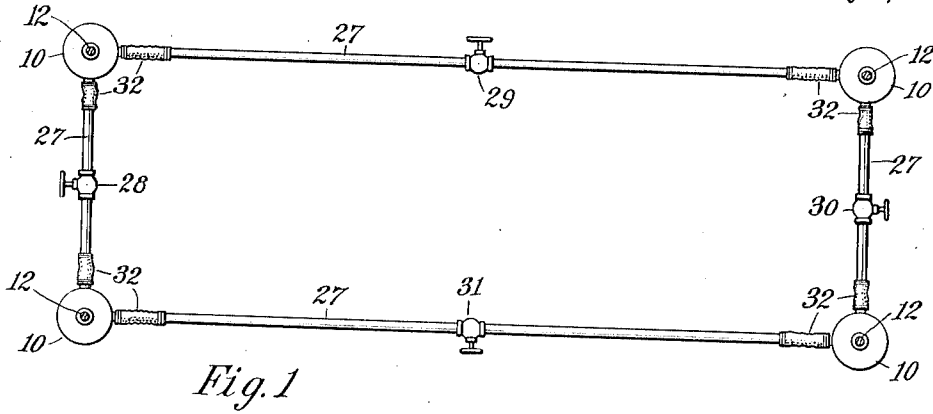
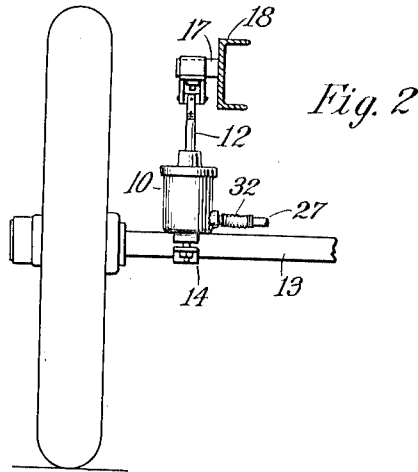
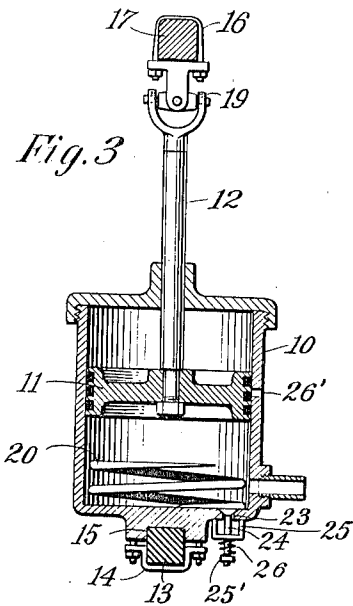
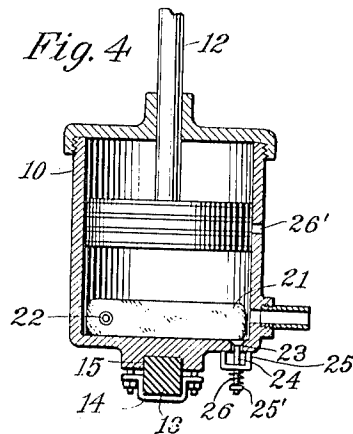


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CUSHIONING MEANS FOR VEHICLES.
APPLICATION FILED DEC. 8, 1910.

1,066,712.

Patented July 8, 1913.



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UNITED STATES PATENT OFFICE.

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CUSHIONING MEANS FOR VEHICLES.

1,066,712.

Specification of Letters Patent.

Patented July 8, 1913.

Continuation of application Serial No. 528,414, filed November 16, 1909. This application filed December 8, 1910. Serial No. 596,207.

To all whom it may concern:

Be it known that I, BENSON P. COOPER, a citizen of the United States, residing at Ithaca, in the county of Tompkins and State of New York, have invented certain new and useful Improvements in Cushioning Means for Vehicles, of which the following is a full, clear, and exact description.

This invention relates to pneumatic cushioning devices for vehicles, to be used in combination with or in place of the ordinary metallic springs, pneumatic tires, shock-absorbers and the like, and its chief object, stated briefly, is to provide improved means for the purpose, of simple and durable construction.

A farther object is to provide means whereby the air pressure in the several air-cushions employed may be equalized, so that no corner or end of the vehicle will have a less yielding support than another.

To these and other ends the invention consists in the novel features of construction and combinations of elements hereinafter described, and more particularly set forth in the claims.

The invention can be embodied in a variety of forms, and of these I have selected for illustration and specific description herein the one which at the present time is considered to exhibit the various features of the invention in their most convenient and effective form. This embodiment is illustrated in the accompanying drawing, in which—

Figure 1 is a sectional plan view of the four air cylinders and their pressure-equalizing connections. Fig. 2 a detail elevation of one of the air cylinders, showing a convenient mode of connection with the axle and vehicle body. Fig. 3 is a vertical section of one of the cylinders, showing the interior parts, and Fig. 4 is a vertical section of a modification.

My invention provides for the mounting of a cushioning cylinder at preferably each corner of the vehicle, each cylinder being provided with a cooperating piston confining a resilient body of air between it and the end of the cylinder so that the vehicle body will be yieldingly supported, in whole or in part by the bodies of air according to the number of cylinders employed and whether or not other resilient devices are also employed, as will be readily understood. In the draw-

ing the cylinders are designated by 10, each containing a cooperating reciprocating piston 11 having a stem 12 extending out through a head of its cylinder. It is evident that the cylinder may be connected to or mounted on the axle and the piston connected to the vehicle body, or vice versa, but in practice I prefer the former method, as indicated in the drawing. Various means for connecting the parts named may be provided. For example the cylinders may be rigidly and securely mounted on the axle 13 by means of a strap or clip 14 passing under the axle and bolted to the bottom of the lower cylinder-head, the latter being provided with a notch or recess 15 in which the axle fits. At the upper end the stem or piston rod is connected to the vehicle body or to the chassis, as by means of a U-clip 16 embracing a stud 17 extending laterally from the side member 18 of the chassis. In the present embodiment a universal joint 19 of suitable construction is employed between the piston stem and the chassis, to permit more or less play of the parts relative to each other without subjecting them to excessive stresses. It is to be understood, however, that the use of such a joint is not essential.

From the foregoing it will be seen that the pistons, and through them the vehicle body, rest on the resilient bodies of air contained in the cylinders below the pistons; which bodies of air act as cushions or springs, but in a more efficient manner than the ordinary springs or cushioning devices with which I am familiar.

In connection with the cylinders, supplemental or auxiliary cushioning means may be provided, to prevent the pistons at any time resting on the bottoms of the cylinders, as for example when the vehicle has stood unused for a considerable time, during which the air may leak out of the cylinders. For the purpose mentioned I prefer to employ a strong coil-spring 20, as in Fig. 3, mounted on the bottom of the cylinder, or a strong pneumatic tube 21 as in Fig. 4. In the latter case the tube 21 is provided with a suitable valve 22 through which the tube may be pumped full of air. Of course the valve is to be extended through the cylinder wall for convenient connection with a pump or other source of compressed air.

Instead of supplying the cylinders with

compressed air from an external source, as for example a tank of air under pressure or an air-pump I prefer to make each cylinder and piston an air pump to supply the compressed air needed. For this purpose the cylinder is provided with a port 23 in its base, which port is controlled by a check-valve 24, the stem of which is slidably mounted in a yoke 25 on the bottom of the cylinder. Encircling the stem, between the yoke and the adjustable nut or stop 25', is a light coil spring 26 holding the valve yieldingly on its seat. Now when the vehicle is running the upward movement of the piston due to the movement of the body will draw air into the cylinder through the port 23, the valve 24 being of course lifted from its seat. At the downward movement of the piston, however, the valve will be seated and the port closed, thereby entrapping air between the piston and the lower cylinder-head. In this way the air pressure in the cylinder is speedily increased. Eventually the pressure might become great enough to lift the piston against the upper head and even hold it there with considerable firmness. To obviate this contingency means may be provided for permitting escape of air from the cylinder whenever the pressure therein is great enough to hold the piston above a suitable point. For this purpose the cylinder wall is provided with a port 26', located, say, at about the middle point between the cylinder-heads or a little above such point. Under normal conditions, when running on a comparatively smooth road the air pressure developed in the cylinder may not be sufficient to raise the piston above the outlet port 26', and such port is therefore closed by the piston or is open to the space above the latter. But as the pressure is increased the piston may be lifted above the port, thereby allowing air to escape from the lower part of the cylinder into the atmosphere. It will also be seen that if the construction is such that no air can escape from above the piston except through the port 26' the piston will float, as it were, between two bodies of air, yieldingly opposing vertical movement of the piston. Inasmuch as the upward movement is also opposed by gravity it will, in general be found sufficient to employ compressed air for the lower air-cushion only.

The adjustable stop 25' on the stem of the inlet valve may also be employed to regulate the pressure in the cylinder. Thus by setting up the nut or stop the tension of the valve spring may be increased, so that greater upward movement of the piston will be necessary to open the valve; while by contrary adjustment the valve will be held less firmly in its seat and hence will admit air more readily.

Unequal action of the several cushioning

devices in their air-compressing function may result in one cylinder having a higher pressure than another, particularly when an escape port, 26', is not employed. One corner or end of the vehicle would therefore be higher than the rest or would be supported less yieldingly, the effect being in a sense like that which would result when with ordinary metallic springs one or more is stiffer than the rest. To obviate this drawback I propose to provide equalizing connections between the cylinders, preferably in the form of pipes or tubes 27 connected to the lower portions of the cylinders. Now if one or more cylinders pump in more air than the rest the excess will flow to the others through the connecting tubes, thereby equalizing the pressure. Moreover, if the operation of any cylinder should be impaired, as for example by the check or inlet valve leaking or sticking the other cylinders will supply the needed air. For the purpose of cutting out one or more cylinders when desired, as when totally disabled, the equalizing devices are provided with manually operable valves 28, 29, 30, 31, by which communication through the pipes can not only be cut off altogether but also regulated or controlled as desired. Thus if the cylinder shown at the lower left hand corner of Fig. 1, for example, should be disabled, the valves 28 and 31 may be closed, thereby cutting the damaged cylinder out of the series.

The equalizing pipes are preferably made flexible, so that their connections with the cylinders will not be strained by the stress incident to the vehicle's movements. For this purpose short flexible sections 32 may be employed at each cylinder. These sections may be of any suitable character, for instance short pieces of hose such as used in air-brake systems.

I have shown four cylinders in the drawing, one for each corner of the vehicle, but it will be understood that the invention is not confined to this particular number. On the contrary, the number employed depends largely on the load to be carried, as for example a heavy load may require as many as four cylinders on each axle. It will also be apparent that the number used depends, in a measure, upon their capacity, one large cylinder for each wheel being under some conditions as effective as two or more. It is also to be understood that the invention is not confined to the details of construction herein specifically described, but may, as previously stated, be embodied in other forms without departing from its proper spirit and scope as defined by the appended claims.

The present application is a continuation of my prior application, Serial No. 528,414, filed November 16, 1909.

I claim:

1. The combination with a vehicle body and a supporting axle therefor, of air cushioning devices comprising a cylinder and a piston therein, means for conveying air from one device to another whereby to equalize the pressure therebetween and means for allowing the escape of air from said cylinder when the volume of air below said piston exceeds a predetermined value.

2. In combination with a vehicle body and supporting axle therefor, of air cushion cylinders, cooperating pistons between the vehicle body and the axles at the sides of the former, cylinders having air intake ports, air outlet ports so placed that they are adapted to maintain the pistons at a uniform height in said cylinders, pipes connecting the cylinders and permitting the flow of air from cylinder to cylinder, and valves in said pipes to control such flow of air.

3. The combination with a vehicle body and supporting axles therefor of air cushion cylinders, and cooperating pistons between the vehicle body and the axles, valves adapted to admit air to said cylinders, pipes connecting said cylinders and permitting the flow of air from cylinder to cylinder, means to control said flow of air, air ports for the escape of air from respectively above and below said piston when said piston is respectively in substantially low and high position in said cylinder, said ports adapted to maintain an air cushion upon the extreme upward movement of said piston.

4. The combination with a vehicle body and a supporting axle therefor, of air-cushion cylinders and cooperating pistons between the vehicle body and the axle, an equalizing pipe connecting the cylinders and permitting flow of air from cylinder to cylinder whereby to equalize the pressure therein, and a valve in said pipe to regulate the flow of air therethrough.

5. The combination with a vehicle body and a supporting axle therefor, of air cushion cylinders and cooperating pistons between the vehicle body and the axle, means enabling a cylinder and its cooperating piston to pump air into the former, and an equalizing pipe connecting the cylinders and permitting air to flow from cylinder to cylinder whereby to equalize the pressure therein.

6. The combination with a vehicle body and a supporting axle therefor, of compressed air cushioning devices between the vehicle body and the axle, means enabling vertical movements of the vehicle body to provide compressed air for said devices, and means connecting the devices one with another and permitting air to flow therebetween whereby to equalize the pressure in the devices.

7. The combination with a vehicle body and a supporting axle therefor, of compressed air cushioning devices between the vehicle body and the axle, means enabling the cushioning devices to supply their own compressed air, means for conveying air from one cushioning device to another whereby to equalize the pressure therebetween, and means for regulating the flow of air through said air-conveying means.

8. The combination with a vehicle body and a supporting axle therefor, of air-cushion devices between the vehicle body and the axle, and means for conveying air from one device to another whereby to equalize the pressure therebetween, said system of connected devices being provided with means permitting the escape of air when the pressure within the system exceeds a predetermined value.

9. The combination with a vehicle body and supporting axles therefor, of air-cushion cylinders and cooperating pistons between the vehicle body and the axles at the sides of the former, the cylinders being provided with air-inlet ports, check valves controlling said ports, pipes connecting the cylinders and permitting flow of air from cylinder to cylinder, and valves in said pipes to control such flow of air.

10. The combination with a vehicle body and a supporting axle therefor, of air-cushion cylinders and cooperating pistons between the vehicle body and the axle, auxiliary yielding means inside the cylinders for supporting the vehicle body yieldingly when the cylinders are empty of air, means associated with a cylinder and enabling the movement of the cooperating piston to pump air into the cylinder, and means for conveying air from cylinder to cylinder to equalize the pressure therein.

11. The combination with a vehicle body and a supporting axle therefor of compressed air cushioning devices between the vehicle body and the axle, means enabling vertical movements of the vehicle body to provide free air for said device and compress said air, means for controlling the supply of said free air, and means connecting the devices one with another and permitting air to flow therebetween whereby to equalize the pressure in the devices.

In testimony whereof I affix my signature in the presence of two subscribing witnesses.

BENSON P. COOPER.

Witnesses:

EDWARD N. JACKSON,
MARY E. HOLMES.