

July 29, 1924.

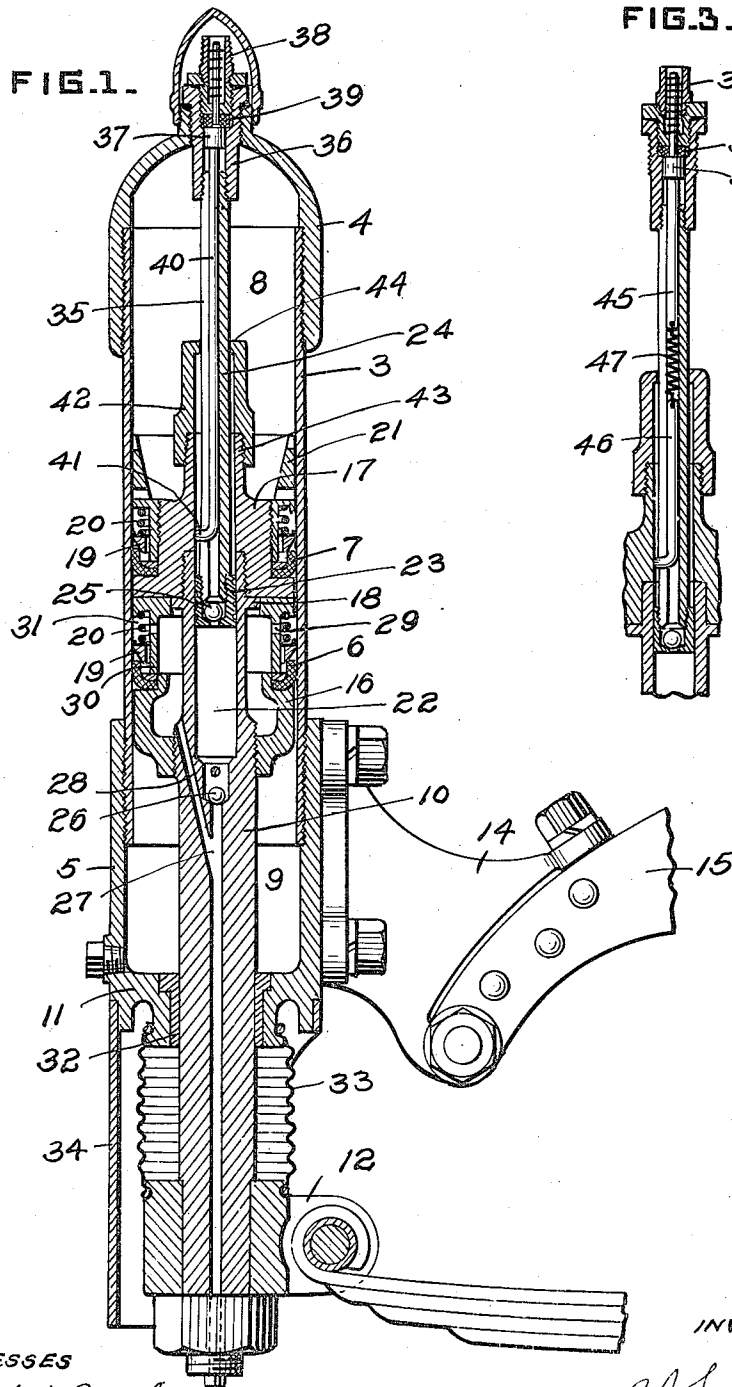
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J. J. McELROY

AUTOMATIC AIR SPRING

Filed Dec. 19, 1921

2 Sheets-Sheet 1



WITNESSES
J. Herbert Bradley.

INVENTOR
By John J. McElroy
Green and McElroy
His Attorneys in fact

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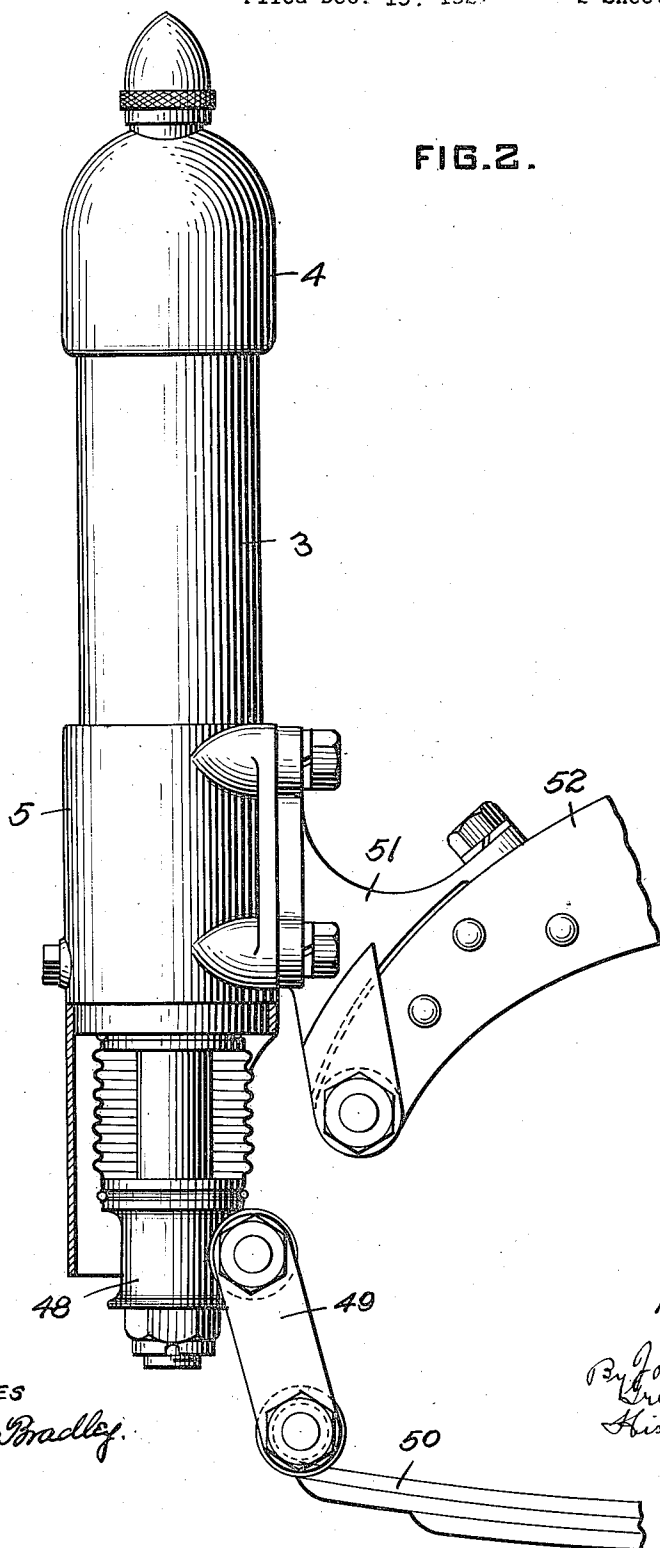
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FIG. 2.



WITNESSES
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UNITED STATES PATENT OFFICE.

JOHN J. McELROY, OF NEW HAVEN, CONNECTICUT, ASSIGNOR TO THE WESTINGHOUSE AIR SPRING COMPANY, OF NEW HAVEN, CONNECTICUT, A CORPORATION OF PENNSYLVANIA.

AUTOMATIC AIR SPRING.

Application filed December 19, 1921. Serial No. 523,397.

To all whom it may concern:

Be it known that I, JOHN J. McELROY, a citizen of the United States, and a resident of New Haven, in the county of New Haven and the State of Connecticut, have made a new and useful Invention in Automatic Air Springs, of which the following is a specification.

This invention relates to hydro-pneumatic devices of the type set forth by Letters Patent No. 1,036,043 issued to George Westinghouse on August 20th, 1912.

In the present application as in said patent, the invention is embodied in a fluid compression device adapted for use as a compression spring broadly applicable in any relation where two bodies are so associated that resilient support of one is desirable, and a general object in view in this application as in said patent is to embody the principle of resilient support by an elastic compression medium such as air in a commercially practical self-contained air-tight compression device adapted to serve all of the purposes and functions of a spring.

This invention also resembles that of said patent in so far as a fluid tight joint between the sliding surfaces of the device is maintained by means of a liquid seal.

This invention also resembles that of Patent No. 1,179,253, issued to George Westinghouse on April 11, 1916 in that successive annular packings for the sliding joint between the plunger and the cylinder are utilized and a pump, having its intake connected up to the space between said packings, is utilized for withdrawing sealing liquid from between the packings and returning it to the load supporting cushion chamber.

This invention also resembles that of Patent No. 1,146,335 issued to Richard Liebau on June 13, 1915, in that the pump for transferring liquid from the sliding joint to the load supporting cushion chamber has one of its elements carried by one of the relatively movable members forming a part of the cushion chamber, while the other pump member is mechanically connected to the other relatively movable member forming the cushion chamber.

This invention also resembles that of Patent No. 1,340,233 issued to Richard Liebau on May 18, 1920, in that means are utilized for automatically forcing air into the cushion chamber and for automatically bleeding air therefrom in accordance with the position of the members forming the cushion chamber.

According to the present invention which is broadly applicable for use as a spring for motor vehicles (which hereinafter without any idea of limiting the invention, will be referred to as an air spring) sufficient air pressure is automatically maintained within the cushion chamber for sustaining the load and excess pressure in the cushion chamber over and above that necessary to maintain the spring in normal running position is automatically bled from the cushion chamber during the extension movements of the spring and therefore, during the time of decreasing pressure in the cushion chamber.

An object of this invention is to provide a simple self-pumping and self-regulating air spring having the sliding joint thereof sealed with liquid and in which the liquid seal is automatically maintained.

This, as well as other objects which will readily appear to those skilled in this particular art, I attain in the device described in the specification and illustrated in the drawings accompanying and forming a part of this application and in which Figure 1 is a view in sectional elevation of a front air spring for vehicles embodying this invention. Fig. 2 is a view in side elevation of a rear spring embodying this invention, portions of the mud guard and boot being removed for convenience in illustration and Fig. 3 is a fragmentary sectional view of a modification of the bleeder device.

The device consists of a suitable length of internally ground tubing 3 (preferably steel) to the upper end of which a dome shaped head 4 is threaded and to the lower end of which a cup-shaped casting 5 is threaded.

A piston or plunger carrying two annular cup shaped packings 6 and 7 arranged to slide within tubing 3 divides the interior

of the air spring into a variable volume load supporting cushion 8 and a rebound or re-coil check cushion 9.

A piston rod 10 carries the piston or plunger and projects through bottom 11 of the air spring and by means of a suitable connector 12 is connected to the front end of one of the leaf springs (Fig. 1) of the vehicle while cup-shaped member 5 which forms the lower portion of the air spring is formed for suitable connection to bracket 14 carried by one front horn 15 of the vehicle frame.

The piston of the air spring preferably consists of a lower chambered member 16 threaded onto the piston rod and an annular upper member 17 threaded onto the upper end of the piston rod so as to abut against an annular shoulder 18 formed on said rod. Parts 16 and 17 form supports for the cup leather packings and their outer peripheries are preferably machined so as to form bearing surfaces suitable for sliding on the inner surface of cylinder 3.

Each of the packings is provided with a cone expander 19 for its upper free edge and expander springs 20 yieldingly hold the expanders in place.

Member 17 is provided with an upwardly extending flange 21 for increasing the bearing surface of the piston.

The upper end of the piston rod as well as member 17 is drilled to form a pump barrel 22 within which a pump piston 23 operates. The pump piston is carried at the lower end of a hollow piston rod 24 and a ball 25 seated at the lower end of the pump piston serves as a discharge valve for the pump. A ball 26 seated in a sub-bore of the pump barrel serves as the inlet valve to the pump which is connected by means of ducts 27 and 28 and holes 29 in the spacer 30 with space 31 between annular cup packings 6 and 7.

The opening in bottom member 11 around piston rod 10 is bushed as shown at 32 and a flexible dust boot 33 extends from an annular flange on bottom member 11 to an annular flange on connector 12.

A mudguard 34 formed of sheet metal is secured to the lower end of bottom member 11 and serves to protect the boot and improve the appearance of the device.

Pump piston rod 24 which is hollow is longitudinally slotted on one side as shown at 35 and the upper end of this rod is threaded into a depending nipple 36 threaded into a central opening in dome member 4. An inwardly opening valve 37 seated by means of a coil spring 38 against a soft seat 39 is provided with a stem 40 terminating at its lower end in a trigger 41. An annular nut 42 threaded onto an upward extension 43 of member 17 is provided with

an annular lip 44 with which trigger 41 is adapted to collide when the air spring approaches the limit of its expansion movements. Collision between trigger 41 and lip 44 opens valve 37 and allows an outflow of air from cushion chamber 8 thereby relieving the pressure therein thus causing the air spring to collapse to normal or operating position.

In Fig. 3 a modified form of relief valve stem is shown and in this form the stem is divided into two parts 45 and 46 connected together by means of a tension spring 47. With this construction, the relief of pressure can be adjusted by adjusting the tension of coil spring 38 or by substituting springs of different tensions for spring 38.

In Fig. 3 which illustrates a rear air spring, the lower end of the piston rod 10 is provided with a connector 48 and this, by means of a shackle 49, is connected to the rear end of one of the rear steel springs 50 of the vehicle. A bracket 51 is utilized for connecting the air spring to the rear of the vehicle frame 52.

Having thus described my invention, what I claim is:—

1. In an air spring, a variable volume cushion chamber, an internal pump for forcing air into said chamber, a spring loaded relief valve for said chamber and means operating upon extension movements of said spring for opening said relief valve.

2. In an air spring, relatively movable members forming a variable volume cushion chamber, a pump for forcing air into said chamber, a spring loaded relief valve carried by one of said members and means on the other of said members for opening said relief valve.

3. In an air spring, a cylinder, a piston slidable therein, an air pump having its barrel carried by said piston and its plunger carried by said cylinder, a spring loaded relief valve at the top of said cylinder and means operatively connected to said valve and having a lost motion connection with said piston for opening said valve upon abnormal extension movements of said air spring.

4. In an air spring relatively movable members forming a cushion chamber, a pump for forcing air into said chamber, a spring loaded relief valve at the top of said chamber and means for opening said relief valve during times of decreasing pressure within said chamber.

5. In an air spring, a cushion, a rebound check chamber, a piston separating said chamber, successive annular packings on said piston, a pump arranged to remove liquid from between said packings and for forcing it and air into said cushion chamber, a spring loaded relief valve at the top

of said cushion chamber and means for opening said relief valve at times of maximum pressure in said rebound check chamber.

6. In an air spring, a cushion chamber adapted to contain air and oil, rebound check means, a piston carrying successive annular packings between said chamber and said means, a pump for forcing air into said chamber, and having its inlet connected to

the space between said packings, a spring loaded relief valve for said chamber and means for opening said relief valve during lowering pressure in said chamber.

In testimony whereof, I have hereunto subscribed my name this 5th day of December, 1921.

JOHN J. McELROY.