J. W. A. ELLING.

SHOCK ABSORBER.

APPLICATION FILED JAN. 6, 1914.

1,187,290. Patented June 13, 1916.

Fig. 1

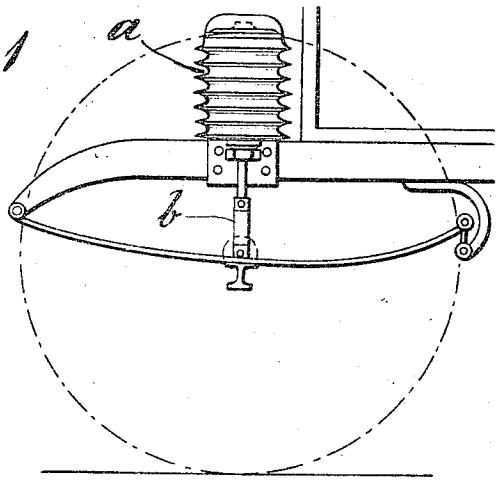


Fig. 5

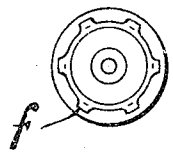


Fig. 3

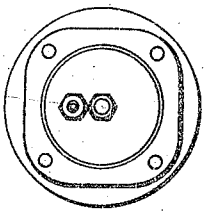


Fig. 4

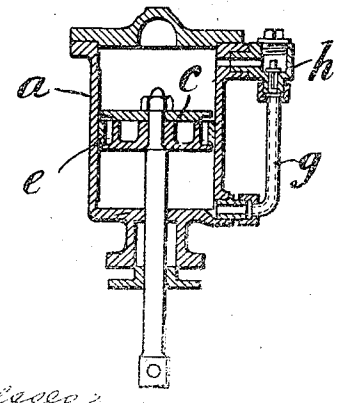
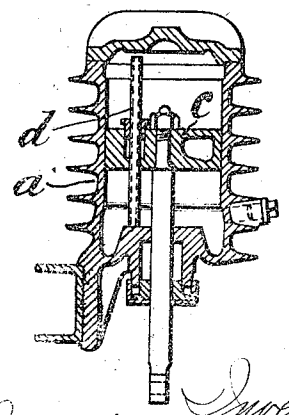


Fig. 2



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UNITED STATES PATENT OFFICE.

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SHOCK-ABSORBER.

1,187,290. Specification of Letters Patent. Patented June 13, 1916.

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To all whom it may concern:

Be it known that I, JENS WILLIAM AEGIDIUS ELLING, a subject of the King of Norway, residing at Christiania, Norway, have invented certain new and useful Improvements in Shock-Absorbers, of which the following is a specification.

Carriage springs will work correctly, when interruptions of equilibrium take place, but wrong as soon as the new equilibrium has taken place and the parts, the body, the frame and the axle of the car, are returning to the normal position. If the wheel of a car running with great speed on a horizontal road arrives at a gradually rising unevenness on the ground the wheel will during its rising movements deflect the spring because said body cannot follow with the same rapidity. When the vertical acceleration on the wheel occasioned by the said unevenness ceases the inertia of the wheel will still act and further deflect the spring until said inertia is consumed in the work of acceleration exerted on the body of the car. After the wheel has arrived to its highest position the frame will still continue to rise acceleratingly and continue herewith also during the following downward movement of the wheel, until the latter has arrived at its resting or normal position relative the frame of the car. The frame will then continue to rise (although retarding). After the wheel has touched the ground a part of its inertia will be converted into heat, while the balance will lift the wheel again and thereby further prevent the frame from arriving at its resting position. The wheel will not be at rest before having by repeated strokes against the ground converted the vertical component of its inertia into heat which is imparted or conducted to the wheel and to the pavement. If the wheel has pneumatic tires, the same will be much damaged, as the speed during the down-stroke generally is much greater than during the first rising movement. The pavement also suffers from these compressions of the pneumatic tires, the binding medium being at first pressed into the pavement and then sucked out of the same in the shape of dust. If the wheel has solid tires the shocks will be violent and the noise great, and the jolting of the axle etc. will cause breakage.

The present invention relates to an improved method of subduing or reducing the violence of the movements of the wheels of rapid running road cars, as is caused by the unevennesses on the road-surface said method consisting in subjecting the wheels (and the axle), after having been lifted (or lowered) by an unevenness, to intermittent forces so as to obtain movements of longer periods and of smaller amplitudes, for the purpose of attaining reductions of vibrations imparted to the wheels and the car-body.

A further object of the invention is to provide means for the practical execution of the method said means consisting of a cylinder, wherein is working a piston which is combined with a valve mechanism, which by each return movement of the piston makes communication between the spaces on both sides of the piston, but at the movement of the piston a small fraction of the length of the stroke at once cuts off said communication. Of the two parts, the cylinder and the piston the one is secured to the frame and the other to the axle of the vehicle.

An embodiment of my invention is illustrated in two modes of execution on the accompanying drawing, in which—

Figure 1 is a side elevation of the forecarriage of a motor-car provided with an apparatus according to my invention. Fig. 2 is a sectional view of cylinder with tube-valve. Fig. 3 is a plan view of same. Fig. 4 is a sectional view of cylinder with annular valve, and Fig. 5 is a plan view of piston body.

In Figs. 2 and 3 *a* is the cylinder of the apparatus, which in the present case is mounted on the frame of the motor-car. *c* is the piston the rod of which in the ordinary manner works air-tight through the bottom of the cylinder. The rod is by a connecting-rod *b* connected with the axle.

The characteristic feature of the apparatus consists in the piston being provided with a valve mechanism consisting of a tube *d*, which slides air-tight in the piston and follows the latter by friction; the tube *d* is a little shorter than the distance between the bottom and the cover of the cylinder.

The working of the apparatus is the following: As soon as the wheel is lifted and the piston in the cylinder also is lifted, the tube *d* will immediately close against the top of the cylinder and consequently the air above the piston is compressed, while the air below the same expands. The frame of the car will consequently be lifted. When the spring and the air pressure has overcome the

inertia of the wheel, the piston will during the commencement of the down-stroke take along with it the tube *d*, whereby communication is established between the space on both sides of the piston and the air pressure on both sides is equalized. As soon as the tube has closed against the bottom of the cylinder compression takes place below the piston and expansion above the same. It will now depend upon the dimensions of the cylinder and the spring whether the wheel will reach the ground before the frame of the car has come nearer down to its normal position, with a speed corresponding only to the acceleration of the gravity. After the wheel has touched the ground no great jumping can take place because the piston at once carries the tube up against the top of the cylinder with the consequent compression above and expansion below the same.

In the second execution, Figs. 4 and 5, the piston *c* is of a smaller diameter than the cylinder *a* and it is provided with projections or ribs *f*, Fig. 5, forming passages between them and supporting a packing ring *e*, which works on the piston with a small play at top and bottom so as to establish communication between the spaces on both sides of the piston during each reversion of the latter, just in the same manner as according to Fig. 2.

For the purpose of lubrication a quantity of oil is introduced into the space below the piston, said oil being carried to the space above the piston either through pipe *d*, Fig. 2, the compressed air forcing the oil through said pipe during the downward movement, or through a by-pass or pipe *g*, Fig. 4, having an automatically closing valve *h*. The oil may also be contained in a chamber from which it is carried in suitable manner. The air-cylinder will consequently by any disturbance of equilibrium act as an ideal spring (with increasing tension) in addition to the ordinary spring, but after attaining the state of equilibrium it will not only cease to act as the ordinary spring, but act direct against the latter. It will thus spare the pavement as well as the tire, and the jumping movement of the car will be somewhat less than by the employment of spring alone. Even by very small unevenness on the road the air-cylinder will produce a ride more free from jolts than by ordinary spring alone; the size of the unevennesses must of course be greater than the play of the tube *d* in the cylinder. As the inertia of the wheel will be converted into heat, it is better, that this action takes place in an element on the car itself, than in the heating of the tire and of the pavement. It is easy to get the heat conducted from the cylinder by external cooling surface, while it for instance by pneumatic tires would incur heavy working expenses.

It is evident that pneumatic tires will not be necessary when the wheels come down smoothly and afterward do not jump in a degree worth mentioning. It is evident that the spring can now be quite elastic as the intermittent action of the piston prevents oscillations.

Having described my invention, I claim:

1. A shock absorber comprising a cylinder closed at its ends, a piston operable in said cylinder and arranged to provide a chamber at each side thereof within the cylinder, and means for establishing communication between said chambers, said means comprising a hollow tube movably mounted in the piston and adapted to contact at either end with a closed end of the cylinder for closing the passage through said tube and interrupting communication between the chambers upon reciprocation of the piston.

2. A shock absorber comprising a cylinder closed at its ends, a piston operable in said cylinder and arranged to provide a chamber at each side thereof within the cylinder, and means for establishing communication between said chambers, said means comprising a hollow tube movably mounted in the piston and having its end portion extending from opposite sides of said piston into the chambers aforesaid, the ends of said tube being disposed adjacent to the closed ends of the cylinder whereby on initial movement of the piston to open communication between the chambers and upon further movement to interrupt communication on contact of an end of the tube with its adjacent cylinder end.

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

JENS WILLIAM AEGIDIUS ELLING.

Witnesses:
M. E. Gullormoly,
Ruth Lindstrom.