

PATENT SPECIFICATION

(11)

1 584 316

1 584 316

- (21) Application No. 40394/77 (22) Filed 28 Sept. 1977
(31) Convention Application No. 20 164 (32) Filed 10 Feb. 1977 in
(33) Italy (IT)
(44) Complete Specification published 11 Feb. 1981
(51) INT. CL.³ B62K 25/16
(52) Index at acceptance
B7E 401 CS
(72) Inventor CARLO DOVERI



(54) IMPROVEMENTS IN OR RELATING TO SUSPENSIONS FOR WHEELS

(71) We, PIAGGIO & C. S.P.A., a Societe per Azioni organised under the laws of Italy, of Via Antonio Cecchi 6—Genova, Italy, 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:—

10 This invention relates to a suspension for a wheel of a vehicle, which is particularly adapted for the front wheel which directs the movements of a two- or three-wheeled vehicle, said suspension being characterized by functional and constructional properties which are particularly advantageous over the suspensions which are used at present for motor-assisted vehicles.

20 Among the properties which are particularly appreciated for motor cycles due to their influence on the manoeuvrability of the steering handle, vehicle stability, economy in initial and running costs, particular mention is deserved by the reduction of downward stroke during oscillation, especially when bumps are experienced, the maintenance of functionality during braking, a low weight and a reduction of the number of component parts.

30 Telescopic-fork suspension are widespread, which maintain the constancy of the downward stroke and absorb the bumps on motor cycles fairly well also during braking, since the braking moment does not load the suspension springs and thus does not reduce the excursion of the springs.

40 Such suspensions, however, are impaired by certain defects among which the most important is that of the wear of the sliding guides of the telescoping members, due to the high transversal loads relative to the direction of the sliding velocity, which are experienced also during the normal operation of the suspension due to the bending moments on the telescoping legs caused by the reaction of the ground. In addition to the consequent necessity of frequent up-keep, to prevent a quick increase of the clearances and thus also of the bumps and

losses of lubricant and shock-absorbing fluid, friction may have a negative bearing also on the optimization of the dampening efficiency of the suspension. Other serious drawbacks are the high weight and cost due to the necessity of accurate machining and resistance of the materials so as to reduce wear and also to the requirement of imparting to the long fork that stiffness, especially in terms of twist resistance, which is sufficient to have a stable vehicle.

Other widely used suspensions are those of the type having longitudinally oscillating arms which are properly sprung and which support the wheel axle either forward or rearward. These suspensions thus have cylindrical matching surfaces only and thus are much less prone to wear. Furthermore their component parts, moreover, operate under more favourable conditions so that they can be more lightweight. They, however, do not afford the above indicated advantages which are desirable of the telescopic suspensions.

75 The constancy of the downward stroke and the ability of absorbing the braking moment by rigid component parts can be achieved, on the contrary, also with the suspensions of the type having longitudinal parallelograms; they, however, are very intricate and much less resistant to twisting forces, the weight being the same, due to the considerable number of component parts pivotally linked to each other.

85 The number of component parts of said suspensions can nearly be halved by mounting the wheel on a plane which is in a cantilever relationship relative to the suspension, as it occurs in motor cars, but the increase in size and weight required in order to minimize the lateral deformations which are caused by the stresses due to the defect of symmetry of the suspension relative to loads lying on the wheel plane, can be accepted, from a practical standpoint, in the only case of the suspensions having very short oscillating arms but a few of the aforementioned advantages must thereby be given up.

None of the suspensions previously men- 100

8 2

tioned has attained a satisfactory trade off between operability and economy.

This is an object of the present invention to overcome, to a large extent, the 5 abovementioned problems by providing a suspension which has a small variation in its downward stroke while also absorbing the braking moment without influencing the stroke of the suspension and which has a 10 small number of component parts, these latter working under the best possible stress conditions giving low initial and running costs.

According to the present invention there 15 is provided, a cantilever-type suspension for a vehicle wheel, comprising a supporting structure, a single rigid arm carrying the wheel in cantilever fashion and pivoted to the supporting structure for swinging 20 movement restricted by the rigidity of the arm to a plane parallel to the plane of the wheel, a single resiliently contractible telescopic leg having an upper end pivoted to the supporting structure and a lower end 25 pivoted to the rigid arm, and a wheel-brake including a stationary supporting part and a movable braking part, the stationary support part being rigidly connected to the telescopic leg.

The invention will be described in more 30 detail, by way of example, with reference to the accompanying drawings in which:—

Figure 1 shows the suspension in side-elevational view, partly in cross-section, 35 taken along the line A-A of Figure 3.

Figure 2 shows the suspension in cross-sectional view, taken along the line B-B of Figure 1, and

Figure 3 shows a rear view of the suspension, the wheel being shown partially in cross-sectional view.

A wheel 1 can be rotated about a pin 2 which is integral with an arm 3: the latter oscillates about the axis x-x of a bearing 4 45 which is borne by a handle-bar tube 5. The pin 2, in addition, is rotatably coupled, through a member 6, to an end 7 of a telescopic leg 8: the leg houses resilient members 8' and shock-absorbing members 50 8" of the suspension, and is hinged at the top, at the point 9, to the handle-bar tube.

The end 7 of the telescopic leg, in addition, is fast to a plate 10 which carries the brake shoes, of the drum brake type, 55 and relevant control members.

The forces, transversal bending moments, and twisting moments applied to the suspension by the loads active upon the wheel can be absorbed and transferred onto the 60 steering structure 5 by the arm 3 only which must thus be adequately sized. The loads lying on the plane of the wheel and passing through the axis of the handle-bar can be absorbed by the arm 3 of the telescopic leg which thus works under com-

pression and expansion only and thus is not subjected to stresses due to transversal forces.

The variation of the downward stroke during the oscillation is restricted by the 70 fact that during normal operation the axle of the arm 3, having an appropriate length, is nearly perpendicular to the axis y-y of rotation of the handle-bar.

During braking, the reaction torque 75 acting on the plate 10 is transferred to the handle-bar tube through a force which passes through the axis of the pin 2 and the axis x-x of oscillation of the arm 3, and a force, parallel and contrarywise 80 directed, which acts at the point of the junction 9 of the telescoping leg.

Inasmuch as the axis of the arm 3 and the axis of the telescoping member 8 form, during oscillation, an angle which is but 85 slightly different from the average angle of 90 degrees, the components of said reactional forces biasing the braking torque will stress in a quite negligible manner the resilient members of the telescopic member. 90 The reaction to the braking moment, as applied to the point 9 impresses, conversely, a bending stress to the telescoping leg, but to a degree which is much slighter than it would have been in the case of a com- 95 pletely telescopable suspension since the latter is also supposed to support the braking force. In the suspension according to this invention, the braking force is absorbed predominantly by the arm 3. The stroke 100 of the suspension as absorbed by the braking force is thus virtually nil.

The invention, therefore fulfils the requirements set forth above by employing a reduced number of component parts which 105 are themselves simple and which are connected together in a simple way, the loads being distributed thereamong in a well balanced manner. The result is a low-weight and a low cost suspension which is 110 a long felt want for motor cycles.

Among many possible modifications the wheel pin can be inserted into the telescopic leg rather than on the swinging arm and it can be noncoincident with the 115 connection hinge between the leg and the arm. Thus the braking system can be of the disc type rather than of the drum type and the swinging arm can be placed behind the wheel rather than before the same and 120 such changes can also be variously combined with one another.

WHAT WE CLAIM IS:—

1. A cantilever-type suspension for a vehicle wheel, comprising a supporting 125 structure, a single rigid arm carrying the wheel in cantilever fashion and pivoted to the supporting structure for swinging movement restricted by the rigidity of the arm to a plane parallel to the plane of the wheel, 130

tioned has attained a satisfactory trade off between operability and economy.

This is an object of the present invention to overcome, to a large extent, the abovementioned problems by providing a suspension which has a small variation in its downward stroke while also absorbing the braking moment without influencing the stroke of the suspension and which has a small number of component parts, these latter working under the best possible stress conditions giving low initial and running costs.

According to the present invention there is provided, a cantilever-type suspension for a vehicle wheel, comprising a supporting structure, a single rigid arm carrying the wheel in cantilever fashion and pivoted to the supporting structure for swinging movement restricted by the rigidity of the arm to a plane parallel to the plane of the wheel, a single resiliently contractible telescopic leg having an upper end pivoted to the supporting structure and a lower end pivoted to the rigid arm, and a wheel-brake including a stationary supporting part and a movable braking part, the stationary support part being rigidly connected to the telescopic leg.

The invention will be described in more detail, by way of example, with reference to the accompanying drawings in which:—

Figure 1 shows the suspension in side-elevational view, partly in cross-section, taken along the line A-A of Figure 3.

Figure 2 shows the suspension in cross-sectional view, taken along the line B-B of Figure 1, and

Figure 3 shows a rear view of the suspension, the wheel being shown partially in cross-sectional view.

A wheel 1 can be rotated about a pin 2 which is integral with an arm 3: the latter oscillates about the axis x-x of a bearing 4 which is borne by a handle-bar tube 5. The pin 2, in addition, is rotatably coupled, through a member 6, to an end 7 of a telescopic leg 8: the leg houses resilient members 8' and shock-absorbing members 8'' of the suspension, and is hinged at the top, at the point 9, to the handle-bar tube.

The end 7 of the telescopic leg, in addition, is fast to a plate 10 which carries the brake shoes, of the drum brake type, and relevant control members.

The forces, transversal bending moments, and twisting moments applied to the suspension by the loads active upon the wheel can be absorbed and transferred onto the steering structure 5 by the arm 3 only which must thus be adequately sized. The loads lying on the plane of the wheel and passing through the axis of the handle-bar can be absorbed by the arm 3 of the telescopic leg which thus works under com-

pression and expansion only and thus is not subjected to stresses due to transversal forces.

The variation of the downward stroke during the oscillation is restricted by the fact that during normal operation the axle of the arm 3, having an appropriate length, is nearly perpendicular to the axis y-y of rotation of the handle-bar.

During braking, the reaction torque acting on the plate 10 is transferred to the handle-bar tube through a force which passes through the axis of the pin 2 and the axis x-x of oscillation of the arm 3, and a force, parallel and contrarywise directed, which acts at the point of the junction 9 of the telescoping leg.

Inasmuch as the axis of the arm 3 and the axis of the telescoping member 8 form, during oscillation, an angle which is but slightly different from the average angle of 90 degrees, the components of said reaction forces biasing the braking torque will stress in a quite negligible manner the resilient members of the telescopic member. The reaction to the braking moment, as applied to the point 9 impresses, conversely, a bending stress to the telescoping leg, but to a degree which is much slighter than it would have been in the case of a completely telescopic suspension since the latter is also supposed to support the braking force. In the suspension according to this invention, the braking force is absorbed predominantly by the arm 3. The stroke of the suspension as absorbed by the braking force is thus virtually nil.

The invention, therefore fulfils the requirements set forth above by employing a reduced number of component parts which are themselves simple and which are connected together in a simple way, the loads being distributed thereamong in a well balanced manner. The result is a low-weight and a low cost suspension which is a long felt want for motor cycles.

Among many possible modifications the wheel pin can be inserted into the telescopic leg rather than on the swinging arm and it can be noncoincident with the connection hinge between the leg and the arm. Thus the braking system can be of the disc type rather than of the drum type and the swinging arm can be placed behind the wheel rather than before the same and such changes can also be variously combined with one another.

WHAT WE CLAIM IS:—

1. A cantilever-type suspension for a vehicle wheel, comprising a supporting structure, a single rigid arm carrying the wheel in cantilever fashion and pivoted to the supporting structure for swinging movement restricted by the rigidity of the arm to a plane parallel to the plane of the wheel,

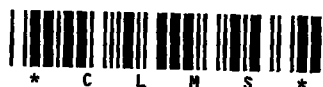


⑨

- a single resiliently contractable telescopic leg having an upper end pivoted to the supporting structure and a lower end pivoted to the rigid arm, and a wheel-brake including a stationary support part and a movable braking part, the stationary support part being rigidly connected to the telescopic leg.
2. A suspension according to claim 1, wherein the wheel is carried by an axle fixed to the rigid arm.
3. A suspension according to claim 2, wherein the axle also provides the pivot connecting between the rigid arm and the lower end of the telescopic leg.
4. A suspension according to any preceding claim, wherein the wheel-brake is a drum brake including movable brake shoes and a stationary support plate which is fastened to the lower end of the telescopic leg.
5. A suspension according to any preceding claim, wherein the supporting structure is the steering rod of a wheeled vehicle.
6. A cantilever-type suspension substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

REDDIE & GROSE.

Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd., Berwick-upon-Tweed, 1980.
Published at the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.



* C L M S *

10

RECEIVED BY HAND
24 JUN 1981
RECEIVED BY HAND