Abstract: This invention concerns a leaf spring suspension, of semi-independent suspension type, including a twist beam (2) which consists of at least two leaf springs (1) made of polymeric material with non-aligned fibres, in a quarter elliptical configuration, a spring (1) with one end attached to a twist bar (2) and another end (4) to a chassis (7) or sub-chassis (8).
Declarations under Rule 4.17:

— of inventorship (Rule 4.17(iv))

Published:

— with international search report (Art. 21(3))

— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))
DESCRIPTION

COMPOSITE TWIST BEAM AXLE

FIELD OF THE INVENTION

Twist beam suspension is a suspension architecture that combines simplicity and economic advantages, and is part of some of the interesting systems existing in the market.

Thanks to a system of operation recognised as interesting, the combination of all these characteristics makes this a popular concept among entry-level segments, segments A, B and some platforms from C and D.

PRIOR ART

Introduced for the first time in 1974 in the first generation VW Golf, the twist beam is made up of two trailing arms which are fitted between the bushes and the wheel hub, a beam called the cross beam, a spring seat and a damper bracket.
SUMMARY OF THE INVENTION

The trailing arm, which is originally included between a bush, which serves as the interface with the chassis, and the wheel hub, is now metal and has the purpose of locating the wheel in relation to the bodywork.

The coil spring, supported in the damper bracket, has the purpose of providing insulation from irregularities on the road and supporting the weight of the vehicle.

Although this solution allows for greater available volume, the damper bracket and the corresponding coil spring occupy considerable volume. As useful volume is reduced, the cost of the assembly increases, with a high weight and requiring a high number of components.

The proposed suspension concept is based on the concept of semi-independent suspension. This concept seeks to transfer the function that is currently performed by the coil spring to the trailing arm.

BRIEF DESCRIPTION OF THE DRAWINGS

The description given below is provided with regard to the attached drawings which are presented as reference only, not being exhaustive, in which:

- figure 1 is a perspective view of the twist beam of the prior art;
- figure 2 is a top view of the twist beam in a "U" shape;
- figure 3 is a top view of the twist beam in a "V" shape;
- figure 4 is a top view of the twist beam in a circular arc shape;
- figure 5 is a top view of the twist beam in an elliptical arc shape;
- figure 6 is a view of the polymer material with non-aligned fibres of the leaf spring;
- figure 7 is a perspective view of a chassis;
- figure 8 is a perspective view of the sub-chassis;
- figure 9 is a side view of the leaf spring with a quarter elliptical configuration;
- figure 10 is a side view of the cross section along its length;
- figure 11 is a sectional view along the horizontal plane;
- figure 12 is a sectional view along the vertical plane;

Captions for the figures:
(1) Spring leaf;
(2) Twist beam;
(3) Damper bracket;
(4) Attachment to the chassis;
(4a) Multiple attachment to the chassis;
(5) Tyre;
(7) Chassis; and
DESCRIPTION OF THE INVENTION

This invention seeks to give the trailing arm a spring leaf configuration, as shown in figures 2-5.

The spring leaf suspension, of semi-independent suspension type, comprising a twist beam (2), includes at least two leaf springs (1) of polymeric material with non-aligned fibres, with a quarter elliptical configuration, as can be seen in fig. 9.

Polymeric material with non-aligned fibres supports multi-axial forces, shown in fig. 6.

The spring (1) has one end attached to a twist beam (2) and another end (4) to a chassis (7) or sub-chassis (8).

MODELS FOR EXECUTING THE INVENTION

The spring leaf can be made, specifically, from GFC (Glass Fibre Composite) or any other material with elastic characteristics that guarantee the desired behaviour.

The spring leaf suspension (1) can also be made of:
- glass fibre;
- basalt fibre;
- jute fibre; and
- carbon fibre.

The spring leaf (1) has a section that is not constant along its length, which will depend above all on the dynamic requirements and expectations specified for the vehicle involved.

The spring leaf (1) has a section:
- variable along its length, shown in fig. 10.
- variable along the horizontal plane, represented in fig. 11; and
- variable along the vertical plane, represented in fig. 12.

The joint between the spring leaf (1) and the other components, specifically the twist beam (2) the chassis (7) or sub-chassis (8), as can be seen in figures 7 and 8, may be an attachment, specifically, with screws, glue, mechanically embedded, or by other means.

The twist beam (2) has a "U" shape, as shown in Fig. 2, or a "V" shape, as shown in Fig. 3, when the attachment of the spring leaf (1) is made on the twist beam (2).

In spring leaf suspension (1), the twist beam (2) is shaped in a circular arc, as shown in Fig. 4, or an elliptical arc, as shown in Fig. 5, when the attachment of the spring leaf (1) is made on the twist beam (2).
Additionally, the inclusion of the spring leaf (1) eliminates the need for a spring seat.

This new concept, described in this proposed invention, makes the assembly more economical, increasing the space available within the car cabin, as well as simplifying its method of construction.

Notwithstanding current functioning, this solution allows for:

1. A reduction in the number of components;
2. Cost reduction;
3. An increase in the space of the cabin;
4. Reduction in the weight of the assembly.

As will be evident to an expert in the field, several detailed changes are possible, which must be included within the scope of this invention.

The invention must only be limited by the spirit of the claims below.
1. Leaf spring suspension, of semi-independent suspension type, including a twist beam (2) characterised by its inclusion of at least two leaf springs (1) of polymeric material with non-aligned fibres, with a quarter elliptical configuration, springs (1) that have one end attached to a twist beam (2) and another end (4) to a chassis (7) or sub-chassis (8).

2. Leaf spring suspension, based on claim 1, characterised by a quarter elliptical configuration of the springs (1) that have one end attached to a twist beam (2) and at the other end (4) to a sub-chassis (8).

3. Spring leaf suspension, based on claim 1, characterised by spring (1) polymer, made of glass fibre composite.

4. Spring leaf suspension, based on claim 1, characterised by spring (1) polymer, made of basalt fibre composite.

5. Spring leaf suspension, based on claim 1, characterised by spring (1) polymer, made of jute fibre composite.

6. Spring leaf suspension, based on claim 1, characterised by spring (1) polymer, made of carbon fibre composite.
7. Spring leaf suspension based on claim 1, characterised by an attachment between the spring leaf (1) and its corresponding components, specifically the twist beam (2), the chassis (7) or sub-chassis (8), carried out with screws.

8. Spring leaf suspension based on claim 1, characterised by an attachment between the spring leaf (1) and its corresponding components, specifically the twist beam (2), the chassis (7) or sub-chassis (8), carried out with glue.

9. Spring leaf suspension based on claim 1, characterised by an attachment between the spring leaf (1) and its corresponding components, specifically the twist beam (2), the chassis (7) or sub-chassis (8), carried out with mechanical embedding.

10. Spring leaf suspension based on claim 1, characterised by the twist beam (2), in a "U" shape, when the attachment of the spring leaf (1) is made on the twist beam (2).

11. Spring leaf suspension based on claim 1, characterised by the twist beam (2), in a "V" shape, when the attachment of the spring leaf (1) is made on the twist beam (2).

12. Spring leaf suspension based on claim 1, characterised by the twist beam (2), in a circular arc
shape, when the attachment of the spring leaf (1) is made on the twist beam (2).

13. Spring leaf suspension based on claim 1, **characterised by** the twist beam (2), in an elliptical arc shape, when the attachment of the spring leaf (1) is made on the twist beam (2).

14. Spring leaf suspension based on claim 1, **characterised by** the twist beam (1) with a variable cross section along its length.

15. Spring leaf suspension based on claim 1, **characterised by** the twist beam (1) with a variable section along the horizontal plane.

16. Spring leaf suspension based on claim 1, **characterised by** the twist beam (1) with a variable section along the vertical plane.
### INTERNATIONAL SEARCH REPORT

**A. CLASSIFICATION OF SUBJECT MATTER**

INV. B60G11/04 B60G11/10 B60G21/05

According to International Patent Classification (IPC) into both national classification and IPC

**B. FIELDS SEARCHED**

Minimal documentation searched (classification system followed by classification symbols)

B60G

Documentation searched other than minimal documentation to the extent that such documents are included in the fields searched

Electronic database consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
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Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:
  * "A" document defining the general state of the art which is not considered to be of particular relevance
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  * "O" document referring to an oral disclosure, use, exhibition or other means
  * "P" document published prior to the international filing date but later than the priority date claimed

**Date of the actual completion of the international search**

11 October 2013

**Name and mailing address of the ISA**

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NL-2280 HV Rijswijk
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**Date of mailing of the international search report**

18/10/2013

**Authorized officer**

Savel on, Olivier
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