

UNITED STATES PATENT OFFICE.

JAMES B. KIRBY, OF CLEVELAND, OHIO.

SHOCK ABSORBER.

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To all whom it may concern:

Be it known that I, JAMES B. KIRBY, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Shock Absorbers, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to that class of devices employed for restraining the excessively violent movements of vehicle springs, especially those of automobiles, thereby rendering the movement of the vehicle body more comfortable and decreasing the danger of breaking the springs. These devices have received the somewhat inaccurate but well understood name of "shock absorbers." The particular class of such devices to which this invention belongs is that wherein the relative movement of the parts is restrained or retarded by the movements of a fluid enclosed in a casing, and the main object of the invention is the provision of a device of this character wherein the movement of the fluid shall be restrained to an extent which depends upon the violence of the shock which creates such movement. Other objects of the invention are the provision of a device of this character which shall be extremely simple, compact, of few parts, and easily attached to the machine; the provision of a shock absorber which shall offer the same character of action at all times regardless of the initial weight carried by the vehicle, which shall be unresponsive to minor blows and to all gentle movement of the springs, but responsive to all the severer shocks; which shall offer no resistance to the downward movement of the body and only a proportional resistance to the upward movement thereof; while further objects and advantages of the invention will become apparent as the description proceeds.

In the drawings accompanying and forming a part of this application I have shown a preferred embodiment of my invention together with its mode of application to the rearward part of an automobile, although it will be understood that a great many changes can be made in details of construction and that the device is equally applicable to the front axle as to the rear axle. In these drawings Fig. 1 is a perspective view of my improved shock absorber showing its

mode of attachment to an automobile; Figs. 2 and 3 are vertical sectional views corresponding to the lines 2—2 and 3—3, respectively, of Figs. 4, 5 and 6; Figs. 4, 5 and 6 are horizontal sectional views corresponding to the lines 4—4, 5—5 and 6—6, respectively, of Figs. 2 and 3; and Fig. 7 illustrates a modified form of device.

Describing the parts by reference characters, my improved shock absorber comprises a hollow metal casing 1 having suitable attaching ears 2—2 and a removable top 3, the rearward face of the casing being made flat to facilitate its attachment to a suitable part of the automobile body, such as the spring hanger 4. Journalled transversely of the upper part of this casing is a horizontal rock-shaft 5 carrying an arm 6 whose outer end is connected to the axle 7 by suitable means such as the rigid link 8, the latter preferably having ball joints 9—9 at its end so that universal movement may exist.

One side of the casing contains the well 11 and the opposite side contains the vertical cylinder 12 provided with the piston 13, connected by means of the piston rod 14, to the free end of an operating arm 15 whose opposite end is attached to the rock shaft 5. Leading laterally from the lower part of this cylinder are two passageways, 20 and 21, which communicate with the well 11 by means of ducts 22, 23, respectively. The passageway 20 is preferably made by drilling horizontally into the bottom of the cylinder from the outside of the casing so as to intersect the duct 22, and afterwards threading that portion of the passageway which lies outside said duct as shown at 25. I then insert in said threaded portion an apertured plug 26 in which is slidably mounted the stem 27 having at its inner end the integral conical head 28 and at its outer end the removable flat head 29. Pressing against the latter head is the spring 30 and outside of the spring is the screw plug 31, which serves the double purpose of closing the bore and adjusting the tension of said spring. Threaded in the other duct 23 is the valve seat 35 which carries the downwardly opening, spring-pressed, poppet valve 36 whose stem 37 rises into the well 11.

The valve head 28 is formed with its larger end innermost and of such a size as to pass loosely through the passageway 20, and

is normally supported a short distance inside of the end of said passageway as shown in Figs. 2 and 6. The casing is filled with any suitable non-freezing liquid, preferably a good lubricating oil. Upon increasing or decreasing the weight in the car, the parts will assume without obstruction the relative position determined by the stiffness of the vehicle spring, and in the operation of the vehicle the normal slow or gentle action of the spring can occur without opposition, the oil having a free movement into the cylinder through both of the passageways and having a free movement out of that cylinder through the passageway 20 so long as its movement is slow. Also in case the wheels shall strike an obstruction which throws them upwardly suddenly towards the body, or in case the body shall acquire a downward movement relatively to the axle, the resulting upward movement of the piston occurs without opposition, regardless of the violence, the valve 36 opening for the purpose; but any severe upward movement of the body relatively to the wheels, which is the kind of movement that causes breakage of springs, discomfort to passengers and injury to loads, causes such a rush of fluid past the valve 28 as to draw it outwardly towards its seat and thereby restrict the area of the liquid passage by an amount which is proportional to the pressure. Sufficient leakage is provided, either around the valve 28 or around the piston 13 or by apertures in the parts, to permit a slow return of the oil to the well 11 even though the valve 28 be forced to its position of extreme closure. In this way the parts are enabled to resume slowly their original positions ready to cushion the next blow, and the amount of cushioning effect is at all times substantially proportional to the violence of the jolt.

In the construction shown in Fig. 7 the passageway 21 and its valve are omitted and only a single passageway 20^a employed, which is larger and cylindrical and opens into the well 11 by a port 40 controlled by a sliding valve 41 formed in its side with a tapering port 42. This valve is normally held inwardly by the light spring 43, and when displaced outwardly a given distance comes into contact with a second spring 44 whose tension is adjusted by the screw 45. The ports 40, 42 are tapered so as to restrict the fluid movement at the proper rate, and are large enough to admit fluid to the cylinder at a sufficiently high rate for all reasonable spring speeds and above this point some restraint is not amiss. Upon an upward movement of the body the valve 41 first moves sufficiently far to contact with the spring 44, even with a comparatively gentle movement, and thus closes the port sufficiently to afford a considerable restriction of

fluid movement in case the pressure of the latter be sufficiently great to move the valve past this point.

It will be understood that many variations in design, arrangement and construction of the various parts and numerous substitutions of equivalents for the parts themselves can be made within the scope of my invention wherefore I do not restrict myself in any way except as specifically set forth in the claims hereto annexed.

Having thus described my invention, what I claim is:

1. In a device of the character described, in combination, a fluid-containing casing having a well and a cylinder therein, there being two passageways between said cylinder and well, a piston in said cylinder, a valve in one of said passageways adapted to permit free movement of fluid from said well to said cylinder, and a valve in the other passageway adapted to permit a restricted movement of fluid from said cylinder to said well, said last valve being normally open and arranged to close in the direction of fluid movement.

2. In a device of the character described, in combination, a fluid-containing casing having a well and a cylinder therein, there being two passageways between said cylinder and well, a piston in said cylinder, a valve in one of said passageways adapted to permit free movement of fluid from said well to said cylinder, a normally open valve in the other passageway adapted to close upon movement of fluid outwardly from said cylinder toward said well and to restrict such passageway in proportion to such movement, and an adjustable spring tending to oppose the closing movement of said valve.

3. In a device of the character described, in combination, a fluid-containing casing having a well and a cylinder therein, there being two passageways between said cylinder and well, a piston in said cylinder, and a spring pressed valve in each passageway both of which open toward the cylinder, the spring of one valve acting at all times to keep it closed and that of the other to keep it open.

4. In a device of the character described, in combination, a casing having a well and a cylinder therein, a piston in said cylinder, and a plurality of passageways between said well and the portion of said cylinder at one end of said piston, an inwardly opening, spring-seated, inlet valve in one passageway, and an inwardly-opening, spring-opened, outlet valve in another passageway adapted to be displaced outwardly by the movement of fluid therepast and when so displaced to obstruct its passageway by an amount which is substantially proportional to its displacement.

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5. In a device of the character described, in combination, a fluid-containing casing adapted to be attached to one part of an automobile and having therein a well and a cylinder, means establishing communication between said cylinder and well, a piston in said cylinder and operatively connected to a relatively movable part of the automobile, and means for restricting the flow of fluid from said cylinder to said well by an amount which varies directly with the speed of the piston movement and is independent of the extent of such movement.

6. In a device of the character described, in combination, a fluid-containing casing adapted to be attached to one part of an automobile and having therein a well and a cylinder, a piston in said cylinder operatively connected to a relatively movable part of the automobile, one end of said cylinder being in open communication with said well, means for permitting the movement of fluid between the opposite end of said cylinder and well substantially unimpeded so long as its rate of movement is small, and means operative when the pressure inside the last named end of said cylinder rises to a predetermined point for restricting the outflow therefrom by an amount which is proportional to that pressure.

7. In a device of the character described, in combination, a fluid-containing casing adapted to be attached to one part of an automobile and having therein a well and a

cylinder, a piston in said cylinder operatively connected to a relatively movable part of the automobile, a passageway connecting said cylinder and well, a valve in said passageway, and a spring tending to move said valve toward said cylinder and arranged to hold said valve stationary until the pressure in said cylinder exceeds a predetermined amount and then to permit the valve to move outwardly, said valve being arranged to restrict the opening through the passageway by an amount increasing with such outward movement.

8. In a device for restraining the relative movement between two spring-connected members of a vehicle, in combination, a liquid containing casing adapted to be secured to one of the vehicle members, a movable displacing member therein and fitting the walls thereof so as to separate the same into a pressure chamber and a storage chamber, means for securing said displacing member to the other vehicle-member, there being a passageway extending from one chamber to the other, a valve operatively associated with said passageway, and a spring normally holding said valve open while permitting it to approach its seat the same by an amount which is at all times proportional to the excess of pressure existing in the pressure chamber over that in the storage chamber.

In testimony whereof, I hereunto affix my signature.

JAMES B. KIRBY.