Dec. 10, 1935. E. WIELAND 2,023,943

SHOCK ABSORBER FOR SPRING SUSPENDED ROAD VEHICLES

Filed July 12, 1934

Fig. 1.

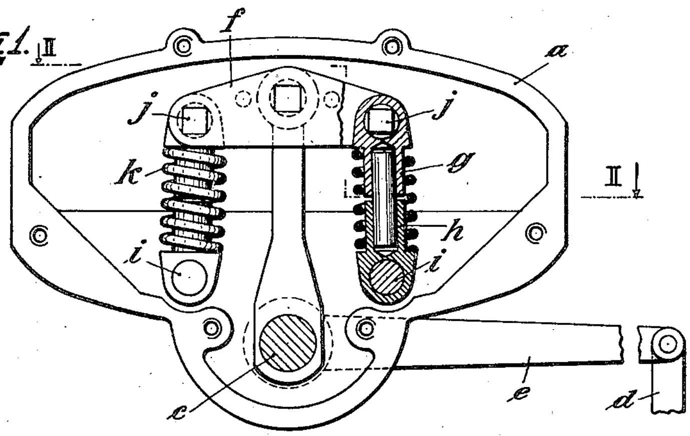



Fig. 2.

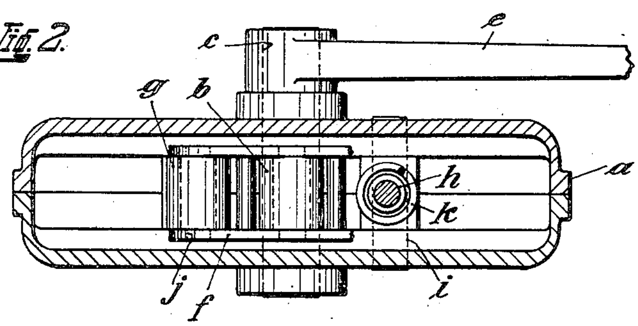



Fig. 3.

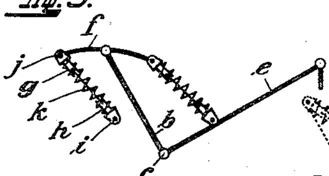



Fig. 5.

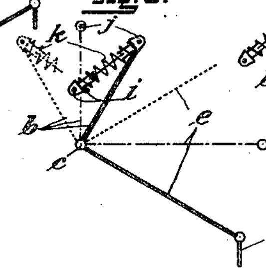



Fig. 4.

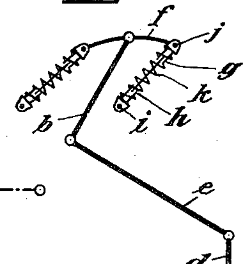
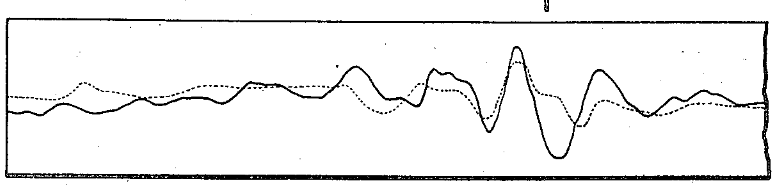



Fig. 6.



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# UNITED STATES PATENT OFFICE

2,023,943

## SHOCK ABSORBER FOR SPRING SUSPENDED ROAD VEHICLES

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In Switzerland July 17, 1933

3 Claims. (Cl. 267—20)

In spring suspended road vehicles shocks produced in passing over uneven places are transmitted to a considerable extent to the vehicle frame. These shocks are more particularly noticeable when passing over depressions, owing to what may be termed the "after effect". This is due more particularly to the fact that the car frame follows the vertical movements of the wheels and axles only with a certain lag so that frequently it drops very quickly when the wheels have already passed over the depression, and are again moving upwards. Thus the main cause of shocks in passing over depressions or holes is due to a temporary reduction in the supporting action of the springs, which allows the chassis to drop.

In passing over raised parts or projectings in the road, the reverse action takes place, the supporting force of the springs being temporarily increased, with the result that the car frame is projected upwardly.

Shock absorbers have been already proposed for the purpose of reducing or increasing the supporting force of car springs at the moment of passing over depressions and projections in the road, in which the wheel axles are connected to the upper part or body of the car by means of a spring controlled system of levers including a toggle joint, or with a slide in the form of a double wedge movable to and fro in spring shears. As on bad roads the alternate up and down movements of the wheels caused by the unevenness of the road, follow each other very quickly, more particularly at high speed, the reversing movements produce blows on all the parts of the shock absorber, so that, in particular, parts sliding to and fro are exposed to rapid wear, and freely oscillating springs are subject to risk of breakage. Shock absorbers with parts sliding to and fro and those with freely oscillating springs, have therefore a very short life, are not very reliable, and cannot be mounted in housings in a dust-proof manner.

The disadvantages of the well known shock absorbing devices are avoided by the improved shock absorber according to the present invention. The invention relates to a shock absorber of the well known kind in which the wheel axles are connected to the chassis by means of a spring-controlled lever which can swing about an axis out of a central position. The invention consists mainly in that the lever is held in its central position by spring means pressing in a direction towards the free end of the said lever, and having at least one point of support situated between the ends of the lever. When the lever is swung out of its central position the said spring means acts laterally on the lever in the direction of its swinging movement. Thus on the lever being rotated, a considerably greater component force in the direction of rotation is obtained than with the already mentioned well known shock absorbers of this kind, that is to say a considerably improved damping of shocks, coupled wtih the advantage of a compact and simple mechanism which can be easily enclosed in a dust-proof manner, and thus be protected from the injurious action of dust, dirt, moisture, flying stones, etc. Owing to the possibility of using guided springs which act on a shock taking place, the lateral oscillations cannot have an injurious effect on them. The device remains reliable for a long time, and is entirely noiseless owing to the rotary positive movements of all the parts without sliding friction.

In order that the invention may be clearly understood, and readily carried into practice, two constructions of shock absorber according to the invention are illustrated, by way of example only, in the accompanying drawing.

In the drawing:—

Figure 1 is a side elevation of one construction of shock absorber with half of its casing removed.

Figure 2 is a section on the line II—II of Figure 1.

Figures 3 and 4 illustrate diagrammatically various lever and spring positions.

Figure 5 illustrates diagrammatically an alternative construction, and

Figure 6 is a shock diagram for the same stretch of road when using a well known type of shock absorber, and when using a shock absorber according to the present invention, the full line showing the damping action of the known shock absorber, and the dotted line showing the action of a shock absorber according to the present invention. In a divided casing *a*, a lever *b* is secured to a spindle *c* on which is mounted outside the casing *a* lever *e* connected by means of a rod *d* to a wheel axle. The casing *a* is secured to the car chassis or frame (not shown in the drawing). The freely oscillating upper end of the lever *b* is connected by means of a balance beam *f* to the upper ends of two spring guides *g*, *h*, of variable length on either side of the lever *b*, and pivoted to the beam *f* at *j*. The lower parts *h* of the said spring guides are pivoted about pins *i* arranged above the level of the spindle *c*. On the guides *g*, *h* are disposed helical compression springs *k*. The part of the casing *a* between the pins *i*, the guides *g*, *h*, and the balance beam *f* form together an articulated parallelogram, the side *f* of which is connected in the centre, but above the pivots *j*, to the lever *b*; that is to say it can swing laterally with the latter towards either side, out of the central position. The part of the casing *a* between the pins *i* is immovable since it is part of the wall of the casing which is fixed. The distance between the pivot pins *i* is slightly greater than that between the pins *j*, so that the lever *b* is normally held by the springs *k* in the central position or position of equilibrium. As soon as the wheel axle makes a downward movement relatively to the chassis due to a depression in the road (Figure 4), the lever *b* will be rotated out of its central position to the right, whilst on passing over a projection, it will be rotated to the left. As the pivots *j*, *j* and *i*, *i* of the springs *k* are situated intermediately between the ends of the lever *b*, i. e. between planes parallel to each other passing through the said ends, the distance between the corresponding pairs of pivots *j* and *i* must increase, which is readily permitted, since, as already stated, the guides *g*, *h* are of variable length, being formed by cup-shaped parts slidable on one and the same rod.

Thus on the hinged parallelogram being moved out of its position of equilibrium, the pivot points *j* at each side of the lever *b* will move away from the pivot points *i*. It follows from this that the shock absorber springs *k*, which are stressed to the greatest extent in the position of equilibrium, will come into action with an increasing lateral shock angle, that is to say will expand, on the hinged parallelogram moving out of its central position. Owing to the distance between the corresponding pivots *j* and *i* being smaller than the distance between the pivots of the lever *b*, the angular deflection of the parts *g*, *h* is greater than that of the lever *b*, so that the expanding springs *k* exert on the lever *b* a lateral force tending to increase its deflection.

The subsequent rebound of the wheel axle must then overcome the force of the springs *k*, owing to which the intensity of the shock transmitted to the chassis is damped. As the springs *k* are held by guides and subject to compression they cannot set up lateral oscillations under the action of the very quick successive movements to and fro or deflections, which oscillations may involve great risk of breakage for the springs.

In the alternative constructions illustrated diagrammatically in Figure 5, the balance beam *f* is omitted, and the springs *k* are brought closer together in front of and behind, the lever *b*, and are connected directly with the oscillating or free end of the latter. The springs are shorter than the lever *b*, and their lower ends are mounted intermediately between the ends of the lever on pivot pins *i* projecting inwardly from the walls of the casing *a*, and arranged either in the vertical plane of the spindle *c* or on both sides, and close to it. The action of the springs *k* on the lever *b* is exactly the same as in the construction previously described and illustrated by Figures 1–4. The construction is however, considerably simpler, the oscillating masses are smaller, and the casing could also be made somewhat smaller, which is a great advantage having regard to the compactness of construction necessary owing to the limited space available in motor vehicles. The casing *a* may be filled with oil or grease so as always to ensure an easy mobility of all the moving parts.

What I claim is:—

1. Shock absorber means for spring suspended wheeled vehicles including a spindle revoluble on an axis fixedly positioned with respect to the frame of the vehicle, means connecting the spindle to a wheel axle of the vehicle to rotate the spindle as the axle moves toward and from the vehicle frame, a lever fixed on said spindle and projecting radially therefrom, a balance beam pivoted at its center to the upper end of said lever to swing about an axis parallel to the axis of the spindle, and springs each having one end connected to a respective end of said balance beam and urging said balance beam end away from said spindle.

2. Shock absorber means for spring suspended wheeled vehicles including a spindle revoluble on an axis fixedly positioned with respect to the frame of the vehicle, means connecting the spindle to a wheel axle of the vehicle to rotate the spindle as the axle moves toward and from the vehicle frame, a lever fixed on said spindle and projecting radially therefrom, a balance beam pivoted at its center to the upper end of said lever to swing about an axis parallel to the axis of the spindle, springs each having one end connected to a respective end of said balance beam and urging said balance beam end away from said spindle, and pins positioned on opposite sides of said lever in fixed relation to the vehicle frame and having the remaining ends of said springs attached thereto.

3. Shock absorber means for spring suspended wheeled vehicles including a spindle revoluble on an axis fixedly positioned with respect to the frame of the vehicle, means connecting the spindle to a wheel axle of the vehicle to rotate the spindle as the axle moves toward and from the vehicle frame, a lever fixed on said spindle and projecting radially therefrom, a balance beam pivoted at its center to the upper end of said lever to swing about an axis parallel to the axis of the spindle, springs each having one end connected to a respective end of said balance beam and urging said balance beam end away from said spindle, and pins positioned on opposite sides of said lever in fixed relation to the vehicle frame and having the remaining ends of said springs attached thereto, the space between said pins being greater than the space between the attachments of the springs to the balance beam.

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