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SYNCHRONOUS ACTING VACUUM SNUBBER

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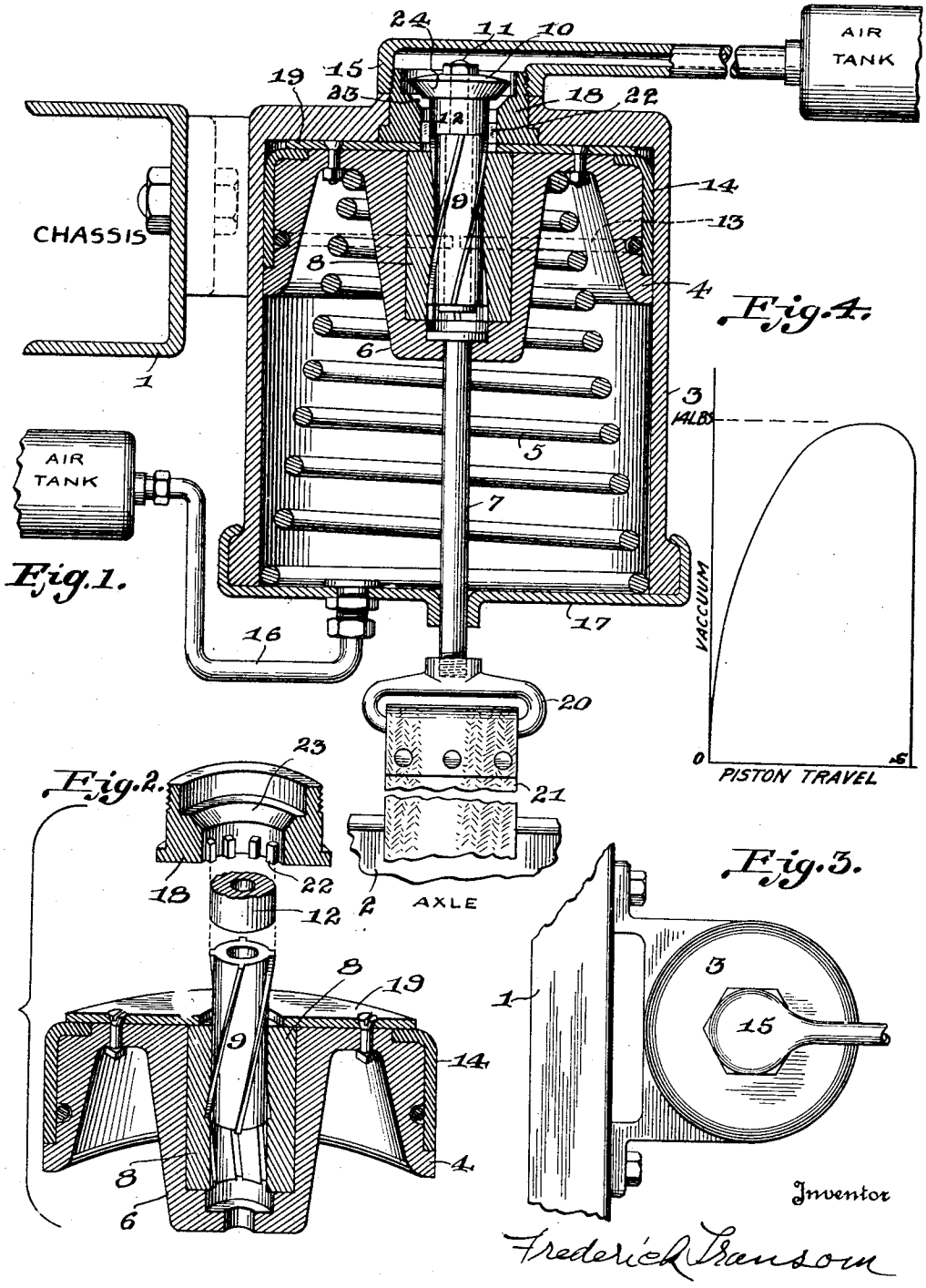


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Inventor

Frederick Transom

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FREDERICK TRANSOM, OF WASHINGTON, DISTRICT OF COLUMBIA

SYNCHRONOUS ACTING VACUUM SNUBBER

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My invention relates to rebound check devices, as used on automobiles, and more especially to a device of this kind known as a vacuum snubber, in which atmospheric pressure is utilized to arrest the vertical movements of a car body, due to road inequalities.

One object of my invention is to provide a device which will impress an instantaneous and continuous snubbing action on the car body as soon as it begins an upward movement.

Another object of the invention is to permit the car body to make downward movements free from all snubbing pull.

Another object is to increase the piston area exposed to atmospheric pressure, and also reduce the overall dimensions of the vacuum snubber cylinder with the same piston stroke.

Other objects and advantages of the invention will appear as the description proceeds.

In the accompanying drawings which constitute part of this specification:—

Figure 1 is a vertical cross section of a snubber mechanism illustrating my invention;

Figure 2 is a distributed perspective view, partly cross-sectional, showing the relation of the snubber piston to its valve mechanism;

Figure 3 is a top plan view of the snubber cylinder attached to a chassis.

Figure 4 is a theoretical diagram.

In the operation of automobiles it is found that uncomfortable and dangerous riding qualities develop because of the spring suspension of the car body. At best the spring system can be suitable for only one load value, and a fairly smooth road; sometimes a road which appears to be uniform will set up a succession of disturbing impulses that soon cause dangerous oscillations in the car body because of the principle of resonance.

Various devices have been applied to counter-act the effects of unsuitable loads and rough roads. One of the most promising of these has been the vacuum snubber, which utilizes the pull of an atmospheric vacuum to counter-act any distortion of the main springs of the car. The vacuum snubber action can be coordinated to exert its protective pull at precisely the right instant to damp out the harmful succession of spring distortions, but heretofore the design of these snubbers has been too bulky and expensive, and the coordination provisions have lacked absolute certainty and continuity of action and, moreover, have failed to operate on a correct principle of design.

My improvements give a light, compact, powerful and inexpensive vacuum snubber, which acts with complete certainty and instantaneous promptness to arrest any departure of the spring system from its normal safe riding position and, furthermore, acts on a correct coordination cycle in accomplishing this result.

Referring to Figure 1 it will be seen the invention consists essentially of a cylinder 3, secured to the car chassis by brackets, integral with the cylinder and a piston 4 slidable freely in the cylinder and driven constantly towards one end thereof by means of a spiral spring 5. The piston is provided with a leather sealing ring 14 which is kept in close wiping contact with the walls of the cylinder by a spring ring 13. The spring 5 is so designed in power that it acts simply to promptly return piston 4 to the inner limit of its travel with respect to the cylinder, it does not function in any way to effect a snubbing action directly, its purpose, as stated, is simply to drive the piston 4, weighing only a few ounces, back into its cylinder the instant strap 21, attached to the car axle, relaxes.

As shown in Figure 1 the piston is at the upper, or inner, limit of its stroke with spring 5 fully extended. This position of the parts is only possible immediately after the wheels of the car have had a severe road shock, sufficient to drive chassis 1 and axle 2, closely together. Due to this shock the springs of the car become considerably flattened and, unless checked, will produce a powerful rebound effect throwing the car body upwards.

From the above explanation it will be seen that a similar relative movement of piston and cylinder takes place with every change

in the distance, separating axle and chassis. Normally these parts rest in a position intermediate to that shown in Figure 1, depending on the load the car may be carrying at the time, and my invention provides valve mechanism so designed that any departure from this normal position must take place upwardly against a restraining vacuum, but downwardly there is no vacuum pull whatever, i. e., the car body always moves downwardly as if it had no snubber attached to it. The effect of this coordination of car body movement and snubber action is to quickly damp out any tendency to oscillation, up and down.

The operation of this valve mechanism is explained as follows:

The piston 4 carries a nut 8, fixed therein, which has very quick threads, practically spiral flutes. These threads, or flutes, engage like pitched threads on a sleeve 9, which is rotatably mounted on a valve-stem 11, see Figure 1. The valve stem also carries a valve 10, having a boss 12 and a miter edge 24 which engages a valve seat 23 on a bush 18.

In operation, supposing the valve 10 seated, the first effect of any upward movement of the piston 4 will be to cause engagement between the threads of the nut 8 and those of the sleeve 9, see Figures 1 and 2. This engagement will impart an upward lift to the valve 10 and unseat it, opening the interior of cylinder 3 to atmospheric pressure. The amount of the upward lift is determined by the pitch of the screw threads or flutes and can be made anything desired. As the valve 10 lifts it will bring up against a cap 15, screwed to bush 18 and further movement of piston takes place solely because the sleeve 9 can rotate on the stem 11. At the most 15 pounds will be sufficient to unseat valve 10 for each square inch of valve opening area.

The first effect of a downward movement of the piston is to close valve 10 tightly and keep it closed under a pressure determined by the friction of the screw pitch. As shown in Figure 1 the first $\frac{1}{16}$ of an inch of piston movement would close the valve 10. Any further movement downwardly would be effective in setting up a vacuum, which would be broken the instant the piston started on its return trip.

The amount of twist given the flutes of sleeve 9 is very slight at most, for small sizes of snubber the flutes can be practically straight grooves, but it is obvious that any desired strength of lift can be given the valve actuation, depending solely on the pitch of the flute. The nearer the flutes are kept to a straight line the less friction will be set up and the smoother the operation.

Considering now the effect of the above described valve operation on the action of the snubber with respect to the vehicle, it will be noted that all upward movements of the chassis with respect to its axle will take place with the valve closed, and the space between the piston and cylinder will be a closed chamber no matter how short or how long the stroke, the greater the stroke the higher the vacuum. The first effect of every down movement of the chassis with respect to its axle will be to open the valve and release the vacuum, so that the car body falls simply by its own weight and without any harmful pull from the snubber mechanism.

Vacuum snubbers have the decided advantage over both hydraulic and mechanism spring snubbers that there is never any need to take up wear of parts necessary. Atmospheric pressure is always instantly available to act as a check. The constant vibration of road travel quickly impairs close adjustment of mechanical devices and hydraulic ones inevitably leak, a very slight leak being enough to seriously affect the snubbing action.

As explained earlier in the specification my invention is the first device in the vacuum art to provide parts operating in an absolutely controlled sequence or cycle of coordination with the car body movements.

As shown in Figure 1 the air exhaust and supply is taken from air tanks with flexible walls. This prevents an accumulation of road dust in the mechanism by enabling the same air to be used over and over, but if desired the valve 10 and cap 17 can open directly to the atmosphere.

In Figure 2 the projections 22 guide the boss 12 of the valve 10, at the same time allowing a free passage of air to and from the cylinder as piston rod 7 causes the piston to move in and out of the cylinder.

Figure 4 shows the variation in vacuum conditions within cylinder 3, when piston 4 is located near its normal riding position. The maximum possible vacuum is close to 14 pounds per square inch and since in the normal position of the springs there is an air space over the piston, the rise of the vacuum will be more or less gradual, as is disclosed in the curve starting from the origin at 0. For a piston position as shown in Figure 1 the rise in vacuum would be much more rapid and this illustrates a valuable feature of the vacuum snubber device, in that the stroke of the piston automatically regulates the formation of the vacuum. Heavy shocks cause quick acting, powerful snubs. Light shocks are smoothed out by slight vacuums, slowly formed.

In all cases however the release of the vacuum is very prompt on opening of valve 10 as indicated in the curve.

The invention described and claimed in this application constitutes further improvements in an invention described and claimed generically in an application filed Feb. 5, 1927, entitled Vacuum snubber, Serial No. 166,209, by same applicant.

Having fully described my invention what I claim is:

1. In a vacuum snubber, a cylinder, a piston, means for attaching each af these parts respectively to the chassis and axle of an automobile and friction actuated valve mechanism interconnecting said parts whereby vertical movement of the chassis in one direction develops a vacuum pull to arrest the movement and chassis movement in the opposite direction takes place free from snubbing action.

2. In a vacuum snubber for vehicles, a cylinder carried by the vehicle chassis, a reciprocable piston therein, and valve parts, synchronously controlled by screw acting means upon a change in direction of reciprocation of said piston.

3. A valve actuation mechanism comprising a valve stem, a threaded sleeve, freely rotatory between shoulders on said stem, and a reciprocatory nut having thread engagement with said sleeve, whereby a relief motion takes place between said nut and said stem.

4. A vehicle rebound control device comprising a snubber part connected to the vehicle chassis, a snubber part connected to the car axle and valve control means whereby said parts are held together by atmospheric pressure during movements of separation of chassis and axle but are allowed to slide freely with respect to each other during all movements of approach of chassis and axle, said valve control means comprising a relief motion connection between said snubber parts.

5. In a vacuum vehicle snubber, a snubber part fixed to the vehicle chassis, a snubber part attached to the vehicle axle, spring means for forcing said parts together and valve motion means for causing atmospheric pressure to hold said parts together, said valve motion means acting as a screw engagement between said snubber parts.

6. In a vehicle rebound check, means acting to damp out movements of a vehicle car body to and from its axles by drawing in and ejecting air, in combination with sealed container means connected to said first named means and serving as a reservoir to supply and store the air drawn in or ejected thereby, whereby a closed air circulation is maintained and roadway dust contamination prevented.

FRED'K TRANSOM.