S. D. INGHAM.

EXPANSIBLE CHAMBER.

APPLICATION FILED APR. 1, 1914.

1,151,595.

Patented Aug. 31, 1915.

2 SHEETS—SHEET 2.

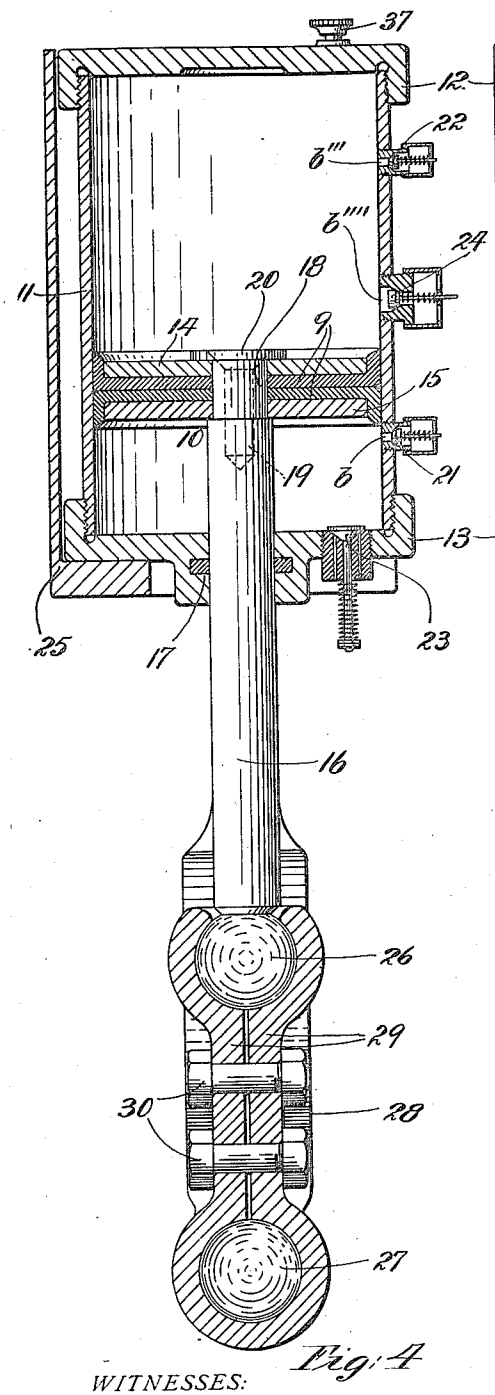


Fig. 4

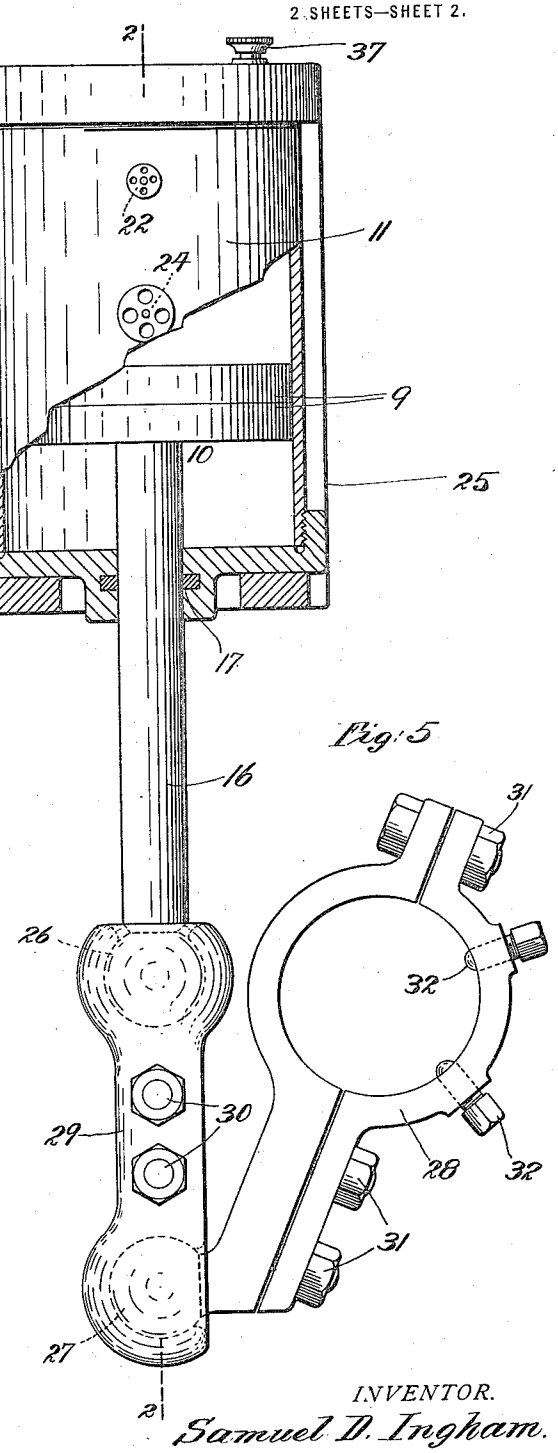


Fig. 5

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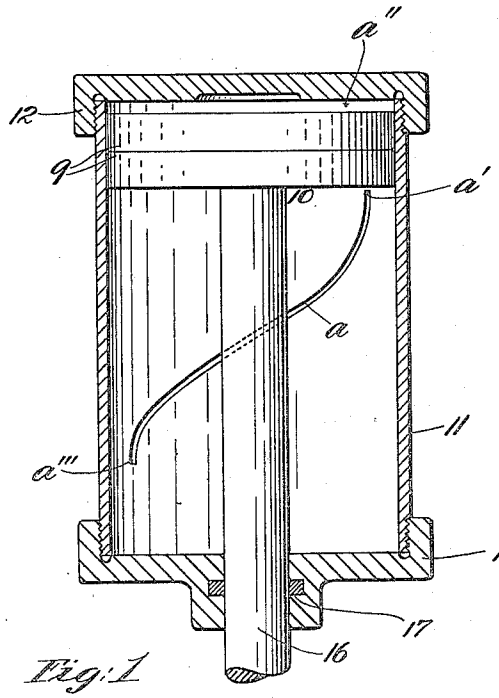


Fig. 1

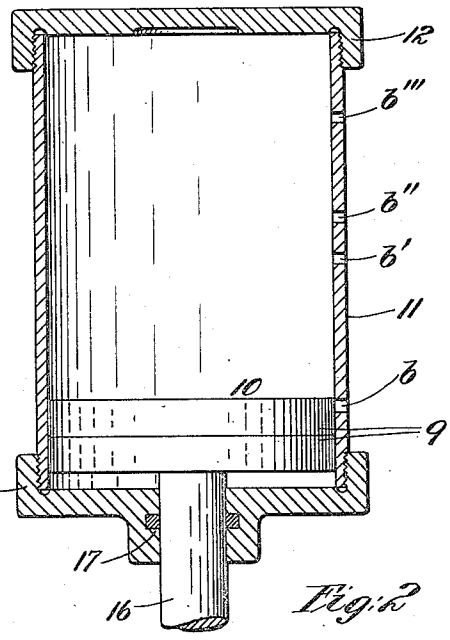


Fig. 2

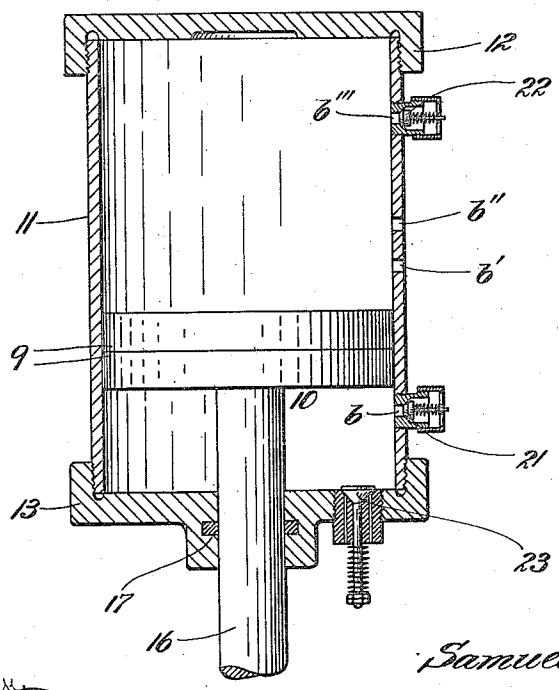


Fig. 3

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EXPANSIBLE CHAMBER.

1,151,595. Specification of Letters Patent. Patented Aug. 31, 1915.

Application filed April 1, 1914. Serial No. 828,816.

To all whom it may concern:

Be it known that I, SAMUEL D. INGHAM, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a certain new and useful Improved Expansible Chamber, of which the following is a specification.

This invention relates, broadly speaking, to expansible chambers calculated to sustain a weight elastically, or to act as a buffer in minimizing shock, and has more particular relation to the providing of a shock absorber for self propelled vehicles for which it is primarily designed.

The principal object of the present invention may be said to reside in the providing of an expansible chamber designed to permit of an easy and freely responsive action to that of the referred shock or jar, so as to gradually absorb the same and then permit of the gradual return of parts affected to normal position.

A further object of the present invention is to provide a device of the class described embracing a cylinder closed at both ends against the expulsion of air, the side wall of which cylinder intermediate its ends is constructed to permit of the admission and expulsion of atmospheric air, which cylinder is provided with a plunger operative through the cylinder for gradually expelling air from that part of the cylinder toward which it is advancing until the plunger passes that portion of cylinder wall which permits egress of air, whereupon a confined cushion of air is formed in that particular end of cylinder, during which plunger movement atmospheric air is being drawn into the opposite portion of the cylinder for similar expulsion and compression upon the opposite movement of the plunger.

Other and further objects of the invention reside in the providing of an expansible chamber the coöperative parts of which are so designed, proportioned, arranged and constructed that the air admission and expulsion ports are disposed one in advance of the other to permit of a graduated, responsive action of a reciprocating piston for efficiently cutting down and finally absorbing, by means of an encompassed or confined air cushion at the chamber ends, both shocks and the rebound effects resulting therefrom.

With these and other objects in view, the invention consists, generally speaking, in the improvements hereinafter described and finally pointed out in the claims.

The nature, characteristic features and scope of the invention will be more fully understood from the following description, taken in connection with the accompanying drawings forming part hereof and in which:

Figure 1, is a view in central section of a type of expansible air chamber embodying the invention, Fig. 2, is a similar view of a slightly modified form, Fig. 3, is a similar view of a further modified form, Fig. 4, is a similar view of a still further modified form, the same being illustrated as embracing a shock-absorber for self-propelled vehicles, and Fig. 5, is a side view of Fig. 4, partly sectioned.

In the drawings, there is disclosed a physical embodiment of the improvement, designed in accordance with the methods best known to me at this time for practising the invention.

Obviously, variations may be made of the particular form and arrangement of parts here shown without departing from the fair scope and spirit of the invention.

Referring now to the drawings and more particularly to Fig. 1, 10, designates a plunger working in a cylinder 11, closed at both ends by heads comprising preferably removable caps 12, and 13, which caps as shown have screw threaded relation with the cylinder wall. Ready access to the cylinder interior may thus be had for repair or other purposes. The plunger may be of any suitable construction but, in practice, is made up of superimposed disks 9, of pliable material, as leather, fitted between metallic disks 14, and 15, as clearly shown in Fig. 4. The metallic disks are of smaller diameter than the inside dimensions of the cylinder 11, but the pliable disks, however, are of a diameter in excess of the cylinder diameter. The peripheral rims of these disks 9, are diverged so as to lie between the rims of the metallic disks and the inner wall of the cylinder to closely hug the same, the advantages of which will be apparent.

A plunger rod 16, passing through a suitably packed bearing 17, of the cylinder 11, has rigidly fixed thereto the plunger 10. As shown the plunger rod is slightly reduced in diameter at 18, to form a shoulder, upon which abuts the lower metallic disk 15, the reduced part of the plunger rod passing through the remaining disks and termi-

nating flush with the top of the upper metallic disk 14. The plunger and plunger rod are secured together by a suitable element, shown in the drawings as being a machine screw 19, a countersunk washer 20, being present to receive the head thereof.

The cylinder wall as disclosed in Fig. 1, is slotted as at a, preferably spirally to prevent wear upon the plunger, which slot is disposed intermediate of the closed cylinder ends. This slot is of a size or dimension to permit of the proper amount of atmospheric air being admitted to and expelled from the cylinder during the plunger movement. As the plunger moves toward the position shown in Fig. 1, for instance, air within the cylinder beyond the plunger is gradually expelled through the slot a, until the plunger passes the part a', of the slot, whereupon a confined cushion of air is formed at a''. During this plunger movement, atmospheric air has been drawn into the opposite portion of the cylinder, so that as the plunger returns in the opposite direction, such air is gradually expelled until the part a''', of the slot is reached, atmospheric air meanwhile being admitted beyond the plunger. Should the plunger continue in its movement beyond part a''', of the slot, a confined cushion of air is formed with respect to this particular end of the cylinder 11.

The normal position of the plunger is disclosed in Figs. 3, 4, and 5. For illustrative purposes, assuming that the cylinder is fixed to the frame of a self-propelled vehicle and that the plunger rod is connected to a rear or front axle of the vehicle, shocks or jars, as the vehicle wheels pass over an obstruction, force the plunger farther into the cylinder. This inward movement of the plunger decreases the volume of air within the cylinder by causing air to expel through that portion of the slot beyond the plunger, thus increasing the intensity of pressure. The intensity of pressure acts to resist the force exerted against the plunger and the farther inward the plunger moves, the greater the pressure until when the plunger moves beyond part a', of the slot, a compact cushion of air is present between the cylinder cap 12, and the plunger top, which cushion of air serves to absorb the final shock impulse. It may be stated in this connection that after the plunger passes the part a', the intensity of pressure of confined air above the plunger increases many pounds to the square inch with the gradual inward movement of the plunger so that a maximum pressure intensity is obtained with the result described.

In Fig. 2, a slightly modified form is disclosed. In lieu of a slot, ports b, b', b'', and b''', are formed in the cylinder wall. These ports are open so that at all times there may be free admission or expulsion of air during the plunger movement. As shown, the ports b', and b'', are adjacent and arranged substantially midway of the cylinder heads. The ports b, and b''', are located one adjacent the cylinder head 13, and the other adjacent the cylinder head 12. It is thought that the operation of the plunger through the cylinder in connection with these ports will be sufficiently apparent from the foregoing description without going into details, which would amount to repetition.

In Fig. 3, a further modified form is shown, in which while ports b' and b'', remain as in Fig. 2, the remaining ports are closed by adjustable, spring pressed outwardly opening valves 21, and 22, of any suitable type. There is also present in the cylinder head 13, a port provided with an inwardly opening adjustable spring pressed valve 23. Normally, the plunger assumes a position between the ports b, and b', so that ports b' and b'' are open to the atmospheric air. With the plunger moving outwardly, valve 23 is opened by suction to admit atmospheric air to the cylinder behind the plunger. As the plunger movement continues, air is gradually expelled through ports b', and b'', and b''', to decrease the volume of air within the cylinder beyond the plunger and increase the intensity of pressure as before described. Finally, when the plunger passes port b''', a confined air cushion is formed as described. In the return plunger movement it will be understood that valve 21, opens and valve 23, remains closed.

In Figs. 4, and 5, further modified constructions are disclosed. Instead of ports b', and b'', a single port b'''', is present, provided with an adjustable, spring pressed, inwardly opening valve 24. The other valved ports are the same as shown in Fig. 3. As the plunger 10, moves outwardly, from normal position, as shown, valve 23, opens, valve 21, remains closed, valve 24, opens after plunger passes the same and air is expelled through port b'''. In the return movement of the plunger, valve 24, is closed until after plunger passes the same, valve 21, is open and valves 22 and 23, closed.

As showing one method of arrangement of a compressible chamber embodying the invention in application to a self-propelled vehicle, a generally L-shaped bracket 25, apertured to coöperatively seat the cylinder bottom, in practice is attached to a suitable part of a vehicle frame. The plunger rod 16, is provided at its lower end with a spherical part 26. Connecting the part 26, and a similar part 27, fixed to one of the free ends of a two-part axle clamp 28, is a two-part socket 29, the parts being bolted together as at 30. Such attachment, em-

bracing a pair of ball and socket joints forms a universal connection particularly adapted to prevent straining of the cylinder and parts and accommodate lateral sway of a vehicle. The axle clamp is adapted to be secured upon the vehicle axle as by bolts 31. To prevent turning of the parts thus clamped, set screws 32, may be utilized.

37 designates a grease or oil cup for the cylinder 11. Any of the above described compressible cylinders when mounted upon a self-propelled vehicle provide means for gradually decreasing and finally absorbing shocks and jars and also provide means for gradually cutting down and finally absorbing the resulting rebound effect of the vehicle springs.

What I claim is:

1. A device of the class described embracing a cylinder the respective ends of which are closed to the expulsion of air, a plurality of ports in the cylinder wall whereof the outermost ports are disposed short of the cylinder ends and are open to air expulsion but closed to air admission and whereof at least some of the intermediate ports are open to air admission and egress and a plunger operative in said cylinder.

2. A device of the class described embracing a cylinder the respective heads of which are closed against the expulsion of air, a plurality of ports arranged one in advance of the other in the cylinder wall, one of said ports being disposed immediately short of each cylinder head, said latter ports being closed to admission of atmospheric air and the remaining or intermediate ports being open to atmospheric air admission, an inwardly opening valved port for one cylinder head and a plunger operable through the cylinder.

3. A device of the class described embracing a cylinder the respective heads of which are closed against the expulsion of air, a plurality of ports arranged one in advance of the other in the cylinder wall with one port adjacent each cylinder head and the other ports intermediate thereof, at least some of which ports are open for the admission and expulsion of atmospheric air, an inwardly opening valved port for one cylinder head and a plunger operable through the cylinder.

4. A device of the class described embracing a cylinder the respective heads of which are closed for the expulsion of air, a plurality of ports arranged one in advance of the other in the cylinder wall the outermost ports being disposed short of the cylinder heads and the intermediate ports being disposed adjacent one another, the latter ports at least being open for the admission and expulsion of atmospheric air, an inwardly opening valved port for one cylinder head and a plunger operative in said cylinder the extreme strokes of which are calculated to cut off, a complemental outermost port and form in a cylinder end a confined cushion of air.

5. A device of the class described embracing a cylinder the respective heads of which are closed for the expulsion of air, but one of them open for the admission of atmospheric air, a plurality of ports arranged one in advance of the other in the cylinder wall the outermost ports being disposed short of the cylinder heads and the other ports being disposed intermediate thereof the former being closed to the admission of atmospheric air but open to air expulsion and the intermediate ports being open for the admission and egress of atmospheric air, an inwardly opening valved port for one cylinder head and a plunger operative in the cylinder and calculated in its extreme strokes to pass a complemental outermost port to form a confined air cushion at a cylinder end.

6. A device of the class described embracing a cylinder the respective ends of which are closed to the expulsion of air, a plurality of ports arranged one in advance of the other in the cylinder wall whereof the outermost ports are open for air expulsion but closed against air admission said ports being disposed immediately short of the cylinder ends and whereof the intermediate ports are open to both air admission and expulsion and are disposed immediately adjacent one another midway between the cylinder ends and a plunger operative in said cylinder.

7. A device of the class described embracing a cylinder and a piston operative therein, both cylinder heads being closed to air expulsion and at least one of them closed to air admission, the cylinder side wall being provided with ports for air admission and expulsion of which some of said ports are located short of the cylinder heads and are closed to air admission but allow of air expulsion and of which the remainder of said ports are disposed intermediate of the first mentioned ports at least some of which are open for air admission and egress.

8. A device of the class described embracing a cylinder and a piston operative therein, both cylinder heads being closed to air expulsion and at least one of them closed to air admission, the cylinder wall being provided with a plurality of ports of which some are disposed short of the cylinder heads and are closed to air admission but open for air expulsion and of which some are disposed intermediate of the first mentioned ports and are relatively open for air admission and egress.

9. A device of the class described embracing a cylinder the respective ends of which are closed to the expulsion of air, a plurality of ports in the cylinder wall whereof the

outermost ports are disposed short of the cylinder ends and are open to air expulsion but closed to air admission and whereof the intermediate ports are open to air admission and expulsion and a plunger operative in said cylinder.

In testimony whereof, I have hereunto signed my name.

SAMUEL D. INGHAM.

Witnesses:
SIDNEY E. SMITH,
WILLIAM J. JACKSON.