F. WALTON.

ROAD VEHICLE SUSPENSION.

APPLICATION FILED AUG. 17, 1908.

959,661.

Patented May 31, 1910.

2 SHEETS—SHEET 1.

Fig. 1.

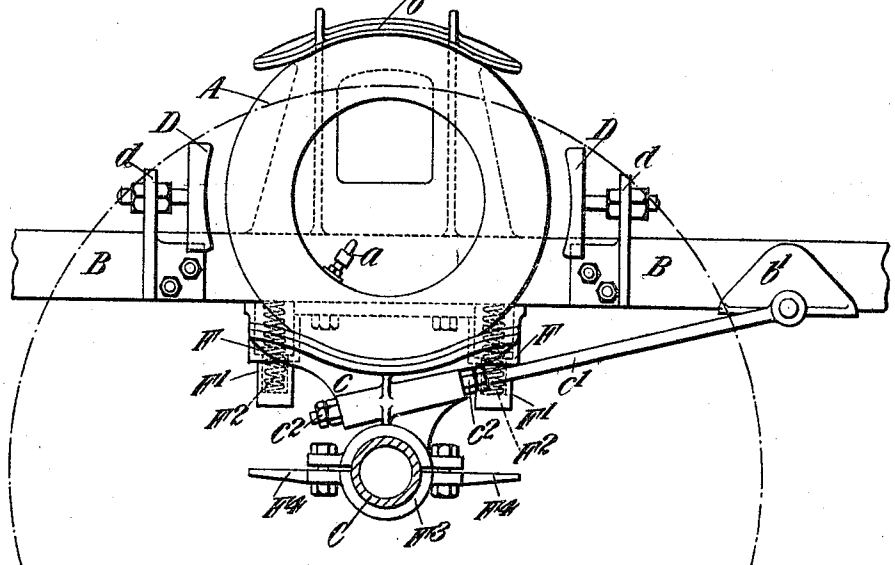
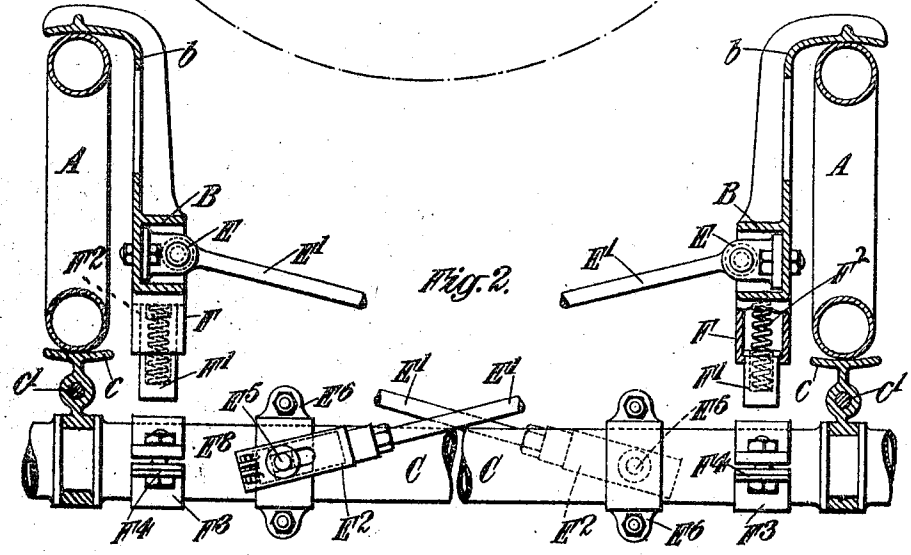


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 4.

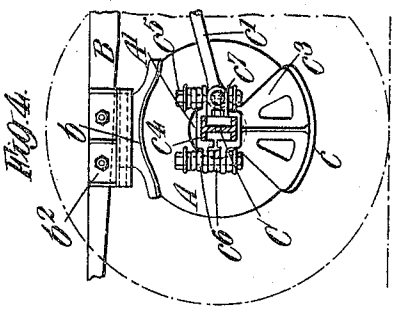


Fig. 5.

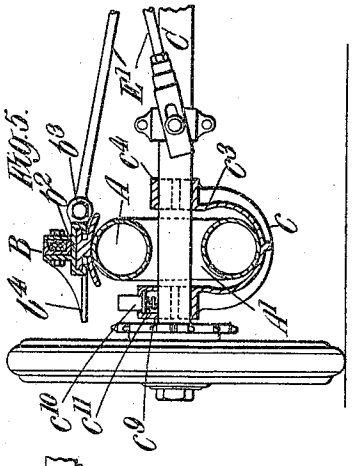


Fig. 3.

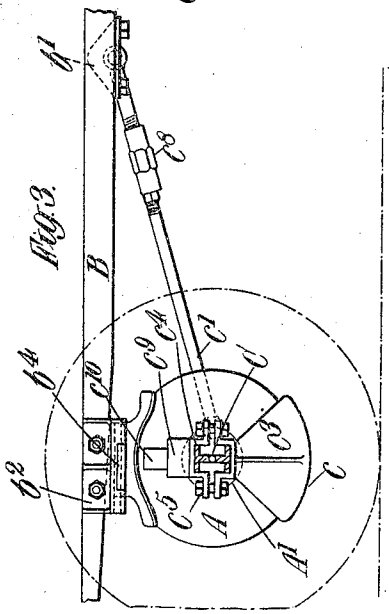


Fig. 8.

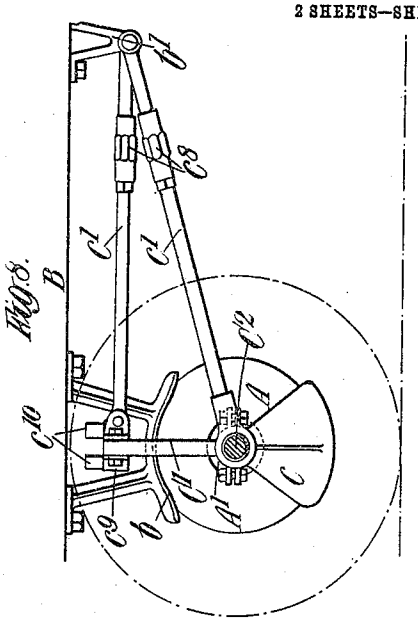


Fig. 7.

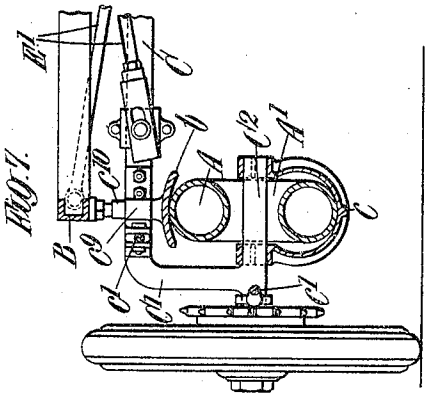
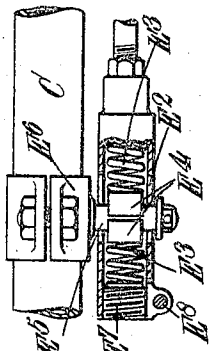


Fig. 6.



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UNITED STATES PATENT OFFICE.

FREDERICK WALTON, OF LONDON, ENGLAND.

ROAD-VEHICLE SUSPENSION.

959,661. Specification of Letters Patent. Patented May 31, 1910.

Application filed August 17, 1908. Serial No. 448,992.

To all whom it may concern:

Be it known that I, FREDERICK WALTON, a subject of the King of Great Britain, residing at 114 Holborn, in the county of London, England, have invented certain new and useful Improvements in or Relating to Road-Vehicle Suspension, of which the following is a specification.

This invention relates to the supporting of road vehicle frames or bodies from their axles, by means of flexible vessels or chambers containing air or fluid under pressure, and has for its chief object to derive a more sensitive and resilient action therefrom than has hitherto been obtained.

In pneumatic supporting devices as heretofore constructed or proposed to be employed, whether consisting of cushions interposed between the axles and the vehicle frame, or of annular pneumatic tubes interposed between the axles and the frame, either in a vertical or a horizontal direction, or encircling the axles and connected to the frame, the sole source of resiliency has been derived from the resistance offered by the air confined within the cushions to compression, due to any change in the capacity or cross sectional shape of such cushions when subjected to a load of a more or less varying character, with the result that their resilient action is mainly dependent upon their cross sectional area which of necessity must be of a somewhat limited size. The available movement for absorbing shocks is further reduced by the internal air pressure which must be sufficient to prevent the walls of the cushions from coming into contact with each other under the maximum load. For improving the action of such pneumatic devices, various arrangements have been employed, for example metal springs have been combined with the pneumatic cushions, and in some cases other pneumatic cushions containing air at a different pressure have been combined therewith, with the object of enabling certain of the cushions to absorb shocks of an ordinary character, the other cushions, or the combined cushions, or cushions and springs being arranged to come into action for absorbing excessive shocks or vibrations, but in all the pneumatic devices, the resiliency has been obtained by the varying compression of the air within the cushions.

According to this invention the springs employed are of the pneumatic cushion type, but instead of obtaining the resiliency solely by the displacement of the air, and the variation in the air pressure caused by the change in the capacity or cross sectional shape of the cushion when subjected to a vibratory force, I employ air or other fluid confined under pressure in a flexible vessel or chamber for maintaining the same in a normal position, and utilize the resiliency occasioned by the resistance offered by such vessel or chamber to deflection or bending movement or to any departure from its normal position, for enabling the vessel or chamber to act in the capacity of a pneumatic or fluid pressure spring. By this means a wider range of action is obtained for taking up shocks or vibrations, a considerably lower pressure can be employed whereby a softer and easier yielding movement is obtained, and a single fluid pressure spring is capable of acting in the capacity of a deflection spring for absorbing all ordinary shocks and vibrations, and of combined deflection and compression spring for absorbing abnormal shock or vibration. This effect has hitherto only been obtained by the employment of two sets of springs in the manner above set forth.

When the springs are of an annular shape they may be supported above the axle, or be arranged concentrically therewith, and in the latter case an important feature of my invention consists in forming and supporting the springs in such a manner that an annular space extends between the axle and the inner periphery of the spring, the lower outer peripheral portion thereof being supported by a member rigidly or yieldingly connected with the axle while the upper portion of the spring is supported by a member connected with the body of the vehicle.

In order that my said invention may be clearly understood and readily carried into effect I will now proceed to describe the same with reference to the accompanying drawings, in which:—

Figure 1 is a sectional elevation of part of a chassis showing one method of supporting the fluid pressure spring. Fig. 2 is a transverse sectional elevation of Fig. 1. Fig. 3 is an outside sectional elevation of part of a chassis showing the fluid pressure spring arranged concentrically in relation to the axle. Fig. 4 shows a slightly modified method of connecting the aforesaid spring to its axle. Fig. 5 is a transverse sec-

tional elevation of Fig. 3. Fig. 6 is a detached view drawn to a larger scale of a connecting device for preventing undue lateral movement between the chassis frame and the axle. Fig. 7 is a transverse sectional elevation of part of a chassis, showing an arrangement for enabling the fluid pressure spring to be removed from the axle without previously taking off the wheel, and Fig. 8 is a side elevation thereof, part of which is shown in section.

A represents the fluid pressure spring, B the side frame of the chassis, and C the axle.

With reference to Figs. 1 and 2, the spring A comprises an endless tube provided with a valve *a* by means of which it can be inflated or charged with fluid to the required pressure for supporting the load it has to carry without its annular shape being unduly changed thereby, it being found in practice, that a much lower pressure is required for retaining the spring in its most effective condition than is required in connection with pneumatic tires. Each of the springs is vertically supported between a bracket *b* extending upwardly from each side frame of the chassis, and a bracket *c* fixed on the axle C directly underneath the bracket *b*. Adjustable stops D carried by brackets *d* secured to the chassis frame on opposite sides of the spring A serve to prevent undue bending movement of the latter. The axle C is connected to the chassis by two radius rods c^1 one of which passes through each of the brackets *c*, and is adjustably secured thereto by the nuts c^2, its opposite end being pivotally mounted on a bracket b^1 secured to each of the side frames B. Any suitable means may be provided for preventing lateral movement between the axles and the frame. In the example shown, each of the side frames B has fixed thereto a bracket E to which is pivoted one end of a rod E^1. The opposite end of such rod is provided with a slotted tubular member E^2 see Fig. 6, for the reception of springs E^3 and bearing blocks E^4 which encircle a pin E^5 projecting from a bracket E^6 secured to the axle. The parts are retained in position within the tubular member by a screw plug E^7 which permits of adjustment of the springs E^3 and is capable of being rigidly secured by a screw E^8 passing through lugs in the tubular member. This arrangement enables the end of the rod to move in a circular path, and provides for a slight amount of lateral resiliency between the side frames and the axle, but prevents undue lateral movement between such parts. To support the body of the vehicle in the event of any of the fluid pressure springs becoming deflated, spring stops are interposed between the side frames B and the axles C. Each stop conveniently comprises two cylinders F containing hollow plungers F^1 and springs F^2 interposed between the frame B to which the aforesaid cylinders are secured, and the ends of the plungers F^1. Fixed on the axle C underneath the aforesaid plungers is a bracket F^3 provided with extensions F^4 to act as abutments for the plungers F^1 under the above stated condition or when otherwise required. The distance between the ends of the plungers F^1 and the extensions F^4 is preferably such as to admit of the maximum required movement between the axle and frame without the supplementary supporting device coming into action.

In the arrangement shown in Figs. 3, 4 and 5, the spring A is mounted concentrically in relation to the axle C, and is so formed as to provide an annular space A^1 between the axle and the inner periphery of the spring. The outer and lower peripheral portion of the spring is supported from the axle by a bracket *c* provided with inwardly extending members c^3 which inclose the opposite sides of the spring A and are connected to the axle C by the caps c^4 and bolts c^5. In Fig. 4, the connection between the bracket *c* and the axle is made of a slightly resilient nature through the interposition of india rubber washers c^6. The upper supporting member *b* is slidably mounted in a bracket b^2 secured to the side frame B, and is retained in its correct position by the spring A and the radius rod c^1. The latter is pivoted at one end to a bracket c^7 fixed to the axle C and at the other end to a bracket b^1 in the manner above set forth, and is formed in two pieces connected together by a right and left hand screw coupling c^8 for adjustment purposes. The rods E^1 for preventing lateral movement between the axle and frame are connected at one end to lugs b^3 formed on the brackets b^2, and at the other end to the axle in the manner already described. The supplementary supporting device is arranged on the cap c^4 of the bracket *c* and comprises a cylinder c^9 for the reception of a hollow plunger c^{10} and a spring c^{11} interposed between the end of the plunger and the upper surface of the axle C, a projecting surface b^4 being formed on the bracket b^2 to act as an abutment for the said plunger when required.

To facilitate the removal of the spring A from the axle C, each end of the latter intermediate of the wheels may be formed with a downwardly extending portion C^1 see Figs. 7 and 8, which terminates in a short horizontal axle C^2. The outer portion of such axle constitutes the journal pin for the wheel, and the inner portion is encircled by the spring A which is retained in position in relation thereto by its top and bottom supporting members *b* and *c* respectively. The lower member *c* is connected to the axle C^2 in the manner above set forth with reference to Figs. 3 and 5 of the drawings and

the upper member b is made in the form of an open bracket, through which the intermediate horizontal portion of the axle passes and is capable of a more or less vertical movement therein. This arrangement enables the springs A to be detached from the axle without previously removing the wheels. The axle is adjustably connected with each side frame and is conveniently retained in its correct position in relation thereto by a pair of radius rods c^1 connected with the two portions C and C^2 of the axle in the manner indicated in Figs. 7 and 8, the said radius rods being provided with right and left hand screw couplings c^8 for adjustment purposes, and connected at their opposite ends to a bracket b^1 fixed to each side frame B. Lateral movement between the axle and frame is prevented by the rods E^1 and their connections in the manner above set forth, and the supplementary supporting devices may consist of cylinders c^9 secured to the opposite sides of the axle C directly underneath the side frames B, and containing spring actuated plungers c^{10}.

If desired the fluid pressure springs may be so arranged as to give a three-point suspension to the vehicle-body, that is to say two of the springs may be mounted on the rear axle and one of them on the front axle, and in this case the spring on the front axle may be arranged parallel with the axle instead of transversely thereto as illustrated in the drawings with respect to the rear axle.

By the arrangements above described a fluid pressure spring is produced which may be solely dependent for its resilient action upon its deflection or bending movement, or be capable of acting as a combined deflection and compression spring by causing a portion of the inner periphery of the spring to meet with a fixed resistance, such for example as the axle itself, at a predetermined point of its bending movement, whereby the said portion of the spring will be compressed between the axle and the upper or lower supporting member as the case may be and its resistance to further movement will be greatly increased.

Any liability of creasing or kinking of the tube when subjected to the aforesaid bending movement may be avoided by means of a light flexible metal rim encircling the inner periphery of the tube and suitably connected therewith, or by suitably reinforcing the tube at those parts where creasing is liable to occur.

The tubes may be manufactured of any suitable material or materials, for withstanding the fluid pressure, and in some cases the material may possess sufficient rigidity to assist in maintaining the normal position of the tubes when under the influence of a load.

The details of construction can be variously modified, so long as the resiliency is obtained by the deflection or bending of the springs from a position normally imparted thereto by the fluid under pressure therein.

What I claim and desire to secure by Letters Patent of the United States is:—

1. The combination with the frame or body of a vehicle and its wheel axles, of a suspension device comprising an annular flexible cushion containing fluid under pressure, arranged edgewise in relation to the frame and axles and unsupported at its inner periphery so that its resiliency is primarily derived by resistance to deflection irrespective of compression and consequent reduction in capacity.

2. The combination with the frame or body of a vehicle and its wheel axles, of a suspension device comprising an annular flexible cushion containing fluid under pressure, and arranged in an approximately upright position between a bracket carried by the vehicle frame and a bracket carried by the wheel axle, the said cushion being unsupported at its inner periphery so that its resiliency is derived by resistance to deflection irrespective of compression and consequent reduction in capacity.

3. The combination with the frame or body of a vehicle and its wheel axles, of a suspension device comprising an annular flexible cushion containing fluid under pressure, and arranged in an approximately upright position between a bracket carried by the vehicle frame and a bracket carried by the wheel axle, the said cushion being unsupported at its inner periphery so that its resiliency is derived by resistance to deflection irrespective of compression and consequent reduction in capacity, and a supplementary resilient supporting device adapted to come into operation only in the event of the flexible cushions becoming deflated.

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

FREDERICK WALTON.

Witnesses:
WM. MELLERSH-JACKSON,
T. SELBY WARDLE.