Nov. 1, 1955 F. STEINBAUER 2,722,288

SHOCK ABSORBER WITH CENTRIFUGAL VALVE

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FIG. 1

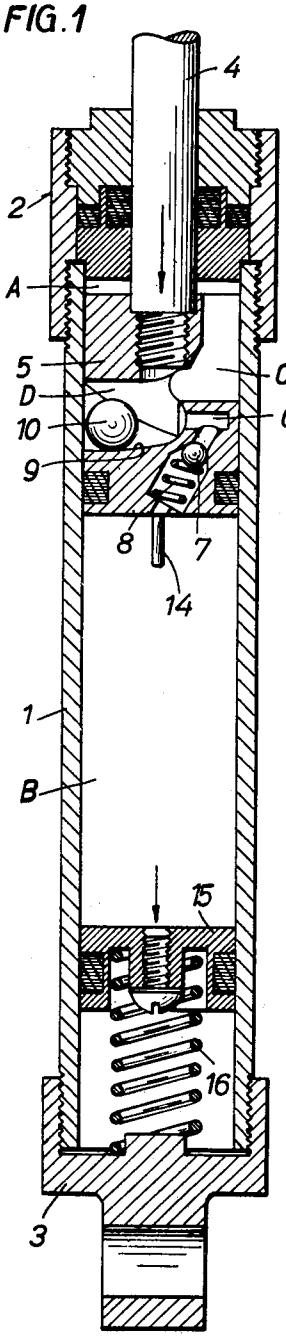


FIG. 2

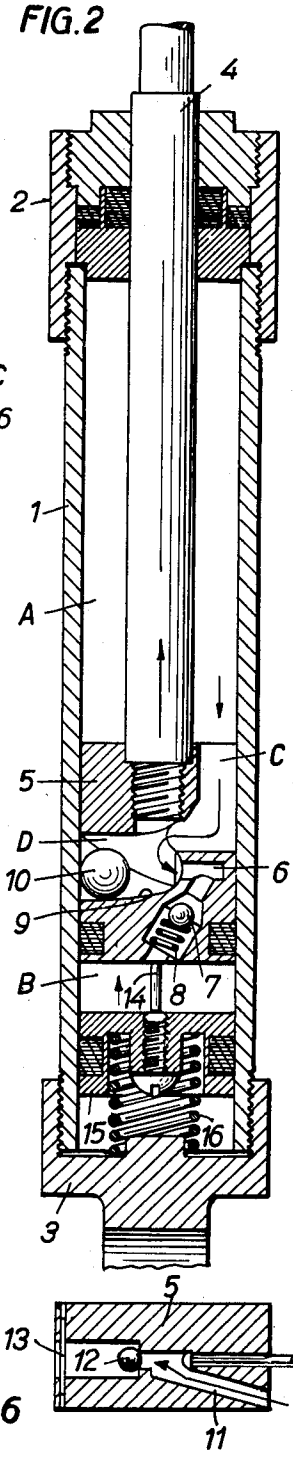


FIG. 3

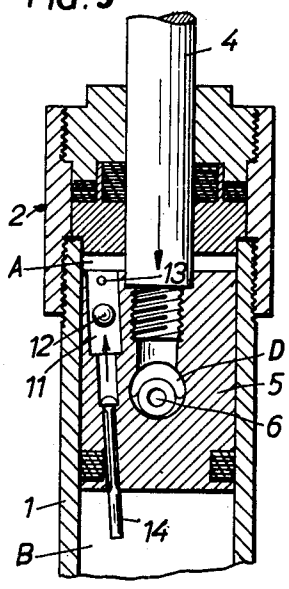


FIG. 4

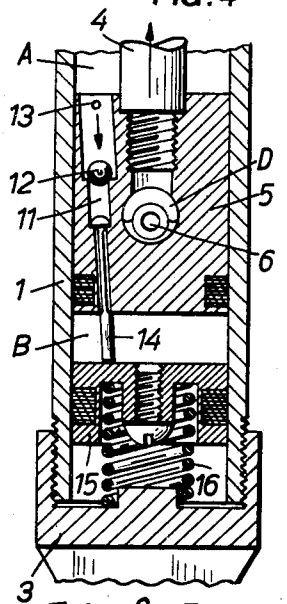
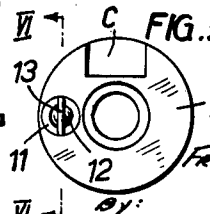


FIG. 6

VI C FIG. 5



VI

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FIG. 7

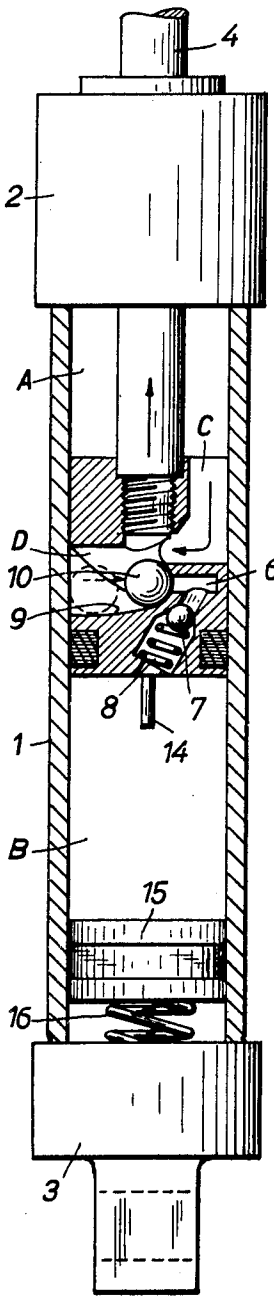


FIG. 8

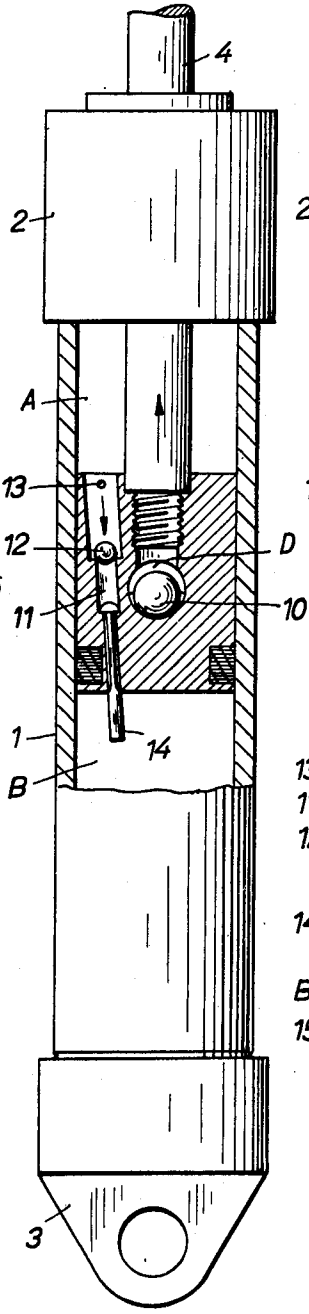
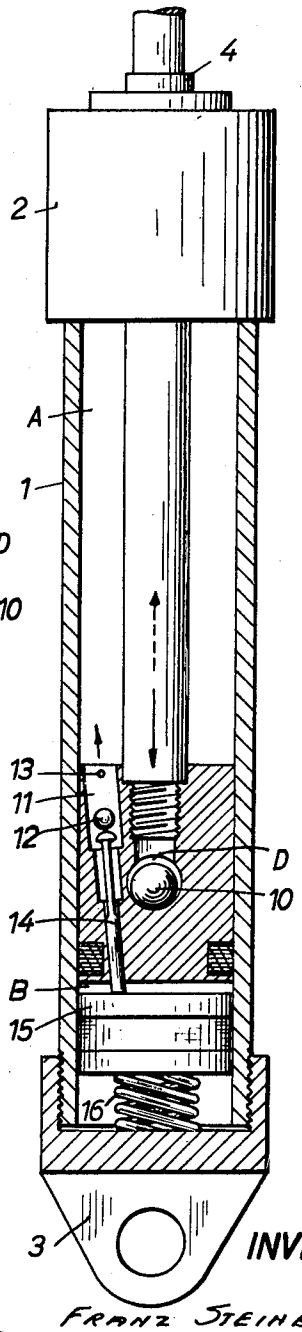


FIG. 9



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SHOCK ABSORBER WITH CENTRIFUGAL VALVE

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Application January 29, 1952, Serial No. 268,774

Claims priority, application Switzerland January 29, 1951

4 Claims. (Cl. 188—88)

The present invention relates to a hydraulic shock-absorbing device for motor-cars, having at least one movable piston in a cylinder.

As generally known, the presently employed hydraulic shock-absorbers only deaden the effect of the shock, i. e. when the car runs over any unevenness in the road, the resulting vibrations of the body of the car are deadened. If a car turns around a curve its body inclines towards the outside of the curve, due to the centrifugal force, so that the weight of the springs on the inside of the bend is reduced whereas it is increased on the outside springs. In order to reduce the outward slant of the body of the car when it turns around a curve, that is to say in order to stabilize the body in its vertical longitudinal section, the shock-absorber according to the invention is provided with a member which is movable transversely to the moving direction of the piston. This member, while it is under the effect of the centrifugal force, has the function to prevent substantially the movement of the piston in one direction.

As a result of the construction of the aforementioned device it is possible to prevent the unloading of the spring on the inside of the curve which otherwise would extend while the car turns around a bend. The body of the car will, therefore, slant less towards the outside of the bend than would be the case if the inside spring were not fixed.

The member which is transversely movable along the direction of movement of the piston is suitably a ball which controls an outlet.

The accompanying drawings give two examples of constructions of shock-absorbers according to the invention:

Fig. 1 shows an axial section of the device functioning as shock-absorber on the left-hand side of the car during the downward stroke of the main piston.

Fig. 2 shows a section according to Fig. 1 during the upward movement of the main piston.

Fig. 3 shows an axial section at a right angle to that of Fig. 1 of the upper part of the device.

Fig. 4 shows an axial section at a right angle to that of Fig. 2 of the lower part of the device.

Fig. 5 shows a top view of the piston according to Figs. 1–4.

Fig. 6 shows a section along the line VI—VI of Fig. 5.

Fig. 7 shows an axial section according to Fig. 2 of the device while it functions as stabilizer.

Fig. 8 shows a section according to Fig. 4 of the device while it functions as stabilizer.

Fig. 8 shows a section according to Fig. 8 with the main piston in its lowest downward position.

The shock-absorbing device according to Figs. 1–9 is composed of an upright cylinder **1**, filled with a damping liquid as for instance oil. The top of said cylinder is closed by a packing head **2**, and the bottom by a cap **3**. By means of this latter the device is mounted in a manner not illustrated, to the axle of the motor-car, to which axle the spring on the left-hand side is also mounted. A piston rod **4** passes through the packing head **2**, the former being connected with the frame in a

manner not drawn in such a way that pressure on the spring results in a down-stroke of the piston rod **4**, whereas if the spring is released the piston rod **4** moves upwards.

A main piston **5** is screwed on to the end of piston rod **4** which enters cylinder **1**. The piston **5** is movable and divides the cylinder into two compartments A and B. In piston **5** there are two chambers C and D which are connected with each other. Chamber C opens into compartment A, and chamber D which is closed on one side by the wall of the cylinder, opens into a passage **6** which is connected by a spring loaded ball valve with compartment B. Said valve is composed of a ball **7** which is pressed by a spring **8** against a conical seat (Figs. 1 and 7). With regard to the horizontal line, bottom plane **9** of chamber D, in which a ball **10** is freely movable, slopes down from the mouth of passage **6** towards the outside. Further, a by-pass duct **11** leads through piston **5**, the upper part of which duct has a bigger diameter, and a ball **12** by which the flow of the liquid is controlled, moves inside this upper part of the duct. Owing to its own weight ball **12** rests on the rim of the narrower part of the duct **11** and is, on the other hand, prevented by a cross-bar **13** from leaving the wider part of the duct at the top. Coaxially to the wider part of the by-pass duct **11** a bolt **14** is arranged, the movement of which is limited inside piston **5**, the head of the bolt acting together with ball **12**.

Compartment B is closed at the bottom by an accessory piston **15** which is movable in cylinder **1**. A spiral spring **16** is placed between the accessory piston **15** and cap **3**, and the space around spring **16** preferably contains air and may be vented to the outside so that the piston **15** will be free to move toward and away from cap **3** in the manner hereinafter described in detail.

The functioning of the described shock-absorbing device is as follows: Supposing the parts of the device are in the position as shown in Figs. 1 and 3, i. e. the springs of the car are loaded to a certain extent and the car is running straight ahead. If a wheel runs over any unevenness so that its spring gets compressed and piston rod **4** is pushed downwards, then oil is pressed out of compartment B by piston **5**, the oil escaping through by-pass duct **11** into compartment A (Fig. 3). As piston rod **4** projects into compartment A, the transverse section of compartment A is less than that of compartment B, therefore compartment A cannot hold the whole volume of oil corresponding to that which is pumped away by the downwards moving piston. An adjustment is attained in as much as the accessory piston **15** moves downwards in the opposite direction to the action of its supporting spring **16**, whereby the capacity of compartment B is increased by the volume of oil which cannot escape into compartment A. As shown in Fig. 1, valve **7/8** is closed during this process. When the ensuing release of the spring takes place, the piston rod **4**, and with it piston **5**, are pulled upwards again (Figs. 2 and 4) during which motion ball **12** closes by-pass duct **11**. The oil in compartment A now forces its way through chambers C and D and passage **6**, opens ball valve **7/8** and runs into the lower compartment B. As the quantity of oil leaving compartment A needs less space than that which becomes free again in compartment B, the size of which increases as the main piston **5** moves upwards, the accessory piston **15** also moves upwards under the action of its spring **16**. The device, therefore, functions as shock-absorber.

If the car turns around a left-hand bend, the weight on the spring of the left-hand wheels is reduced so that there is an upward pull on piston **5**. The centrifugal force, in this case, is effective towards the right and ball **10**, therefore, rolls towards the right along bottom

plane 9 which rises towards passage 6, thereby closing said passage (Fig. 7). No oil can escape from compartment A through chambers C and D and passage 6 into the lower compartment B, consequently the main piston 5 and the piston rod 4 are prevented from moving upwards. Due to this fixation of the upward movement of piston 5 the spring cannot extend. As a result the body of the car inclines less towards the outside as would be the case if the inside spring could stretch freely. The device, therefore, functions as a stabilizer. It is evident that ball 12 (Fig. 8) remains in its place during the fixation of the piston 5 and thus closes the duct 11.

The object of bolt 14, one end of which protrudes into by-pass duct 11 and the other projects out of main piston 5 is shown in Fig. 9. This bolt acts as a safety contrivance which has to prevent the piston 5 from striking upon the accessory piston 15. Before the main piston 5 touches the accessory piston 15, the latter lifts the bolt 14, the head of which, in its turn, pushes ball 12 from its seat and thus opens by-pass duct 11. When the car turns around a bend, piston 5 tries to move upwards, thus causing a certain over-pressure in compartment A. If the car now receives shocks while the curve is taken, piston 5 moves downwards but cannot strike upon accessory 15 because, at a given moment, the bolt 14 touches accessory piston 15 whereupon by-pass duct 11 is opened and, due to the overpressure in compartment A, oil escapes through by-pass duct 11 into compartment B. Main piston 5 rises until accessory piston 15 releases bolt 14 which now again closes duct 11 whereupon the main piston is immobilized again. From the foregoing it is obvious that compression of the spring, that is a downward movement of the main piston 5 is possible when bends in the road are taken, because the moment piston 5 moves downwards, there is over-pressure in compartment B so that the ball 12 is lifted from its seat and duct 11 is opened. A return of oil from compartment B into compartment A is thus possible. Hence piston 5 can, when bends are taken, move up and down between two terminal positions limited by the length of bolt 14. In this way it can be prevented that piston 5 comes down upon accessory piston 15.

It is understood that the member which is transversally movable and has to control the passage may also be a pendulum instead of a freely movable ball 10.

I claim:

1. A hydraulic shock-absorbing device for motor cars comprising an upright cylinder, a piston movable in said cylinder, said cylinder defining two cylindrical spaces at the opposite sides of said piston, said piston having a passageway therein establishing communication between said two cylindrical spaces, a transversely movable ball member for controlling the flow through said passageway, said ball member normally remaining, due to its own weight, in an ineffective position permitting flow through said passageway and, upon being subjected to centrifugal force, being operative to prevent flow of a hydraulic medium through said passageway from one of said cylindrical spaces to the other of said cylindrical spaces, a valve in said piston between said passageway and said other cylindrical space for preventing the return flow of the hydraulic medium from said other cylindrical space through said passageway to said one cylindrical space, and a valve controlled by-pass duct in said piston permitting the return flow of the hydraulic medium therethrough from said other cylindrical space to said one cylindrical space.

2. A hydraulic shock-absorbing device for motor cars according to claim 1; further comprising an auxiliary piston in said cylinder and defining the end of said other cylindrical space remote from the first mentioned piston, and a movable safety member arranged in said by-pass duct for controlling the valve of the latter, said safety member projecting from said first piston into said other cylindrical space and being adapted for actuation by said auxiliary piston to open the valve controlling said by-pass duct when said first piston reaches a predetermined position relative to said auxiliary piston.

3. A hydraulic shock-absorbing device for motor cars according to claim 1; further comprising a piston rod extending through said one cylindrical space and connected to said piston for operating the latter.

4. A hydraulic shock-absorbing device for motor cars according to claim 3; further comprising means compensating, during the movement of said piston by said rod, for the difference in the cross-sectional areas of said two cylindrical spaces resulting from the extension of said rod through said one cylindrical space; said compensating means including an auxiliary piston in said cylinder defining the end of said other cylinder space remote from the first mentioned piston, and a spring interposed between said auxiliary piston and the adjacent end of said cylinder to resiliently resist movement of said auxiliary piston toward said adjacent end of the cylinder.

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