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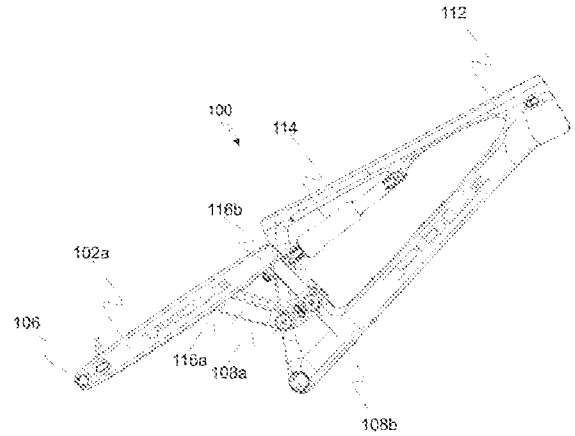
(54) Keksinnön nimitys - Uppfinningens benämning - Title of the invention
**RUNKOJÄRJESTELY PYÖRÄLLISTÄ KULKUNEUVOA VARTEN
Ramarrangemang för ett hjulfordon
FRAME ARRANGEMENT FOR A WHEELED VEHICLE**

Kulkuneuvon, jossa on ainakin kaksi pyörää, tarkoitettu järjestely, joka käsittää kaksi erillistä rungon takaosaa (102a, 102b).

Rungon kukin takaosa (102a, 102b) käsittää ainakin kaksi ensimmäistä liitäntäpistettä (104a, 104b) edessä rungon kussakin takaosassa (102a, 102b) ja toisen liitäntäpisteen (106) pyörää varten takana rungon takaosassa (102a, 102b), sekä vaimenninyksikön (114), joka on järjestetty toiminnallisesti kulkuneuvon rungon etuosan (112) ja rungon erillisten takaosien (102a, 102b) väliin.

Rungon takaosassa (102a, 102b) oleva kukin liitäntäpiste (104a, 104b) on järjestetty mahdollistamaan liittämisen kytkentäosaan (116a, 116b). Kytkentäosat (116a, 116b) on lisäksi liitetty rungon etuosassa (112) oleviin kolmansiin liitäntäpisteisiin (108a, 108b), ja kolmannet liitäntäpisteet (108a, 108b) on järjestetty vastaaviksi pareiksi rungon etuosan (112) kullakin puolella, ja että kunkin kolmansien liitäntäpisteiden (106a, 106b) näistä pareista väliin on järjestetty akseli (110) rungon etuosan (112) läpi, ja että ainakin yksi akseli (110) lukitsee rungon etuosan (112) vastakkaisilla puolilla olevat kytkentäosat (116a, 116b) toisiinsa kiinteään asemaan toistensa suhteen, ja mainittu ainakin yksi akseli (110) on lisäksi järjestetty saamaan aikaan sivusuuntaista jäykkyyttä toisiinsa lukituille rungon takaosille (102a, 102b) niin, etteivät rungon takaosat (102a, 102b) voi pyöriä toisiinsa nähden, jolloin kolmansissa liitäntäpisteissä (108a, 108b) olevat akselit (110) saavat aikaan kääntöliitännän kunkin akselin (110) pyörittäessä suhteessa rungon etuosaan (112), ja jolloin ensimmäiset liitäntäpisteet (104a, 104b) on järjestetty saamaan aikaan kääntöliitäntä kytkentäosille (116a, 116b) kussakin ensimmäisessä liitäntäpisteessä (104a, 104b). Esitetään myös järjestelyn omaava polkupyörä.

An arrangement for a vehicle with at least two wheels, comprising: two separate rear frame members (102a, 102b), each rear frame member (102a, 102b) comprising at least two first connection points (104a, 104b) at the front of each rear frame member (102a, 102b), and a second connection point (106) at the back of the rear frame member (102a, 102b) for a wheel, a damper unit (114) arranged functionally between the front frame part (112) of the vehicle and the separate rear frame members (102a, 102b), characterised in that each connection point (104a, 104b) in a rear frame member (102a, 102b) is arranged to facilitate connection for a coupling member (116a, 116b), the coupling members (116a, 116b) being further connected to third connection points (108a, 108b) in a front frame part (112) and that the third connection points (108a, 108b) are arranged in corresponding pairs on each side of the front frame part (112) and that an axle (110) is arranged between each of these pairs of third connection points (106a, 106b) through the front frame part (112), and that at least one axle (110) interlocks coupling members (116a, 116b) on opposing sides of the front frame part (112) in a fixed position relative to each other and in that said at least one axle (110) is further arranged to provide lateral stiffness to the interlocked to rear frame members (102a, 102b) so that said rear frame members (102a, 102b) cannot rotate in relation to each other, and wherein the axles (110) at the third connection points (108a, 108b) provide a pivotable connection by rotation of each axle (110) in relation to the front frame part (112), and wherein the first connection points (104a, 104b) are arranged to provide a pivotable connection for the coupling members (116a, 116b) at each first connection point (104a, 104b). A bicycle having the arrangement is also disclosed



FRAME ARRANGEMENT FOR A WHEELED VEHICLE

FIELD OF THE INVENTION

5 Generally, the present invention relates to wheeled vehicle frame structures and suspension arrangements thereof. Particularly, however not exclusively, the present invention pertains to an arrangement in accordance with the claims.

10 BACKGROUND

Current bicycle rear frames, especially in the context of mountain bikes, have different rear frames wherein the rear triangle may take various forms and be coupled to the front frame via various link and suspension arrangements. However, the rear triangle itself causes design limitations to the rear
15 frame and usually yields limited space at the rear triangle. Increasing the size of the rear triangle leads to a heavier rear frame design, which is not preferred, since weight-strength optimization is a key design goal in high performance bike design.

20 Further, in the advent of the electric-powered or assisted bicycles the design of bicycles is constrained by the electric motor, which takes up considerable space in the center part of the bicycle frame. The space required by the motor has often been used as an attachment point for the rear frame suspension, especially in 4-bar shortlink suspension solutions. Thus, “Horst” -style 4-
25 bar solutions have become commonplace as the prevailing suspension solution.

The rear frames have to be designed for sufficient stiffness such that the
30 axle point between the rear frame and the front frame has to endure fewer forces. Consequent axle points between the rear frame and the front frame are usually not stiff and may be prone to mechanical failure. Further, the rear frame triangles are bulky, which is logistically difficult, and in case of failure, the whole of rear frame has to be completely replaced for a new one.
35 Ultimately, this also adds up to the design constraints especially in the context of electric-powered bicycles.

SUMMARY OF THE INVENTION

The objective of the embodiments of the present invention is to at least alleviate one or more of the aforementioned drawbacks evident in the prior art techniques particularly in the context of wheeled vehicle arrangements. The objective is generally achieved with an arrangement in accordance with the present disclosure.

A technical advantage of the present invention is that it allows for a type of design for the rear frame that may be called “bridgeless design” freeing up space and providing alternative design options for a wheeled vehicle when compared to typical existing rear frame designs.

A further technical advantage of the present invention is that it provides a frame concept that allows the designer options for controlling the lateral stiffness of the rear frame.

A further technical advantage of the present invention is that it allows for a rear suspension design which leaves space around the bottom bracket of the vehicle frame. Having such space has many advantages and uses but for one this space may be used for easier placement of an electric motor.

A further technical advantage of the present invention is that it provides one type of bicycle frame structure having a rear frame with changeable sides.

In accordance with one aspect of the present disclosure an arrangement for a vehicle with at least two wheels, comprising:

- two separate rear frame members,
- each rear frame member comprising at least two first connection points at the front of each rear frame member, and a second connection point at the back of the rear frame member for a wheel,
- a damper unit arranged functionally between the front frame part of the vehicle and the separate rear frame members,
- characterised in that
- each connection point in a rear frame member is arranged to facilitate connection for a coupling member,
- the coupling members being further connected to third connection points in a front frame part and that the third connection points are

arranged in corresponding pairs on each side of the front frame part and that an axle is arranged between each of these pairs of third connection points through the front frame part, and that at least one axle interlocks coupling members on opposing sides of the front frame part in a fixed position relative to each other and in that said at least one axle is further arranged to provide lateral stiffness to the interlocked to rear frame members so that said rear frame members cannot rotate in relation to each other, and

- wherein the axles at the third connection points provide a pivotable connection by rotation of each axle in relation to the front frame part, and wherein the first connection points are arranged to provide a pivotable connection for the coupling members at each first connection point.

In accordance with one aspect of the present disclosure a bicycle comprising the arrangement for a bicycle frame of claim 1.

Different embodiments of the present invention are disclosed in the dependent claims.

The present invention is especially usable for mountain, enduro and cross-country bicycle frames that may utilize pivotable coupling between a front frame part and a rear frame part of the vehicle frame. The arrangement may be used in various different vehicles including also motored vehicles, such as electric motor-powered bicycles.

As briefly reviewed hereinbefore, the utility of the different aspects of the present invention arises from a plurality of issues depending on each particular embodiment.

The expression “bicycle” is herein used to refer to various wheeled or wheel-based vehicles for a number of users, which may be manually or motor-powered or a combination of the aforementioned, and it is meant to encompass also tricycles quadracycles, and the like. In a broader sense, the expression may be also seen as to encompass motorbikes.

The expression “a number of” may herein refer to any positive integer starting from one (1). The expression “a plurality of” may refer to any positive integer starting from two (2), respectively.

- 5 The term “exemplary” refers herein to an example or example-like feature, not the sole or only preferable option.

Different embodiments of the present invention are also disclosed in the attached dependent claims.

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BRIEF DESCRIPTION OF THE DRAWINGS

Some exemplary embodiments of the present invention are reviewed more closely with reference to the attached drawings, wherein

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Fig. 1 illustrates a general view of an embodiment of the present invention, Fig. 2 illustrates a cutout view of an embodiment of the present invention, Fig. 3 illustrates a view of an embodiment of the present invention showing some aspects of the present invention, and

- 20 Fig. 4 illustrates a view of an embodiment of the present invention showing some aspects of the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

- 25 Figures 1-4 illustrate various aspects of an embodiment of the arrangement (100). The vehicle in this case is a bicycle comprising a front frame part (112) and a rear frame comprising two rear frame part (102a, 102b) connected to the front frame part (112) via coupling members (116a, 116b).

- 30 In this embodiment two coupling members (116a, 116b) on each side of the front frame part (112) form a type of 4-bar link suspension arrangement. The arrangement (100) has two first connection points (104a, 104b) at each the rear frame part (102a, 102b) and two third connection points (108a, 108b) at the front frame part (112), which third connection points (108a, 108b) are located on both sides of the front frame part (112). In this respect, the first connection points (104a, 104b) and third connection points (108a, 108b) may be seen as points in respect to the vehicle, which provide for physical connection points for coupling members (116a, 116b) or such links
- 35

or members of the like between the points but wherein a connection point may constitute a connection point on one point or both sides of the front frame part (112) or the rear frame parts (102a, 102b) depending on the embodiment. Alternatively, a connection point may be even situated inside either of the frame parts, such as an on axle or such connecting member that may provide for pivoting connection, inside a recess or physically outside either of the front frame part (112) or the rear frame parts (102a, 102b). Further, each rear frame part (102a, 102b) has a second connection point (106) at the back of the rear frame member (102a, 102b) for a rear wheel of the bicycle.

A number of coupling members (116a, 116b) is connected at a first connection point (104a, 104b) and a corresponding third connection point (108a, 108b) constituting 2, 3 or 4 coupling members in total and hence 4, 6 or 8 connection points in total depending on whether the coupling members (116a, 116b) are connected through the front frame part (112) and/or whether the coupling members (116a, 116b) are individual links between a first connection point (104a, 104b) and a third connection point (108a, 108b) on each side of the front frame part (112). The two third connection points (108a, 108b) on each side of the front frame part (112) are preferably situated above the bottom bracket of the front frame part (112). In this embodiment, the two third connection points (108a, 108b) are situated above the height of a stretched segment of the drive chain upper part as well as above of the height of instant center of the arrangement (100). In some other embodiments, the two third connection points (108a, 108b) may be set on the level of the height of instant center of the suspension arrangement. Alternatively, in place of the drive chain a jackshaft drive could be used to drive the rear wheel in which case the two third connection points (108a, 108b) may be above of the height of the jackshaft drive. Alternatively, an idler could be used to drive the rear wheel in which case the two third connection points (108a, 108b) may be above of the height of the idler.

Since various physical locations for connection points in each frame part are possible a coupling member (116a, 116b) may constitute a number of direct single links between a first and a third connection point, or a “horse-shoe-shaped” or such three point-shaped member between one first connec-

tion point (104a, 104b) and two third connection points (108a, 108b) or between one third connection point (108a, 108b) and two first connection points (104a, 104b).

- 5 In the illustrated embodiment, both first connection points (104a, 104b) have each a coupling member (116a, 116b) on both sides of the vehicle front frame part (112). First connection points (104a, 104b) may be situated above their corresponding third connection points (108a, 108b) to which said first connection points (104a, 104b) are connected with coupling mem-
10 bers (116a, 116b). The coupling members (116a, 116b) may be set vertically in level or at an incline.

The two third connection points (108a, 108b) comprise means axles for interlocks coupling members (116a, 116b) on opposing sides of the front
15 frame part (112) in a fixed position relative to each other and in that said at least one axle (110) is further arranged to provide lateral stiffness to the interlocked to rear frame members so that said rear frame members cannot rotate in relation to each other. The axles (110) may comprise boron axles. The axles (110) may provide a mating connection with the coupling mem-
20 bers (116a, 116b) for interlocking the rear frame members (102a, 102b). The axles may comprise removable connection means such that the coupling members (116a, 116b) may be removably connected with the axles (110). The axles (110) at the third connection points (108a, 108b) provide a pivotable connection by rotation of each axle (110) in relation to the front
25 vehicle frame (112) and the front frame part (112) preferably comprises bearings in which the axles (110) may rotate. Hence the axles interlock the coupling members (116a, 116b) at the third connection points (108a, 108b) but facilitate pivoting movement of the coupling members (116a, 116b) and the rear frame members (102a, 102b) in a synchronized manner and in the
30 same direction by rotation of the axles in relation to the front frame part (112). At the same time the axles (110) provide stiffness so that the coupling members (116a, 116b) and the rear frame members (102a, 102b) do not rotate against each other although slight movement in this direction may be also allowed in some embodiments. The axles (110) at each third connec-
35 tion point (108a, 108b) may be mutually different in size and design.

The front frame part (112) and rear frame parts (102a, 102b) may comprise different shapes as is generally known in the prior art. For example, a rear

frame part (102a, 102b) may comprise an elongated or tubular shape as illustrated or an open or closed triangular shaped frame structure with stays or such tube structures connected to at least from one end to a rear wheel. The front frame part (112) may comprise different shapes as is generally known in the prior art with or without an electric motor and other related components. For example, the front frame part (112) may comprise a triangular shaped frame structure with a tube stay and a top tube and a down tube, which tubes connect to a head tube further connected to a front wheel. However, various frame designs are feasible since the arrangement (100) allows for a pivotable connection between the front frame part (112) and the rear frame parts (102a, 102b) with various different configurations and design options of the geometry of the coupling members (116a, 116b) as well as the geometry and characteristics of the damper unit (114) providing freedom for designing the arrangement (100) in view of the preferred vehicle frame characteristics and vice versa.

Suitable coupling member (116a, 116b) materials include for example carbon fiber and other such suitable composites, as well as aluminum, steel and various known alloys. As mentioned, a coupling member (116a, 116b) may comprise a linear or curvilinear link connectable at two ends to two connection points. Another possible embodiment comprises a coupling member (116a, 116b) having two linear links connectable at two ends to two connection points, which links are connectable or physically fixed via an axle or physical part or such structure therebetween essentially constituting at least functionally single coupling member (116a, 116b) that may connect with a first connection point (104a, 104b) on either side of each rear frame part (102a, 102b). Similarly, another possible embodiment comprises a coupling member (116a, 116b) having a single physical “horseshoe-shaped”, three-point shaped or triangular-shaped structure, which connects two connection points in one frame part to a single connection in another frame part. Further, the coupling member (116a, 116b) itself may be elastic in the sense that it may provide suspension and bend reversibly without breaking.

The damper unit (114) may comprise a shock absorber, such as a hydraulic or pneumatic shock, usable as a rear shock absorber between a front frame part (112) and the rear frame parts (102a, 102b). The damper unit (114) may be chosen or adjusted for rider weight, riding style, terrain, suspension

travel, sag, or any combination of these or other factors in view of the preferred suspension design. The damper unit (114) needs to have a connection point located at the coupling members (116a, 116b), such that the damper unit (114) is connected to the vehicle front frame part (112) and to either of the corresponding coupling members (116a, 116b) on opposing sides. Tthe damper unit (114) may be arranged functionally between the vehicle front frame part (112) and the separate rear frame members (102a, 102b) such that the damper unit (114) is connected to the vehicle front frame part (112) and to the corresponding coupling members (116b) on opposing sides being closest to the vehicle front frame part (112). The other connection point of the damper unit (114) may be somewhere on the front frame part (112) such as on the upper part of the front frame part (112) as illustrated. The damper unit (114) is preferably pivotably connected at both of its connection points.

By altering the orientation of the coupling members (116a, 116b), and first connection point (104a, 104b) and third connection point (108a, 108b) locations and damper unit (114) connection in limits of the described underlying limitations it is possible to create various types of desired suspension kinematics that may be used for various different applications.

20

The present disclosure may be used to design bicycle frames with various different anti-squat and leverage ratio profiles in view of design preferences and the application of the particular arrangement (100) embodiment. For example, a skilled person will be able to design various embodiments by altering various design parameters, such as materials, material strengths, geometries, damper unit characteristics, frame structures, axle characteristics and the like in the confines of the arrangement (100) as claimed herein. A skilled person will appreciate the fact that the disclosed embodiments were constructed for illustrative purposes only, and the innovative fulcrum reviewed herein will cover further embodiments, embodiment combinations, variations and equivalents that better suit each particular use case of the invention.

30

CLAIMS

1. An arrangement (100) for a vehicle with at least two wheels, comprising:

- 5 - two separate rear frame members (102a, 102b),
- each rear frame member (102a, 102b) comprising at least two first connection points (104a, 104b) at the front of each rear frame member (102a, 102b), and a second connection point (106) at the back of the rear frame member (102a, 102b) for a wheel,
- 10 - a damper unit (114) arranged functionally between the front frame part (112) of the vehicle and the separate rear frame members (102a, 102b),
- **characterised in that**
- each connection point (104a, 104b) in a rear frame member (102a, 102b) is arranged to facilitate connection for a coupling member (116a, 116b),
- 15 - the coupling members (116a, 116b) being further connected to third connection points (108a, 108b) in a front frame part (112) and that the third connection points (108a, 108b) are arranged in corresponding pairs on each side of the front frame part (112) and that an axle (110) is arranged between each of these pairs of third connection points (106a, 106b) through the front frame part (112), and that at least one axle (110) interlocks coupling members (116a, 116b) on opposing sides of the front frame part (112) in a fixed position relative to each other and in that said at least one axle (110) is further arranged to provide lateral stiffness to the interlocked to rear frame members (102a, 102b) so that said rear frame members (102a, 102b) cannot rotate in relation to each other, and
- 20 - wherein the axles (110) at the third connection points (108a, 108b) provide a pivotable connection by rotation of each axle (110) in relation to the front frame part (112), and wherein the first connection points (104a, 104b) are arranged to provide a pivotable connection for the coupling members (116a, 116b) at each first connection point (104a, 104b).
- 25
- 30
- 35

2. The arrangement (100) according to claim 1, wherein the rear frame members are elongated.

3. The arrangement (100) according to any preceding claim, wherein the at least two first connection points (104a, 104b) are situated at the half-way closer to the front of each rear frame member (102a, 102b).
- 5 4. The arrangement (100) according to any preceding claim, wherein the at least two first connection points (104a, 104b) are situated at the front of each rear frame member (102a, 102b).
- 10 5. The arrangement (100) according to any preceding claim, wherein the at least two first connection points (104a, 104b) are situated on the inner side of the rear frame members, such that the first connection points (104a, 104b) are situated on the same side to which the rear wheel is situated in relation to the rear frame members and the coupling members (116a, 116b) are connected to this side of the rear frame members (102a, 102b).
- 15 6. The arrangement (100) according to any preceding claim, wherein the third connection points (108a, 108b) are situated above the height of a stretched segment of the drive chain, jackshaft drive or idler.
- 20 7. The arrangement (100) according to any preceding claim, wherein the third connection points (108a, 108b) are situated on the outside surface of the front frame part (112).
- 25 8. The arrangement (100) according to any preceding claim, wherein one of the axles (110) is bigger than the other.
- 30 9. The arrangement (100) according to any preceding claim, wherein a damper unit (114) is arranged functionally between the vehicle front frame part (112) and the separate rear frame members (102a, 102b) such that the damper unit (114) is connected to the vehicle front frame part (112) and to either of the corresponding coupling members (116a, 116b) on opposing sides.
- 35 10. The arrangement (100) according to claim 9, wherein the damper unit (114) is arranged functionally between the vehicle front frame part (112) and the separate rear frame members (102a, 102b) such that the damper unit (114) is connected to the vehicle front frame part (112) and to

the corresponding coupling members (116b) on opposing sides being closest to the vehicle front frame part (112).

11. The arrangement (100) according to any preceding claim, wherein
5 the axles (110) are boron axles.

12. The arrangement (100) according to any preceding claim, wherein
the axles (110) provide a mating connection with the coupling members
(116a, 116b).
10

13. The arrangement (100) according to any preceding claim, wherein
the coupling members (116a, 116b) are removably connected with the axles
(110).

14. The arrangement (100) according to any preceding claim, wherein
15 the damper unit (114) is connected pivotably in relation to the front frame
part (112) and the rear frame members (102a, 102b).

15. A bicycle comprising the arrangement (100) of claim 1.

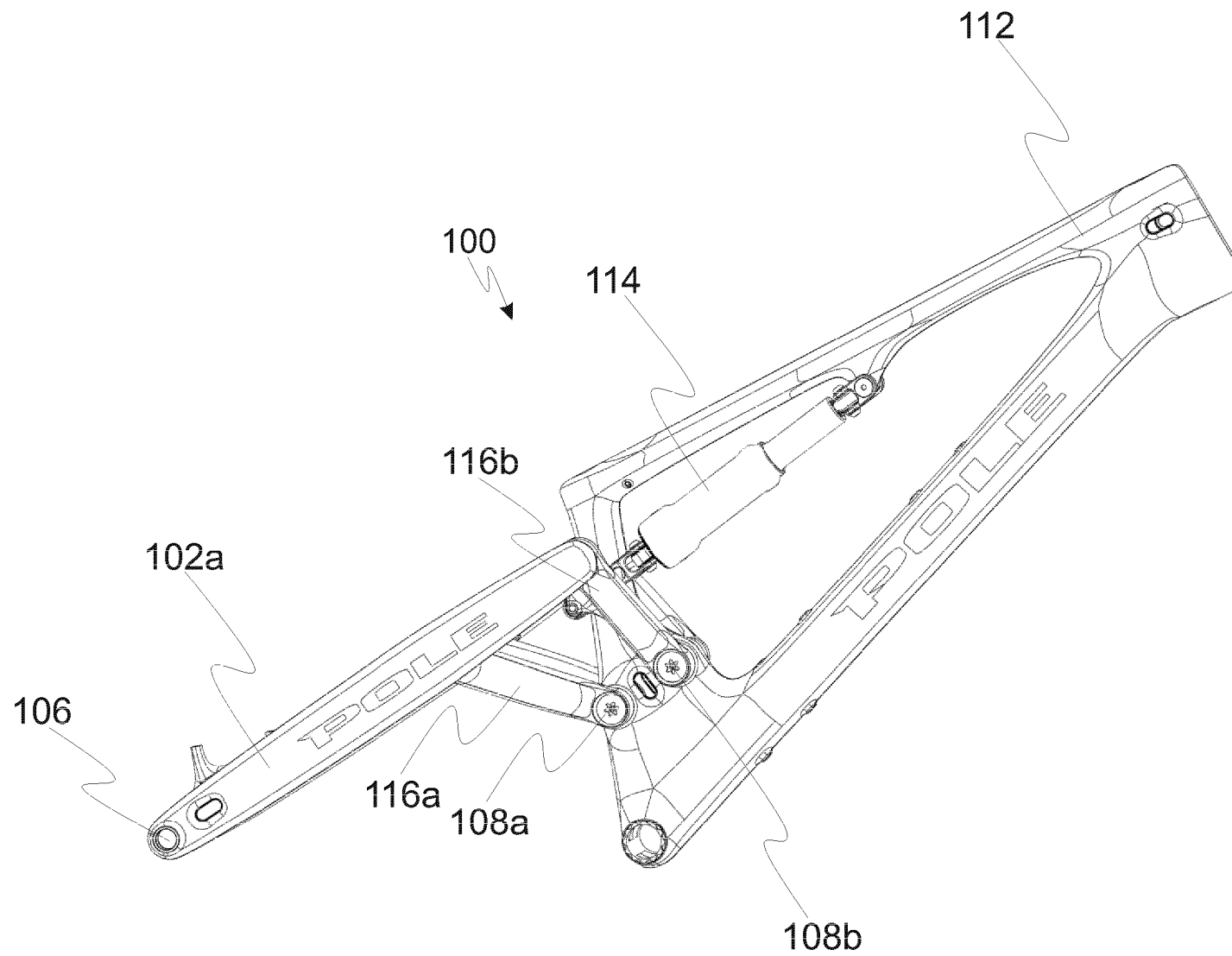


Figure 1

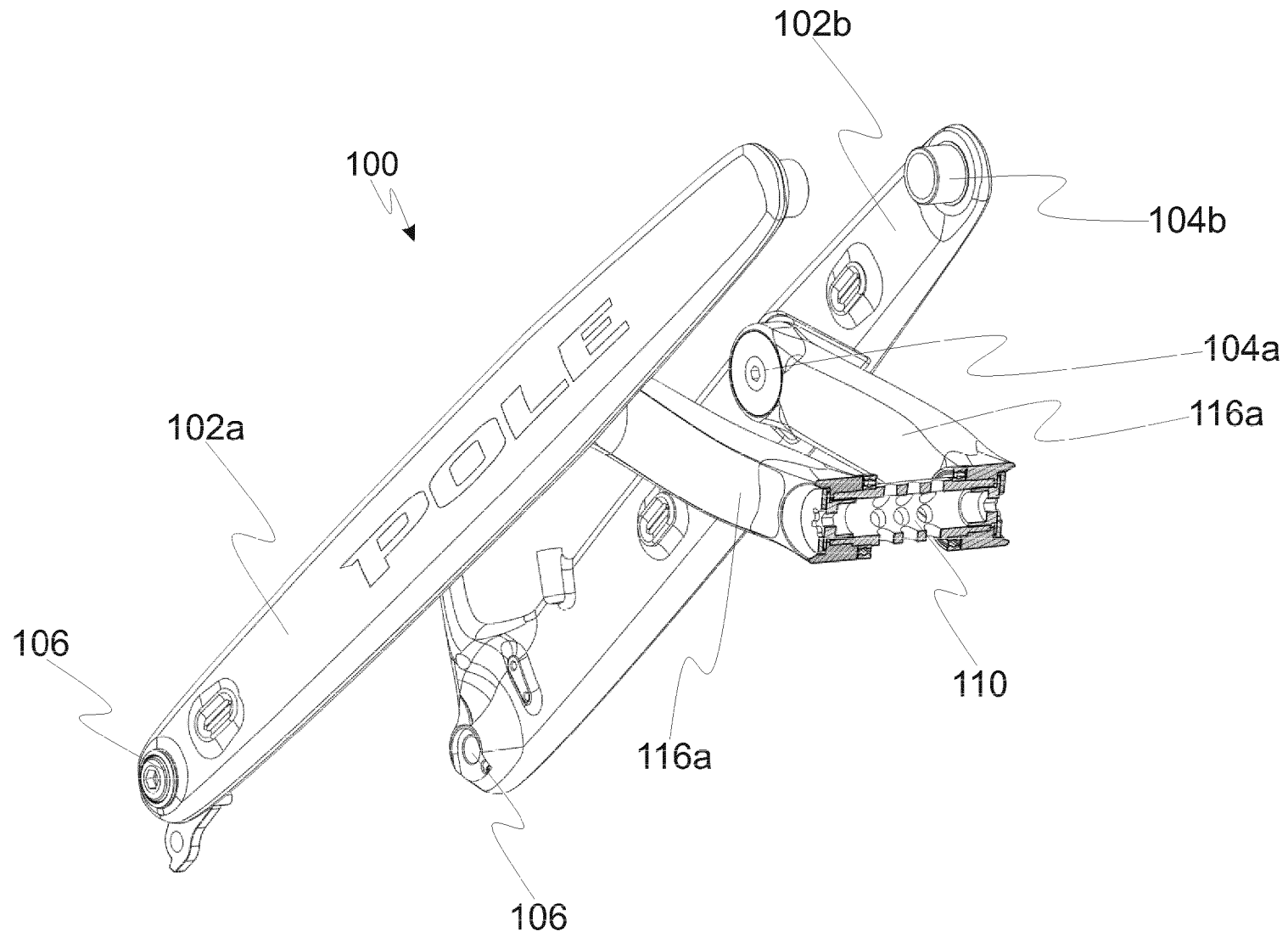


Figure 2

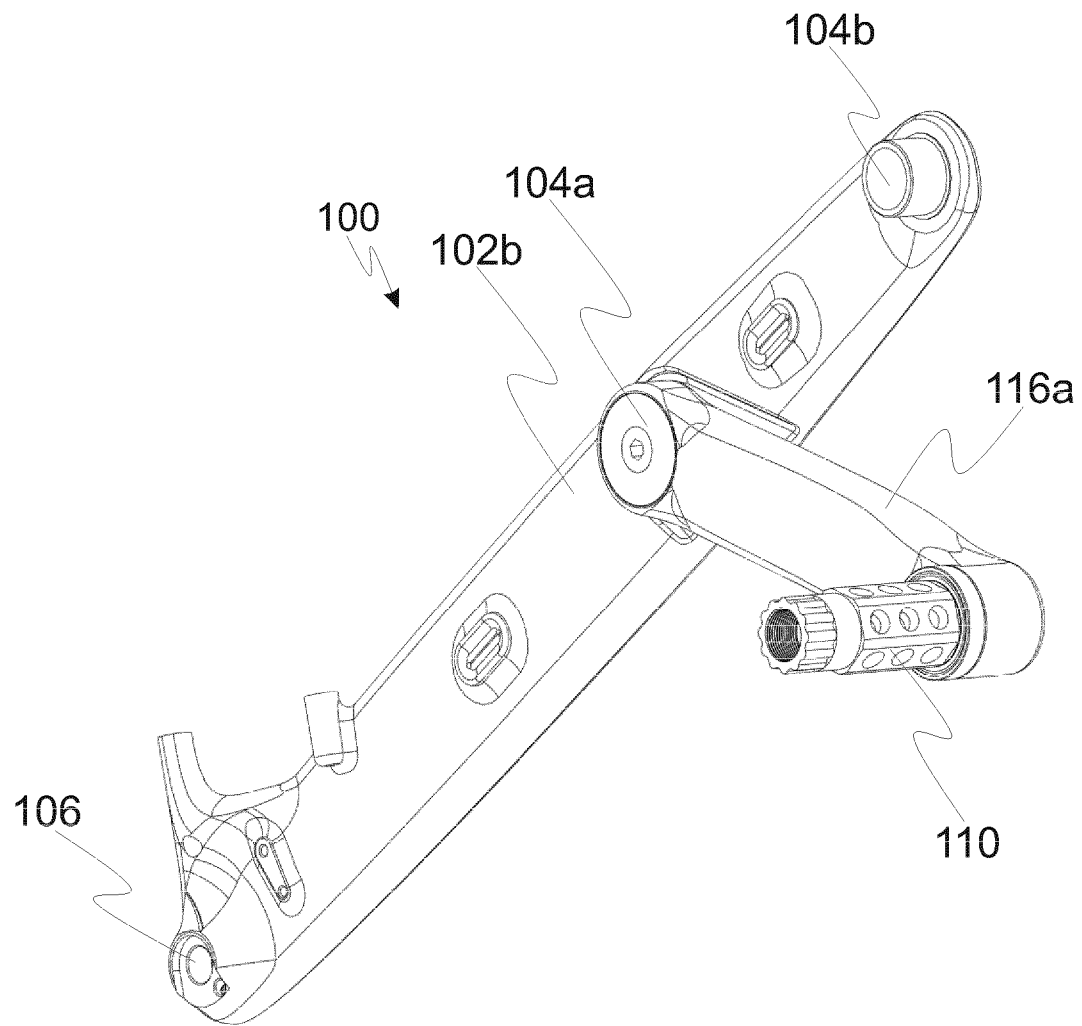


Figure 3

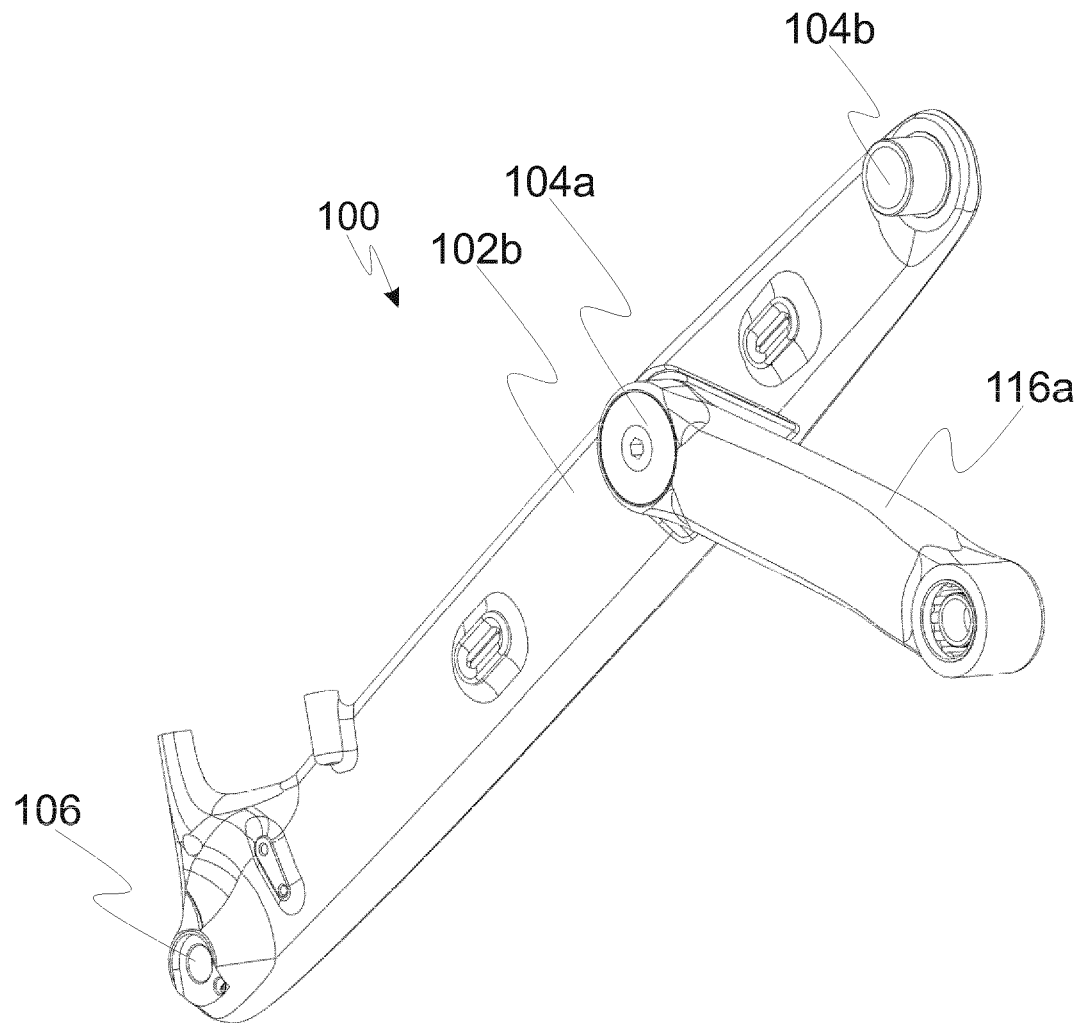


Figure 4

FINNISH PATENT AND REGISTRATION OFFICE

Finnish Patent and Registration Office

FI-00091 PRH

SEARCH REPORT

PATENT APPLICATION No.		CLASSIFICATION	
20227135		IPC B62K 25/28 (2006.01)	CPC B62K 25/286
PATENT CLASSES SEARCHED (classification systems and classes)			
IPC: B62K			
DATABASES CONSULTED DURING THE SEARCH			
EPODOC, EPO-Internal full-text databases, Full-text translation databases from Asian languages, WPIAP, IPRally			

DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*)	Bibliographic data on the document and relevant passages	Relevant to claims
X	WO 2022171740 A1 (POLE BICYCLE COMPANY OY [FI]) 18 August 2022 (18.08.2022)	1-7, 9-15
Y	page 8, line 10 - page 10, line 22; figures 1 and 2	8
Y	EP 1026073 A1 (FOURNALES JEAN PIERRE [FR]) 09 August 2000 (09.08.2000) paragraphs [0025] - [0028]; figure 1	8
A	US 6161858 A (TSENG DIING-HUANG [TW]) 19 December 2000 (19.12.2000) column 2, lines 18-35; figures 1-4	1-15

Continued on the next sheet ☐

*) X Document indicating that the invention is not novel or does not involve an inventive step with respect to the state of the art.
Y Document indicating that the invention does not involve an inventive step with respect to the state of the art if combined with one or more other documents in the same category.
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Further information given in the annex ☐

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