

PATENT SPECIFICATION

(11) 1 261 895

DRAWINGS ATTACHED

- (21) Application No. 41961/68 (22) Filed 4 Sept. 1968
 (61) Patent of Addition to No. 1 073 473 dated 26 Feb. 1965
 (23) Complete Specification filed 4 Sept. 1969
 (45) Complete Specification published 26 Jan. 1972
 (51) International Classification B 60 g 15/06; F 16 f 9/06
 (52) Index at acceptance
 F2S 8M2A13 8M2A2 8M2A6A 8M2A6X 8M2A9 8M2P1A
 8M3A2 8M3A3X
 B7D 2A2A 2A2H 2A4B1
 (72) Inventor ROBERT THROWELL BURTON



(54) IMPROVEMENTS IN VEHICLE SUSPENSION

(71) We, GIRLING LIMITED, a British Company, of Kings Road, Tyseley, Birmingham 11, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to improvements in a suspension unit for a vehicle wheel, the suspension unit being of the kind in which a stub axle is carried by a substantially vertical telescopic strut of which the lower end is, in use, articulated by linkage to the vehicle chassis or frame and the upper end is, in use, supported in an anchorage allowing a limited degree of angular movement, the suspension unit including a helical compression spring.

Such a suspension unit is hereinafter referred to as "a suspension unit of the kind set forth."

The specification of our British Patent No. 1073473 describes and claims a suspension unit of the kind set forth which comprises a single tube telescopic hydraulic damper of which the cylinder carries a stub axle for the wheel and which incorporates an air or gas spring adapted to support a part of the load on the wheel and comprising a volume of air or gas under pressure located within the cylinder. In the construction described and illustrated in that specification, the space for air or gas under pressure is located at the lower end of the cylinder and is separated from the liquid with which the remainder of the cylinder is filled by a separator piston slidably mounted in the cylinder, or by a rolling diaphragm.

The invention provides a suspension unit of the kind set forth for a vehicle wheel, the strut comprising a single tube telescopic hydraulic damper including a cylinder, a piston working in the cylinder, and a piston rod carrying the piston and extending through a seal at the upper end of the cylinder, wherein the cylinder has at its upper end a portion whose diameter is greater than the portion of the cylinder with-

in which the piston works, the upper end portion containing an air or gas spring comprising a volume of air or gas under pressure.

The larger diameter portion of the cylinder, which contains the air or gas spring, could be made by expanding the upper end of a tube which provides the working surface of the cylinder, the gland or other seal for the piston rod being of correspondingly increased external diameter. Preferably, however, there is provided within the larger diameter portion of the cylinder an inner wall which supports the seal and defines with the said larger diameter portion an annular chamber, the inner wall being formed with at least one port, through which liquid in the annular chamber can drain into the portion of the cylinder in which the piston works.

By way of example, a particular embodiment of the invention is described below with reference to the accompanying drawing, which shows parts of a suspension unit in longitudinal section.

The construction illustrated comprises a cylinder 10 containing oil or other liquid, in which works a piston 11 carried by a piston rod 12, which extends through a seal 13 at the upper end of the cylinder. Valve-controlled passages through the piston allow liquid to flow through the piston in both directions against resistances determined by the loading of the valve.

The lower end of the cylinder is closed by a fitting 14, which carries a stub axle 15 for the vehicle wheel and connections for the linkage (not shown) which articulates the lower end of the suspension unit to the vehicle chassis so as to guide it for substantially vertical movement. The upper end of the piston rod 12 is adapted for connection to a bearing (not shown) which is housed in a flexible mounting on the vehicle chassis. A helical compression spring 16 is engaged between abutments 17, 18 on the cylinder and piston rod respectively, this spring taking part of the load on the suspension unit.

[Price 25p]

The cylinder 10 has at its upper end a portion of enlarged diameter, constituted by a two-part casing 19, which surrounds and is welded to a tube 20, which constitutes the part of the cylinder in which the piston 11 works. The tube 20 extends upwardly through the casing 19 and supports the seal 13 for the piston rod. The annular chamber 21 enclosed between the outer wall 19 and the inner wall 20 is in communication through ports 22 and 23 in the inner wall with the interior of tube 20. Chamber 21, which is located above the normal liquid level in the cylinder, is charged with a volume of air or gas under substantial pressure which constitutes a gas spring, effective to support a part of the load on the suspension unit. It will be appreciated that the fluid pressure within the cylinder exerts a net upward thrust on the piston rod and that any downward movement of the piston brings an increased length of the piston rod within the cylinder and so increases the pressure.

Any damper liquid which may be deposited in the chamber 21 as a result of unusual or violent operation of the unit will drain back into its working position through the port 22, which is located at the lower end of the chamber, the slight delay in the return of the liquid allowing some de-aeration to take place before return. In the construction illustrated, upward or rebound movement of the piston is limited by the engagement of a collar 24 on the piston rod 12 with a rubber buffer 25, which is secured in the cylinder below the seal 13 and serves to prevent noise. If the piston itself were allowed to rise high enough to obstruct drainage port 22, liquid could be trapped between the piston and the seal, providing an hydraulic rebound stop; this effect can be prevented by the provision, as shown, of a second port 23 at a higher level. Port 23 also allows the air or gas pressures inside

and outside tube 20 to equalise without interfering with the return flow of liquid through drain port 22.

The unit is of the type in which the seal is self priming.

WHAT WE CLAIM IS:—

1. A suspension unit of the kind set forth for a vehicle wheel, the strut comprising a single tube telescopic hydraulic damper including a cylinder, a piston working in the cylinder, and a piston rod carrying the piston and extending through a seal at the upper end of the cylinder, wherein the cylinder has at its upper end a portion whose diameter is greater than the portion of the cylinder within which the piston works, the upper end portion containing an air or gas spring comprising a volume of air or gas under pressure.

2. A suspension unit in accordance with claim 1, wherein there is provided within the larger diameter portion of the cylinder an inner wall which supports the seal and defines with the said larger diameter portion an annular chamber, the inner wall being formed with at least one port, through which liquid in the annular chamber can drain into the portion of the cylinder in which the piston works.

3. A suspension unit in accordance with claim 2, wherein the said inner wall is constituted by an upward continuation of the wall of the portion of the cylinder within which the piston works.

4. A suspension unit for a vehicle wheel, constructed and arranged to operate substantially as herein described and as shown in the accompanying drawing.

A. A. THORNTON & CO.,
Chartered Patent Agents,
Northumberland House,
303/306 High Holborn,
London, W.C.1.

The cylinder 10 has at its upper end a portion of enlarged diameter, constituted by a two-part casing 19, which surrounds and is welded to a tube 20, which constitutes the part of the cylinder in which the piston 11 works. The tube 20 extends upwardly through the casing 19 and supports the seal 13 for the piston rod. The annular chamber 21 enclosed between the outer wall 19 and the inner wall 20 is in communication through ports 22 and 23 in the inner wall with the interior of tube 20. Chamber 21, which is located above the normal liquid level in the cylinder, is charged with a volume of air or gas under substantial pressure which constitutes a gas spring, effective to support a part of the load on the suspension unit. It will be appreciated that the fluid pressure within the cylinder exerts a net upward thrust on the piston rod and that any downward movement of the piston brings an increased length of the piston rod within the cylinder and so increases the pressure.

Any damper liquid which may be deposited in the chamber 21 as a result of unusual or violent operation of the unit will drain back into its working position through the port 22, which is located at the lower end of the chamber, the slight delay in the return of the liquid allowing some de-aeration to take place before return. In the construction illustrated, upward or rebound movement of the piston is limited by the engagement of a collar 24 on the piston rod 12 with a rubber buffer 25, which is secured in the cylinder below the seal 13 and serves to prevent noise. If the piston itself were allowed to rise high enough to obstruct drainage port 22, liquid could be trapped between the piston and the seal, providing an hydraulic rebound stop; this effect can be prevented by the provision, as shown, of a second port 23 at a higher level. Port 23 also allows the air or gas pressures inside

and outside tube 20 to equalise without interfering with the return flow of liquid through drain port 22.

The unit is of the type in which the rod seal is self priming.

WHAT WE CLAIM IS:—

1. A suspension unit of the kind set forth for a vehicle wheel, the strut comprising a single tube telescopic hydraulic damper including a cylinder, a piston working in the cylinder, and a piston rod carrying the piston and extending through a seal at the upper end of the cylinder, wherein the cylinder has at its upper end a portion whose diameter is greater than the portion of the cylinder within which the piston works, the upper end portion containing an air or gas spring comprising a volume of air or gas under pressure.
2. A suspension unit in accordance with claim 1, wherein there is provided within the larger diameter portion of the cylinder an inner wall which supports the seal and defines with the said larger diameter portion an annular chamber, the inner wall being formed with at least one port, through which liquid in the annular chamber can drain into the portion of the cylinder in which the piston works.
3. A suspension unit in accordance with claim 2, wherein the said inner wall is constituted by an upward continuation of the wall of the portion of the cylinder within which the piston works.
4. A suspension unit for a vehicle wheel, constructed and arranged to operate substantially as herein described and as shown in the accompanying drawing.

A. A. THORNTON & CO.,
Chartered Patent Agents,
Northumberland House,
303/306 High Holborn,
London, W.C.1.

