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(71) Applicant: **IVECO MAGIRUS AG**
89079 Ulm (DE)

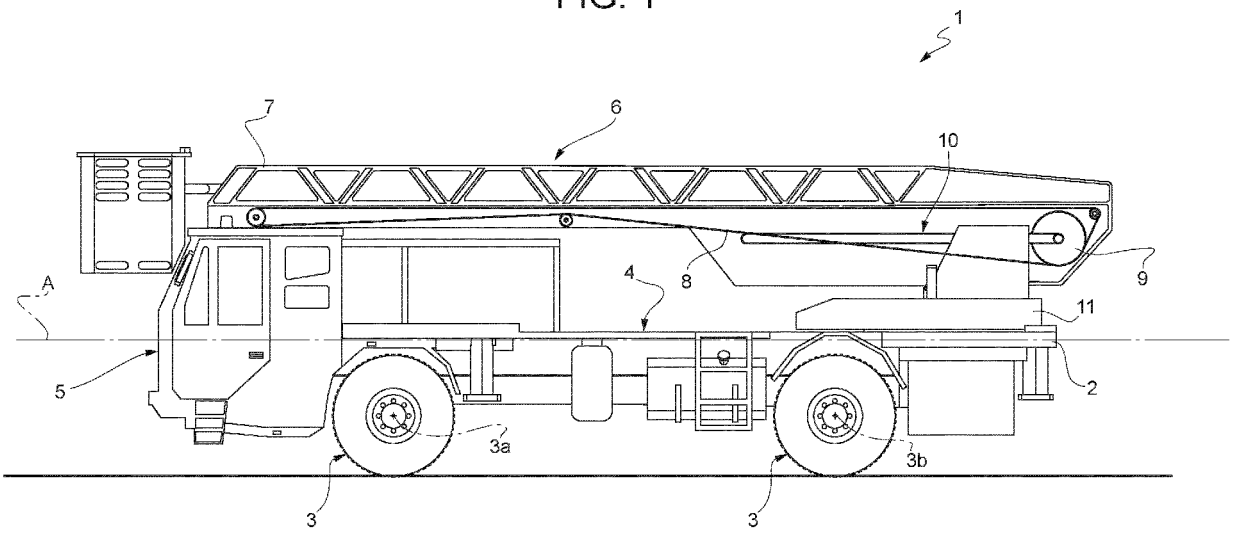
(72) Inventor: **BAUMANN, Andreas**
89079 Ulm (DE)

(74) Representative: **Studio Torta S.p.A.**
Via Viotti, 9
10121 Torino (IT)

(54) **IMPROVED RESCUE VEHICLE PROVIDED WITH A LADDER ASSEMBLY**

(57) Rescue vehicle (1) comprising a chassis (2) movable on ground, and a ladder assembly (6) configured to extend or retract with respect to the chassis (2), the rescue vehicle (1) comprising a winch device (9) configured to control the extraction or retraction of the ladder assembly (6), wherein the winch device (9) is carried in a movable way with respect to the chassis (2).

FIG. 1



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Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This Patent Application claims priority from Italian Patent Application No. 102021000023573 filed on September 13, 2021.

TECHNICAL FIELD

[0002] The present invention concerns a rescue vehicle, in particular a rescue vehicle comprising a ladder assembly.

[0003] The present invention finds its preferred, although not exclusive, application in a rescue vehicle such as a firefighting vehicle. Reference will be made to this application by way of example below.

BACKGROUND OF THE INVENTION

[0004] Rescue vehicles such as firefighting vehicles are equipped with a telescopic ladder assembly configured to extend to allow reaching high and/or distant places in order to ensure rescue and/or firefighting operations.

[0005] In particular, such telescopic ladder is carried by vehicle frame and actuated via a winch device configured to retract or feed a cable that allows the extension or retraction of the ladder. For instance, an example of such telescopic ladder is disclosed in EP EP2182164 A1.

[0006] Such winch device is usually place in the rear portion of the rescue vehicle in order to provide sufficient stability to the vehicle when the ladder is extended since the winch device is particularly heavy.

[0007] However, even if such position of the winch device is optimal during a rescue operation, i.e. when the vehicle is standstill or moving at a very low velocity, the same position is not functional when the vehicle is moving.

[0008] Indeed, the load of the winch acts on the rear axle that is overcharged during motion of the vehicle due to its acceleration.

[0009] Furthermore, such heavy load acting on the rear axle decreases the steering performances of the vehicle, thereby limiting the permissible speed or increasing the possibility of incidents.

[0010] Therefore, the need is felt to improve the stability of the rescue vehicles both during ladder movement and in vehicle travelling.

[0011] An aim of the present invention is to satisfy the above mentioned needs in a cost effective and optimized way.

SUMMARY OF THE INVENTION

[0012] The aforementioned aim is reached by a rescue vehicle and a related control method as claimed in the appended set of claims.

BRIEF DESCRIPTION OF DRAWINGS

[0013] For a better understanding of the present invention, a preferred embodiment is described in the following, by way of a non-limiting example, with reference to the attached drawings wherein:

- Figure 1 is a schematic lateral view of a rescue vehicle according to the invention in a first operative condition;
- Figure 2 is a schematic lateral view of a rescue vehicle according to the invention in an intermediate operative condition; and
- Figure 3 is a schematic lateral view of a rescue vehicle according to the invention in a second operative condition.

DETAILED DESCRIPTION OF THE INVENTION

[0014] In the accompanying figures reference 1 discloses a rescue vehicle 1, in particular a firefighting vehicle, comprising a chassis 2 movable on ground via rolling means 3. In particular, the vehicle 1 comprises wheels carried by at least a front axle 3a and at least a rear axle 3b with respect to a longitudinal axis A of the vehicle 1.

[0015] In detail, chassis 2 defines a vehicle's body 4 and a cab 5. The vehicle 1 furthermore comprises a ladder assembly 6 carried by vehicle's body 4 and preferably extending over cab 5.

[0016] As per se known, the ladder assembly 6 by vehicle's body 4 and comprises a plurality of ladder segments 7.

[0017] In particular, the ladder segments 7 are placed one within/adjacent the other in order to define a first operative configuration, retracted with respect to the chassis 2, wherein the ladder assembly 6 has a minimum length and a second operative configuration, extracted with respect to the chassis 2, wherein the ladder assembly has a maximum length and the ladder segments 7 are arranged one consecutive with respect to the other according to the ladder assembly direction.

[0018] In detail, the ladder segments 7 are operated via at least an actuator cable 8 that is extracted or retracted via a winch device 9 around a plurality of pulleys, as per se known.

[0019] In greater detail, the ladder assembly 6 and the winch device 9 are both carried by a ladder base 11 that is fixedly carried by vehicle's body 4.

[0020] Preferably, the ladder base 11 and/or ladder assembly 6 is carried in a turntable manner with respect to vehicle's body 4.

[0021] According to the invention, the winch device 9 in a movable way with respect to vehicle's body 4. In particular, the winch device 9 is carried in a movable way with respect to ladder base 11.

[0022] More preferably, the winch device 9 is movable in a linear manner with respect to the longitudinal axis A of the vehicle. In this case, the winch device 9 can be

supported on guide means 10 that can be realized on the ladder base 11 (as shown) or on vehicle's body 4.

[0023] The winch device 9 is preferably moved via actuator means (not shown), such as electro-hydraulic or electromechanical means in order to move along its path.

[0024] In particular, the winch device 9 can be moved along its path between a first operational position wherein it is placed in a rear position with respect to the vehicle rear axle 3b and a second operational position wherein it is placed between the front and rear axles 3a, 3b.

[0025] Moreover, the winch device 9 is controlled, during its movement, to rotate about its rotation axis to compensate the length of the cable that control the ladder assembly 6 in order to avoid an extraction of its segments 7.

[0026] Furthermore, the vehicle 1 may comprise locking means (not shown) configured to selectively lock the winch device along its path in one between the first and second aforementioned operational positions or in an intermediate position thereof.

[0027] In particular, the vehicle 1 comprises an electronic control unit, not shown, such as the ECU of the vehicle and configured to control the actuator means to move winch device 9 on the base of the operating status of the vehicle 1.

[0028] In particular, the electronic control unit detects the following two conditions via related sensor means;

- The retracted or extracted status of the ladder assembly; and
- The speed of the vehicle.

[0029] If the electronic control unit detects that the ladder is at least partially extracted and/or the vehicle is moving above a preset threshold, then the movement of the winch device 9 is inhibited.

[0030] If the electronic control unit detects that the ladder is retracted and the vehicle is moving below a preset threshold, then the movement of the winch device 9 is allowed and controlled consequently.

[0031] The electronic control unit elaborates data retrieved by the sensor means and control according to the above logic the movement of the winch device 9 from first to second position or an intermediate position there between.

[0032] The first and second limit positions may be varied, within the physical limits provided by guide means 10, by user input to the electronic control unit according to the vehicle and ladder equipment.

[0033] The control of the winch device position may be executed automatically by the electronic control unit or by input of the user of the vehicle via input means such as a button, an icon or a display, both placed in the cab of the vehicle on or a separated device, such as a portable device by the driver.

[0034] The operation of the above described vehicle according to the invention is the following.

[0035] During a rescue operation, wherein the ladder is extracted, at least partially, the winch device 9 movement is inhibited in the first operational position and the weight of the weight of the winch device 9 increases the stability of the vehicle.

[0036] During a travelling, when the vehicle is moving at high speed, the winch device 9 movement is inhibited in the second operational position and the weight of the weight of the winch device 9 increases the stability of the vehicle.

[0037] During standstill/low speed of the vehicle and when the ladder is retracted, the winch device 9 movement is enabled and the winch device can be displaced between the first and second operational positions or in any position there between.

[0038] The present invention further relates to a control method for increasing the stability of a rescue vehicle as described above and comprising the following phases:

i) Detecting vehicle speed and operational status of the ladder assembly;
ii) If the vehicle speed is below a preset threshold value and the ladder is retracted, than enable the control of winch device position;
iii) If the vehicle speed is above a preset threshold value and/or the ladder is at least partially extracted, than inhibit the control of the winch device position.

[0039] In particular, the control of winch device position comprises the step of controlling actuator means for displacing the winch device between the first and second operational positions.

[0040] The aforementioned step further comprise, in parallel, a rotation of the winch device to regulate the cable length in order to avoid an extraction of ladder segments.

[0041] The control method can further comprise the step of locking the position of winch device with respect to the vehicle's body when its position has been controlled.

[0042] In view of the foregoing, the advantages of a rescue vehicle and related method according to the invention are apparent.

[0043] Thanks to the movable winch device, it is possible to obtain a very stable operative condition during the extraction of the ladder, i.e. during rescue operation and, on different operative condition, to reduce the negative effects on rear axle load and maneuverability of the vehicle.

[0044] Accordingly, it is possible to have less strict design requirements about rear axle loads of the vehicle or about maneuverability of the latter. Indeed, the change of position of the winch device reduces loads on the rear axle thereby improving the maneuverability of the vehicle.

[0045] Furthermore, the proposed solution can be totally automatized, thereby allowing the user to quick and easily control the winch device position management.

[0046] It is clear that modifications can be made to the

described rescue vehicle and related method which do not extend beyond the scope of protection defined by the claims.

[0047] As defined above, the movement of the winch device may follow any path according to the specific position of the ladder assembly and typology of rescue vehicle.

[0048] The typology of ladder assembly and its coupling to the work vehicle may be any according to the necessity of the rescue vehicle.

Claims

1. Rescue vehicle (1) comprising a chassis (2) movable on ground, said rescue vehicle (1) comprising a ladder assembly (6) configured to extend or retract with respect to said chassis (2), said rescue vehicle (1) comprising a winch device (9) configured to control the extraction or retraction of said ladder assembly (6), wherein said ladder assembly (6) defines a ladder base (11), said winch device (9) being carried in a movable way by said ladder base (11), **characterized in that** said winch device (9) is carried in a movable way with respect to said ladder base (11).

2. Rescue vehicle according to claim 1, wherein said winch device (9) is movable along a longitudinal axis (A) of said rescue vehicle (1).

3. Rescue vehicle according to claim 1 or 2, wherein said winch device (9) is movable between a first operational position when said ladder assembly (6) is at least partially extracted to a second operational position when said ladder assembly (6) is retracted, said first operational position being placed in a rear positon with respect to a longitudinal axis (A) of said rescue vehicle (1).

4. Rescue vehicle according to claim 3, wherein said rescue vehicle (1) comprises at least a front axle (3a) and at least a rear axle (3b) both carrying rolling means (3), said winch device (9) being placed, in its second operational position, between said front and rear axles (3a, 3b) and, in its first operational position, coincident or rear to said rear axle (3b).

5. Rescue vehicle according to any of the preceding claims, wherein said chassis (2) defines a vehicle's body (4), said winch device (9) being carried in a movable way by said vehicle's body (4).

6. Rescue vehicle according to claim 5, wherein said ladder base (11) being turntable with respect to said chassis (2).

7. Rescue vehicle according to any of the preceding claims, further comprising actuator means configured to move said winch device (9) with respect to said chassis (2) .

8. Rescue vehicle according to claim 3 in combination with any of claims 4 to 7, comprising locking means configured to selectively lock said winch device (9) in one between said first and second operational positions.

9. Rescue vehicle according to any of the preceding claims, further comprising an electronic control unit configured to automatically control the movement of said winch device (9).

10. Rescue vehicle according to claim 9, further comprising sensor means to detect vehicle speed and retracted or extracted status of said ladder assembly (6), said electronic control unit comprising elaboration means configured to elaborate the data retrieved by said sensor means to control consequently said winch device (9).

11. Control method for increasing the stability of a rescue vehicle (1) according to claim 10, said control method comprising the following phases:

    i) Detecting vehicle speed and operational status of said ladder assembly (6);
    ii) If the vehicle speed is below a preset threshold value and said ladder assembly (6) is retracted, than enable the control of winch device position;
    iii) If the vehicle speed is above a preset threshold value and/or said ladder assembly (6) is at least partially extracted, than inhibit the control of the winch device position.

12. Control method according to claim 11, wherein the control of winch device position comprises the step of controlling actuator means for displacing said winch device (9) between first and second operational positions.

13. Control method according to claim 12, wherein , in parallel to the control of actuator means, it is controlled a rotation of said winch device (9) about its rotation axis to avoid an extraction of said ladder assembly (6).

14. Control method according to any of claims 11 to 13, further comprising the step of locking the position of said winch device (9) with respect to said chassis (2) after said position has been controlled.

FIG. 1

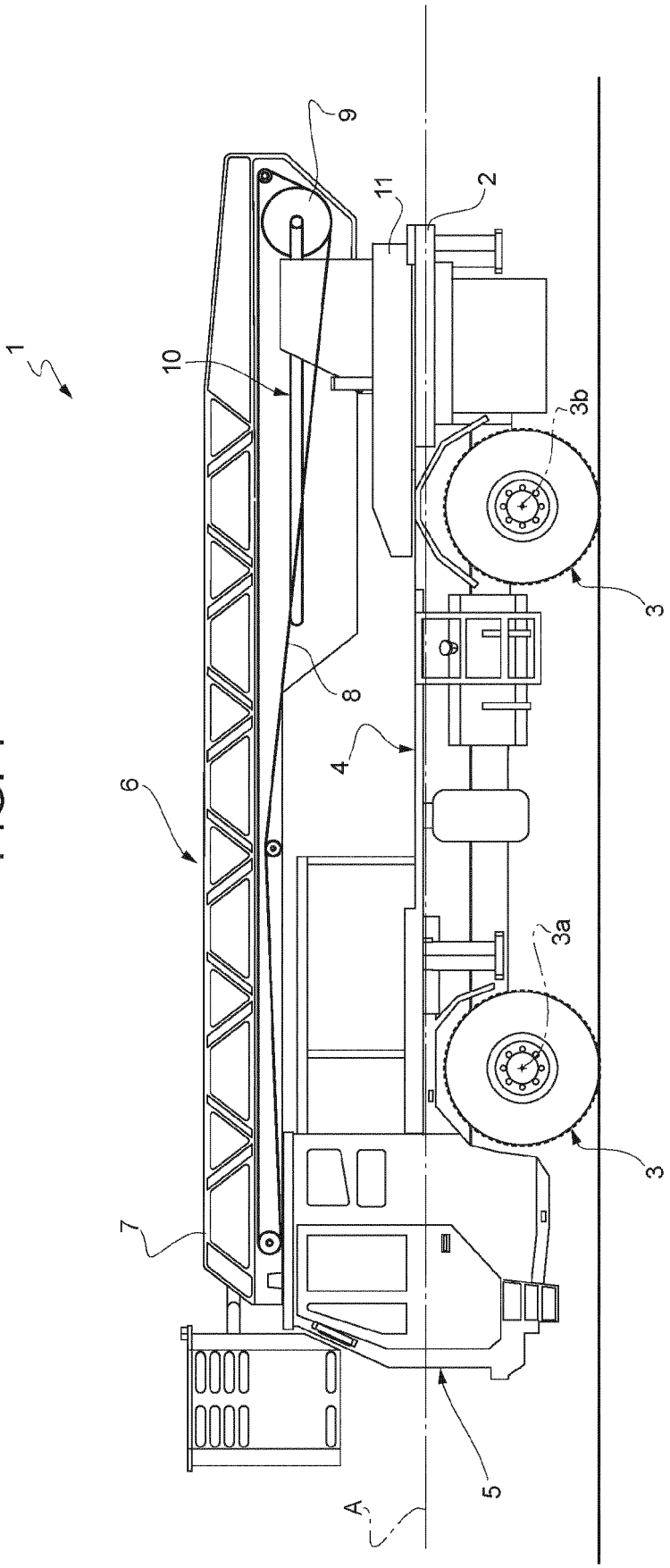


FIG. 2

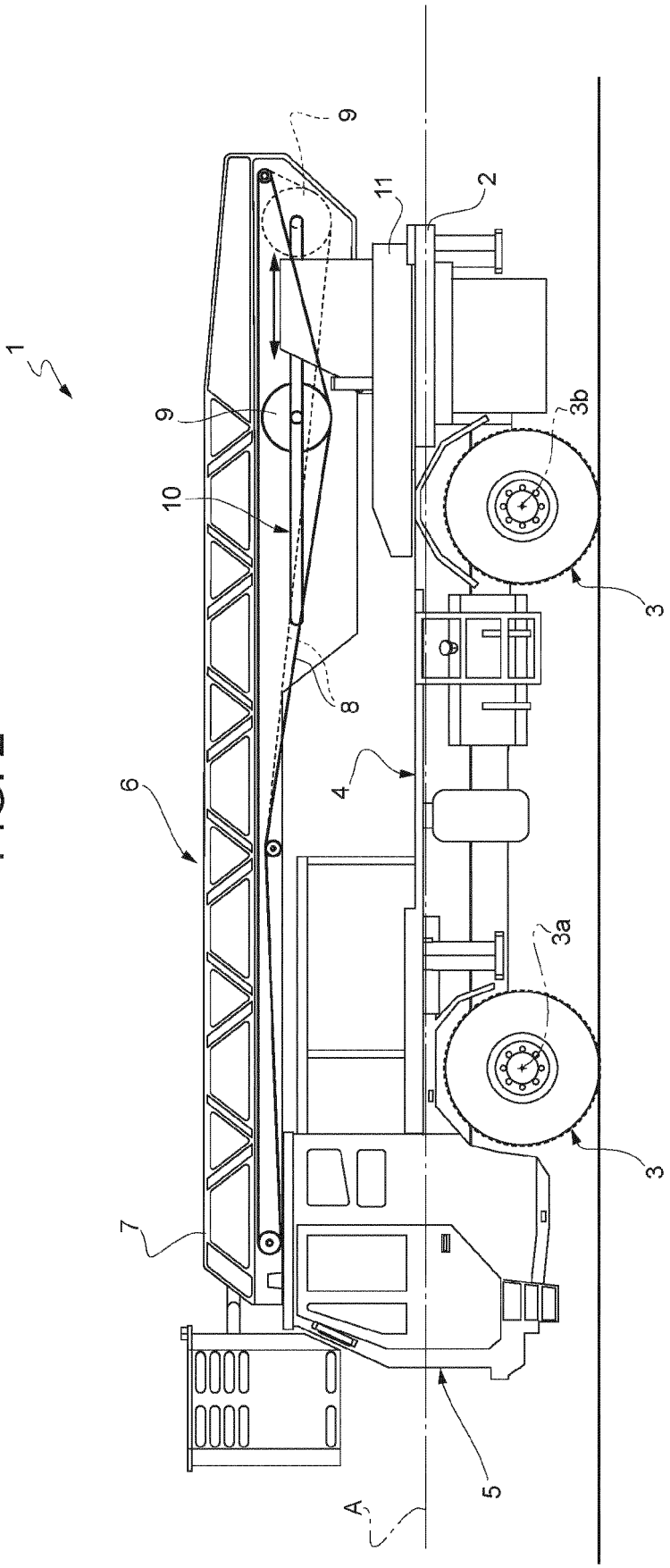
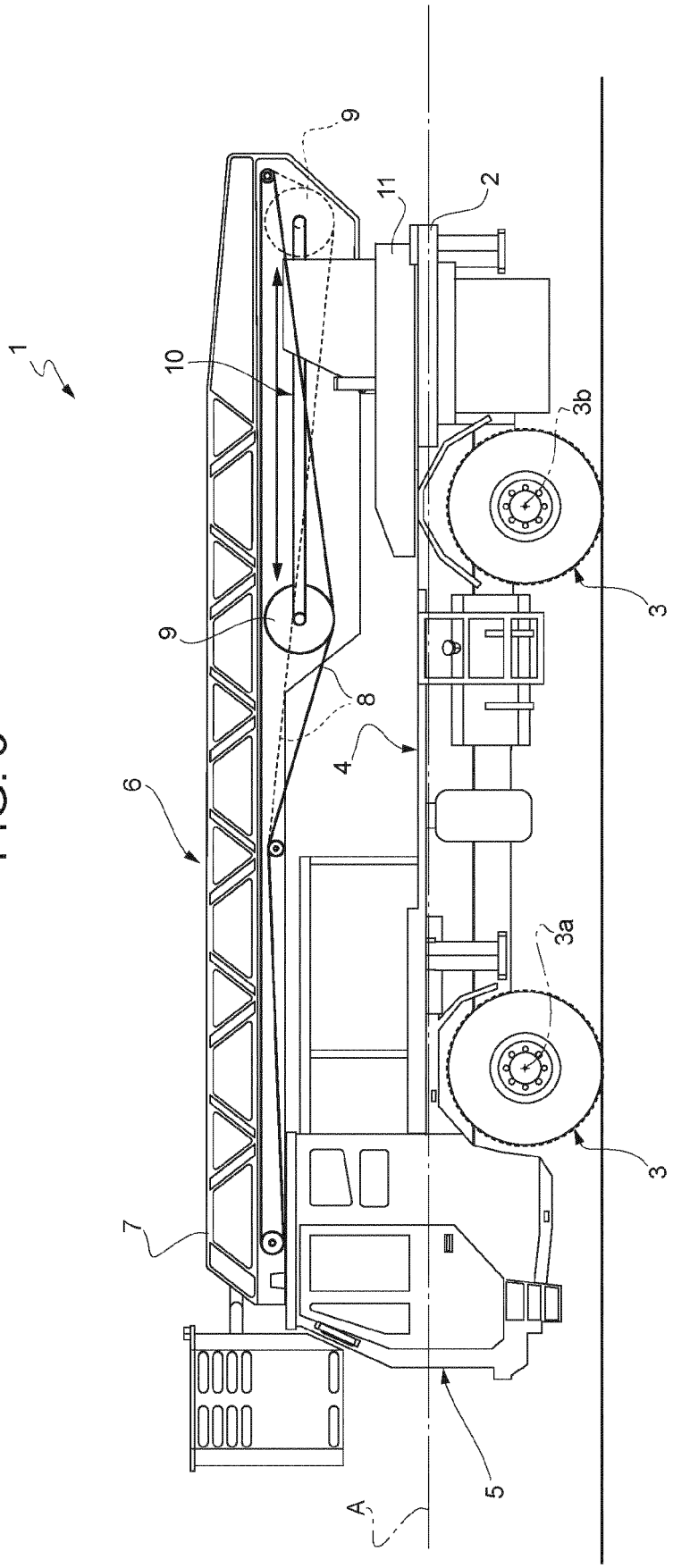


FIG. 3



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EUROPEAN SEARCH REPORT

Application Number
EP 22 19 5075

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 0 154 069 A2 (MERRYWEATHER & SONS [GB]) 11 September 1985 (1985-09-11)	1,3,5-14	INV. E06C5/16
A	* figures 1-6 * * page 14, line 10 * * claim 18 * * page 14, line 3 - line 16 *	2,4	
X	JP S61 11900 U (UNKNOWN) 23 January 1986 (1986-01-23)	1-10	
A	* figures 1-6 *	11-14	
A	US 2015/273252 A1 (LENZ JR KENNETH C [US] ET AL) 1 October 2015 (2015-10-01) * figures 1-12 *	1-14	

TECHNICAL FIELDS SEARCHED (IPC)

E06C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	30 September 2022	Petrinja, Etiel

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 22 19 5075

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30-09-2022

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		JP S60188592 A	26-09-1985
JP S6111900 U	23-01-1986	NONE	
US 2015273252 A1	01-10-2015	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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- IT 102021000023573 **[0001]**
- EP 2182164 A1 **[0005]**