



(51) International Patent Classification:

B62D 21/04 (2006.01) B62D 21/09 (2006.01)

B60P 1/04 (2006.01) B62D 21/12 (2006.01)

B62D 33/077 (2006.01)

(21) International Application Number:

PCT/SE2019/050449

(22) International Filing Date:

17 May 2019 (17.05.2019)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

1850717-8 12 June 2018 (12.06.2018) SE

(71) Applicant: SCANIA CV AB [SE/SE]; 151 87 Södertälje (SE).

(72) Inventor: JOHANSSON, Anders; Långbrovägen 57, 125 33 Älvsjö (SE).

(74) Agent: SANDBERG, Mikael; Scania CV AB, 151 87 Södertälje (SE).

(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, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN,

HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, 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, ST, 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, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

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

(54) Title: AUXILIARY FRAME FOR SUPPORTING A VEHICLE BODY

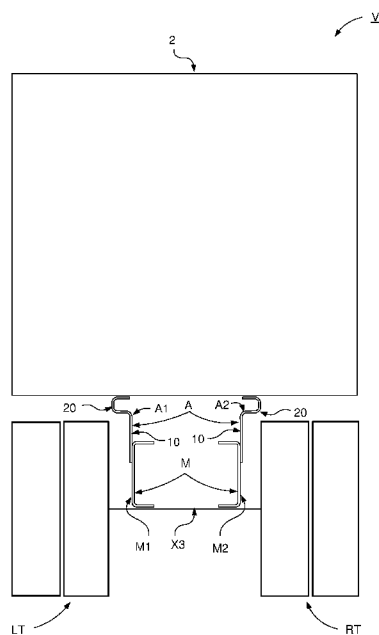


Fig. 4

(57) Abstract: The present invention relates to an auxiliary frame (A) for supporting a vehicle body portion (2) such as a tipper. The auxiliary frame (A) comprises two beam members (A1, A2) configured to be attached to longitudinal beams (M1, M2) of a main frame (M) of a vehicle chassis. The respective beam member (A1, A2) has a cross sectional profile having a straight web portion (10) and a hook shaped end portion (20). The straight web portion (10) is configured to be attached to a longitudinal beam (M1, M2) of the main frame (M) and the hook shaped end portion (20) is configured for supporting the vehicle body portion (2). The present invention also relates to a vehicle.



## AUXILIARY FRAME FOR SUPPORTING A VEHICLE BODY

## TECHNICAL FIELD

The invention relates to an auxiliary frame for supporting a vehicle body portion  
5 of a vehicle. The invention also relates to a vehicle.

## BACKGROUND ART

Certain heavy vehicles such as e.g. construction vehicles and mining tipper  
vehicles require an auxiliary frame for supporting the tipper body. The auxiliary  
10 frame is attached to the longitudinal beams of a main frame of the vehicle  
chassis, the longitudinal beams having a C-profile with the opening facing each  
other. The auxiliary frame is required both in order to increase the level of the  
chassis above the vehicle wheels and to increase the bending strength as well  
as torsional stiffness of the chassis.

15 A solution is to provide an auxiliary frame with two beam members which have  
rectangular profiles, e.g. beams with C-profiles that have been modified to  
rectangular profiles by welding vertical plates to close the open side of the C-  
profile in order to increase the strength and the torsional stiffness. These  
beams with essentially rectangular profiles then need to be attached to the  
20 longitudinal beams of the main frame via fastening members which are  
attached to the longitudinal beam by means of screw joints and welded to the  
auxiliary beam member.

During operation of e.g. a mining tipper vehicle the vehicle may in certain  
situations such as e.g. twisting of the chassis and tilt during tipping while  
25 carrying heavy load which may result in cracks in the beam members of the  
auxiliary frame.

## OBJECTS OF THE INVENTION

An object of the present invention is to provide an auxiliary frame for supporting a vehicle body portion of a vehicle which is robust and durable.

5 Another object of the present invention is to provide a vehicle comprising such an auxiliary frame.

## SUMMARY OF THE INVENTION

10 These and other objects, apparent from the following description, are achieved by a method, a control device, a vehicle, a computer program and a computer readable medium, as set out in the appended independent claims. Preferred embodiments of the method and the control device are defined in appended dependent claims.

15 Specifically an object of the invention is achieved by an auxiliary frame for supporting a vehicle body portion of a vehicle. The auxiliary frame comprises two beam members configured to be attached to longitudinal beams of a main frame of a vehicle chassis. The respective beam member has a cross sectional profile having a straight web portion and a hook shaped end portion. The straight web portion is configured to be attached to a longitudinal beam of the main frame and the hook shaped end portion is configured for supporting the  
20 vehicle body portion.

25 Hereby a lighter and more robust auxiliary frame may be obtained. By thus providing a lighter auxiliary frame the weight of the vehicle chassis will affect the load of the vehicle to a lesser extent, thus allowing more load on the vehicle, e.g. a tipping vehicle. The shape of the respective beam member with the cross sectional profile having a straight web portion and an opposite hook shaped end portion no welding is required in order to attach the respective beam member to the respective longitudinal beam. The shape of the respective beam member facilitates attaching the respective beam member to

the respective longitudinal beam by means of screw joints, which in turn facilitates reducing the need for cross sectional beams to a minimum. With the shape of the respective beam member having a cross sectional profile having a straight web portion and an opposite hook shaped end portion a resilient function is obtained. The shape of the respective beam member facilitates utilizing material, e.g. steel, with a high yield limit. With the hook shaped end portion of the respective beam member of the auxiliary frame a more evenly distributed pressure between the vehicle body portion, which is supported by the two beam members, and the vehicle chassis comprising the two beam members may be obtained without having to use beam members with rectangular profiles which are heavy. The shape of the respective beam member with the cross sectional profile having a straight web portion and an opposite hook shaped end portion facilitates a more favourable force distribution to the respective longitudinal beam having a C-shaped profile, essentially hitting the shear centre of the respective C-shaped longitudinal beam.

According to an embodiment of the auxiliary frame the straight web portion is configured to be arranged substantially vertically to constitute a lower portion of the auxiliary frame.

20 According to an embodiment of the auxiliary frame the hook shaped end portion is configured to extend laterally from the web portion and constitute a substantially horizontal support portion.

According to an embodiment of the auxiliary frame the beam member is configured to extend upwardly from a longitudinal beam of the main frame.

25 According to an embodiment of the auxiliary frame the hook shaped end portion comprises a substantially horizontal lower portion extending laterally from the straight web portion, a substantially horizontal upper portion and an intermediate curved portion connecting the lower and upper portions.

According to an embodiment of the auxiliary frame the straight web portion is configured to be attached to a web portion of a longitudinal beam by means of screw joint members. By thus utilizing screw joints for the attachment the need for cross sectional beams of the chassis is reduced to a minimum.

- 5 According to an embodiment of the auxiliary frame the longitudinal beams have a C-shaped cross sectional profile, the longitudinal beams running at a distance from each other with the respective C-opening facing each other, wherein the opening of the hook shaped end portion of the respective beam member are facing each other. Hereby a more favourable force distribution to
- 10 the respective longitudinal beam is provided, the force essentially hitting the shear centre of the respective C-shaped longitudinal beam. Hereby the support for the vehicle body portion becomes wider in that the distance between the hook shaped portions of the respective beam member of the auxiliary frame is greater compared to using beam members with rectangular
- 15 cross sectional profiles.

Specifically an object of the invention is achieved by a vehicle comprising an auxiliary frame as set out herein.

#### BRIEF DESCRIPTION OF THE DRAWINGS

- 20 For a better understanding of the present invention reference is made to the following detailed description when read in conjunction with the accompanying drawings, wherein like reference characters refer to like parts throughout the several views, and in which:

Fig. 1 schematically illustrates a side view of a vehicle according to an embodiment of the present disclosure;

25

Fig. 2 schematically illustrates a plan view of a vehicle in fig. 1 showing its chassis and wheel axles with vehicle wheels according to an embodiment of the present disclosure;

Fig. 3a schematically illustrates a perspective view of portion of a beam member of an auxiliary frame attached to a longitudinal beam of a main frame of a vehicle according to an embodiment of the present disclosure;

5 Fig. 3b schematically illustrates a perspective view of portion of a beam member of an auxiliary frame attached to a longitudinal beam of a main frame of a vehicle according to an embodiment of the present disclosure;

Fig. 3c schematically illustrates a profile of a beam member of an auxiliary frame attached to a longitudinal beam of a main frame of a vehicle according to an embodiment of the present disclosure; and

10 Fig. 4 schematically illustrates a rear view of the vehicle in fig. 1.

#### DETAILED DESCRIPTION

Fig. 1 schematically illustrates a side view of a vehicle V according to the present invention. The exemplified vehicle V is a commercial vehicle in the shape of a truck. The exemplified vehicle V is a tipper vehicle. The vehicle V has a cab 1 and a tippable load carrying body 2.

20 The vehicle according to the present disclosure could be any suitable vehicle requiring auxiliary frame according to the present disclosure such as a construction vehicle. The vehicle according to the present disclosure could be an autonomous vehicle.

The vehicle V has front wheels LF of which the left wheel LF is shown. The vehicle V has tractive wheels LD of which the left wheel LD is shown. The vehicle has rear wheels LR of which the left wheel LR is shown.

25 The vehicle V comprises a vehicle chassis C. The vehicle chassis C comprises a main frame M and an auxiliary frame A. The vehicle chassis C is configured to support the tippable load carrying body 2 by means of the auxiliary frame A.

The auxiliary frame A is configured to support the tippable load carrying body 2.

Fig. 2 schematically illustrates a plan view of a vehicle V in fig. 1 showing its chassis and wheel axles with vehicle wheels according to an embodiment of the present disclosure.

The vehicle V has a front wheel axle X1 with left and right front wheels LF, RF. The vehicle has a drive axle X2 with left and right tractive wheels LD, RD. The vehicle has a rear wheel axle X3 with left and right rear wheels LT, RT. The rear wheel axle X3 is according to an embodiment a tag axle.

As described with reference to fig. 1, the vehicle V comprises a vehicle chassis C, comprising a main frame M and an auxiliary frame A.

The main frame M comprises a left longitudinal beam M1 and a right longitudinal beam M2. The left and right longitudinal beams M1, M2 are arranged to run in the longitudinal direction of the vehicle V at a distance from each other.

The auxiliary frame A comprises a left beam member A1 and a right beam member A2. The left and right beam members A1, A2 are configured to be attached to the longitudinal beams M1, M2 of the main frame M. The left beam member A1 is configured to be attached to an upper outer portion of the left longitudinal beam M1, see also fig. 4. The right beam member A2 is configured to be attached to an upper outer portion of the right longitudinal beam M2, see also fig. 4. The left and right beam members A1, A2 are arranged to run in the longitudinal direction of the vehicle V along the left and right longitudinal beams M1, M2 from a rear position of the vehicle and a certain distance along the vehicle so as to provide support for a vehicle body portion, e.g. a tippable load carrying body 2 as illustrated in fig. 1. The left and right beam members A1, A2 are thus arranged to run in the longitudinal direction of the vehicle V at a distance from each other.

The chassis C of the vehicle V may comprise a set of cross sectional beams C1, C2, C3, C4, C5. Cross sectional beams are arranged at a suitable distance from each other between the longitudinal beams M1, M2 of the main frame M and the beam members A1, A2 of the auxiliary frame. With the solution  
5 according to the present invention the number cross sectional beams of the auxiliary frame may be reduced.

A portion of a beam M1 of the main frame M and a portion of a beam member A1 of the auxiliary frame A attached to the beam M1 are described in more detail with reference to fig. 3a-c.

10 Fig. 3a schematically illustrates a perspective view of portion of a beam member A1 of an auxiliary frame attached to a longitudinal beam M1 of a main frame of a vehicle according to an embodiment of the present disclosure, fig. 3b schematically illustrates another perspective view of the portion of the beam member A1 and portion of the longitudinal beam M1 to which the beam  
15 member is attached; and fig. 3c schematically illustrates a profile of the beam member A1 attached to the longitudinal beam M1 according to an embodiment of the present disclosure.

The beam member A1 has a cross sectional profile having a straight web portion 10 and a hook shaped end portion 20. The straight web portion 10 is  
20 configured to be attached to a longitudinal beam M1 of a main frame of the chassis of a vehicle.

The hook shaped end portion 20 is configured for supporting a vehicle body portion, as illustrated in fig. 1 and fig. 4.

The longitudinal beam M1 has a C-shaped cross sectional profile. The C-shaped longitudinal beam M1 has a substantially horizontal lower portion 32,  
25 a substantially horizontal upper portion 34 and an intermediate straight web portion 36 connecting the lower portion 32 and upper portion 34. The intermediate straight web portion 36 has an outer side 36a facing away from the direction of the horizontal lower portion 32 and horizontal upper portion 34,



and an opposite inner side 36b. The C-shaped cross sectional profile of the longitudinal beam M1 forms an opening O1 with the inner side 36b as the end of the opening O1.

5 According to this embodiment of the beam member A1 the straight web portion 10 has a lower end portion 12 configured to be attached to an upper portion of the beam M1. The lower end portion 12 of the straight web portion 10 is configured to be attached to an upper portion of the intermediate straight web portion 36 of the horizontal beam M1. The inner side 10b of the straight web portion 10 is arranged to face the outer side 36a of the intermediate straight web portion 36 when the beam member A1 is attached to the longitudinal beam M1.

The straight web portion 10 has an outer side 10a and an opposite inner side 10b.

15 According to this embodiment of the beam member A1 the hook shaped end portion 20 comprises a substantially horizontal lower portion 22 extending laterally from the straight web portion 10, a substantially horizontal upper portion 24 and an intermediate curved portion 26 connecting the lower portion 22 and upper portion 24.

20 The substantially horizontal upper portion 24 of the hook shaped end portion 20 has an upper side 24a on which a body portion of the vehicle is intended to rest.

25 The hook shaped end portion 20 of the beam member A1 forms an opening O2 facing in the same direction as the opening O1 of the C-shaped cross sectional profile of the longitudinal beam M1 when the beam member A1 is attached to the longitudinal beam M1, as illustrated in fig. 3a-c.

As illustrated in fig. 3a and 3c, the straight web portion 10 of the beam member A1 is according to this embodiment configured to be attached to the straight

web portion 36 of the longitudinal beam M1 by means of screw joint members J.

With the shape of the beam member A1 having a cross sectional profile having a straight web portion 10 and an opposite hook shaped end portion 20 a resilient function is obtained, see fig. 3c.

As illustrated in fig. 3c the hook shaped end portion 20 will provide a resilient deformation when subjected to a force F. Due to the shape of the beam member A1 with the cross sectional profile having the straight web portion 10 and the opposite hook shaped end portion 20 the deformation will be relatively small and the essentially horizontal upper portion 24 of the hook shaped end portion 20 will remain essentially horizontal but slightly lowered, see dotted line of upper portion 24'. The deformation of the essentially horizontal lower portion 22 of the hook shaped end portion 20 is also illustrated with dotted lines as lower portion 22'.

Due to the shape of the beam member A1 with the cross sectional profile having the straight web portion 10 and the opposite hook shaped end portion 20 and its attachment to the longitudinal beam M1 with the C-shaped profile where the opening O2 of the hook shaped end portion 20 and the opening O1 of the C-shaped longitudinal beam facing in the same direction a more favourable force distribution is facilitated, where the force essentially is transferred to the shear centre of the C-shaped longitudinal beam M1.

Thus, when the beam member A1 is attached to the longitudinal beam M1, the substantially horizontal lower portion 22 of the hook shaped end portion 20 of the beam member A1 is extending laterally from the straight web portion 10 in a direction opposite to the direction of the substantially horizontal lower portion 32 and substantially horizontal lower portion of the C-shaped longitudinal beam M1.

Fig. 4 schematically illustrates a rear view of the vehicle V in fig. 1.

The vehicle V has a vehicle body portion 2 in the shape of a tippable load carrying body 2. As described with reference to fig. 1 the vehicle V comprises a vehicle chassis comprising a main frame M and an auxiliary frame A. The vehicle chassis is configured to support the tippable load carrying body 2 by means of the auxiliary frame A. The auxiliary frame A is thus configured to support the tippable load carrying body 2. In fig. 4 the rear wheel axle X3 with the rear wheels LT, RT is shown.

As described with reference to fig. 2 the main frame M comprises a left longitudinal beam M1 and a right longitudinal beam M2. The left and right longitudinal beams M1, M2 are arranged to run in the longitudinal direction of the vehicle V at a distance from each other.

According to this embodiment the longitudinal beams M1, M2 have a C-shaped cross sectional profile. The longitudinal beams M1, M2 are configured to run at a distance from each other with the respective C-opening facing each other. The C-shaped longitudinal beams M1, M2 are thus arranged standing with its lower and upper essentially horizontal portions extending in the transversal extension of the vehicle V and the essentially straight web portion connecting the upper and lower essentially horizontal portions is extending in a direction essentially orthogonal to the longitudinal and transversal extension of the vehicle. The longitudinal beams M1, M2 are supported by the wheel axles of the vehicle V.

The auxiliary frame A comprises a left beam member A1 and a right beam member A2. The left and right beam members A1, A2 are configured to be attached to the longitudinal beams M1, M2 of the main frame M. The left beam member A1 is configured to be attached to an upper outer portion of the left longitudinal beam M1. The right beam member A2 is configured to be attached to an upper outer portion of the right longitudinal beam M2. The left and right beam members A1, A2 are arranged to run in the longitudinal direction of the vehicle V along the left and right longitudinal beams M1, M2.

The respective beam member A1, A2 has a cross sectional profile having a straight web portion 10 and a hook shaped end portion 20. The straight web portion 10 of the left beam member A1 is attached to the left longitudinal beam M1 and the straight web portion 10 of the right beam member A2 is attached to the right longitudinal beam of the main frame M of the chassis of a vehicle V.

The hook shaped end portion 20 of the respective beam member A1, A2 is configured for supporting the vehicle body portion 2, e.g. a tippable load carrying body 2. The left and right beam members A1, A2 are thus arranged to run in the longitudinal direction of the vehicle V at a distance from each other.

In this embodiment the straight web portion 10 of the respective beam member A1, A2 is configured to be arranged substantially vertically to constitute a lower portion of the auxiliary frame A. The straight web portion 10 of the respective beam member A1, A2 is thus extending in a direction essentially orthogonal to the longitudinal and transversal extension of the vehicle V. A lower portion of the straight web portion 10 of the respective beam member A1, A2 is attached to the outer side of an upper portion of the straight web portion of the respective C-shaped longitudinal beams M1, M2.

In this embodiment the hook shaped end portion 20 of the respective beam member A1, A2 is configured to extend laterally from the web portion 10 and constitute a substantially horizontal support portion.

In this embodiment the respective beam member A1, A2 is configured to extend upwardly from the respective longitudinal beam M1, M2 of the main frame M. In this embodiment the respective beam member A1, A2 is configured to extend upwardly from the respective longitudinal beam M1, M2 of the main frame M so that the hook shaped end portion 20 is above the level of the vehicle wheels, here illustrated with the wheels LT, RT.

The opening of the hook shaped end portion 20 of the respective beam member A1, A2 are facing each other.

The foregoing description of the preferred embodiments of the present invention has been provided for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Obviously, many modifications and variations will be apparent to practitioners skilled in the art. The embodiments were chosen and described in order to best explain the principles of the invention and its practical applications, thereby enabling others skilled in the art to understand the invention for various embodiments and with the various modifications as are suited to the particular use contemplated.

## CLAIMS

1. An auxiliary frame (A) for supporting a vehicle body portion (2) of a vehicle (V), the auxiliary frame (A) comprising two beam members (A1, A2) configured to be attached to longitudinal beams (M1, M2) of a main frame (M) of a vehicle chassis (C), wherein the respective beam member (A1, A2) is configured to extend upwardly from a longitudinal beam (M1, M2) of the main frame (M),  
5 **characterized in that** the respective beam member (A1, A2) has a cross sectional profile having a straight web portion (10) and a hook shaped end portion (20), the straight web portion (10) being configured to be attached to a longitudinal beam (M1, M2) of the main frame (M) and the hook shaped end portion (20) being configured for supporting the vehicle body portion (2).  
10
2. The auxiliary frame according to claim 1, wherein the straight web portion (10) is configured to be arranged substantially vertically to constitute a lower portion of the auxiliary frame (A).
- 15 3. The auxiliary frame according to claim 1 or 2, wherein the hook shaped end portion (20) is configured to extend laterally from the web portion and constitute a substantially horizontal support portion.
4. The auxiliary frame according to any of claims 1-3, wherein the hook shaped end portion (20) comprises a substantially horizontal lower portion (22) extending laterally from the straight web portion (10), a substantially horizontal upper portion (24) and an intermediate curved portion (26) connecting the lower and upper portions (22, 24).  
20
5. The auxiliary frame according to any of claims 1-4, wherein the straight web portion (10) is configured to be attached to a web portion (36) of a longitudinal beam by means of screw joint members (J).  
25
6. The auxiliary frame according to any of claims 1-5, wherein the respective beam member (A1, A2) is configured to be connected to longitudinal beams (M1, M2) having a C-shaped cross sectional profile and running at a distance

from each other with the respective C-opening (O1) facing each other, wherein the opening (O2) of the hook shaped end portion (20) of the respective beam (A1, A2) member are facing each other.

7. A vehicle (V1) comprising an auxiliary frame (A) according to any of claims  
5 1-6.

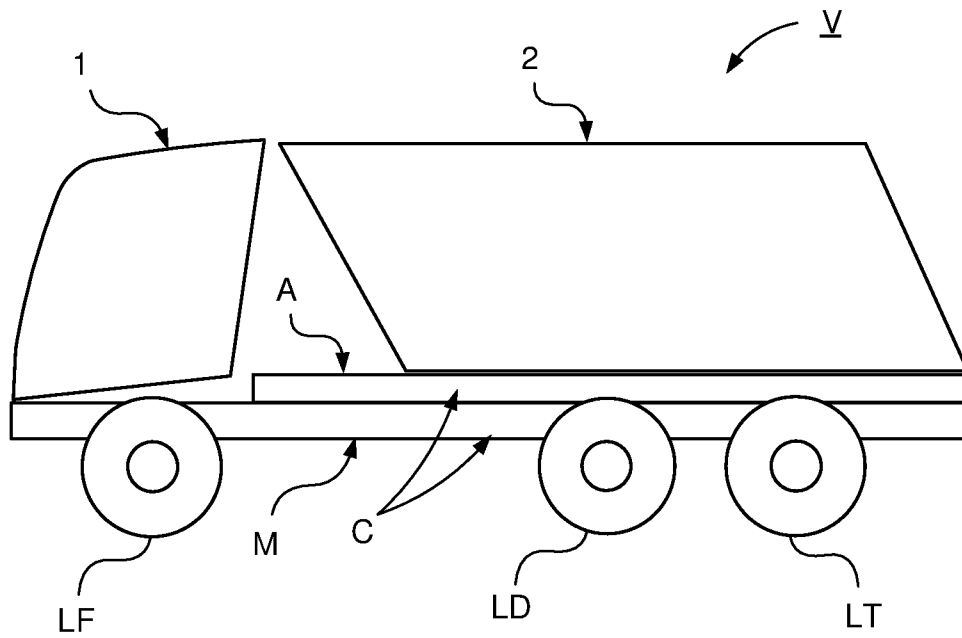


Fig. 1

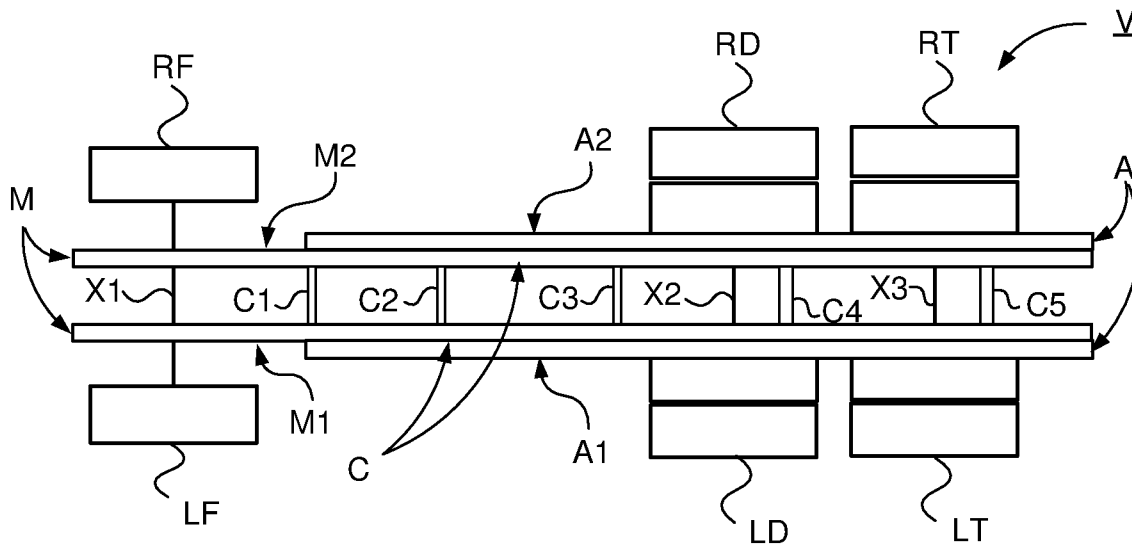


Fig. 2



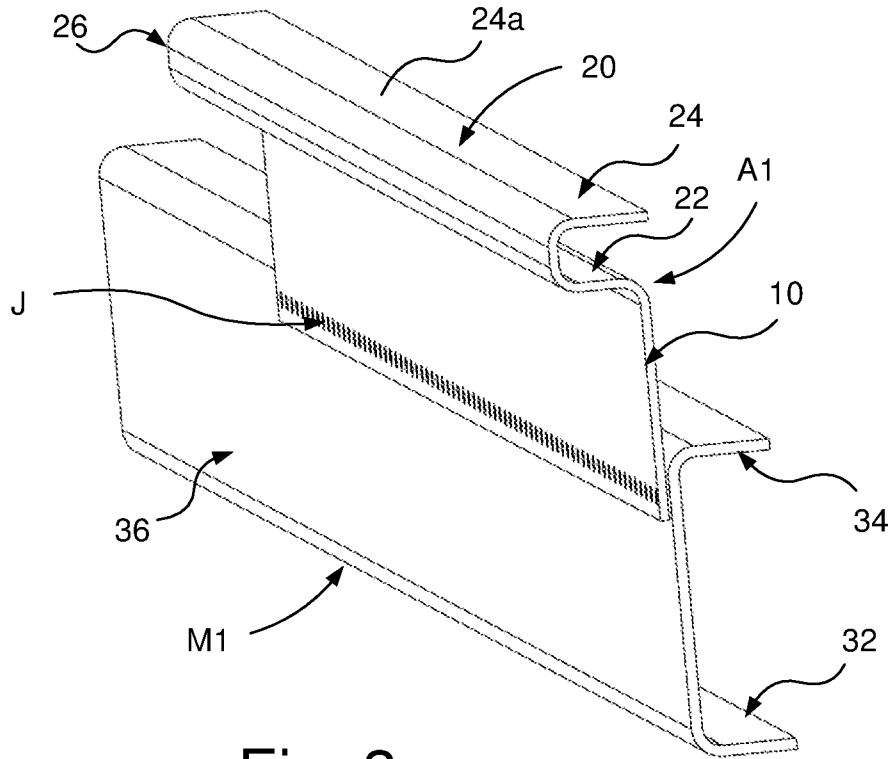


Fig. 3a

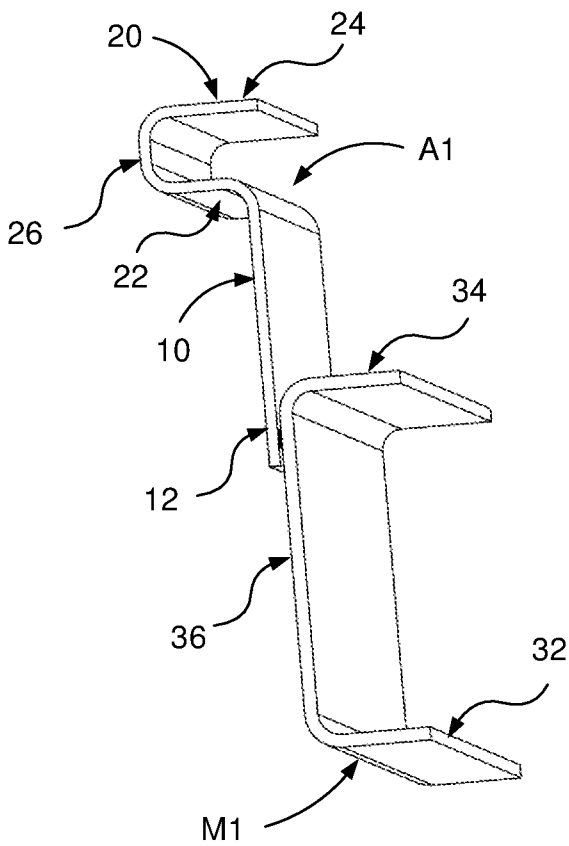


Fig. 3b

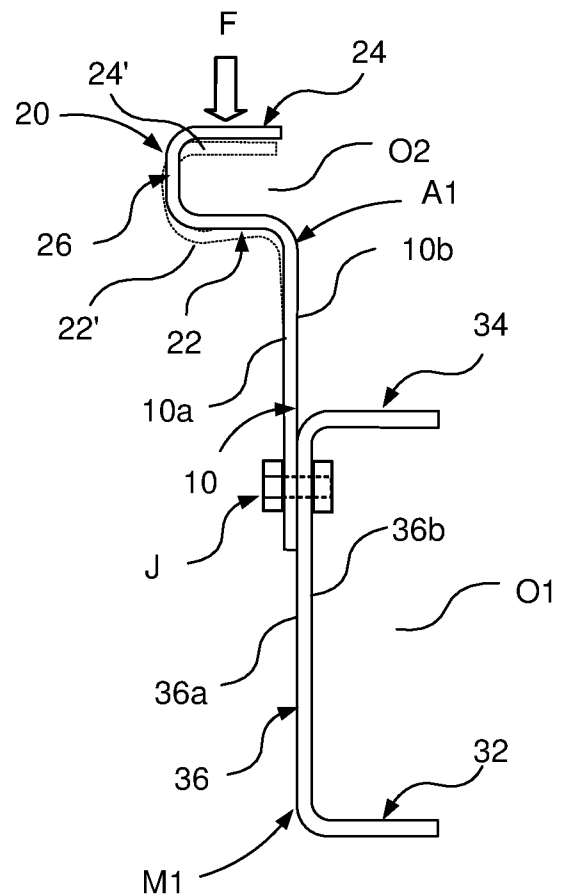


Fig. 3c

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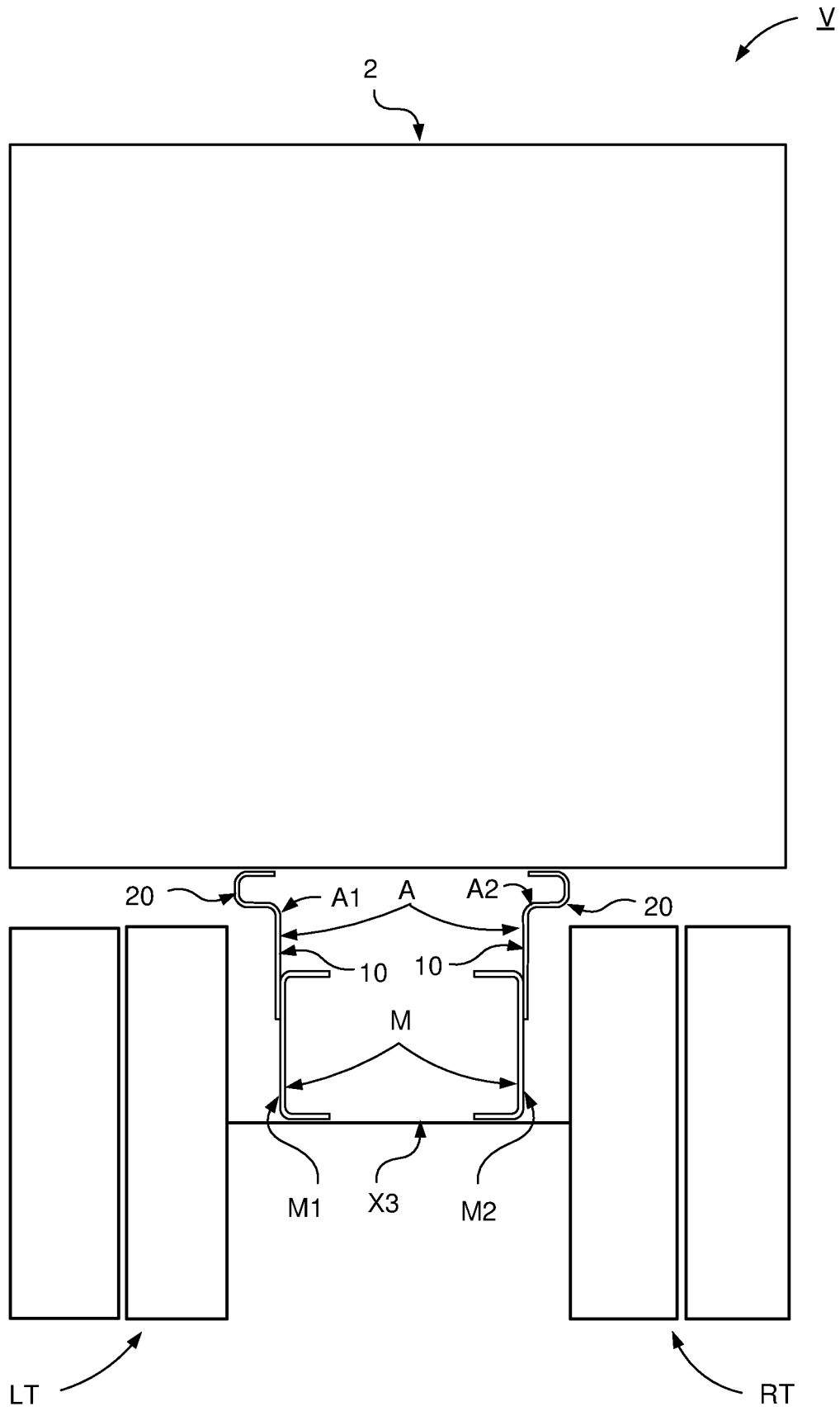


Fig. 4

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/SE2019/050449

A. CLASSIFICATION OF SUBJECT MATTER		
IPC: see extra sheet		
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)		
IPC: B60P, B62D		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
SE, DK, FI, NO classes as above		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
EPO-Internal, PAJ, WPI data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 20090033127 A1 (DUERR RAINER ET AL), 5 February 2009 (2009-02-05); paragraphs [0008], [0011], [0013], [0016], [0030]-[0031], [0044]-[0045]; figures 1A,2,2A --	1-7
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A	CN 102616291 B (CIMC VEHICLE GROUP CO LTD), 20 August 2014 (2014-08-20); page 4, paragraph [0003]; page 5, paragraph [0007]; page 6, paragraph [0001]; figures 2B, 14 --	3, 4
<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:		
"A" document defining the general state of the art which is not considered to be of particular relevance		"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
"D" document cited by the applicant in the international application		"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
"E" earlier application or patent but published on or after the international filing date		
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"P" document published prior to the international filing date but later than the priority date claimed		"&" document member of the same patent family
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## INTERNATIONAL SEARCH REPORT

International application No.  
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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A	EP 3037325 A1 (MEILLER FAHRZEUGE ET AL), 29 June 2016 (2016-06-29); paragraphs [0007], [0009], [0011], [0025]- [0026]; figures 1, 2 --	1-7
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**Continuation of:** second sheet

**International Patent Classification (IPC)**

**B62D 21/04** (2006.01)

**B60P 1/04** (2006.01)

**B62D 33/077** (2006.01)

**B62D 21/09** (2006.01)

**B62D 21/12** (2006.01)

## INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

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