as set forth in claim 2 wherein said valve operating means includes a roller member which is in contact with said cam when said piston is in operative position and which operates in response to movement of said cam to move said push rod in an axial direction.

6. A device as set forth in claim 1 wherein said piston has an opening through its side wall which communicates with said outlet when said piston is in operative position to form a part of said passageway but wherein said opening is blocked against communication with said outlet when said piston is in idle position.

7. A device as set forth in claim 6 wherein said cylinder is equipped with spaced annular gaskets forming an annular chamber about said piston and wherein said opening communicates with said chamber when said piston is in operative position.

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