

(19)



(11)

**EP 4 534 472 A1**

(12)

**EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
**09.04.2025 Bulletin 2025/15**

(51) International Patent Classification (IPC):  
**B66F 11/04<sup>(2006.01)</sup>**

(21) Application number: **24204294.3**

(52) Cooperative Patent Classification (CPC):  
**B66F 11/044; B66F 11/046**

(22) Date of filing: **02.10.2024**

(84) Designated Contracting States:  
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB  
GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL  
NO PL PT RO RS SE SI SK SM TR**  
Designated Extension States:  
**BA**  
Designated Validation States:  
**GE KH MA MD TN**

(71) Applicant: **Sartor, Fiorenzo**  
**6922 Morcote (CH)**

(72) Inventor: **Sartor, Fiorenzo**  
**6922 Morcote (CH)**

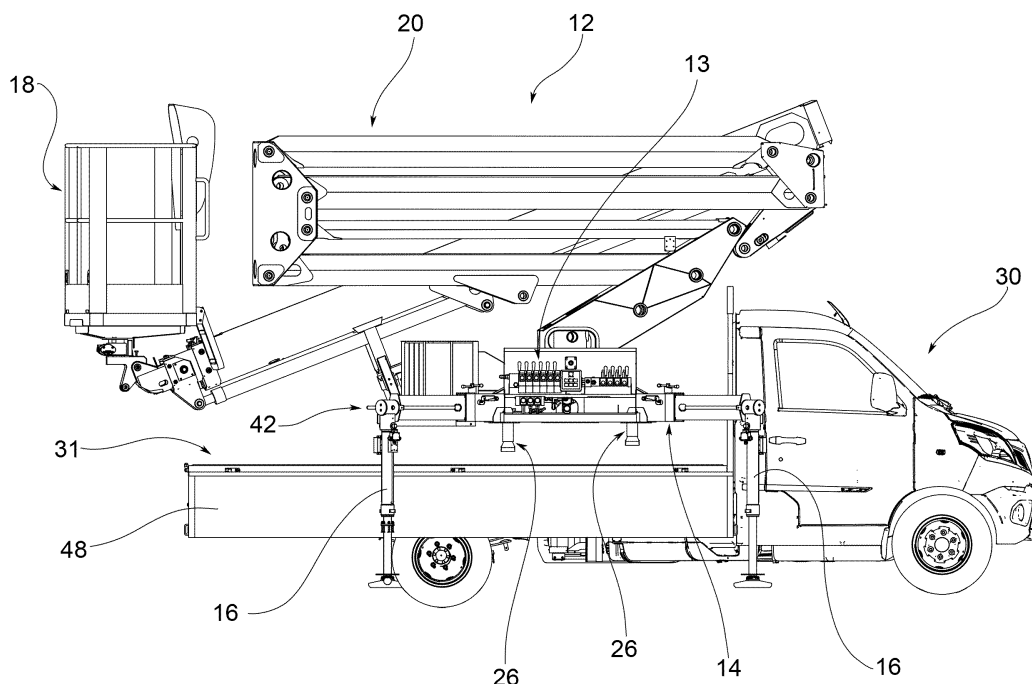
(74) Representative: **Busana, Omar et al**  
**Jacobacci & Partners S.p.A.**  
**Piazza Mario Saggin, 2**  
**35131 Padova (IT)**

(30) Priority: **04.10.2023 IT 202300020595**

(54) **ELEVATING WORK PLATFORM AND TRUCK COMPRISING SUCH ELEVATING WORK PLATFORM**

(57) An elevating work platform (12) comprises a base (14) comprising legs (16) adapted to stabilize the elevating work platform (12), an arm (20) having a first end (22) connected to the base (14); and a platform (18) connected to a second end (24) of the arm (20). The elevating work platform (12) comprises connection means (26) for mechanically connecting the elevating work platform (12) to the frame (28) of a truck (30). The

truck (30) is in turn provided with a truck bed (31) for transporting various types of goods, and with connection means (26) to the elevating work platform (12). The connection means (26) are adapted to make a rigid and temporary mechanical connection between the elevating work platform (12) and the frame (28) of the truck (30).

**FIG.3****EP 4 534 472 A1**

## Description

### FIELD OF APPLICATION

**[0001]** The present invention relates to an elevating work platform and a truck comprising such elevating work platform.

### PRIOR ART

**[0002]** As is known, elevating work platforms (EWPs) may be associated with a truck, and are used in various fields for performing work at a certain height.

**[0003]** This type of associated overhead platform of the truck consists of a base rigidly connected to the structure of the truck, an extendable arm and a platform. As for the extendable arm, depending upon the instance of the maximum length to be reached it may be of the telescopic and/or foldable type, in several sections.

**[0004]** Legs are also provided on the structure of the truck that may be extracted and, through the use of special actuators, used to stabilize the truck so that the arm may be extended.

**[0005]** Stabilization of the truck is thus accomplished by virtue of the extraction of the legs, and the truck itself acts as ballast for using the platform.

**[0006]** The object is a truck used by a varied group of individuals, for example in the construction sector, in the civil sector, in tree pruning, etc.

**[0007]** Generally, this type of truck may be owned by the company that is using it, but very often it is rented out to small craftsmen, or to operators who use it occasionally.

**[0008]** In the case of platforms with a very long arm, in order to drive the truck whereupon they are applied, it is necessary to have a specific license which is not always available to those who need to use the platform.

**[0009]** It is therefore clear that the elevating work platforms of the prior art, although widely used and appreciated, are not without drawbacks.

### DISCLOSURE OF THE INVENTION

**[0010]** The object of this invention is therefore that of overcoming, at least in part, the disadvantages of the prior art.

**[0011]** A first task of the present invention is to provide an elevating work platform wherein the management thereof is more efficient than the elevating work platforms of the prior art.

**[0012]** A second task of the present invention is to provide an elevating work platform which may also be owned by small craftsmen for performing occasional work.

**[0013]** A third task of the present invention is to provide a truck comprising an elevating work platform that may also be used by a small craftsman for other purposes.

**[0014]** This need is satisfied by an elevating work plat-

form according to claim 1, by a truck comprising an elevating work platform according to claim 16, and by a coupling and decoupling process between the elevating work platform and the truck according to claims 20 and 21.

### DESCRIPTION OF THE DRAWINGS

**[0015]** Further features and advantages of the present invention will become more apparent from the following detailed description of preferred, non-limiting embodiments thereof, wherein:

- Figure 1 shows in schematic form a side view of an elevating work platform according to one possible embodiment;
- Figure 2 shows in schematic form a side view of a truck whereupon an elevating work platform according to a possible embodiment may be provided;
- Figure 3 shows in schematic form a truck that is about to be coupled with an elevating work platform according to a possible embodiment;
- Figure 4 shows the truck and the elevating work platform of Figure 3, coupled, in another usage configuration;
- Figure 5 shows in schematic form a rear view of a truck and of an elevating work platform according to a possible embodiment in a first usage configuration;
- Figure 6 shows in schematic form a rear view of the truck of the elevating work platform of Figure 5, in a second usage configuration;
- Figure 7 shows in schematic form a rear view of the truck and of the elevating work platform of Figures 5 and 6 in a third usage configuration;
- Figure 8 shows schematically a rear view of the truck of the elevating work platform of Figure 5, 6, 7 in a fourth usage configuration;
- Figures 9-12 show in schematic form a side view of a portion of an elevating work platform according to one possible embodiment, in two usage configurations;
- Figures 13-14 show in schematic form two possible steps for coupling the elevating work platform to the truck according to a possible embodiment.
- Figure 15 shows, in schematic form, a plan view from above of a truck according to a possible embodiment.

**[0016]** Elements or parts of elements common to the embodiments described hereinafter will be indicated with the same numerical references.

### DETAILED DESCRIPTION

**[0017]** In Figure 1, an elevating work platform according to the present invention is indicated with the reference numeral 12.

**[0018]** The elevating work platform comprises a base

14 in turn comprising legs 16 adapted to stabilize the elevating work platform 12, an arm 20 having a first end 22 connected to the base 14; and a platform 18 connected to a second end 24 of the arm 20.

**[0019]** Furthermore, the elevating work platform 12 comprises connection means 26 for mechanically connecting the elevating work platform 12 to a frame 28 of a truck 30 arranged with a truck bed 31 and sides 48, 49.

**[0020]** The connection means are adapted to make a rigid and temporary mechanical connection between the elevating work platform 12 and the frame 28 of the truck 30.

**[0021]** As may be seen in Figure 1, a swivel joint 32 on which the arm 20 is arranged may be provided on the base 14.

**[0022]** According to a possible embodiment, the arm 20 may be articulated and/or telescopic.

**[0023]** In the present discussion, the arm 20 will not be discussed further, insofar as it is not the specific subject matter of the present invention. In other words, the arm 20 may be an arm that is commonly used in the prior art of this field.

**[0024]** The elevating work platform 12 may comprise interfaces for the supply of hydraulic power and the supply of electrical power. Such interfaces may be used to connect the elevating work platform 12 to suitable hydraulic and/or electrical sources which may be arranged on a truck and/or integrated into the elevating work platform 12.

**[0025]** According to one possible embodiment, which may be seen for example in the accompanying figures, the base 14 may comprise two crossbars 38, 40 arranged in an X, the legs 16 being arranged at the ends 382, 402 thereof.

**[0026]** In the embodiment shown in the accompanying figures, the crossbars 38, 40 have two ends 382, 402, each provided with a leg 16, for a total of four legs 16.

**[0027]** Advantageously, the ends of the crossbars 38, 40 may be arranged at the corners of a rectangle or square. In this way, the relative legs 16 may perform the stabilizing function of the elevating work platform 12.

**[0028]** According to alternative embodiments, the elevating work platform 12 may comprise a different number of legs 16, for example three arranged at the corners of an equilateral triangle. In any case, those skilled in the art may, in order to meet specific needs, implement the elevating work platform 12 with a greater or lesser number than four legs 16.

**[0029]** According to a possible embodiment, the crossbars 38, 40 may be of the telescopic type, and preferably provided with a locking mechanism 41 adapted to lock the crossbars 38, 40 in the extracted position and/or in the retracted position.

**[0030]** The locking mechanism 41, which may be seen for example in Figure 4, may comprise a spring-loaded pin provided with a handwheel which may be screwed or partially unscrewed in order to block or unblock, respectively, the movement of the crossbar 38, 40.

**[0031]** As may be seen in Figure four, the crossbars 38, 40 may be of the truck bed type, for example in two sections wherein the end section is inserted inside the central section.

**[0032]** According to one possible embodiment, the legs 16 may be rotatable with respect to the base 14, so as to assume a first configuration in which they face downwards and may act to stabilize the elevating work platform 12, and a second configuration in which they face upwards. Such configurations are represented, for example, in Figure 5, in which the legs 16 face downwards, and in Figure six, in which the legs 16 face upwards.

**[0033]** Advantageously, in the second configuration in which the legs 16 face upwards, said legs are rotated by 180° with respect to the first configuration.

**[0034]** For this purpose, each leg 16 may be arranged on the base 14 by means of a cylindrical hinge 42. For example, the cylindrical hinge may comprise an inner pin and an outer casing, which may rotate with respect to the inner pin. Advantageously, the inner pin may be arranged at the end 382, 402 of the crossbar 38, 40.

**[0035]** The cylindrical hinge 42 may be of the lockable type, comprising a through pin 422 that may be inserted in the cylindrical hinge 42 to lock the hinge itself in the two configurations. In other words, referring to the hinge embodiment just described, the through pin 422 may be coupled using holes provided on the outer casing and respective holes provided on the inner pin. In this way, if the holes provided on the outer casing are opposite one to the other, there are two possible positions and they may be obtained using a 180° rotation of the outer casing with respect to the inner pin.

**[0036]** According to one possible embodiment, the through pin 422 may comprise a control lever 424 having a lever end 426 adapted to couple with an abutment 428 arranged on the outer surface of the cylindrical hinge 42, to lock the pin 422 when it is inserted in the cylindrical hinge 42. The abutment 428 may, for example, be a tab that, together with the outer surface of the cylindrical hinge, forms a seat for the lever end 426.

**[0037]** In order to rotate the leg 16 from the first configuration to the second configuration, it may therefore be necessary to rotate the lever 424 in order to disengage the lever end 426 from the abutment 428, extract the through pin 422, rotate the leg by 180°, reinsert the through pin 422, and lock the position by rotating the lever 424, coupling the end 426 with the abutment 428.

**[0038]** According to one possible embodiment, the legs 16 may be of the extendable type, and preferably of the hydraulic type. In a manner that is self-evident, each leg 16 may be connected to the hydraulic and/or electrical interfaces for the power supply thereof. The extendable legs 16 thus allow for the stabilization of the elevating work platform.

**[0039]** The connection means 26 may comprise at least one ball 44 adapted to be connected to the frame 28, at least one corresponding ball-and-socket joint 46

arranged on the base 14, and at least one corresponding locking pin 47 adapted to couple with a first hole 442 arranged on said at least one ball 44 and with corresponding second holes 462 arranged on said at least one ball-and-socket joint 46. Figures 13, 14 show the positions assumed by the balls 44 and by the ball-and-socket joints 46 before being coupled and after being coupled, respectively.

**[0040]** According to one possible embodiment, there may be four balls 44, with corresponding ball-and-socket joint 46 arranged on the crossbars 38, 40. Advantageously, the ball-and-socket joints 46 and the balls 44 may be arranged at the corners of a rectangle.

**[0041]** In Figure 2, a truck 30 is also shown which comprises an elevating work platform 12 as just described.

**[0042]** As may be seen for example in Figure 2, the truck 30 comprises sides 48, 49 of a type known per se. For example, the truck may comprise two lateral sides 48 and a rear side 49. The sides 48, 49 may be of the tilting type.

**[0043]** According to one possible embodiment, the at least one ball 44 may be welded to the frame 28 of the truck 30. In alternative embodiments, the ball 44 may be fastened differently to the frame 28 of the truck 30, for example by means of a bolted connection. Advantageously, the connection between the ball 44 and the frame 28 of the truck 30 does not modify the frame 28. In other words, according to a preferable aspect of the present invention, no holes or other machining is performed on the frame 28 of the truck 30.

**[0044]** In this discussion, specific reference has been made to the use of balls and respective ball-and-socket joints for connection, alternatives may however be provided, such as: bolted connections, eccentric mechanisms, etc.

**[0045]** According to one possible embodiment, the truck bed 31 of the truck 30 may be provided with hatches 33 for access to the frame 28 of the truck 30. The hatches 33 may be always open, or they may be provided with a closable lid when the truck bed is used without an elevated work platform.

**[0046]** According to one possible embodiment, the truck 30 may comprise corresponding hydraulic and electrical interfaces adapted to couple with said hydraulic and electrical interfaces of the elevating work platform in order to power the elevating work platform.

**[0047]** With reference to Figures 5-10, a coupling and decoupling method between an elevating work platform 12 and a truck 30 according to this invention will now be described in the essential form thereof.

**[0048]** The coupling method between a truck and an elevating work platform may comprise the steps of:

- a) providing a truck and an elevating work platform as just described;
- b) positioning the truck 30 in a reverse trajectory with the elevating work platform 12;

- c) opening the sides 48, 49 of the truck bed 31, opening the hatches 33 if the truck bed 31 comprises them, so as to make the connection means 26 provided on the frame 28 accessible;
- d) reversing until obtaining the vertical alignment of the connection means 26, arranged on the base 14 on the frame 28;
- e) activating the elevating work platform, through hydraulic and electrical connections to power sources present on the truck 30 or independent of the truck 30, and controlling the ascent of the legs 16 until they are completely withdrawn, so that the connection means 26 are in the connection position;
- f) deactivating the elevating work platform 12, preferably from the main panel 13;
- g) unlocking the vertical position of the legs 16 by unlocking the cylindrical hinges 42;
- h) rotating the legs by about 180°, so that they face upwards and locking the cylindrical hinge 42;
- i) unlocking the extracted position of the crossbars 38, 40, retracting the crossbars 38, 40, locking the crossbars 38, 40 in position;
- l) locking the mechanical connection of the elevating work platform 18 to the truck 30; and
- m) closing the sides 48, 49.

**[0049]** The method for separating an elevating work platform from a truck may comprise the steps of:

- a') providing a truck and an elevating work platform as just described;
- b') reversing the elevating work platform 12 into the storage position;
- c') opening the sides 48, 49;
- d') unlocking the mechanical connection of the elevating work platform 18 to the truck 30;
- e') unlocking the retracted position of the crossbars 38, 40, extracting the crossbars 38, 40, locking the crossbars 38, 40 in position;
- f') unlocking the vertical position of the legs 16 by unlocking the cylindrical hinges 42;
- g') rotating the legs by about 180°, so that they face downwards and locking the cylindrical hinge 42;
- h') activating the elevating work platform, through hydraulic and electrical connections to power sources, and controlling the descent of the legs 16 until they are completely extracted, so that the base 14 rises with respect to the truck bed 31 of the truck 30 and the connection means 26 are disconnected;
- f') deactivating the elevating work platform 12, preferably from the main panel 13;
- g') disconnecting the elevating work platform from the hydraulic and electrical connections with the power sources present on the truck 30 or independent of the truck 30;
- h') advancing the truck 30 until it exits from the encumbrance of the elevating work platform;
- i') possible closing the hatches 33 if the truck bed 31

comprises them, so as to make the connection means 26 provided on the frame 28 inaccessible; and

l') closing the sides 48, 49 of the truck bed 31.

[0050] With reference to the Figure from 5-10, the steps that move the legs from the active position (extracted crossbars 38, 40) extracted, and legs 16 facing downwards, will be described.

[0051] Figure 10 shows a configuration wherein the elevating work platform is coupled with the truck 30 and the legs 16 face downwards and are completely extended. In other words, this is the configuration wherein the platform 18 may be used through the extension and/or articulation of the arm 20.

[0052] In Figure 9, the legs were shortened due to the movement of the pneumatic pistons arranged on the legs 16. In this case, the truck is still connected to the elevating work platform, but is not lifted from the ground as in the previous step.

[0053] In a subsequent step, shown in Figure 6, the legs are rotated in such a way as to be facing upwards, for example in the manner described above.

[0054] Subsequently, with reference to Figure 7, the crossbars 38, 40 are retracted so that the base 14 may be contained inside the truck bed of the truck 30.

[0055] Figure 8 shows the step wherein the sides 48 of the truck 30 are raised so that the truck 30 may transport the elevating work platform.

[0056] Now, again with reference to the same figures, a method for disconnecting the elevating work platform 12 from the truck 30 will be described.

[0057] For example, from the situation shown in Figure 9 wherein the legs 16 are shortened, the connection means 26 are disconnected and the legs 16 are extended as shown in Figure 1, in such a way as to allow the truck bed of the truck 30 to be extracted.

[0058] Obviously, in order to allow the truck 30 to be extracted, the crossbars 38, 40 must be extracted.

[0059] Advantageously, the truck may therefore be used as ballast and/or as a source for hydraulic and electrical power.

[0060] The advantages that may be achieved by this invention are thus now apparent.

[0061] Firstly, an elevating work platform has been provided, which may be used with a generic type of truck.

[0062] Furthermore, the elevating work platform may be unloaded from the truck when there is no need to use it, and the truck may be used separately as a normal working means.

[0063] Furthermore, insofar as the lifting platform may be disconnected from the truck, the platform allows craftsmen to have a truck available that may be used both as a lifting platform and as a traditional type of truck.

[0064] Furthermore, with the elevating work platform of the present invention, it is possible to easily and effectively couple it with a truck.

[0065] In fact, with "detachable" trucks of the prior art,

the user, in having to use a truck with a tilting truck bed, with an elevating work platform must:

- go to the yard;
- remove the tilting truck bed using other lifting means (for example a crane or overhead crane);
- reverse under the elevating work platform; and
- connect the elevating work platform as described above.

[0066] Whilst, with trucks specifically set up as an elevating work platform of the prior art, removing the PLE from the truck in order to temporarily reallocate the use thereof to a truck bed would be prohibitively laborious, and insofar as it is true that they are not equipped with a truck bed, they would be useless to a user in need of transporting various materials.

[0067] A person skilled in the art will be able to make modifications to the embodiments described above and/or substitute described elements with equivalent elements, in order to satisfy particular requirements, without departing from the scope of the accompanying claims.

## Claims

1. Elevating work platform (12) comprising a base (14) comprising legs (16) adapted to stabilise the elevating work platform (12); an arm (20) having a first end (22) connected to said base (14); and a platform (18) connected to a second end (24) of said arm (20); said elevating work platform (12) comprising connection means (26) for mechanically connecting said elevating work platform (12) to a frame (28) of a truck (30) arranged with a truck bed (31); said connection means (26) being adapted to make a rigid and temporary mechanical connection between the elevating work platform (12) and the frame (28) of the truck (30).
2. Elevating work platform (12) according to the preceding claim, **characterised in that** on said base (14) is arranged a swivel joint (32) on which is arranged said arm (20).
3. Elevating work platform (12) according to any one of the preceding claims, **characterised in that** said arm (20) is articulated and/or telescopic.
4. Elevating work platform (12) according to any one of the preceding claims, **characterised in that** it comprises interfaces for the supply of hydraulic power and the supply of electrical power.
5. Elevating work platform (12) according to any one of the preceding claims, **characterised in that** said base (14) comprises two crossbars (38,40) arranged in an X, said legs (16) being arranged at the ends

- (382,384; 402,404) of said crossbars (38,40).
6. Elevating work platform (12) according to the preceding claim, **characterised in that** said crossbars (38,40) are of the telescopic type, and are preferably arranged with a locking mechanism 41 adapted to lock the crossbars (38,40) in the extracted position and/or in the retracted position. 5
  7. Elevating work platform (12) according to any one of the preceding claims, **characterised in that** said legs (16) are rotatable with respect to the base (14), so as to assume a first configuration in which they face downwards and can act to stabilise the elevating work platform (12), and a second configuration in which they face upwards. 10
  8. Elevating work platform (12) according to the preceding claim, **characterised in that** in the second configuration in which they face upwards, they are rotated 180° with respect to the first configuration. 20
  9. Elevating work platform (12) according to any one of claims 7-8, **characterised in that** each leg (16) is arranged on said base (14) by means of a cylindrical hinge (42). 25
  10. Elevating work platform (12) according to the preceding claim, **characterised in that** said cylindrical hinge (42) is of the lockable type, said cylindrical hinge (42) comprising a through pin (422) which can be inserted in said cylindrical hinge (42) to lock the hinge itself in the two configurations. 30
  11. Elevating work platform (12) according to the preceding claim, **characterised in that** said through pin (422) comprises a control lever (424) having a lever end (426) adapted to couple with an abutment (428) arranged on the outer surface of the cylindrical hinge (42), to lock the through pin (422) when it is inserted in the cylindrical hinge (42). 35 40
  12. Elevating work platform (12) according to any one of the preceding claims, **characterised in that** said legs (16) are extendable, and preferably of the hydraulic type. 45
  13. Elevating work platform (12) according to any one of the preceding claims, **characterised in that** said connection means comprise at least one ball (44) adapted to be connected to the frame (28), at least one corresponding ball-and-socket joint (46) arranged on the base (14), and at least one corresponding locking pin (47) adapted to couple with a first hole (442) arranged on said at least one ball (44) and with corresponding second holes (462) arranged on said at least one ball-and-socket joint (46). 50 55
  14. Elevating work platform (12) according to the preceding claim, **characterised in that** there are four said balls (44) and there are four corresponding ball-and-socket joints (46), said ball-and-socket joints (46) being arranged on said crossbars (38,40).
  15. Elevating work platform (12) according to any one of claims 13-14, **characterised in that** said ball-and-socket joints (46) and said balls (44) are arranged at the corners of a rectangle (42).
  16. Truck (30) comprising an elevating work platform (12) according to any one of the preceding claims.
  17. Truck (30) according to the preceding claim, **characterised in that** it comprises lateral sides (48).
  18. Truck (30) according to any one of claims 16-17, **characterised in that** said at least one ball (44) is welded to the frame (28) of said truck (30).
  19. Truck (30) according to any one of claims 16-18, **characterised in that** it comprises corresponding hydraulic and electrical interfaces adapted to couple with said hydraulic and electrical interfaces to power said elevating work platform (12).
  20. Method for coupling a truck and an elevating work platform, **characterised in that** it comprises the steps of:
    - a) arranging a truck and an elevating work platform according to any one of claims 16-19;
    - b) positioning the truck (30) in reverse trajectory with the elevating work platform (12);
    - c) opening the sides (48, 49) of the truck bed (31), opening the hatches (33) if the truck bed (31) comprises them, so as to make the connection means (26) arranged on the frame (28) accessible;
    - d) reversing until obtaining the vertical alignment of the connection means (26) arranged on the base (14) and on the frame (28);
    - e) activating the elevating work platform, through hydraulic and electrical connections to power sources present on the truck (30) or independent of the truck (30), and controlling the ascent of the legs (16) until they are completely withdrawn, so that the connection means (26) are in the connection position;
    - f) deactivating the elevating work platform 12, preferably from the main panel (13);
    - g) unlocking the vertical position of the legs (16) by unlocking the cylindrical hinges (42);
    - h) rotating the legs by about 180°, so that they face upwards and locking the cylindrical hinge (42);
    - i) unlocking the extracted position of the cross-

bars (38, 40), retracting the crossbars (38, 40),  
locking the crossbars (38, 40) in position;  
l) providing to lock the mechanical connection of  
the elevating work platform (18) to the truck (30);  
and  
m) closing the sides (48, 49).

5

- 21. Method for separating an elevating work platform from a truck and an elevating work platform characterised in that** it comprises the steps of:

10

a') arranging a truck according to any one of claims 16-19;  
b') reversing into the storage position of the elevating work platform (12);  
c') opening the sides (48, 49);  
d') providing to unlock the mechanical connection of the elevating work platform (18) from the truck (30);  
e') unlocking the retracted position of the crossbars (38, 40), extracting the crossbars (38, 40), locking the crossbars (38, 40) in position;  
f') unlocking the vertical position of the legs (16) by unlocking the cylindrical hinges (42);  
g') rotating the legs by about 180°, so that they face downwards and locking the cylindrical hinge (42);  
h') activating the elevating work platform, through hydraulic and electrical connections to power sources, and controlling the descent of the legs (16) until they are completely extracted, so that the base (14) rises with respect to the truck bed (31) of the truck (30) and the connection means 26 are disconnected;  
f') deactivating the elevating work platform (12), preferably from the main panel (13);  
g') disconnecting the elevating work platform from the hydraulic and electrical connections with the power sources present on the truck (30) or independent of the truck (30);  
h') advancing the truck (30) until it exits from the encumbrance of the elevating work platform;  
i') possibly closing the hatches (33) if the truck bed (31) comprises them, so as to make the connection means (26) arranged on the frame (28) inaccessible; and  
l') closing the sides (48, 49) of the truck bed (31).

15

20

25

30

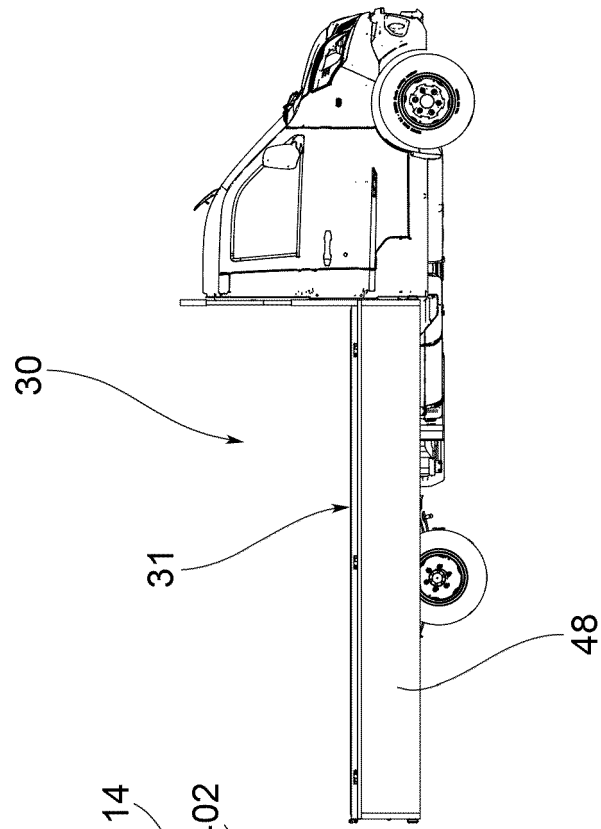
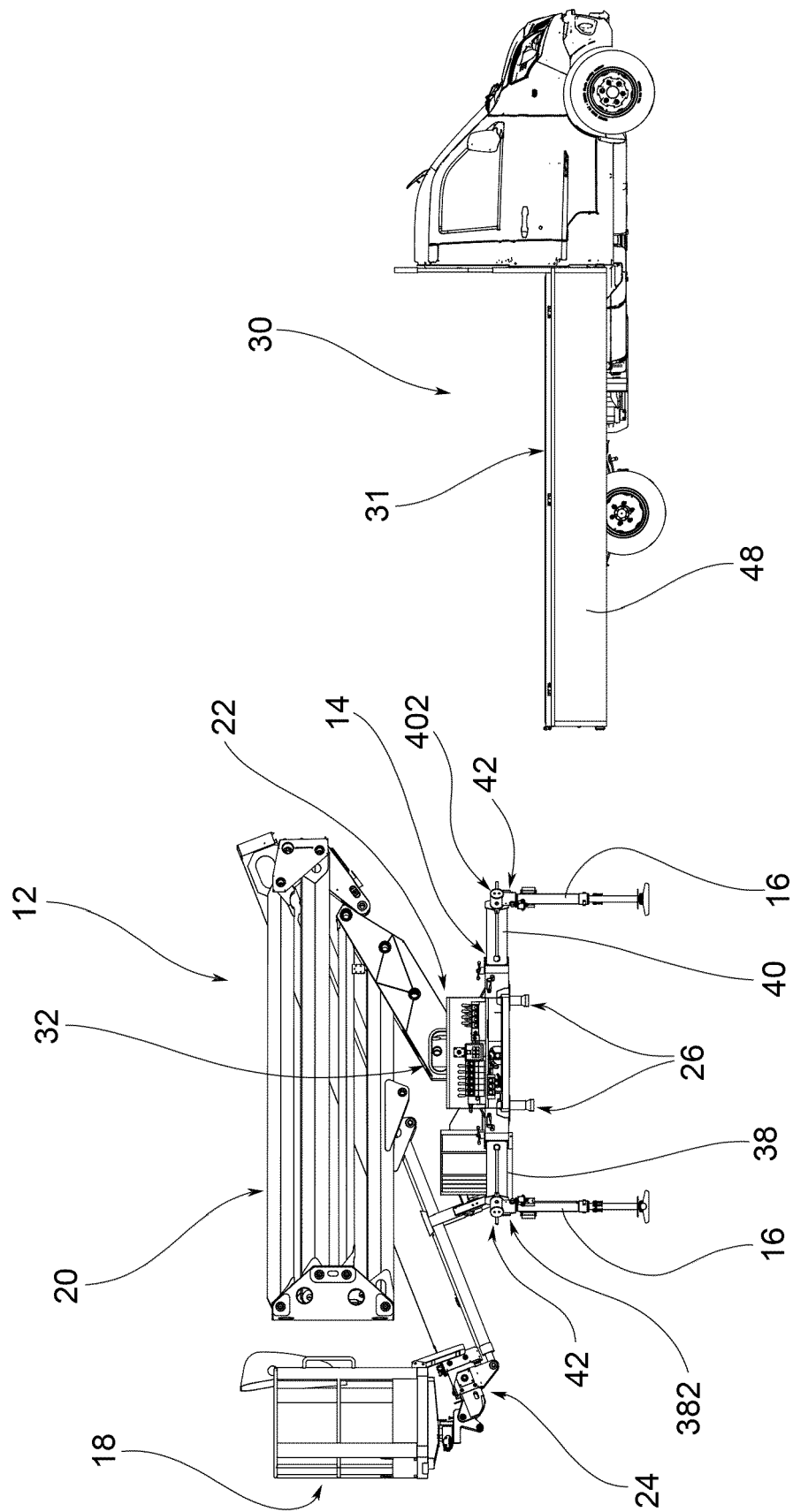
35

40

45

50

55



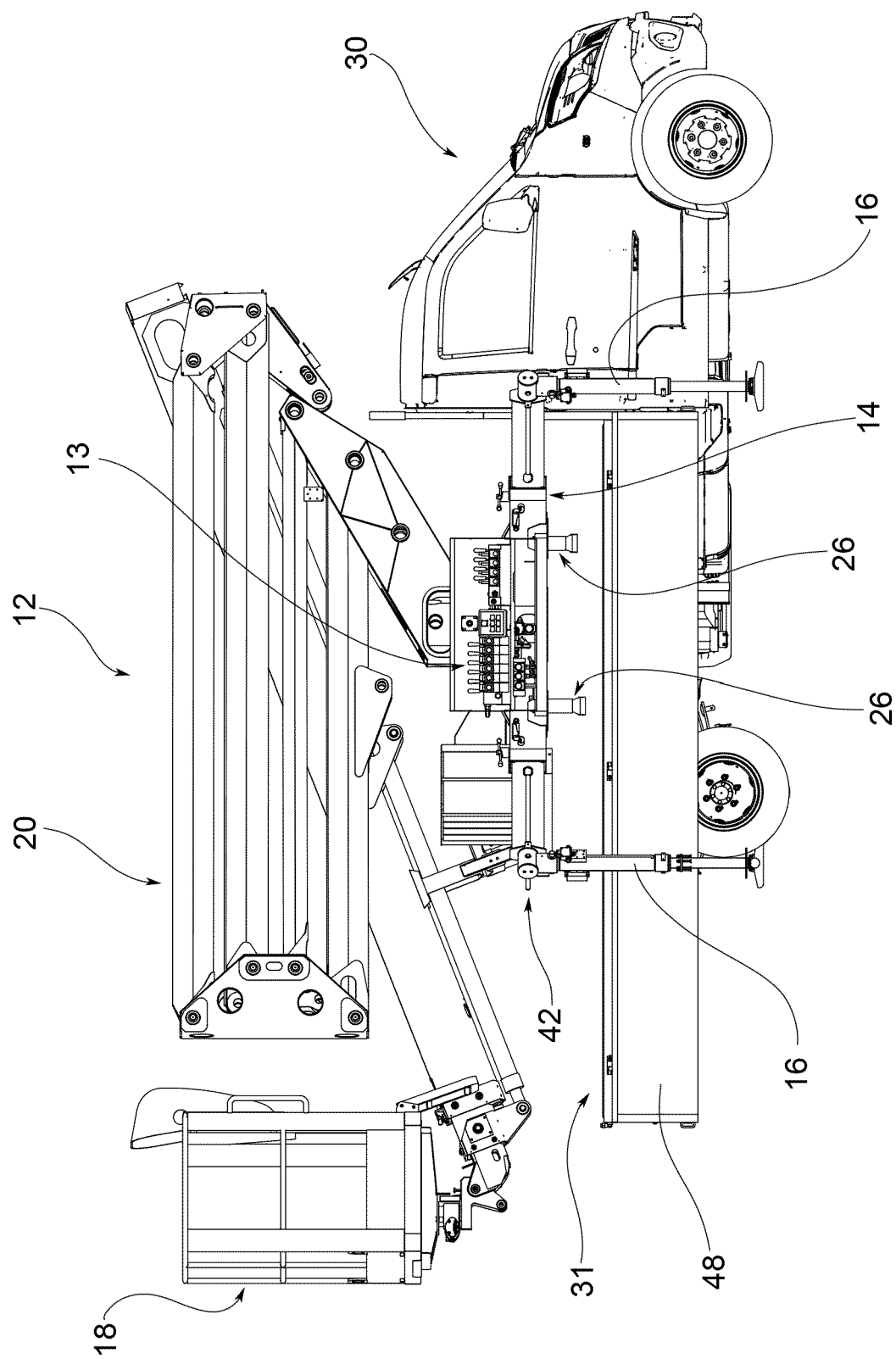
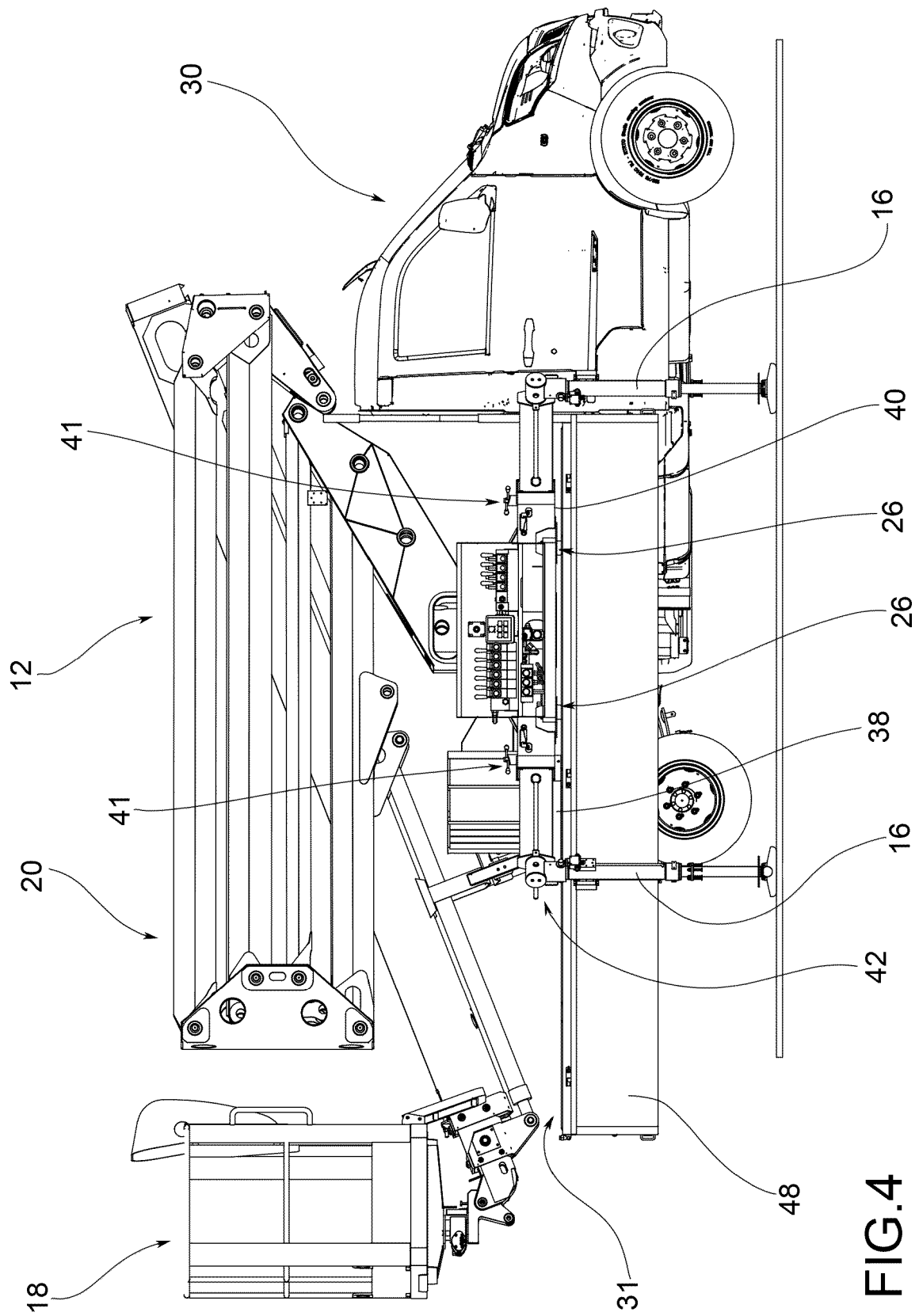


FIG.3



**FIG. 4**

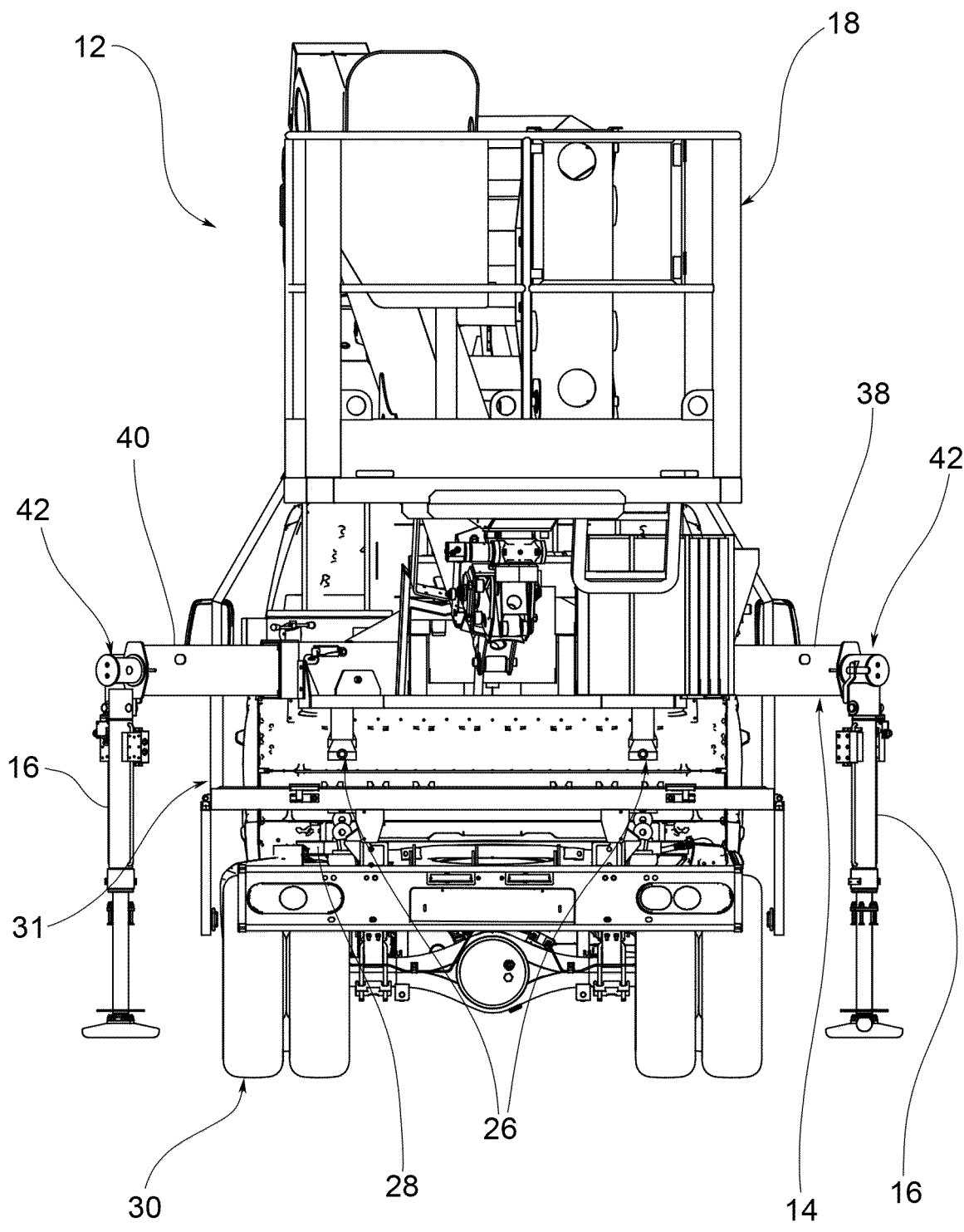


FIG.5

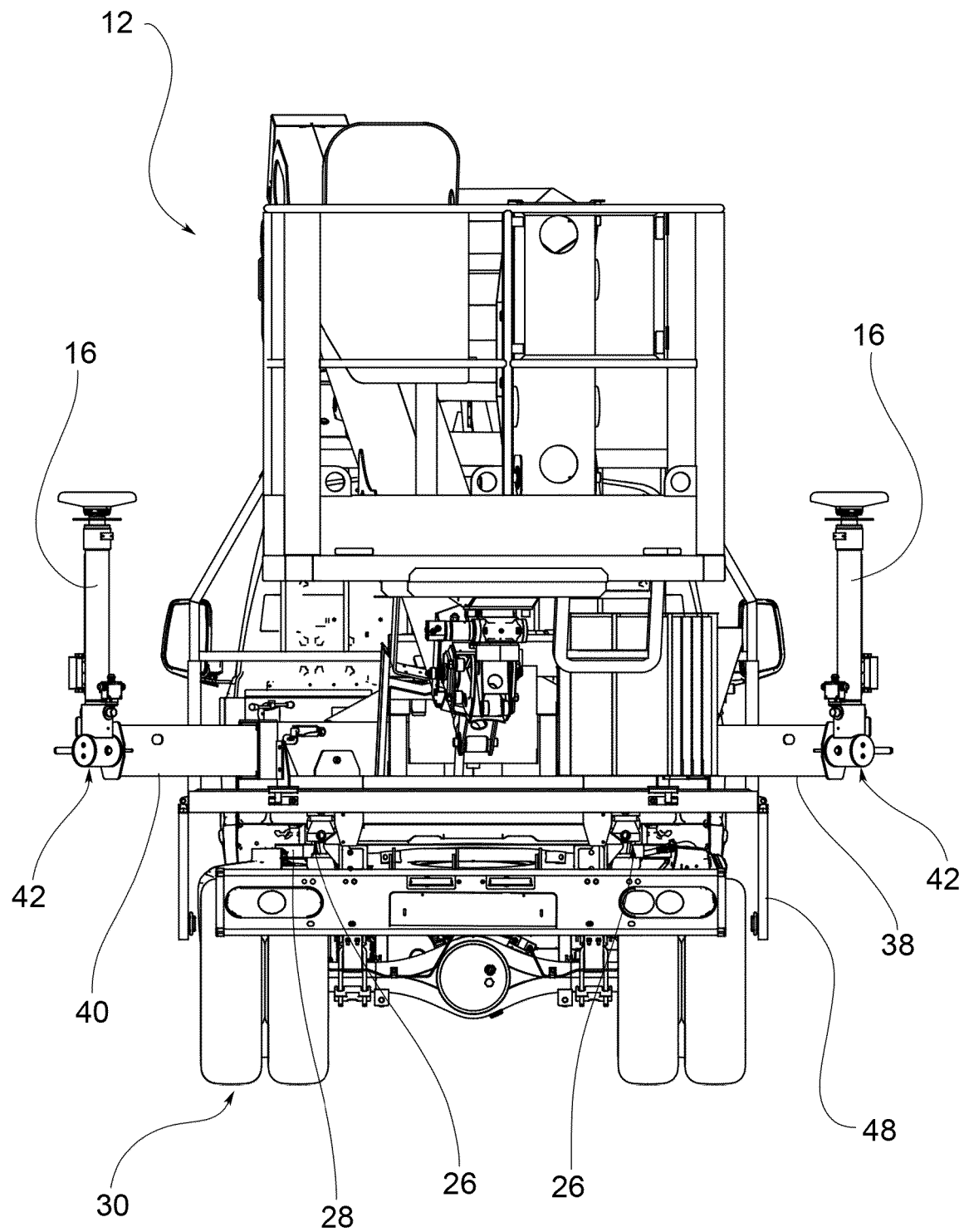


FIG.6

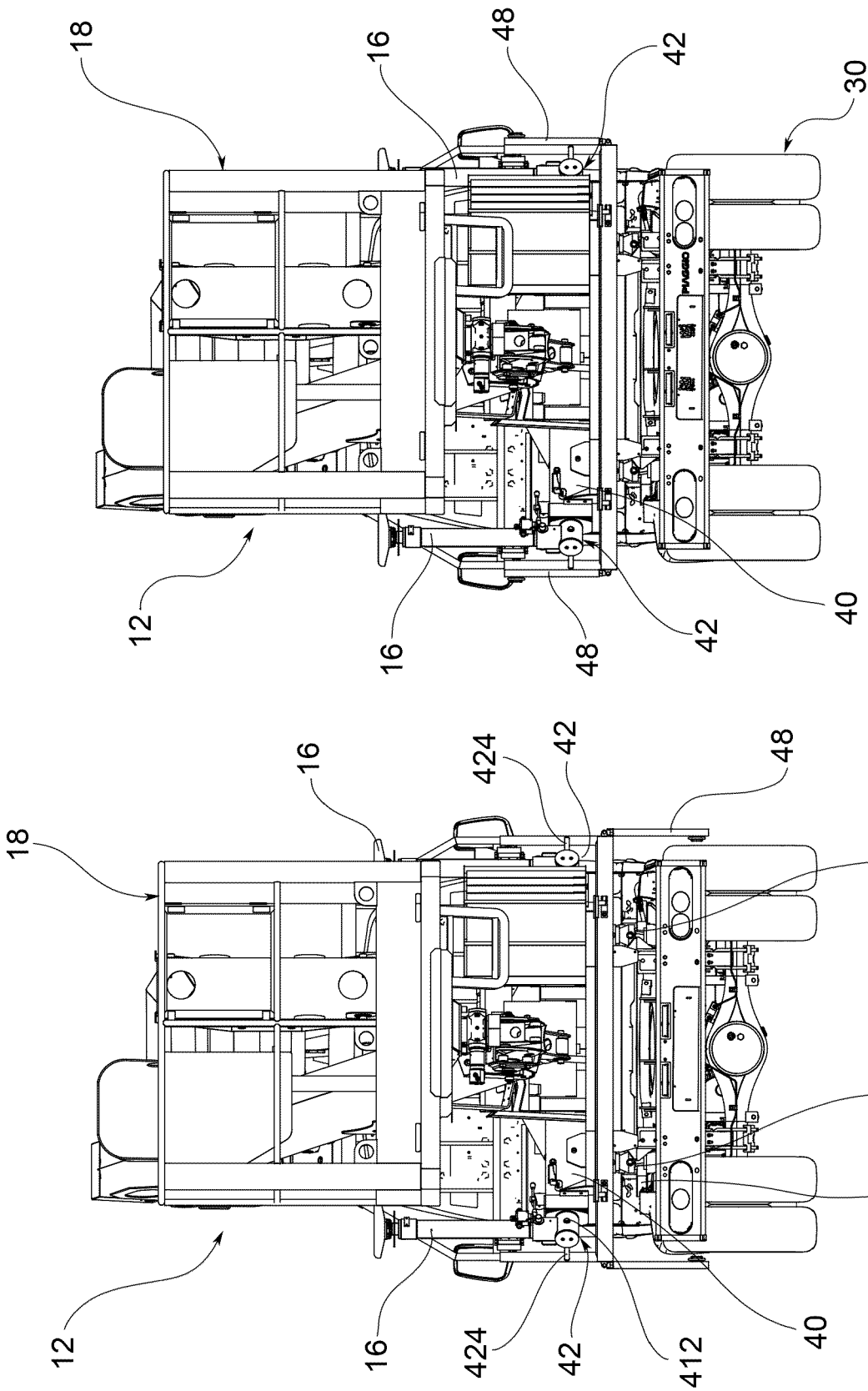


FIG.8

FIG.7

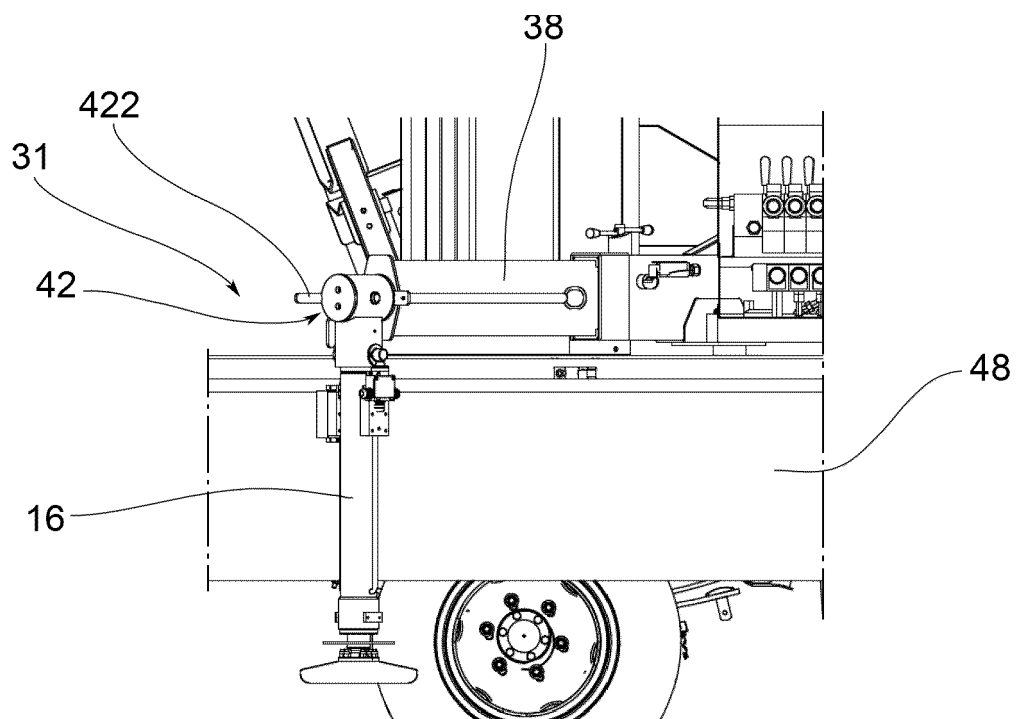


FIG.9

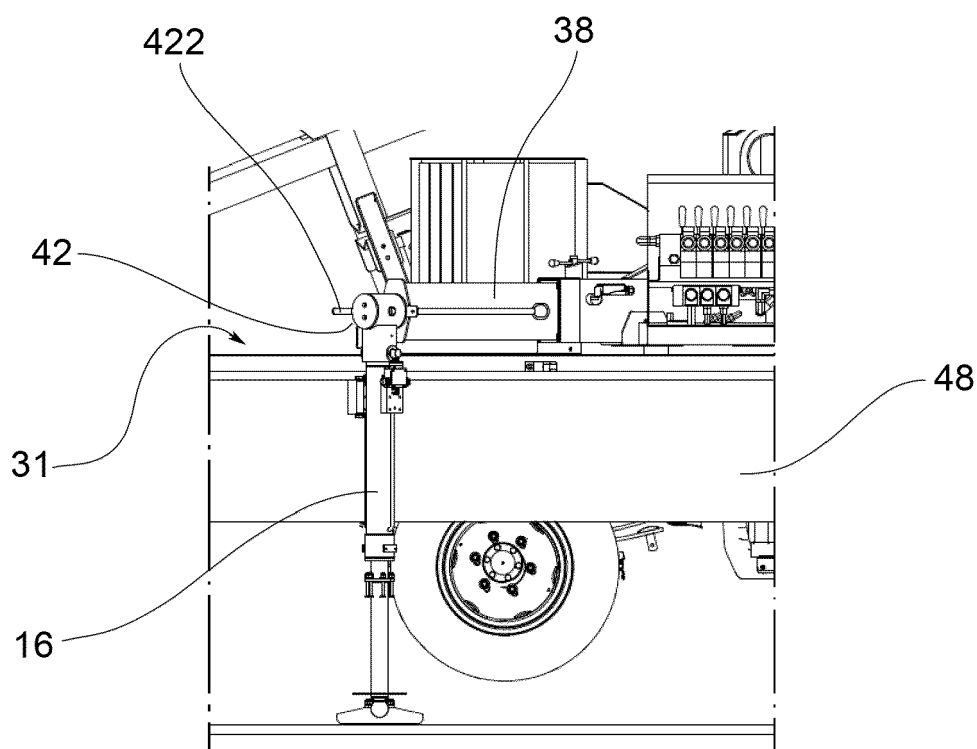
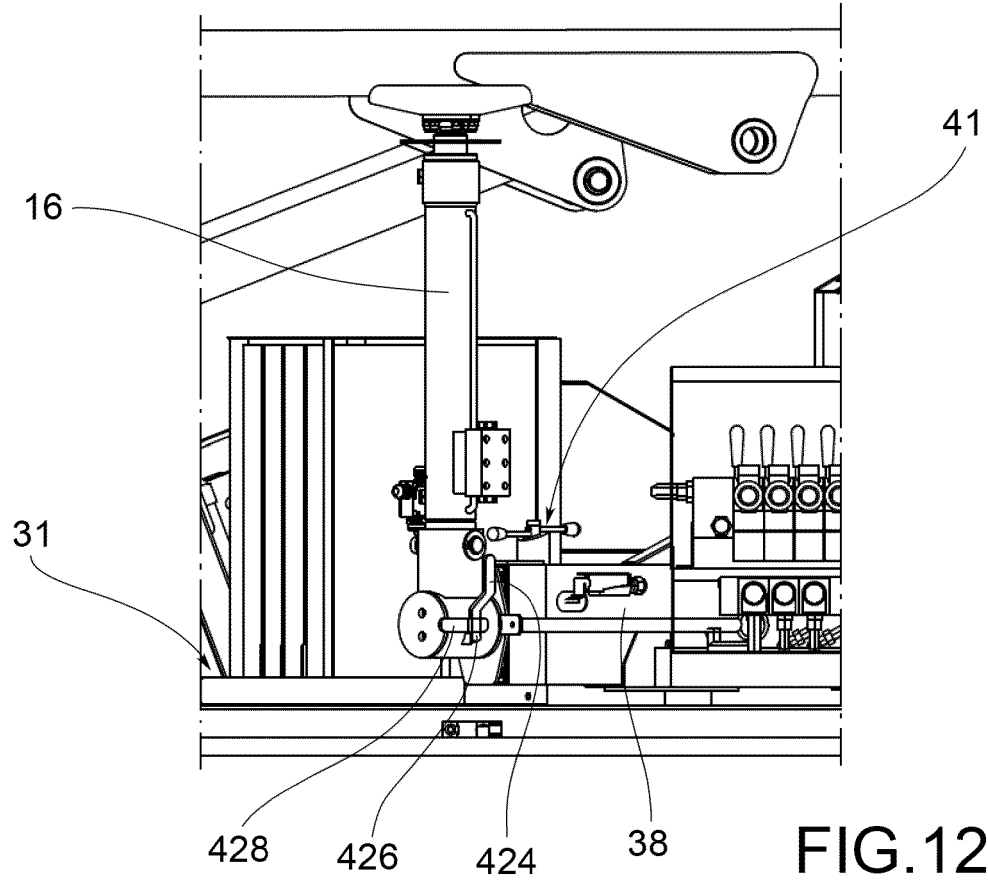
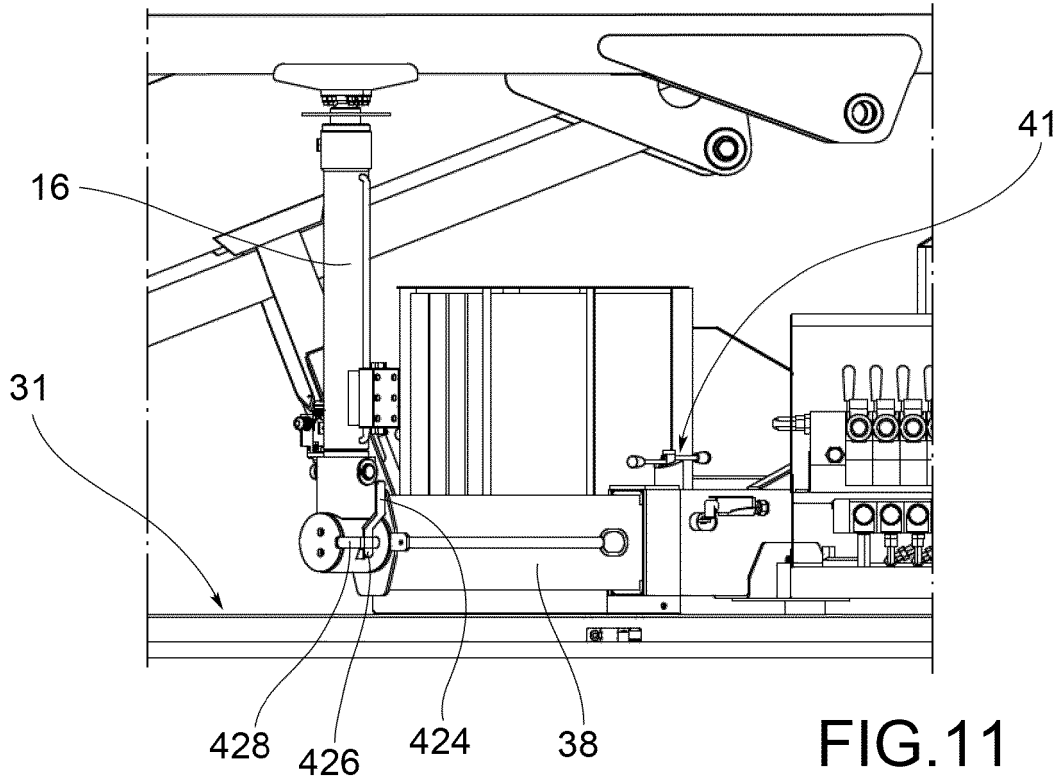


FIG.10



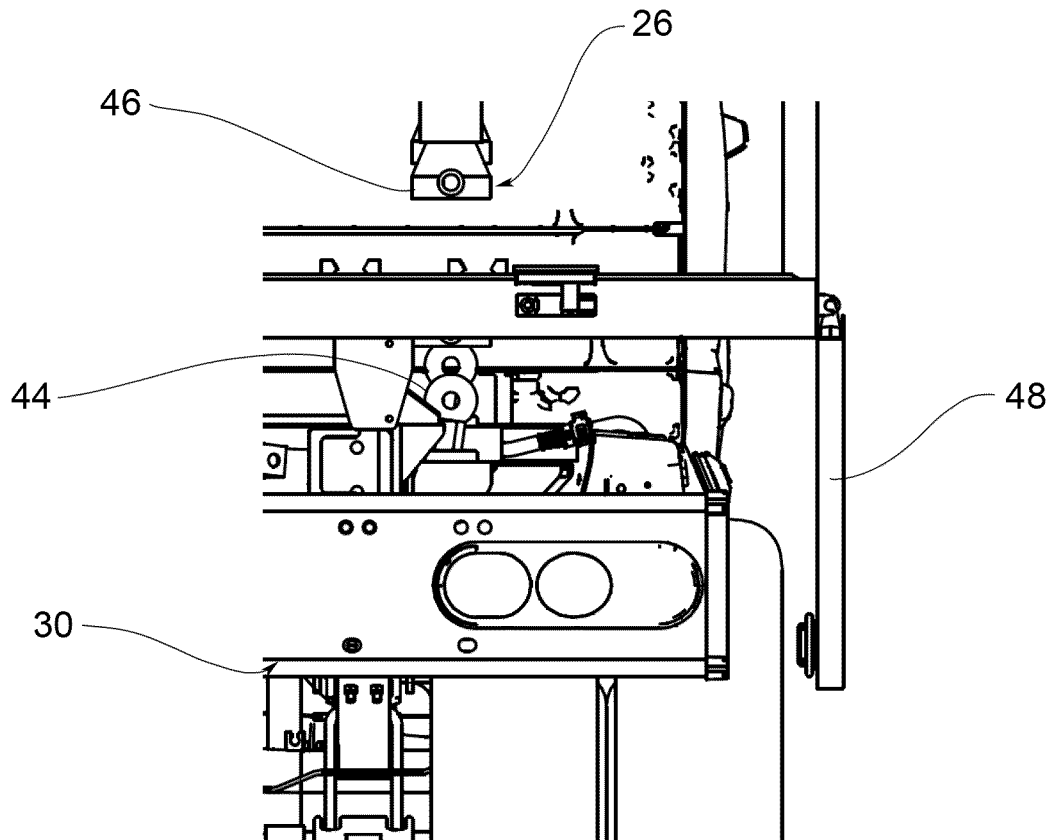


FIG.13

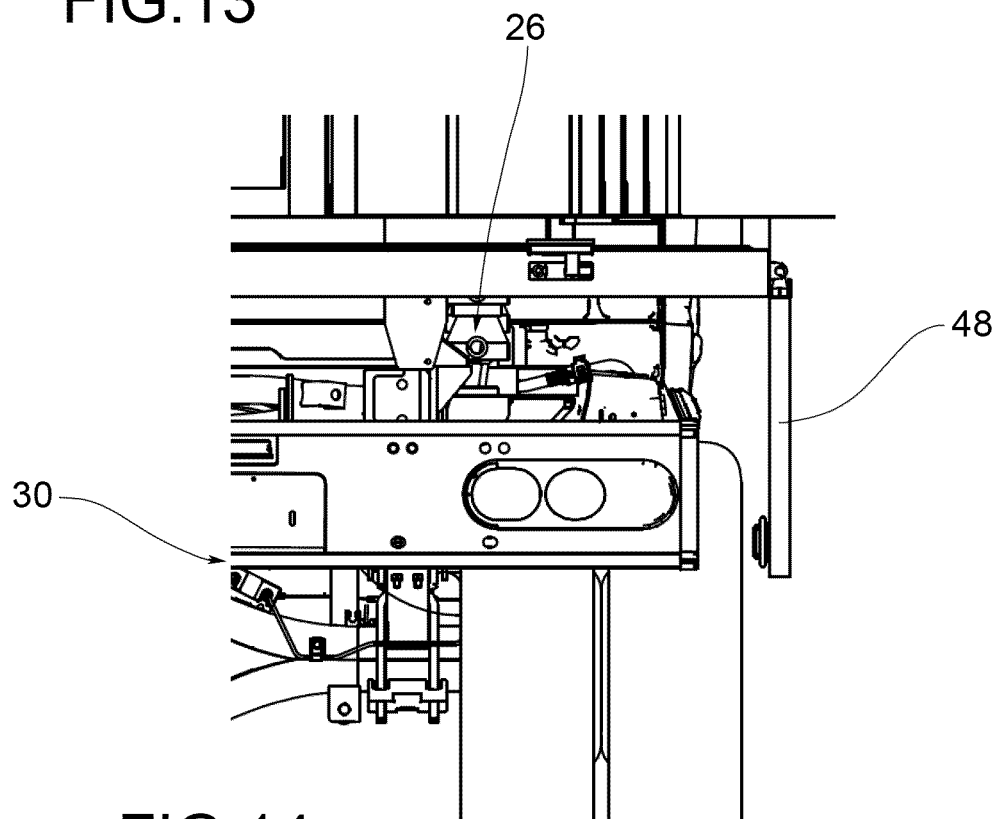
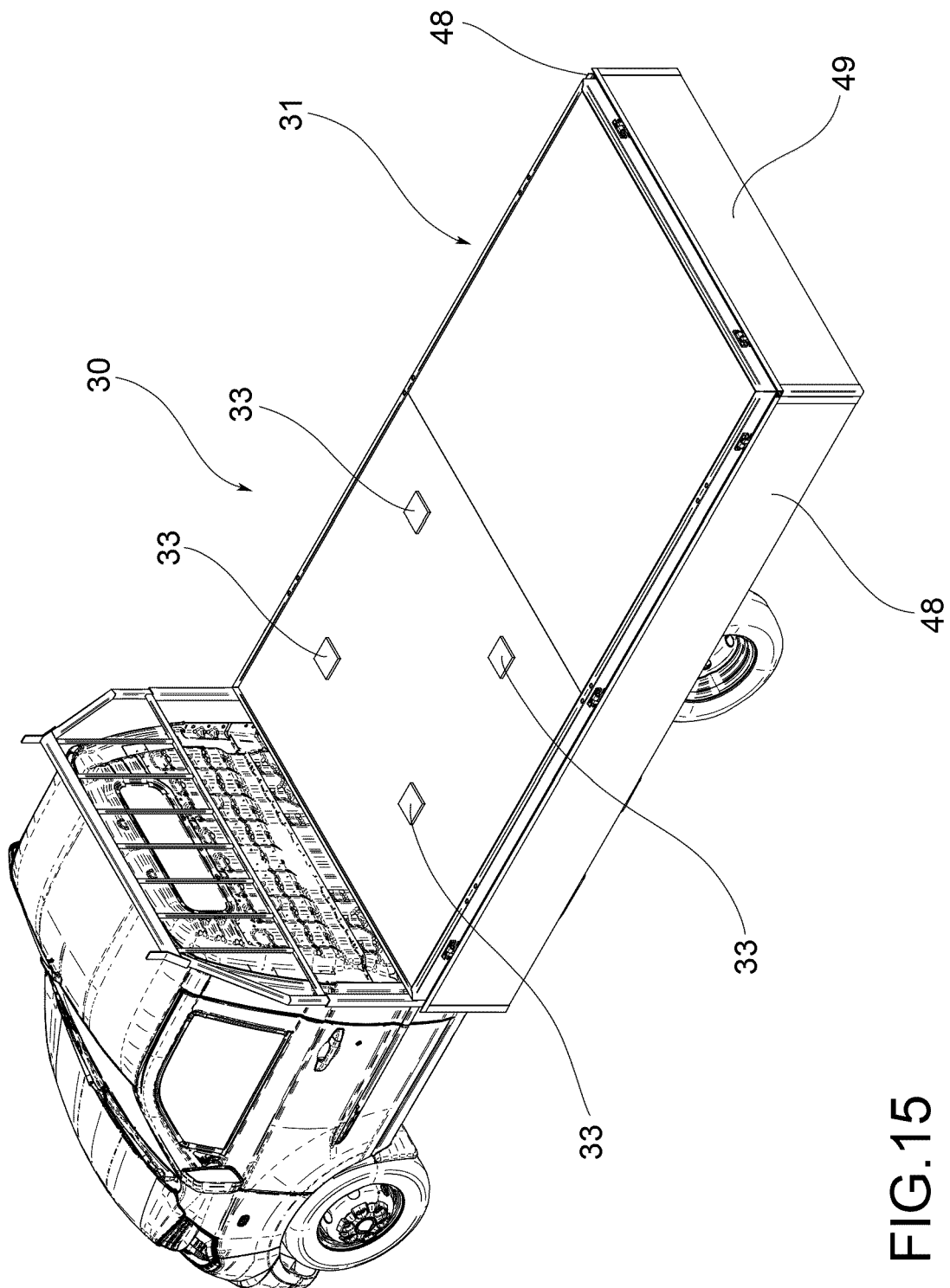


FIG.14



**FIG. 15**



## EUROPEAN SEARCH REPORT

Application Number

EP 24 20 4294

## 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                                                                                                                                                                                                                       | US 5 934 409 A (CITRON STEVEN D [US] ET AL) 10 August 1999 (1999-08-10)       | 1,3,4,<br>6-9,12,<br>16,17,<br>19-21                                                                                                                                                                                                                                         | INV.<br>B66F11/04                       |
| A                                                                                                                                                                                                                       | * column 4, line 19 - line 30 *<br>* abstract *<br>* figures *                | 2,5,10,<br>11,<br>13-15,18                                                                                                                                                                                                                                                   |                                         |
| X                                                                                                                                                                                                                       | US 2009/045011 A1 (NIEMELA CAL G [US] ET AL) 19 February 2009 (2009-02-19)    | 1-4,6-9,<br>12                                                                                                                                                                                                                                                               |                                         |
| A                                                                                                                                                                                                                       | * abstract *<br>* figures *                                                   | 5,10,11,<br>13-21                                                                                                                                                                                                                                                            |                                         |
| X                                                                                                                                                                                                                       | GB 2 120 633 A (BENFORD LIMITED) 7 December 1983 (1983-12-07)                 | 1-4,6-9,<br>12                                                                                                                                                                                                                                                               |                                         |
| A                                                                                                                                                                                                                       | * abstract *<br>* figures *                                                   | 5,10,11,<br>13-21                                                                                                                                                                                                                                                            |                                         |
| X                                                                                                                                                                                                                       | EP 2 554 508 A1 (ALDERCOTE LTD [GB]) 6 February 2013 (2013-02-06)             | 1-4,6-8,<br>12,16,<br>17,19-21                                                                                                                                                                                                                                               | TECHNICAL FIELDS<br>SEARCHED (IPC)      |
| A                                                                                                                                                                                                                       | * abstract *<br>* figures *                                                   | 5,10,11,<br>13-15,18                                                                                                                                                                                                                                                         | B66F                                    |
| X                                                                                                                                                                                                                       | US 5 868 218 A (LAWSON GEORGE LESLIE [CA]) 9 February 1999 (1999-02-09)       | 1-8,12,<br>16,17,<br>19-21                                                                                                                                                                                                                                                   |                                         |
| A                                                                                                                                                                                                                       | * abstract *<br>* figures *                                                   | 9-11,<br>13-15,18                                                                                                                                                                                                                                                            |                                         |
| The present search report has been drawn up for all claims                                                                                                                                                              |                                                                               |                                                                                                                                                                                                                                                                              |                                         |
| Place of search                                                                                                                                                                                                         |                                                                               | Date of completion of the search                                                                                                                                                                                                                                             | Examiner                                |
| The Hague                                                                                                                                                                                                               |                                                                               | 20 January 2025                                                                                                                                                                                                                                                              | Colletti, Roberta                       |
| CATEGORY OF CITED DOCUMENTS                                                                                                                                                                                             |                                                                               | T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>& : member of the same patent family, corresponding document |                                         |
| X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document |                                                                               |                                                                                                                                                                                                                                                                              |                                         |

EPO FORM 1503 03.82 (P04C01)

# ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

EP 24 20 4294

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on  
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

20-01-2025

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
|-------------------------------------------|---------------------|----------------------------|---------------------|
| US 5934409 A                              | 10-08-1999          | AU 745786 B2               | 28-03-2002          |
|                                           |                     | CA 2295068 A1              | 07-01-1999          |
|                                           |                     | EP 0991583 A1              | 12-04-2000          |
|                                           |                     | JP 3263090 B2              | 04-03-2002          |
|                                           |                     | JP 2001503004 A            | 06-03-2001          |
|                                           |                     | US 5934409 A               | 10-08-1999          |
|                                           |                     | US 6173810 B1              | 16-01-2001          |
|                                           |                     | WO 9900319 A1              | 07-01-1999          |
| -----                                     |                     |                            |                     |
| US 2009045011 A1                          | 19-02-2009          | CA 2638673 A1              | 16-02-2009          |
|                                           |                     | US 2009045011 A1           | 19-02-2009          |
| -----                                     |                     |                            |                     |
| GB 2120633 A                              | 07-12-1983          | NONE                       |                     |
| -----                                     |                     |                            |                     |
| EP 2554508 A1                             | 06-02-2013          | DK 2554508 T3              | 17-11-2014          |
|                                           |                     | EP 2554508 A1              | 06-02-2013          |
|                                           |                     | GB 2493381 A               | 06-02-2013          |
| -----                                     |                     |                            |                     |
| US 5868218 A                              | 09-02-1999          | CA 2177508 A1              | 29-11-1997          |
|                                           |                     | US 5868218 A               | 09-02-1999          |
| -----                                     |                     |                            |                     |