

Suspension system for tracked vehicles and a tracked vehicle with a suspension system.

BACKGROUND OF THE INVENTION AND PRIOR ART

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The present invention relates to a suspension system for tracked vehicles according to the preamble of claim 1. The invention also relates to a tracked vehicle with such a suspension system according to the preamble of claim 9.

- 10 In tracked vehicles the support wheels takes up the weight of the vehicle. The support wheels are arranged on opposite sides of the vehicle for contact against the inside of a respective endless drive track, wherein the support wheels are rotatably journaled at an outer end of a respective rocker arm.
- 15 The support wheels are resiliently suspended with rocker arms in the body of the vehicle by means of a suspension system. Thereby the suspension system supports the entire suspension movement of the rocker arms about a pivot axis extending transversely to the longitudinal extension of the vehicle.
- 20 The suspension system is built up of torsion elements, which may comprise a rubber bushing which is rotationally fixed to the pivot axis and which rubber bushing is enclosed by and fixedly connected to an outer bushing sleeve arranged to be fixedly fastened in the side of the vehicle body.
- 25 Document SE 511665 C2 shows a known suspension system comprising a torsion element in the form of a rubber bushing and in the form of a torsion bar in metal, which rubber bushing and torsion bar are connected in series in order to simultaneously and together take up torque exerted on the rocker arms.
- 30 According to the known suspension system the rubber bushing will however take up the entire weight of the vehicle, which may result in a permanent deformation of the rubber bushing. Since the rubber bushing takes up the entire weight of the vehicle, the

rubber bushing will also be sensitive to overload, which may result in failure of the suspension system.

5 Document WO 98/54017 A1 shows a suspension system comprising a combination of torsion springs and air springs, which cooperate to take up weight from a vehicle. Air springs are often bulky, making it difficult to supplement an existing suspension system with air springs.

10 In view of the background above there is a need to further develop a suspension system for tracked vehicles.

SUMMARY OF THE INVENTION

15 The object of the present invention is to provide a suspension system for tracked vehicles, which suspension system can take up high load.

An additional object of the invention is to provide a suspension system for tracked vehicles, which suspension system has a reduced sensibility to overload.

20 Yet another object of the invention is to provide a suspension system for tracked vehicles, which suspension system can be applied to one of the tracked vehicle existing suspension system.

25 Yet another object of the invention is to provide a suspension system for tracked vehicles, which suspension system requires a small installation space.

30 These objects are achieved with a suspension system for tracked vehicles of the initially mentioned kind, which is characterized by the features specified in claim 1. These objects are also achieved with the tracked vehicle of the initially mentioned kind, which is characterized by the features specified in claim 9.

Such a suspension system, which has a support device adapted to cooperate with the rocker arm to relieve the first torsion element, can take up a high load and has a reduced sensibility to overload.

- 5 Preferably, the support device of the suspension system comprises one with the rocker arm cooperating support arm, which at its inner end to a limited extent is pivotably journalled in the side of the vehicle body, which support arm comprises a second pivot axis extending transversely to the longitudinal extension of the vehicle, wherein a second torsion element is rotationally fixed to the second pivot axis and which said second torsion element is arranged to be fixedly fastened in the side of the vehicle body.
- 10 Thereby the suspension system according to the invention requires a limited and small installation space and can be applied to a one at the tracked vehicle existing suspension system.
- 15 The suspension system can comprise an arbitrary number of rocker arms and support arms depending on the size and weight of the tracked vehicle.

Additional advantages of the invention are apparent from the following detailed description.

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BRIEF DESCRIPTION OF THE DRAWINGS

In the following is described, as examples, preferred embodiments of the invention with reference to the accompanying drawings, in which:

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Fig. 1 shows a side view of a tracked vehicle provided with a suspension system according to a first embodiment of the present invention,

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Fig. 2 shows a side view of how the suspension system is arranged in the body of the vehicle,

Fig. 3 shows a perspective view of a rocker arm with associated first pivot axis and

first torsion element,

Fig. 4 shows a perspective view of a support device,

5 Fig. 5 shows a schematic perspective view of the suspension system at normal load,

Fig. 6 shows a schematic perspective view of the suspension system at increased load, and

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Fig. 7 shows a schematic side view of a suspension system according to a second embodiment.

15 DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

Fig. 1 shows a side view of a tracked vehicle 1 provided with a suspension system 2 according to the present invention. Along opposite sides of the vehicle 1 a number of support wheels 4 are arranged for contact against the inside of a respective endless drive track 6. The support wheels 4 are rotatably journaled at an outer end of a respective rocker arm 8, which at its inner end to a limited extent is pivotably journaled in the side of 1 the vehicle body 10. A support device 11 is arranged to cooperate with the respective rocker arm 8.

25 Fig. 2 shows in a side view how the suspension system 2 is arranged in the side of the vehicle's 1 body 10. The support wheels 4 are in Fig. 2 removed from the respective rocker arm 8, so that it is clear how each rocker arm 8 cooperates with the respective support device 11. By means of the support device 11 the suspension system 2 can take up a high load from the tracked vehicle 1 and have a reduced sensibility to overload.

30 The side of the vehicle's 1 body 10 can also be comprised of so called suspension beams 13 in which the suspension system 2 is arranged. Suspension beams 13 can be

so arranged at the vehicle 1 that the rocker arms 8 are arranged in pairs on opposite sides of respective suspension beam 13.

Fig. 3 shows a view in perspective of how the rocker arm 8 comprises a first pivot axis 12 extending transversely to the longitudinal extension of the vehicle 1. For purpose of clarification, the of the suspension system 2 constituent components have been placed at a distance from each other.

A first torsion element 14 is rotationally fixed to the first pivot axis 12 and the first torsion element 14 is also arranged to be fixedly fastened in the side of the vehicle body 10. When the rocker arm 8 is rotated about the centre axis 15 of the first pivot axis 12 a torsional force is generated in the first torsion element 14. The rocker arm 8 also has a shaft pivot 20 on which one or several support wheels 4 may be provided.

Fig. 4 shows a perspective view of the support device 11, which comprises a support arm 18 which to a limited extent is pivotably journalled in the side of the vehicle body 10. For purpose of clarification, the of the support device 11 constituent components have been placed at a distance from each other. The support arm 18 comprises a second pivot axis 22 which extends transversely to the longitudinal extension of the vehicle 1. A second torsion element 23 is rotationally fixed to the second pivot axis 22 and which second torsion element 23 is arranged to be fixedly fastened in the side of the vehicle body 10. When the support arm 18 is rotated around the centre axis 25 of the second pivot axis 22, a torsional force is generated in the second torsion element 23. The support arm 18 is configured to cooperate with the rocker arm 8 by bearing against this, which will be described further below. Preferably, a roller 40 is journalled at the outer end of the support arm 18, which roller 40 is arranged to bear against and roll on the rocker arm 8. According to the in Fig. 4 shown embodiment, the support arm 18 extends in a plane which coincides with the centre axis 25.

Referring to figures 3 and 4, the first and the second torsion elements 14, 23 comprise a respective first and second rubber bushing 27, 29, which are rotationally fixed with the respective first and second pivot axes 12, 22. The rubber bushings 27 are enclosed

by and fixedly connected to a respective first and second outer bushing sleeve 16, 30, which are arranged to be firmly fixed in the side of the vehicle body 10.

5 The rubber bushings 27, 29 enclose and are fixedly connected to the respective first and second inner bushing sleeves 24, 32, which are rotationally fixedly arranged on respective pivot axis 12, 22 with splined joint 26. Preferably, the rubber bushings 27, 29 are fixedly vulcanized in the respective outer bushing sleeves 16, 30 and on the respective inner bushing sleeves 24, 32, so that the rubber bushings 27, 29 and the re-
 10 spective inner and outer bushing sleeves 24, 32; 16, 30 form a coherent unit. The sus- pension and damping characteristics of the suspension system 2 can be varied by vary- ing the length and the material composition of the first and second rubber bushings 27, 29.

15 The respective outer bushing sleeves 16 are supported by a respective first and second support housing 28, 34, by which support housings 28, 34 the suspension system 2 with the support device 11 are suspended in the side of the vehicle body 10. The re- spective support housings 28, 34 can be connected with the side of the vehicle body 10 by using an appropriate fastening joint, such as a screw joint, rivet joint or weld joint.

20 A first and second threaded lock pin 36, 38 are arranged to extend coaxially through the respective first and second pivot axis 12, 22 to axially fix the first and second rub- ber bushing 27, 29 and associated components in respective support housing 28, 34. By releasing the respective lock pin 36, 38, each respective rubber bushing 27, 29 and associated components may easily be replaced during service and maintenance of the
 25 suspension system 2 and the associated support device 11.

Fig. 5 shows a schematic perspective view of the suspension system 2 according to the first embodiment of the invention and at a normal load from the vehicle 1. The support arm 18 of the support device 11 is arranged to, at an outer end thereof, bear against the
 30 rocker arm 8 and slide on this. In case a roller 40 is journaled at the outer end of the support arm 18, the roller 40 will bear against and roll on the rocker arm 8 when the rocker arm 8 and the support arm 18 are pivoting about the respective centre axis 15,

25. It is clear that the support arm 18 according to the first embodiment extends substantially axially in a plane coinciding with the centre axis 25.

Fig. 6 shows a schematic perspective view of the suspension system 2 at increased load from the vehicle 1. When an increased torque arises in the first pivot axis 12, the torque is taken up by the spring acting and damping first rubber bushing 27. The rocker arm 8 will, depending on the size of the moment, pivot and angularly displace about the centre axis 15 of the first pivot axis 12, which results in that the rocker arm 8 will affect and cooperate with the support arm 18 of the support device 11. This results in that the support arm 18 will be angularly displaced by the rocker arm 8, which results in that the support arm 18 will pivot about the centre axis 25 of the second pivot axis 22. When the support arm 18 pivots about the centre axis 25 of the second pivot axis 22, the torque from the support arm 18 is taken up by the spring acting and damping second rubber bushing 29. As a result of that the support device 11 cooperates with the rocker arm 8 as described above, the support device 11 will constitute a load carrying reinforcement in the suspension system 2, which results in that the suspension system 2 according to the invention can take up high load and have a reduced sensibility to overload. Thus, the support device 11 is arranged to cooperate with the rocker arm 8 to relieve the first torsion element 14. The suspension system 2 according to the invention can be applied to a existing suspension system of the tracked vehicle 1, wherein the support device 11 comprises a load carrying reinforcement in the existing suspension system.

Fig. 7 shows a schematic side view of a suspension system 102 according to a second embodiment. What distinguishes the second embodiment from the first is that the support arm 118 comprises a first and second substantially axial portion 142, 144, which extend in different directions. Thus, the support arm 118 will extend at an angle, which increases the flexibility for placement of the support device 111 in relation to the rocker arm 8 and the first pivot axis 12. Thus, the support device's 111 attachment in the vehicle's 1 body 10 can be performed at a location where the support device 111 do not come into conflict with other components arranged in the vehicle 1. It is also pos-

sible that the support arm 118 may have a curved shape, wherein the support arm 118 coincides with a plane with a normal, which is parallel to the centre axis 25.

Specified components and features given above may be within the scope of the invention be combined between different specific embodiments.

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Claims

1. Suspension system for a tracked vehicle (1) of the type, comprising support wheels (4) arranged on opposite sides of the vehicle (1) for contact against the inside of a respective endless drive track (6), the support wheels (4) being rotatably journalled at an outer end of a respective rocker arm (8), which at its inner end to a limited extent is pivotably journalled in the side of a vehicle body (10) of the vehicle (1), which rocker arm (8) comprises a first pivot axis (12), which extends transversely to the longitudinal extent of the vehicle (1), wherein a first torsion element (14) is rotationally fixed to the first pivot axis (12) and which first torsion element (14) is arranged to be fixedly fastened in the side of the vehicle body (10), and wherein a support device (11; 111) is arranged to cooperate with the rocker arm (8) to relieve the first torsion element (14), **characterized in that** the support device (11; 111) comprises a support arm (18; 118) which cooperates with the rocker arm (8), which at its inner end to a limited extent is pivotably journalled in the side of the vehicle body (10), which support arm (18; 118) comprises a second pivot axis (22) extending transversely to the longitudinal extent of the vehicle (1), wherein a second torsion element (23) is rotationally fixed to the second pivot axis (22) and said second torsion element (23) is arranged to be fixedly fastened in the side of the vehicle body (10).
2. Suspension system according to claim 1, **characterized in that** an outer end of the support arm (18; 118) is arranged to abut against the rocker arm (8).
3. Suspension system according to claim 2, **characterized in that** a roller (40) is journalled at the outer end of the support arm (18; 118), which roller (40) is arranged to abut against the rocker arm (8).
4. Suspension system according to any of claims 1-3, **characterized in that** the support arm (18) extends substantially axially.

5. Suspension system according to any of claims 1-3, **characterized in that** the support arm (118) comprises a first and second substantially axial portion (142, 144), which extend in different directions.

- 5 6. Suspension system according to any of the above claims, **characterized in that** the first torsion element (14) comprises a first rubber bushing (27), which is rotationally fixed to the first pivot axis (12) and which first rubber bushing (27) is enclosed by and fixedly connected to a first outer bushing sleeve (16) arranged to be fixedly fastened in the side of the vehicle body (10).

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7. Suspension system according to any of claims 1-6, **characterized in that** the second torsion element (23) comprises a second rubber bushing (29) which is rotationally fixed to the second pivot axis (22) and which second rubber bushing (29) is enclosed by and fixedly connected to a second outer bushing sleeve (30) arranged to be fixedly fastened in the side of the vehicle body (10).

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8. Tracked vehicle (1), **characterized in that** it comprises a suspension system (2; 102) according to claims 1-7.