Sept. 8, 1925. 1,552,984

G. B. DOREY

SPRING SUSPENSION

Filed Nov. 17, 1920 2 Sheets-Sheet 1

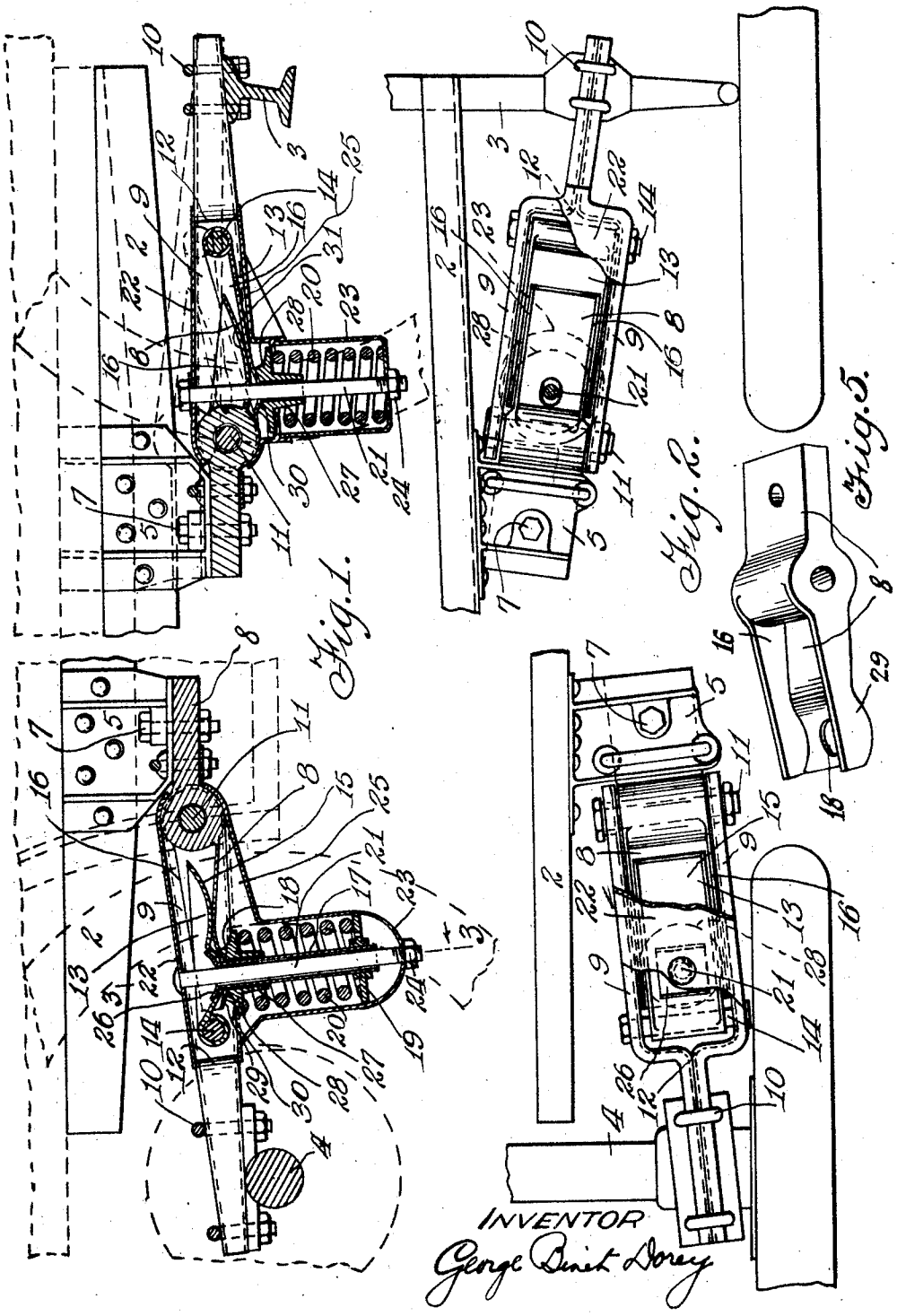


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

INVENTOR

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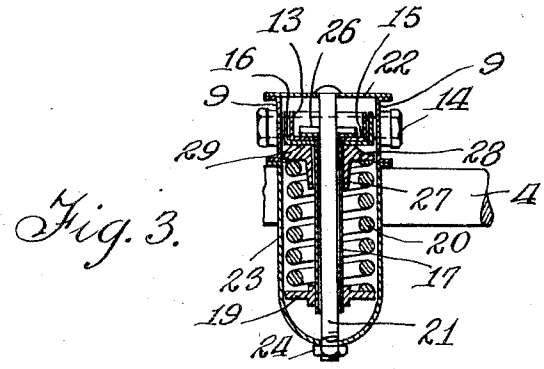


Fig. 3.

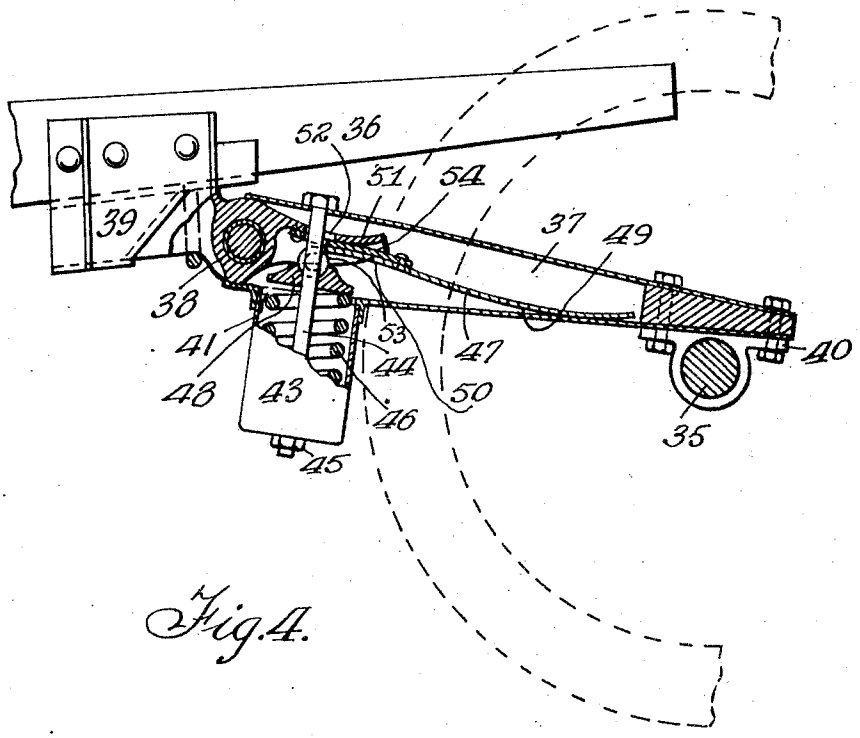


Fig. 4.

INVENTOR

George Benet Dorey

Patented Sept. 8, 1925. 1,552,984

UNITED STATES PATENT OFFICE.

GEORGE BINET DOREY, OF MONTREAL, QUEBEC, CANADA, ASSIGNOR TO FRANK HARTWELL HOPKINS, OF WESTMOUNT, QUEBEC, CANADA.

SPRING SUSPENSION.

Application filed November 17, 1920. Serial No. 424,674.

To all whom it may concern:

Be it known that I, GEORGE BINET DOREY, a subject of the King of Great Britain, and residing at 410 Marcil Avenue, in the city of Montreal, Province of Quebec, Dominion of Canada, have invented certain new and useful Improvements in Spring Suspensions, and do hereby declare the following to be a full, clear, and exact description of same.

This invention relates to a spring connection between parts which are movable one with relation to the other, for influencing or cushioning said movement and appertains particularly to that type of spring connection wherein a lever with a shifting fulcrum is associated with the spring in such manner as to automatically vary the active resistance exerted by the spring proportionately to the extent of movement between the parts.

Briefly stated, the above mentioned arrangement consists of a spring acted upon by a lever which is operable by the movement of one of the said parts and possesses a movable fulcrum which shifts in accordance with the degree of movement of the lever, to produce a leverage decreasing proportionately to the increase of movement of the part and thus increasing the effective resistance of the spring to such movement.

In so far as I am aware, previous designs of this type of spring suspension have been deficient in that provision was not made to set up a positive connection between the relatively movable parts, with the result that the resistable connection existing between the parts was unsuitable for the support of the driving strains of road vehicles and not sufficiently effective for the control of the sudden jolting to which the latter are subjected. An object therefore of this invention is the establishment of a spring connection between relatively movable parts and wherein a lever having a shifting fulcrum acts upon the spring to vary its effective resistance and a positive connection exists between the parts, a special feature being an arrangement whereby the lever with a shifting fulcrum is operated through the medium of another lever included in the connection.

In a device of this character it is desirable to retard or dampen the movement of the lever in order to avoid excessive vibration or oscillation and while this dampening action has been effected heretofore by the development of the frictional engagement between the lever and its abutment, this manner of dampening produces unwarranted wear upon the effective surface of the lever. Another object therefore of the invention is to produce a dampening action through the medium of a separate dampening member so designed as to relieve the effective surface of the differential lever from excessive wear, and to effect a retardation which is increased proportionately to the decrease of leverage, a feature of this arrangement being the utilization of the cushioning spring for the production of the dampening action.

For the purpose of illustration I have shown and will now describe my invention as embodied in the spring suspension of an automobile, the further objects and advantageous features hereinafter described being, in common with the herein described specific adaptation, applicable to other embodiments of the invention.

For full comprehension, however, of my invention, reference should be had to the accompanying drawings forming a part of this specification, in which the same reference characters refer to like parts and wherein:

Fig. 1 is a side elevation, partly in section of my improved spring suspension as embodied in the front and rear suspension of any automobile, the central portion of the letter being broken away.

Fig. 2 is a plan view of Fig. 1 partly in section;

Fig. 3 is a section on line 3—3 Fig. 1;

Fig. 4 is a side elevation of a modified construction, and

Fig. 5 is a perspective view of the extension carried by the chassis.

Referring now to the drawings, 2 indicates the chassis of an automobile and 3 and 4 the front and rear axles respectively thereof.

A bracket 5 is secured to the sides of the chassis and has secured thereto by bolts 7 an extension 8 which will be presently more fully described. The rear axle is connected to the chassis at each side by links which in the preferred form consists of oppositely facing channel beams 9 placed back to back

and abutting at a point adjacent the axle, being secured to the latter by straps 10 and to the chassis by a bolt or pivot pin 11. The pin 11 passes through the extension 8 and bears therein, the links maintaining a positive connection between the axle and chassis and the pivotal connection at 11 accommodating the relative movement between axle and chassis. The abutting beams diverge at a point 12 inwardly of the axle and form a fork which straddles the extension 8 and provides a chamber for the reception of the latter and other working parts as will be described.

In the rear suspension a lever 13 is pivoted at 14 to the link, such lever being located within the forked end of the link and extending over the extension 8, the pivot of the lever being preferably disposed adjacent the point of divergence of the beam 9 and formed with a longitudinally and convexly curved underside 15 adapted to bear upon the upper side of the extension which forms an abutment for the lever. The movement of the link due to relative movement of axle and chassis causes the lever to roll upon its abutment and shift the position of the bearing pivot of the lever with respect to its pivot 14, the connection of the extension 8 to the chassis establishing a fixed abutment for the lever and thus serving to stabilize the action.

In order to decrease the weight of the parts and maintain their requisite strength, the lever and its abutment are made of channel form in cross-section, the sides 16 of the abutment and lever serving to prevent undue lateral relative displacement thereof.

A stem 17 carried by the lever extends downwardly therefrom through an opening 18 in the abutment to a point below same where it is formed with a collar 19 between which and the abutment, a coiled spring 20 bears. In the preferred form the stem 17 is of tubular or sleeve form and slides upon a rod 21 suspended from a plate 22 covering the top of the forked portion of the link the rod extending downwardly to a point below the sleeve, with its lower end passing through a casing 23 and receiving a nut 24 by means of which the casing is removably clamped to the underside of the link. This casing encloses the spring and is extended at the top 25 to close the bottom of the forked portion of the link, serving as a lubricant reservoir and acting in conjunction with top plate 22 and the sides of the link to form a casing completely enclosing the working parts.

The connection between the lever 13 and the sleeve 17 is preferably formed by a flange 26 at the top of the latter and when a movement occurring between chassis and axle, causes the link 9 to swing, said link serves as a lever to move lever 13 and slide the sleeve 17 along rod 21 against the influence of the spring, the movement of the rod 21 and sleeve 17 longitudinally of the abutment during the movement of the lever, being accommodated by the slot 18 which is elongated lengthwise of the abutment for this purpose. As illustrated at the left of Fig. 1 the fulcrum point of lever 13 is comparatively close to pivot 14 and a good leverage is produced to make the spring sensitive to cushion slight movements, the rolling of the lever upon its abutment due to an increasing movement or increased travel of the parts causing the fulcrum to shift away from the point thus decreasing the leverage so that a greater effective resistance will be established to enable the spring to competently cushion the load. In this manner the spring resistance is automatically varied to so sustain different loads that adequate cushioning means is provided for varying road conditions. The appended claims are intended to cover the various modifications of which the just described connection embodying a lever with a shifting fulcrum and operable by another lever, is capable.

The operation in detail is as follows:

When, in the position shown at the left of Fig. 1 with the forward end of link 9 (such end being adjacent pin 11) above the rear end of the link (such end being adjacent the axle 4), the chassis sustains a load, the relative positions of the ends of the link change, the forward end being depressed with respect to the rear end and moves from its position above such rear end, progressively towards a position level with or below the rear end according to the load sustained, the extension 8 with associated sleeve 17 and spring 20 being carried down with the chassis, the lever 13 being also carried down through its pivotal connection 14 with the link. Throughout this movement the link 9 maintains an unvarying distance between the points 4 and 11 and establishes certain definite movement arcs for the forward end of the lever and pivot 14 about the point 4, the arc described by the forward end of the link being of greater extent than the arc described by the point 14 according to the greater radius established between points 4 and 11 than between points 4 and 14. Accordingly during the downward movement under load the extension 8, sleeve 7 and spring 20 move to a greater degree than the pivot 14 with the result that the sleeve through the medium of its flange 26 exerts a downward pull upon the lever 13 causing it to swing upon its pivot 14 whereby the lever 13 is caused to roll upon the extension 8. In its swinging movement about adjacent pivot 14 the radius provided for lever 13 is less than that for the extension 8 and associated spring and

sleeve and such arrangement sets up a retardation to the swinging of the lever. This difference in degree of movement and consequent retardation is compensated for by spring 20 which is compressed between the extension 8 and collar 19 and serves to permit relative movement of the lever and extension in a yielding manner to absorb the load. Initially, under slight movement, the spring resistance is small owing to the small compression and the good leverage established by the bearing of lever 13 upon the extension comparatively close to pivot 14 as shown at the left of Fig. 1, but under a greater load and corresponding more pronounced movement of the parts the spring is compressed to a greater degree and the leverage exerted thereon is reduced by the action of the lever 13 in rolling upon the extension and shifting its fulcrum away from pivot 14.

On the rebound the above described action is reversed, that is, during the upward swinging of the link the lever 13 is caused to swing up and rolling upon extension 8 shift the fulcrum of such lever towards the pivot 14. During this movement the compression of the spring 20 attained by the movement of under load as above described, acts through the flange 26 of sleeve 17 to resist movement of the lever 13 thus creating a snubbing action to dampen the recoil and establish the equilibrium of the device.

The pressure of the spring against the underside of the abutment retards the movement of the sleeve 17 and rod 21 longitudinally of the abutment and acts to dampen undue vibration or oscillation of the levers and thus avoids excessive wear of the parts. The spring thus serves the double purpose of cushioning the load and dampening vibration, the dampening effect being automatically varied according to the load inasmuch as the compression of the spring under a heavy load will cause a firmer bearing of the spring against the abutment and produce greater friction while the lesser spring compression under a light load produces a relatively lighter engagement between spring and abutment with correspondingly decreased friction.

In order to adequately develop this dampening feature and produce a more effective bearing for the spring upon the abtument I have located a bearing shoe between the upper end of the spring and the abutment, this shoe being preferably in the form of a thimble 27 loosely mounted upon sleeve 17 and having a flange 28 against which the spring bears, the abutment being downwardly curved at 29 transversely thereof adjacent the sleeve and the thimble being formed with a correspondingly curved concavity 30 to produce a snug engagement between the parts and maintain such engagement throughout the movement of the thimble.

The foregoing description applies more particularly to the rear suspension of a vehicle as shown at the left of Fig. 1, an adaptation of the invention more suitable for the front suspension being illustrated at the right of said figure where the corresponding parts of the above description are indicated by the same reference characters, the front arrangement showing the parts under load and including lever 13 as disposed beneath the rigid abutment 8 and with its free end resting upon the top of spring 20. A movement of the lever 9 causes lever 13 to fulcrum against the underside of the abutment. This movement of the parts is resisted by the spring at the free end of lever 13, and the variance of leverage to automatically adjust the effective resistance of the spring to varying road and load conditions is produced by forming the underside of the abutment with a convexly curved surface 31 coacting with the lever, similarly to the cooperation of the rear lever and abutment, to shift the fulcrum point of lever 13 with respect to its pivot 14.

In the modification shown by Fig. 4, the connection between axle 35 and chassis 36 is formed by an elongated casing 37 pivoted at 38 to a bracket 39 upon the chassis and strapped at 40 to the axle. An opening 41 is formed in the underside of the casing adjacent its pivoted end for the reception of a separate spring housing 43 clamped in position over the opening by a rod 44 suspended from the top of the casing, extending through the bottom of the housing and carrying a nut 45 bearing against the bottom of the latter.

A coiled spring 46 encircling the rod is located within the housing and has one end of a lever 47 in engagement therewith through the medium of a washer 48. Lever 47 is positioned within and longitudinally of the casing, the lower surface of the lever bearing upon the bottom of the casing and being convexly curved at 49 from a point adjacent the spring to the opposite end of the lever, the upper surface of the lever being convexly curved at a point 50 adjacent the spring, such convexly curved upper surface bearing upon the convexly curved underside of an extension 51 of the bracket located within the casing and slotted at 52 for the passage of the rod 44.

The lever 47 is loosely pivoted to washer 48 at 53 and upon movement of casing 37 due to relative movement between axle and chasses, the leverage exerted by said casing swings lever 47 upon its pivot, the engagement of such latter lever with the stationary extension 51 causing the lever to roll upon its curved surface against the influence of

the spring. This rolling movement of the lever varies the distance between its points of bearing upon casing and extension and thus varies the leverage exerted upon the spring, an increasing movement between chassis and axle reducing the distance between the bearing points to reduce the leverage and a decreasing movement increasing the distance between the points to increase the leverage. A flexible strip 54 of suitable material such as brake lining interposed between the lever and the extension serves to stabilize the action and maintain the desired relative positions of said parts.

The spring suspension hereinbefore described provides a load sustaining cushion, the effective resistance of which is automatically varied to meet varying load conditions, and wherein a positive connection is established between the axle and chassis to maintain a certain fixed relation therebetween and provide a solid support for the driving thrust whereby the cushioning elements are protected from unnecessarily severe strains and the strength and endurance of the whole suspension substantially increased. The device is furthermore particularly designed to provide a complete enclosure for the differential lever and other working parts to protect same from dust, dirt and other foreign matter calculated to decrease their efficiency and affect the proper operation thereof.

It is anticipated that the described arrangements are subject to various modifying developments and the following claims are intended to cover any such developments as come within the scope of the invention.

What I claim is as follows:

1. The combination with two parts between which there is relative movement, of a device for cushioning said movement and including a member connecting the parts and being rigid from the point of connection with one part to the point of connection with the other part, a spring and a pivoted lever having a shifting fulcrum, the pivotal connection of the lever being supported by the connecting member and the latter operating the lever to act upon the spring differentially.

2. The combination with two parts between which there is relative movement, of a device for cushioning said movement and including a member connecting the parts and being rigid from the point of connection with one part to the point of connection with the other part, a fixed abutment carried by one of said parts, a pivoted lever having a shifting fulcrum upon the fixed abutment, the pivotal connection of the lever being supported by the connecting member; and a spring acted upon by the lever.

3. The combination with the frame of a vehicle and the axle thereof between which two parts there is relative movement, of a device for cushioning said movement and including a spring, a lever having a shifting fulcrum for acting upon the spring and a casing for the lever, said casing being connected to both of said parts and rigid from one part to the other to transmit strain directly from one part to the other.

4. The combination with the frame of a vehicle and the axle thereof between which two parts there is relative movement, of a device for cushioning said movement and including a spring, a lever having a shifting fulcrum, for acting upon the spring and a casing for the lever, said casing being connected to both of said parts to transmit strain directly from one part to the other, said casing being also connected to the lever to operate the latter.

5. The combination with the frame of a vehicle and the axle thereof between which two parts there is relative movement, of a device for cushioning said movement and including a spring, a lever having a shifting fulcrum, for acting upon the spring and a member connecting the parts, completely enclosing the lever and being rigid from the point of connection with one part to the point of connection with the other part.

6. The combination with two parts between which there is relative movement, of a device for cushioning said movement and including a spring, a rigid abutment, a lever for acting upon the spring and having a shifting fulcrum upon said rigid abutment, and a second lever for operating said lever with a shifting fulcrum.

7. The combination with two parts between which there is relative movement, of a device for cushioning said movement and including a spring, a rigid abutment, a lever for acting upon the spring and having a shifting fulcrum upon said rigid abutment and a second lever connected at its ends respectively to said parts and to said first mentioned lever to operate the latter.

8. The combination with two parts between which there is relative movement, of an abutment fixedly carried by one of said parts, a lever having a movable fulcrum upon said abutment, a spring resisting the movement of the lever and a member carrying the lever, pivotally connected to one part and rigidly connected to the other part.

9. The combination with a chassis and an axle, of a rigid beam connected to the axle and chassis, an abutment carried by the chassis, a lever carried by the beam and having a shifting bearing upon the abutment and a spring connected to the lever to resist movement of the lever in shifting its bearing upon the abutment.

10. The combination with a chassis and an axle, of a beam connected to the axle and chassis, an abutment carried by the chassis,

a lever carried by the beam and having a convex surface with a rolling bearing upon the abutment and a spring connected to the lever to resist the rolling movement of the lever.

11. The combination with a chassis and an axle, of a beam connected to the axle and chassis, an abutment of channel cross-section carried by the chassis, a lever of channel cross-section located between the sides of the abutment, carried by the beam and having a convex surface with rolling bearing upon the abutment and a spring connected to the lever to resist the rolling movement of the lever.

12. The combination with a chassis and an axle, of a horizontally disposed abutment fixedly secured to the chassis, a pair of beams connected to the axle and pivoted to the chassis said beams being disposed on opposite sides of the abutment, a lever carried by and pivoted between the beams and presenting a convex surface bearing upon said abutment and adapted to roll thereon, a spring resisting the rolling movement of the lever and coverings for the top and bottom of the beams and enclosing the lever abutment and spring.

13. The combination with a chassis and an axle, of a horizontally disposed abutment fixedly secured to the chassis, a pair of beams connected at one end to the axle, diverging about opposite sides of the abutment and pivoted at the opposite end to the chassis, a lever pivoted between and carried by the beams, such lever having a convex surface with a rolling engagement with the abutment, a plate spanning the diverging portions of the beams at the top, a rod carried by said plate and extending downwardly through the lever and abutment, a casing carried by the lower end of the rod and closing the space between the bottom edges of the diverging portions of the beams, a sleeve within the casing carried by the lever and encircling the rod, a flange upon the sleeve near its lower end and a spring bearing between said flange and the under surface of the abutment.

14. The combination with a chassis and an axle, of a horizontally disposed abutment fixedly carried by the chassis, a beam connected at one end to the axle and pivoted at its opposite end to the abutment, a lever pivoted to the beam and having a convex surface in rolling engagement with the upper side of the abutment, a stem carried by and extending downwardly from the lever through the abutment, a flange upon the lower end of the stem and a spring bearing between the flange and the underside of the abutment.

15. The combination with a chassis and an axle, of a horizontally disposed abutment fixedly carried by the chassis and presenting a downwardly curved portion upon its lower surface, a beam connected at one end to the axle and pivoted at its opposite end to the abutment, a lever pivoted to the beam and having a convex surface in rolling engagement with the upper side of the abutment, a stem carried by and extending downwardly from the lever through the downwardly curved portion of the abutment, a flange upon the lower end of the stem, a spring bearing between the flange and the underside of the abutment and a bearing shoe interposed between the top of the spring and the abutment, said shoe being in the form of a thimble encircling the stem and presenting a bearing flange for the top of the spring, the top of the thimble being formed with a concavity corresponding to and engaging with the downwardly curved portion of the abutment.

In testimony whereof, I have signed my name to this specification.

GEORGE BINET DOREY.