



- (51) **International Patent Classification:**
B60B 35/08 (2006.01) *B60G 9/00* (2006.01)
B60G 7/00 (2006.01)
- (21) **International Application Number:**
PCT/NL2014/050143
- (22) **International Filing Date:**
11 March 2014 (11.03.2014)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
2010459 15 March 2013 (15.03.2013) NL
- (71) **Applicant:** VDL WEWELER B.V. [NL/NL]; 10, Eco-
factorij, NL-7325 WC Apeldoorn (NL).
- (72) **Inventor:** AALDERINK, Derk Geert; 46a, Zut-
phenseweg, NL-7245 NV Laren (NL).
- (74) **Agent:** HOUBEN, C.H.W.F.; P.O. Box 3241, NL-2280
GE Rijswijk (NL).
- (81) **Designated States** (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,

AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME,
MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ,
OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA,
SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM,
TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM,
ZW.

- (84) **Designated States** (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ,
UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ,
TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,
EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV,
MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,
TR), OAPI (BF, BJ, CF, CG, CL, CM, GA, GN, GQ, GW,
KM, ML, MR, NE, SN, TD, TG).

Published:

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

(54) **Title:** WHEEL AXLE SUSPENSION WITH V-SHAPED STRAPS.

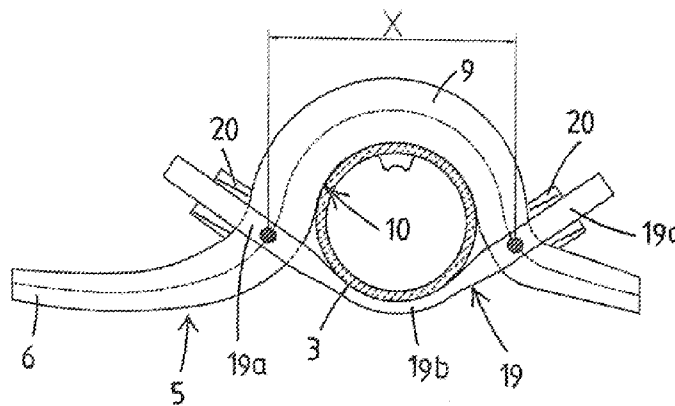
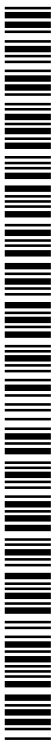


Fig. 1

(57) **Abstract:** A wheel axle suspension of a vehicle comprises an axle body and a flexible trailing arm extending in a longitudinal direction of the vehicle and crossing the axle body substantially perpendicular. The trailing arm has a front spring portion extending in the longitudinal direction of the vehicle and an axle seating portion adjoining the front spring portion. The axle seating portion has a concave side at which the axle body is arranged. The suspension furthermore comprises at least one clamping strap for clamping the axle body and the trailing arm together. The at least one clamping strap has a front leg and a rear leg and an arched portion interconnecting said front and rear leg. The arched portion extends around a part of the circumference of the axle body. The legs of the strap are tensioned with respect to the trailing arm, such that the axle body is clamped between the arched portion of the strap and said concave side of the axle seating portion of the trailing arm. The axle body is arranged directly against the concave side of the axle seating portion of the trailing arm. The front leg of the strap extends towards the front through or along the side of the trailing arm and is supported at the front side of the axle seating portion. The rear leg of the strap extends through or along the side of the trailing arm towards the rear and is supported at the rear side of the axle seating portion.



Title: Wheel axle suspension with V-shaped straps

- 5 The invention relates to a wheel axle suspension of a vehicle, in particular a utility vehicle such as a lorry, a trailer or a semi-trailer.

In particular the invention relates to a wheel axle suspension of a vehicle comprising:

- an axle body of a wheel axle of the vehicle,
- 10 - a flexible trailing arm extending in a longitudinal direction of the vehicle and crossing the axle body substantially perpendicular, said trailing arm having a front spring portion extending in the longitudinal direction of the vehicle and said trailing arm having an axle seating portion adjoining the front spring portion, said axle seating portion having a concave side at which the axle body is arranged,
- 15 - at least one clamping strap for clamping the axle body and the trailing arm together, the at least one clamping strap has a front leg and a rear leg and an arched portion interconnecting said front and rear leg, wherein the arched portion extends around a part of the circumference of the axle body and said legs of the strap are tensioned with respect to the trailing arm, such that the axle body is clamped between the arched portion of the strap
- 20 and said concave side of the axle seating portion of the trailing arm.

In DE 199 46 802 A1 a wheel axle suspension is disclosed in which a trailing arm has a curved portion with a concave underside. Between the axle body and the concave underside of the trailing arm an adaptor part is arranged. U-shaped straps engage the axle body from

25 an underside and have parallel legs which extend upwards along a front and a rear side of the axle body. The legs of the straps are provided with a male thread which in cooperation with nuts are used to tension the clamping connection between the axle body and the trailing arm together. The clamping force provided by the clamping straps is essentially perpendicular to the trailing arm.

30

The object of the invention is to provide an improved wheel axle suspension.

This object is achieved by a wheel axle suspension according to the preamble of claim 1, wherein said axle body is arranged directly against the concave side of the axle

35 seating portion of the trailing arm, and wherein the front leg of the strap extends towards the front through or along the side of the trailing arm and is supported at the front side of the

axle seating portion and the rear leg of the strap extends through or along the side of the trailing arm towards the rear and is supported at the rear side of the axle seating portion.

Preferably the wheel axle suspension according to the invention has two clamping straps
5 arranged, one on either side of the trailing arm.

The wheel axle suspension according to the invention has one or more straps that do not have parallel strap legs. Thereby the clamping force has not only a vertical component, but also a horizontal component. The latter has the effect that the front side and the rear side of
10 the axle seating portion of the trailing arm are tightened slightly together and the surface of the axle seating portion facing the axle body is as it were tightened around the axle body. The resulting deformation of the trailing arm results in a controllable pre-tension that is provided in the trailing arm at the axle seating portion. An advantage is that the changing
15 tension loads due to roll movement of the vehicle are not absorbed in the axle seating portion of the trailing arm, but in the front spring portion of the trailing arm and in the strap itself. This assures a more rigid clamping construction which is not prone to wear and fatigue.

In a particularly suitable embodiment the angle between the front leg and the rear leg of the
20 strap is within the range $90^\circ - 170^\circ$. Without wishing to be bound by any delimitation, in particular a generally V-shaped strap is preferred wherein the angle between the legs is about 110° .

In a possible embodiment at least one of the front leg and rear leg of the strap is provided
25 with a male threaded end. The male threaded end allows for cooperation with a nut to tension the strap against the trailing arm itself or against a support part that is supported by the trailing arm.

In a preferred embodiment both the rear leg and front leg of the strap are provided with a
30 male threaded end.

In a possible embodiment two clamping straps are interconnected, in particular the rear legs or the front legs of the said two clamping straps are interconnected by a bridge portion extending in the width direction over the trailing arm. Preferably, the two clamping straps and
35 the bridge portion are made in one piece.

In a preferred embodiment the axle body has a substantially circular cross section and the axle seating portion of the trailing arm has a curved form with a curved concave side engaging the axle body. The curved concave side preferably encloses the circumference of the axle body over 120° – 180°.

5

In a possible embodiment a half cylindrical shell is arranged around a portion of the circumference of the axle body, wherein a portion of said shell is clamped between the strap and the axle body.

10 Preferably, the shell is provided with a first nose portion bulging out of the cylindrical surface that engages the curved portion of the trailing arm at the front end thereof in line with the front strap leg. The shell is preferably provided with a second nose portion bulging out of the cylindrical portion adjacent the first nose portion that engages the strap.

15 Preferably at one end of the shell a bead is formed, and wherein in the axle body and in the concave side of the curved portion of the trailing arm a recess is formed in which the bead is received as a locking structure.

In another preferred embodiment the axle body has a substantially rectangular cross
20 section. In this embodiment the axle seating portion of the trailing arm is formed as an angular portion constituted by the front spring portion and a downwardly extending portion of the trailing arm adjoining the front spring portion at a rear end thereof and extending substantially perpendicular to the front spring portion.

25 Preferably, the axle seating portion encloses about 50% of the perimeter of the square axle body.

The invention will be elucidated in the following detailed description with reference to the drawing, in which:

30

Fig. 1 shows a portion of a wheel axle suspension according to the invention with clamping straps in a non-tightened state,

Fig. 2 shows the wheel axle suspension of Fig. 1 in which the effect of tightening the straps
35 is illustrated,

Fig. 3 shows the wheel axle suspension as shown in Fig. 2 in which the effects of the loads in a working condition are illustrated,

Fig. 4 shows in a side elevational view another embodiment of a wheel axle suspension
5 according to the invention,

Fig. 5 shows schematically a detail of the wheel axle suspension of Fig. 4, and

Fig. 6 shows schematically in a cross section in the longitudinal direction another
10 embodiment of a wheel axle suspension according to the invention with a square axle body.

In Fig. 4 is shown an example of a wheel axle suspension according to the invention. The vehicle axle suspension 1 comprises a tubular axle body 3 to which wheels can be attached on both sides of the axle body 3. The axle body 3 is mounted to a vehicle by
15 resilient trailing arms 5 which extend in the longitudinal direction of the vehicle on both sides of the vehicle. In the side view of Fig. 4 only one trailing arm 5 is depicted.

The axle body 3 has a circular cross section. The trailing arm 5 crosses the axle body 3 substantially perpendicular. At the location of the axle body 3, the trailing arm has an axle
20 seating portion, which in this embodiment is a curved portion 9, wherein the axle body 3 is arranged on the concave underside of the curved portion 9 of the trailing arm 5, i.e. the axle body 3 is received in an axle seat formed by the concave underside of the curved portion. The curved concave underside encloses the circumference of the axle body over 120° -
180°, in the figure about 180°.

25

The trailing arm 5 is hingedly connected to a bearing bracket 11 arranged on the vehicle chassis 7 at the front of the suspension arm seen in the direction of travel of the vehicle which in this figure is to the left. The trailing arm 5 is thus able to hinge about hinge axis 12.

30 Each trailing arm 5 is provided with a pneumatic spring 15 which is operational between the respective suspension arm 5 and the vehicle chassis 7. In this embodiment, the pneumatic spring 15 is attached to the rear side of the trailing arm 5 seen in the direction of travel of the vehicle.

35 A clamping assembly 17 associated with each trailing arm 5 is provided to retain the axle body 3 and the trailing arm 5 by clamping. In this embodiment, the clamping assembly comprises a strap plate 18 provided at the front side of the axle body and two straps 19 (of

which only one can be seen in Fig. 4) which extend from the front side of the axle body 3 to the rear side of the axle body 3 via the underside of the axle body 3. The front end of the straps 19 are provided with a male thread and with a nut 20 which cooperates with the male thread.

5

In this embodiment the rear ends of the straps are interconnected by a bridge part 21 which is monolithically formed with the straps 19. The bridge part 21 extends in the width direction of the trailing arm 5 over the upper side of the trailing arm, just behind the curved portion 9. By tightening the nuts 20, clamping forces can be applied to the trailing arm 5 and axle body 10 3. The strap plate 18 engages with the upper side of the trailing arm at the transition between the curved portion 9 and the spring portion 6 of the trailing arm, while the straps 19 engage with the underside of the axle body 3.

In Fig. 1 a portion of a similar wheel axle suspension is depicted schematically. In this figure 15 both ends of the strap 19 are provided with a male thread and a nut 20. Obviously a clamping body similar to strap plate 18 as shown in Fig. 4 is available at which the nuts 20 engage, but is not visible in this figure.

The straps 19 have generally a V-shape as can be seen in the figure. The strap 19 has a 20 front leg 19a, a rear leg 19c and an arched portion 19b that interconnects the deviating legs 19a and 19c of the strap 19. In the mounted state, the arched portion 19b extends around a part of the circumference of the axle body 3.

In Fig. 1 the clamping assembly is in a neutral state – a non-tightened state in which the 25 nuts are not tightened. In Fig. 2 the clamping assembly is shown in a tightened state with pre-tension. Fig. 2 shows the effect when the nuts are tightened. The tightening forces are illustrated by an arrow indicated with F. Due to the general V-shape of the strap 19 the clamping force has not only a vertical component, but also a horizontal component. The horizontal clamping force component has the effect that the front side and the rear side of 30 the curved portion 9 of the trailing arm are tightened slightly together. This is indicated by the note that the distance X from the neutral state of Fig. 1 has been reduced to distance Y in the pre-tensioned state ($Y < X$). The concave surface 10 is as it were tightened around the axle body 3. The resulting deformation of the trailing arm 5 results in a controllable pre-tension that is provided in the trailing arm 5 at the clamping region, i.e. at the curved portion 35 9.

In Fig. 3 is shown the laden condition (working). It shows schematically how the trailing arm is loaded, for instance due to roll movements of the vehicle. It can be seen in Fig. 3 that the deformation of the spring part 6 of the trailing arm does not progress beyond the clamping straps 19 ($Y=Y$). This is due to the pre-tension brought in the curved portion 9 of the trailing arm 5 by this specifically designed V-shaped straps 19. Therefore the loads during working condition are not absorbed in the curved portion 9 of the trailing arm 5, but in the spring portion 6 of the trailing arm. Also the strap 19 itself absorbs some of the forces. A more rigid clamping construction which is not prone to wear and fatigue is the result.

10 In the embodiment of Fig. 4 a half cylindrical shell 22 is provided, which can be better seen in Fig. 5. The half cylindrical shell 22 has a cylinder segment portion 23 that is located between the strap 19 and the axle body 3. The shell 22 also has a cylinder segment portion 24 that is located between the concave side of the curved portion 9 and the axle body. Between the portions 23 and 24 there is provided a first nose portion 25 that extends
15 between the front legs 19a of the two parallel straps 19, and that engages the underside of the trailing arm 5 at the convexly shaped transition of the concave surface 10 towards the front spring portion 6. Adjacent the first nose portion 25 a second nose portion 26 is arranged. The second nose portion 26 engages the strap 19, in particular the front leg 19a of the strap 19. The nose portions 25,26 provide rigidity to the shell 22, which is made of
20 metal sheet material.

At the end of the cylinder segment portion 24 a bead 27 is formed, e.g. by folding the plate material to an eyelet. The bead 27 is received in a groove-like indent 4 that extends in the axle body 3 in the longitudinal direction thereof. On the opposite side a groove-like indent 13
25 is formed in the concave surface 10 of the curved portion 9. The cylindrical shell 22 provides a locking mechanism to lock the axle body 3 against undesired rotation with respect to the trailing arm 5.

In Fig. 6 another embodiment of a part of a wheel axle suspension according to
30 The invention is shown. The wheel axle suspension comprises an axle body 103 of a wheel axle of the vehicle, the axle body 103 having a substantially square cross section. The suspension furthermore has a flexible trailing arm 105 extending in a longitudinal direction of the vehicle and crossing the axle body 103 substantially perpendicular. The trailing arm 105 has a front spring portion 106 extending in the longitudinal direction of the vehicle. The front
35 spring portion 106 has an eyelet 104 formed at a front end and a downwardly extending portion 107 adjoining the front spring portion 106 at a rear end thereof. The downwardly extending portion 107 extends substantially perpendicular to the front spring portion 106.

The axle body 103 is arranged in the right angle portion 109 formed by the front spring portion 106 and the downwardly extending portion 107. The right angle portion thus forms an axle seating portion of the trailing arm 105. The right angle portion encloses about 50% of the perimeter of the axle body. The suspension furthermore comprises a clamping strap 5 119 on either side of the trailing arm 105 for clamping the axle body 103 and the trailing arm 105 together.

The clamping straps 119 each have a front leg 119a and a rear leg 119c and an arched or angular portion 119b interconnecting said front and rear leg 119a, 119c. The strap 119 is generally V-shaped. The arched or angular portion 119b extends around a lower front corner 10 103a of the axle body 103 and said legs 119a, 119c of the strap 119 are tensioned with respect to the trailing arm 105, such that the axle body 103 is clamped between the arched or angular portion 119b of the strap 119 and said right angle portion 109 of the trailing arm 105. The axle body 103 is arranged directly against the right angle portion 109 of the trailing arm 105. The front leg 119a of the strap 119 extends upwards along a front side 103b of the 15 axle body 103 and is supported at the front side of the right angle portion 109. The rear leg 119c of the strap 119 extends along an underside 103c of the axle body 103 towards the rear and is supported at the rear side of the right angle portion 109.

In particular the front leg 119a of the strap 119 is supported at the front end of the axle 20 seating portion 109 by inserting the front leg through a bore in a strap plate 118 that is located on the upper side of the trailing arm 105 at the front end of the axle seating portion 109. The front leg is tightened with respect to the strap plate 118 and the trailing arm 105 by a nut 120 that cooperates with the male thread on the front leg 119a of the strap 119. The trailing arm 105 has a recess 123 in the side at the front end of the axle seating portion 109, 25 in which the front leg 119a of the strap 119 is received.

The rear legs 119c of the two straps 119 that are arranged on either side of the trailing arm 105 are interconnected by a bridge part 121. The bridge part 121 extends in the width direction of the trailing arm 105 over the upper side of the trailing arm 105 just behind the 30 downwardly extending portion 107 of the axle seating portion 109 of the trailing arm 105. This structure is similar to the one shown in Figs 4 and 5.

CLAIMS

1. A wheel axle suspension of a vehicle comprising:
- an axle body of a wheel axle of the vehicle,
 - 5 - a flexible trailing arm extending in a longitudinal direction of the vehicle and crossing
- the axle body substantially perpendicular, said trailing arm having a front spring portion extending in the longitudinal direction of the vehicle and said trailing arm having an axle seating portion adjoining the front spring portion, said axle seating portion having a
- 10 concave side at which the axle body is arranged,
- at least one clamping strap for clamping the axle body and the trailing arm together, the at least one clamping strap has a front leg and a rear leg and an arched portion interconnecting said front and rear leg, wherein the arched portion extends around a part of
- 15 the circumference of the axle body and said legs of the strap are tensioned with respect to the trailing arm, such that the axle body is clamped between the arched portion of the strap and said concave side of the axle seating portion of the trailing arm,
- characterized in that**
- said axle body is arranged directly against the concave side of the axle seating portion of the trailing arm, and
- 20 in that the front leg of the strap extends towards the front through or along the side of the trailing arm and is supported at the front side of the axle seating portion and the rear leg of the strap extends through or along the side of the trailing arm towards the rear and is supported at the rear side of the axle seating portion.
- 25 2. The wheel axle suspension according to claim 1, wherein the angle between the front leg and the rear leg of the strap is within the range 90° - 170° , preferably around 110° .
3. The wheel axle suspension according to any one of claims 1 - 2, wherein at least one of the front leg and rear leg of the strap is provided with a male threaded end.
- 30 4. The wheel axle suspension according to claim 3, wherein both the rear leg and front leg of the strap are provided with a male threaded end.
5. The wheel axle suspension according to any one of the claims 1 - 4, wherein two
- 35 clamping straps are arranged, one on either side of the trailing arm.

6. The wheel axle suspension according to claim 5, wherein the rear legs or the front legs of the said two clamping straps are interconnected by a bridge portion extending in the width direction over the trailing arm.
- 5 7. The wheel axle suspension according to claim 6, wherein the two clamping straps and the bridge portion are made in one piece.
8. The wheel axle suspension according to any one of the preceding claims, wherein the axle body has a substantially circular cross section and wherein the axle seating portion
10 of the trailing arm has a curved form with a curved concave side engaging the axle body.
9. The wheel axle suspension according to claim 8, wherein the curved concave side encloses the circumference of the axle body over $120^{\circ} - 180^{\circ}$.
- 15 10. The wheel axle suspension according to claim 8 or 9, wherein a half cylindrical shell is arranged around a portion of the circumference of the axle body, wherein a portion of said shell is clamped between the strap and the axle body.
11. The wheel axle suspension according to claim 10, wherein the shell is provided with
20 a first nose portion bulging out of the cylindrical surface that engages the curved portion of the trailing arm at the front end thereof in line with the front strap leg.
12. The wheel axle suspension according to claim 11, wherein the shell is provided with
25 a second nose portion bulging out of the cylindrical portion adjacent the first nose portion that engages the strap.
13. The wheel axle suspension according to any one of the claims 10 - 12, wherein at
30 one end of the shell a bead is formed, and wherein in the axle body and in the concave side of the curved portion a recess is formed in which the bead is received as a locking structure.
14. The wheel axle suspension according to any one of claims 1 - 7, wherein the axle
35 body has a substantially rectangular cross section and wherein the axle seating portion of the trailing arm is formed as an angular portion constituted by the front spring portion and a downwardly extending portion of the trailing arm adjoining the front spring portion at a rear end thereof and extending substantially perpendicular to the front spring portion.

15. The wheel axle suspension according to claim 14, wherein the axle seating portion encloses about 50% of the perimeter of the axle body.

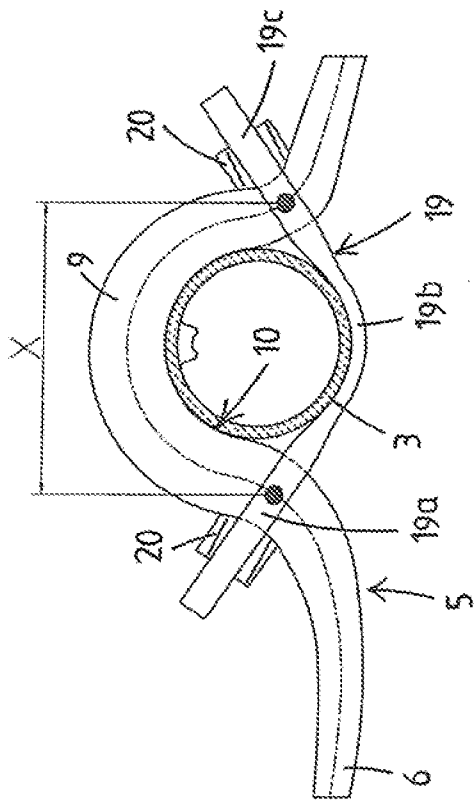


Fig. 1

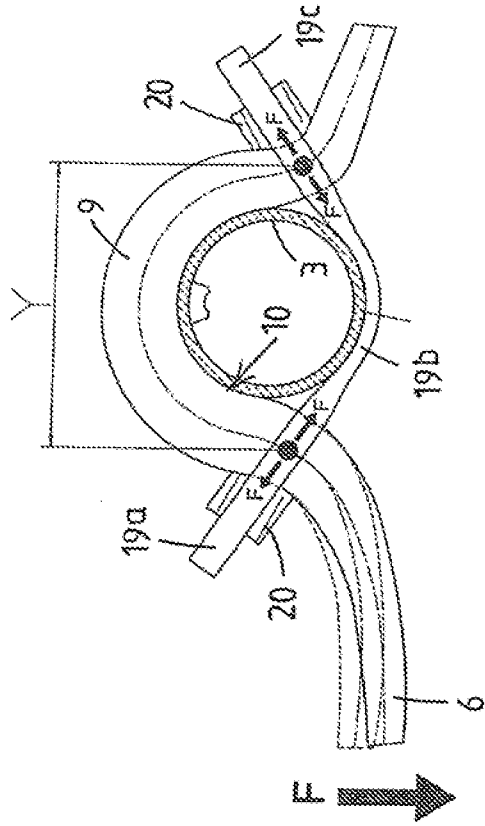


Fig. 3

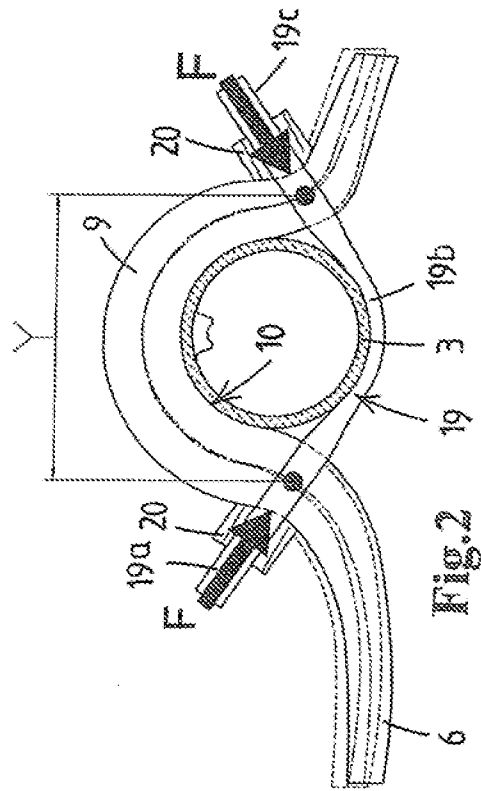


Fig. 2

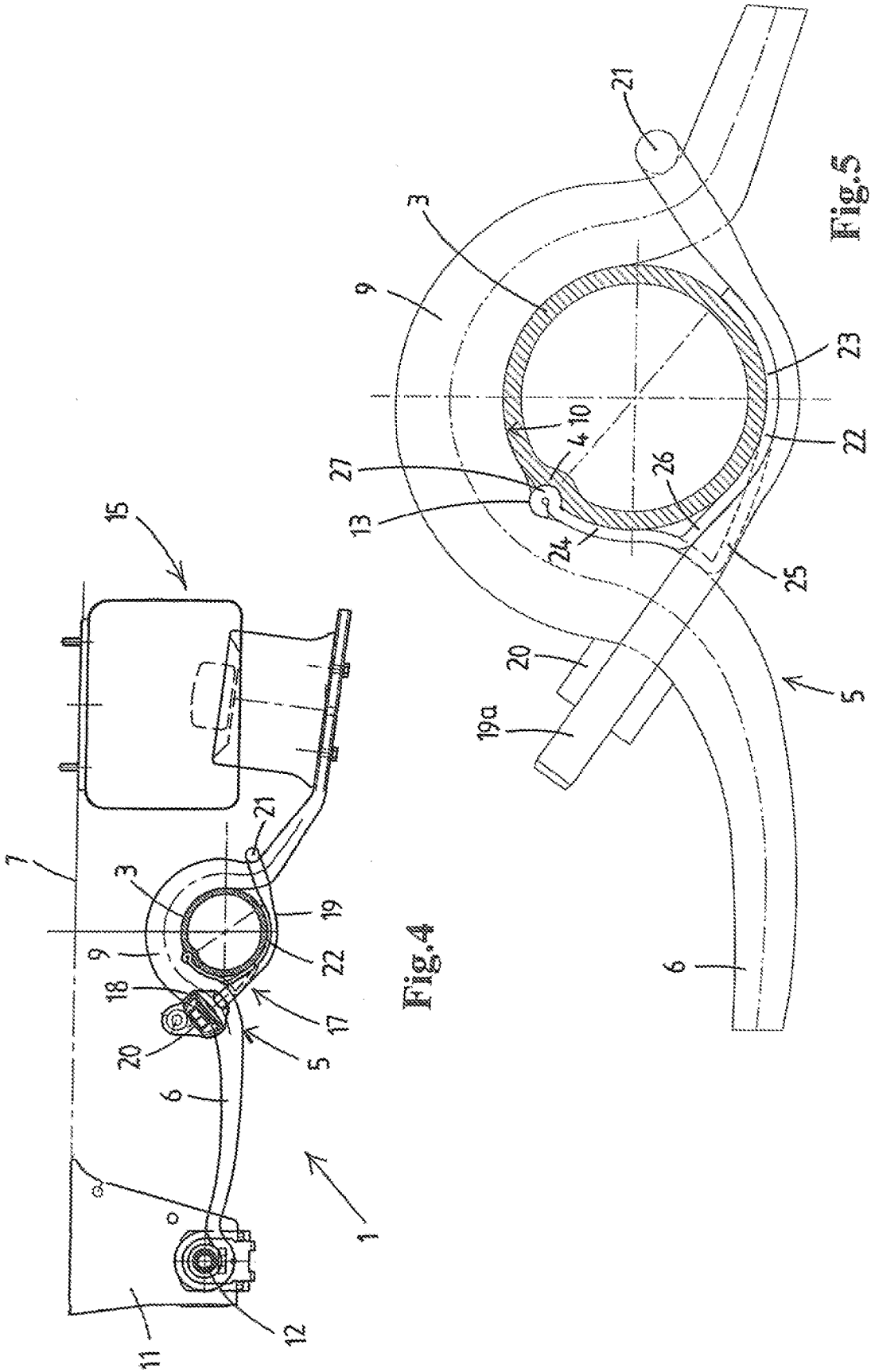


Fig.4

Fig.5

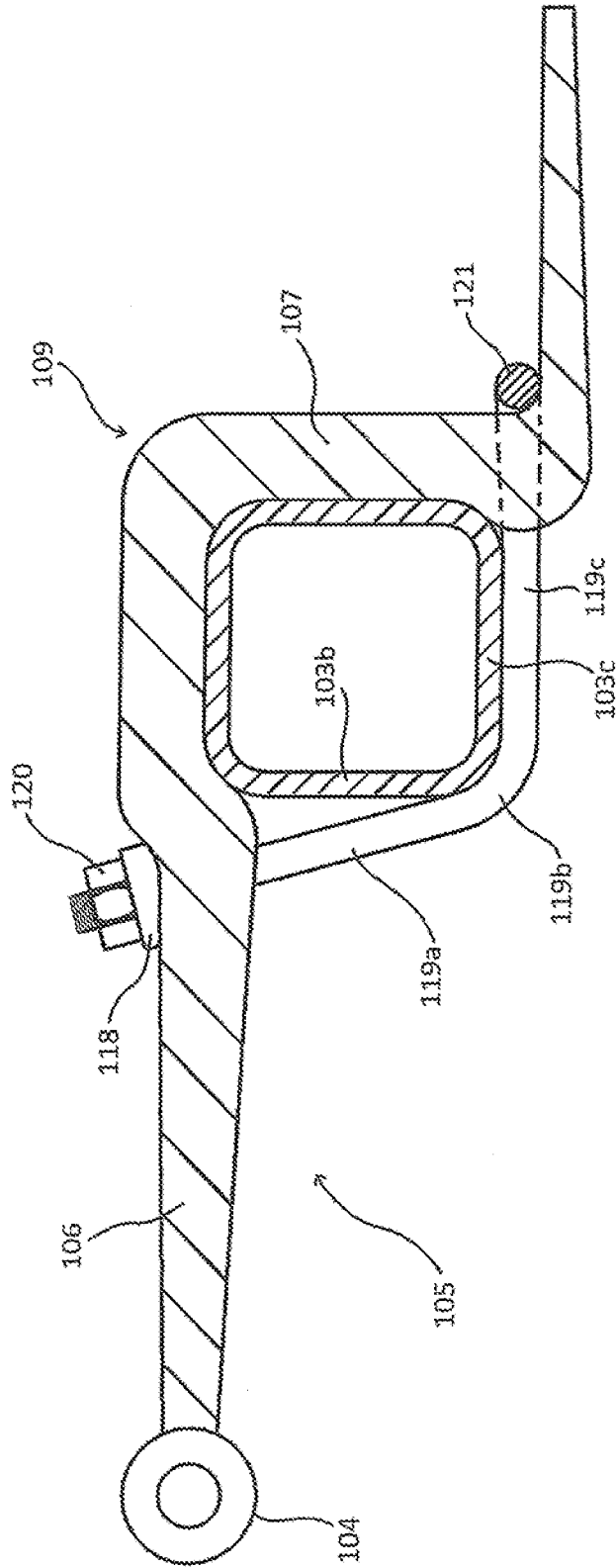


Fig.6

INTERNATIONAL SEARCH REPORT

International application No PCT/NL2014/050143

A. CLASSIFICATION OF SUBJECT MATTER INV. B60B35/08 B60G7/00 B60G9/00 ADD.				
According to International Patent Classification (IPC) or to both national classification and IPC				
B. FIELDS SEARCHED				
Minimum documentation searched (classification system followed by classification symbols) B60B B60G				
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched				
Electronic data base 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				
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.		
X	WO 2012/078031 A1 (VDL WEWELER B V [NL]; AALDERINK DERK GEERT [NL]) 14 June 2012 (2012-06-14)	1,3-5,8, 9		
Y	the whole document	6,7,10, 11,13		
X	----- DE 296 15 286 U1 (TRENKAMP & GEHLE [DE]) 17 October 1996 (1996-10-17) page 4, line 33 - page 5, line 26; figures 3-5	1,3,4,8, 9		
Y	----- WO 2012/154032 A1 (VDL WEWELER B V [NL]; AALDERINK DERK GEERT [NL]) 15 November 2012 (2012-11-15) page 4, line 31 - page 5, line 3; figure 4 ----- -/--	6,7		
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.				
* Special categories of cited documents : <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none; vertical-align: top;"> "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "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 </td> <td style="width: 50%; border: none; vertical-align: top;"> "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family </td> </tr> </table>			"A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "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	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family
"A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "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	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family			
Date of the actual completion of the international search	Date of mailing of the international search report			
15 April 2014	25/04/2014			
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Sluimer, Paul			

INTERNATIONAL SEARCH REPORT

International application No PCT/NL2014/050143

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	DE 199 46 802 A1 (SCHMITZ CARGOBULL AG [DE]) 19 April 2001 (2001-04-19) cited in the application	10, 11, 13
A	figures 1,3 the whole document	1, 3-5, 8, 9, 14
A	----- DE 42 24 965 C1 (BERGISCHE ACHSENFABRIK) 5 August 1993 (1993-08-05) the whole document	1, 14, 15
X, P	----- DE 10 2012 207157 A1 (SAF HOLLAND GMBH [DE]) 31 October 2013 (2013-10-31) the whole document -----	1, 3, 4, 8, 9

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/NL2014/050143

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2012078031 A1	14-06-2012	EP 2648927 A1 WO 2012078031 A1	16-10-2013 14-06-2012

DE 29615286 U1	17-10-1996	NONE	

WO 2012154032 A1	15-11-2012	DE 112011105235 T5 WO 2012154032 A1	27-02-2014 15-11-2012

DE 19946802 A1	19-04-2001	NONE	

DE 4224965 C1	05-08-1993	NONE	

DE 102012207157 A1	31-10-2013	DE 102012207157 A1 WO 2013164139 A1	31-10-2013 07-11-2013
