



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
**15.10.2014 Bulletin 2014/42**

(51) Int Cl.:  
**B66F 11/04<sup>(2006.01)</sup>**

(21) Application number: **14163599.5**

(22) Date of filing: **04.04.2014**

(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 MK MT NL NO PL PT RO RS SE SI SK SM TR**  
 Designated Extension States:  
**BA ME**

(71) Applicant: **Palfinger Platforms Italy S.R.L.**  
**39100 Bolzano (IT)**

(72) Inventor: **Balugani, Paolo**  
**41124 MODENA (IT)**

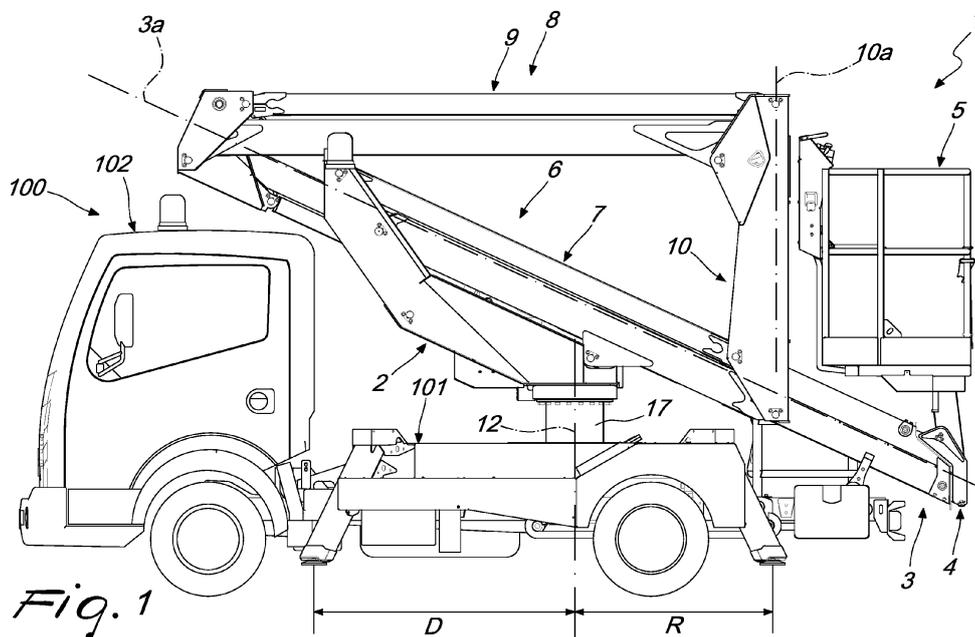
(74) Representative: **Modiano, Micaela Nadia et al**  
**Modiano Gardi Patents**  
**Via Meravigli 16**  
**20123 Milano (IT)**

(30) Priority: **12.04.2013 IT MO20130095**

(54) **Aerial platform**

(57) An aerial platform (1) with reduced space occupation that can be associated with a means of transport (100) and is provided with an articulated arm that comprises an installation base (2) that can be associated with a loading deck (101) of the means of transport (100), an end arm (3) provided with a free end (4) with which a work station (5) is associated, a first articulated quadrilateral (6) provided with a first pair of rockers (7) which are mutually parallel, with respective first ends that are pivoted to the installation base (2), a second articulated quadrilateral (8) provided with a second pair of rockers (9) which are mutually parallel, with respective first ends

that are pivoted to the end arm (3), and a linkage (10) which is pivoted to second ends of the pairs of rockers (7, 9). The aerial platform (1) furthermore comprises actuation means (11) for its transition between an extended working configuration and a compact transport configuration. In the extended working configuration the free end (4) is spaced further from the installation base (2) than in the compact transport configuration; in the compact transport configuration the first pair of rockers (7) and the second pair of rockers (9) are arranged transversely to each other and so as to diverge at the linkage (10).



*Fig. 1*

## Description

**[0001]** The present invention relates to an aerial platform with reduced space occupation.

**[0002]** In order to enable the execution of work at an elevated height, the use is known of aerial platforms that are provided with an articulated arm comprising a plurality of lever mechanisms which can move between an extended working configuration, so as to make it possible to reach the desired height, and a compact transport configuration, which enables the reduction of encumbrance of the platform on a means of transport, such as for example a truck, in order to facilitate its transport by road.

**[0003]** Such articulated arms are normally made up of an installation base that is associated rotatably with the loading deck of the means of transport; an end arm that is provided with a free end associated with a work station, normally known as a basket; a first and a second articulated quadrilateral, each of which is provided with a pair of rockers that are pivoted respectively to the installation base and to the end arm; and a connection linkage that is interposed between the two quadrilaterals and is pivoted to the second ends of the first and of the second pair of rockers.

**[0004]** In addition to this, the aerial platform comprises actuation means, which can be controlled both from the ground and from the work station, and which enable the transition between the two configurations mentioned above. In order to have an optimal compromise between the maximum extension of the aerial platform during work and reduced encumbrances during transport, in the compact transport configuration the two pairs of rockers are arranged horizontal and mutually parallel, while the end arm is arranged transverse to the rockers with its free end directed toward the rear of the means of transport and arranged in a downward region.

**[0005]** Such conventional aerial platforms are not devoid of drawbacks, including the fact that they do not extend far enough to reach elevated working heights and also offer compact dimensions for transporting the platform by road. In fact, the dimensions of the individual rockers are limited to the maximum longitudinal space occupation that can be transported by a normal means of transport by road, and such limitation affects the maximum height that can be reached by the work station, since a larger size of the rockers would make it possible to reach higher working elevations, but would also require the use of special means of transport, consequently increasing the cost of intervention at the site.

**[0006]** Another drawback of such conventional aerial platforms consists in the fact that their use is limited at low working heights which do not require the platform to be extended completely. In fact, for work at low heights, the aerial platform can remain in the compact configuration except for the end arm which can be extended, thus bringing the work station that is located on its free end to the working height. The subsequent rotation of the aerial platform in this "semi-compact" configuration is

however limited by the presence of the cabin, or driver's cab, of the means of transport, since parts of the platform that are still in the compact configuration, such as for example the linkage and the portions of the rockers that are connected to it, can collide with the driver's cab during rotation. In order to prevent such collision, the complete extension of the platform is required, consequently increasing the deployment time. Such drawback is felt more keenly in work to be carried out in enclosed environments, such as for example in factory sheds, the ceiling height of which does not permit the complete extension of the platform, thus requiring other types of aerial platforms to be used in order to reach the desired working height.

**[0007]** The aim of the present invention is to provide an aerial platform with reduced space occupation which eliminates the drawbacks and overcomes the limitations of the known art, by making it possible to reach elevated working heights and by the possibility of installation on a normal means of transport, without the necessity of using special means for its transport by road.

**[0008]** Within this aim, an object of the present invention is to provide a platform that can be fully used even for low working heights, without necessarily being completely extended.

**[0009]** Another object of the invention consists in providing a platform that can also be used in enclosed environments with low ceilings, without requiring the use of different types of platforms.

**[0010]** Another object of the invention consists in providing a platform that is capable of offering the widest guarantees of reliability and safety of use.

**[0011]** Another object of the invention consists in providing a platform that is easy to implement and economically competitive with the known art.

**[0012]** This aim and these and other objects which will become more apparent hereinafter, are all achieved by an aerial platform with reduced space occupation that can be associated with a means of transport and is provided with an articulated arm that comprises an installation base which can be associated with a loading deck of said means of transport, an end arm provided with a free end with which a work station is associated, a first articulated quadrilateral provided with a first pair of rockers which are mutually parallel, with respective first ends that are pivoted to said installation base, a second articulated quadrilateral provided with a second pair of rockers which are mutually parallel, with respective first ends that are pivoted to said end arm, a connection linkage to which respective second ends of said first and second pairs of rockers and actuation means are pivoted for the transition of said aerial platform between an extended working configuration and a compact transport configuration, in said extended working configuration said free end being spaced further from said installation base than in said compact transport configuration, characterized in that in said compact transport configuration said first pair of rockers and said second pair of rockers are arranged

transversely to each other and so as to diverge at said linkage.

**[0013]** Further characteristics and advantages of the invention will become more apparent from the detailed description of a preferred, but not exclusive, embodiment of an aerial platform with reduced space occupation, which is illustrated by way of non-limiting example with the assistance of the accompanying drawings wherein:

Figure 1 is a schematic side view of an embodiment of an aerial platform with reduced space occupation, according to the invention, in the compact transport configuration;

Figure 2 is a schematic perspective view of the aerial platform in Figure 1;

Figure 3 is a schematic side view of the aerial platform, according to the invention, in the extended working configuration;

Figure 4 is a schematic side view of the aerial platform in an intermediate active position between the compact transport configuration in Figure 1 and the extended working configuration in Figure 3;

Figures 5 to 8 schematically show a portion of an articulated arm of the aerial platform, according to the invention, in successive steps during the transition from the compact transport configuration to the extended working configuration.

**[0014]** With reference to the figures, the platform with reduced space occupation, which is generally designated by the reference numeral 1, comprises an articulated arm that is provided with an installation base 2 that is associated with a loading deck 101 of a means of transport 100. This articulated arm comprises an end arm 3 provided with a free end 4 associated with a work station 5, a first quadrilateral 6 and a second quadrilateral 8, which are respectively associated with the installation base 2 and with the end arm 3 and which are mutually connected by way of a connection linkage 10. The first quadrilateral 6 comprises a first pair of rockers 7, which are mutually parallel, the opposite ends of which are pivoted to the installation base 2 and to the linkage 10, while the second articulated quadrilateral 8 is provided with a second pair of rockers 9, which are mutually parallel, with the respective opposite ends pivoted to the end arm 3 and to the linkage 10. The aerial platform 1 furthermore comprises actuation means 11 for its transition between an extended working configuration and a compact transport configuration. In particular, in the extended configuration the free end 4 is spaced further from the installation base 2 than in the compact configuration in order to allow the operator, in the work station 5, to reach the desired height.

**[0015]** According to the invention, in the compact transport configuration the first pair of rockers 7 and the second pair of rockers 9 of the aerial platform 1 are arranged transversely to each other and so as to diverge at the linkage 10. The longitudinal axis 10a of the linkage 10,

which extends substantially along a respective longitudinal axis 10a, is in a substantially vertical position in the inactive configuration. Furthermore, in the same configuration the longitudinal axis 3a of the end arm 3 is arranged substantially in parallel to the first pair of rockers 7, while the second pair of rockers 9 is arranged substantially horizontally. The inclination of the longitudinal axis 3a of the end arm 3 and of the first pair of rockers 7 with respect to a horizontal plane is substantially comprised between 20° and 30° and is preferably 25°. In the compact configuration the free end 4 of the end arm 3 is directed toward the rear of the means of transport 100 at a lower height than the installation base 2, and also below the loading deck 101, while the end pivoted to the second quadrilateral 8, opposite to the free end 4, is arranged above the driver's cab 102 of the means of transport 100. Furthermore, the installation base 2 is associated with the loading deck 101 and is able to rotate about a vertical rotation axis 12. Such rotation axis 12 is spaced from the passenger compartment by a distance D that is larger than the radial space occupation R that is defined between the rotation axis and the linkage 10 in the compact transport configuration, so as to allow a rotation 12 of the aerial platform 1 in the compact configuration about the rotation axis without colliding with the driver's cab 102.

**[0016]** In this particular embodiment, which is illustrated in the accompanying figures, the installation base 2 is associated with the loading deck 101 by interposition of a shank 17 that is coaxial with the rotation axis 12 and can move by rotation about the latter thanks to a movement means of the conventional type. The body of the installation base 2 is an elongated body that is contoured so as not to collide with the driver's cab 102 during its rotation about the rotation axis 12 and is provided with two opposite ends a first of which is associated with the shank 17 and a second of which is directed toward the driver's cab 102 in the compact configuration. Pivoted to the second end are the ends of the first pair of rockers 7 which, in the compact configuration, are inclined by approximately 25° with respect to a horizontal plane and are directed downward, and toward the rear of the means of transport 100, while the other ends are pivoted to the linkage 10. The linkage 10 is arranged vertically with its longitudinal axis 10a allowing a horizontal arrangement with respect to the second pair of rockers 9 which, with the respective ends opposite to the ends that are pivoted to the linkage, are arranged above the driver's cab 102. The installation base 2, the linkage 10 and the two pairs of rockers 7 and 9 can move along a single vertical plane. The end arm 3 is associated with the end of the second pair of rockers 9, which are arranged above the driver's cab 102 in the compact configuration. In the compact configuration the end arm 3 is arranged beside the first pair of rockers 7, directing its free end 4 downward and toward the rear of the means of transport 100, as shown in Figures 1 and 2. Furthermore, the end arm 3 is of the telescopic type so as to enable its elongation during the

steps of working, as shown in Figure 3. In the articulated arm there are also actuation means 11 which comprise at least two actuators 15 and 16, which are defined for example by hydraulic telescopic cylinders, which are provided with opposite ends that can be actuated to move toward and away from each other. A first actuator 15 is associated, with the respective opposite ends, with the installation base 2 and with the first quadrilateral 6, and the second actuator 16 is associated, with the respective opposite ends, with the end arm 3 and with the second quadrilateral 8. In addition, the actuation means 11 comprise a connecting rod 14 that is accommodated within the linkage 10 that is associated, by way of the respective opposite ends, with a first rocker 7a of the first pair of rockers 7 and with a first rocker 9a of the second pair of rockers 9, as shown in Figures 5, 6, 7 and 8. In particular, the pivoting axis of the connecting rod 14 of the first rocker 7a of the first pair of rockers 7 is arranged between the pivot points thereof with the installation base 2 and the linkage 10, while the pivoting axis of the connecting rod 14 of the first rocker 9a of the second pair of rockers 9 is located on a protrusion 18 of the first rocker, outside the pivot points thereof with the linkage 10 and the end arm 3. During the transition between the compact transport configuration and the extended working configuration, the connecting rod 14 enables the synchronous angular movement of the pairs of rockers 7 and 9 with respect to the linkage 10, as well as the automatic movement of the second quadrilateral 8 as a consequence of the movement of the first quadrilateral 6 which is driven by way of the actuation of the first actuator 15. In particular, during such transition the longitudinal axis 10a always remains vertical, while the angular variation between the linkage 10 and the first quadrilaterals 6 is greater than the angular variation defined between the linkage itself and the second quadrilateral 8. In fact, in the compact transport configuration the second quadrilateral 8 forms an angle of approximately 90° with the linkage 10 and the first quadrilateral 6 forms a smaller angle, of approximately 65°, with the linkage, whereas in the extended working configuration both quadrilaterals 6 and 8 form the same angle (comprised between 90° and 180°) with the linkage 10.

**[0017]** The operation of the aerial platform 1 with reduced space occupation is described below.

**[0018]** The aerial platform 1 in the compact transport configuration can be easily transported by a means of transport, such as for example a self-propelled wheeled base or a self-propelled tracked base, to the workplace. After its stabilization on the ground, the aerial platform 1 begins the transition to the extended working configuration. Firstly, the end arm 3 can be extended alone, by actuation of the second actuator 16, leaving the remaining components of the articulated arm in the compact configuration, as illustrated in Figure 4. In such intermediate configuration the end arm 3 can reach, thanks to its telescopic elongation, intermediate heights without extending the two quadrilaterals 6 and 8, thus making it

possible to carry out work at an elevated height even in enclosed spaces with ceilings that are not particularly high. In such intermediate configuration the installation base 2 can rotate freely about the rotation axis 12 with no limitation since its positioning on the loading surface 101 and the compactness of the dimensions of the articulated arm prevent collisions with the driver's cab 102. If the working elevation required is higher, the platform is extended further by operation of the first actuator 15. The extension of the first actuator 15 enables the angular spacing of the first rocker 7a of the first pair of rockers 7 from the installation base 2. At the same time, the connecting rod 14, which is pivoted to the protrusion 18, pulls the first rocker 9a of the second pair of rockers 9, angularly spacing the second pair of rockers from the linkage 10 and extending the aerial platform 1, as illustrated schematically in Figures 5, 6, 7 and 8. The return to the compact transport configuration is defined by the contraction of the first actuator 15 and of the second actuator 16.

**[0019]** In practice it has been found that the aerial platform with reduced space occupation, according to the present invention, achieves the intended aim and objects in that it makes it possible to reach elevated working heights and is capable of being installed on a normal means of transport, without requiring the use of special means for its transport. In fact, the greater length of the linkage with respect to the dimensions of conventional linkages and the inclined positioning of the first articulated quadrilateral with respect to a horizontal plane make it possible to increase the height extension of the platform while also offering limited encumbrance dimensions in the compact configuration, which enable its transport on a normal means of transport, without requiring the use of special means of transport that are particularly cumbersome.

**[0020]** Another advantage of the aerial platform, according to the invention, consists in the fact that it is possible to work at low heights without any limitation. In fact, given the compact nature of the articulated arm and the positioning of the rotation axis on the loading deck, the platform can even be used in a configuration in which it is not completely extended without the risk of colliding with parts of the means of transport, such as for example the driver's cab, during rotation.

**[0021]** Another advantage of the aerial platform, according to the invention, consists in the fact that it can be used at low working heights in enclosed environments. In fact, thanks to the ability to work at low heights without requiring the complete extension of the articulated arm, the aerial platform can be used even in enclosed spaces with ceilings that are not particularly high, such as for example factory sheds, making it possible to use a single aerial platform both inside and outside such structures.

**[0022]** The platform with reduced space occupation thus conceived is susceptible of numerous modifications and variations all of which are within the scope of the appended claims.

**[0023]** Moreover, all the details may be substituted by

other, technically equivalent elements.

**[0024]** In practice the materials employed, provided they are compatible with the specific use, and the contingent dimensions and shapes, may be any according to requirements.

**[0025]** The disclosures in Italian Patent Application No. MO2013A000095 from which this application claims priority are incorporated herein by reference.

**[0026]** Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

### Claims

1. An aerial platform (1) with reduced space occupation that can be associated with a means of transport (100) and is provided with an articulated arm that comprises an installation base (2) which can be associated with a loading deck (101) of said means of transport (100), an end arm (3) provided with a free end (4) with which a work station (5) is associated, a first articulated quadrilateral (6) provided with a first pair of rockers (7) which are mutually parallel, with respective first ends that are pivoted to said installation base (2), a second articulated quadrilateral (8) provided with a second pair of rockers (9) which are mutually parallel, with respective first ends that are pivoted to said end arm (3), a connection linkage (10) to which respective second ends of said first and second pairs of rockers (7, 9) and actuation means (11) are pivoted for the transition of said aerial platform between an extended working configuration and a compact transport configuration, in said extended working configuration said free end (4) being spaced further from said installation base (2) than in said compact transport configuration, **characterized in that** in said compact transport configuration said first pair of rockers (7) and said second pair of rockers (9) are arranged transversely to each other and so as to diverge at said linkage (10).
2. The aerial platform (1) according to claim 1, **characterized in that** in said compact transport configuration said linkage (10) has a respective longitudinal axis (10a) that is arranged substantially vertically.
3. The aerial platform (1) according to claim 1, **characterized in that** in said compact transport configuration the longitudinal axis (3a) of said end arm (3) is arranged substantially in parallel to said first pair of rockers (7) and said second pair of rockers (9) is arranged substantially horizontally.
4. The aerial platform (1) according to one or more of the preceding claims, **characterized in that** in said compact transport configuration said free end (4) is arranged at a lower level than said installation base (2).
5. The aerial platform (1) according to one or more of the preceding claims, **characterized in that** in said compact transport configuration said free end (4) can be positioned below said loading deck (101).
6. The aerial platform (1) according to one or more of the preceding claims, **characterized in that** in said compact transport configuration the end of said end arm (3) which is pivoted to said second quadrilateral (8) can be arranged above the driver's cab (102) of said means of transport (100).
7. The aerial platform (1) according to one or more of the preceding claims, **characterized in that** in said compact transport configuration said longitudinal axis (3a) of said end arm (3) has an inclination, with respect to a horizontal plane, that is substantially comprised between 20° and 30°, and **in that** said free end (4) can be positioned so as to be directed toward the rear of said means of transport (100).
8. The aerial platform (1) according to one or more of the preceding claims, **characterized in that** said installation base (2) is associated rotatably with said loading deck (101) about a vertical rotation axis (12), said rotation axis (12) being arrangeable on said loading deck (101) with respect to said driver's cab (102) at a greater distance (D) than the radial space occupation (R) defined between said rotation axis itself and said linkage (10) in said compact transport configuration.
9. The aerial platform (1) according to one or more of the preceding claims, **characterized in that** said actuation means (11) comprise a connecting rod (14) that is associated moveably with said linkage (10) and is associated, by way of the respective opposite ends, with a first rocker (7a) of said first pair of rockers (7) and with a first rocker (9a) of said second pair of rockers (9), during the transition between said compact transport configuration and said extended working configuration said connecting rod (14) allowing the synchronous angular movement of said first pair of rockers (7) and said second pair of rockers (9) with respect to said linkage (10) and the automatic movement of one of said quadrilaterals (6, 8) following the actuated movement of the other one of said quadrilaterals (8, 6).
10. The aerial platform (1) according to one or more of the preceding claims, **characterized in that** said actuation means (11) comprise at least two actuators

(15, 16), a first (15) of which is interposed between said installation base (2) and said first quadrilateral (6) and an actuator (16) is interposed between said end arm (3) and said second quadrilateral (8).

5

10

15

20

25

30

35

40

45

50

55

6



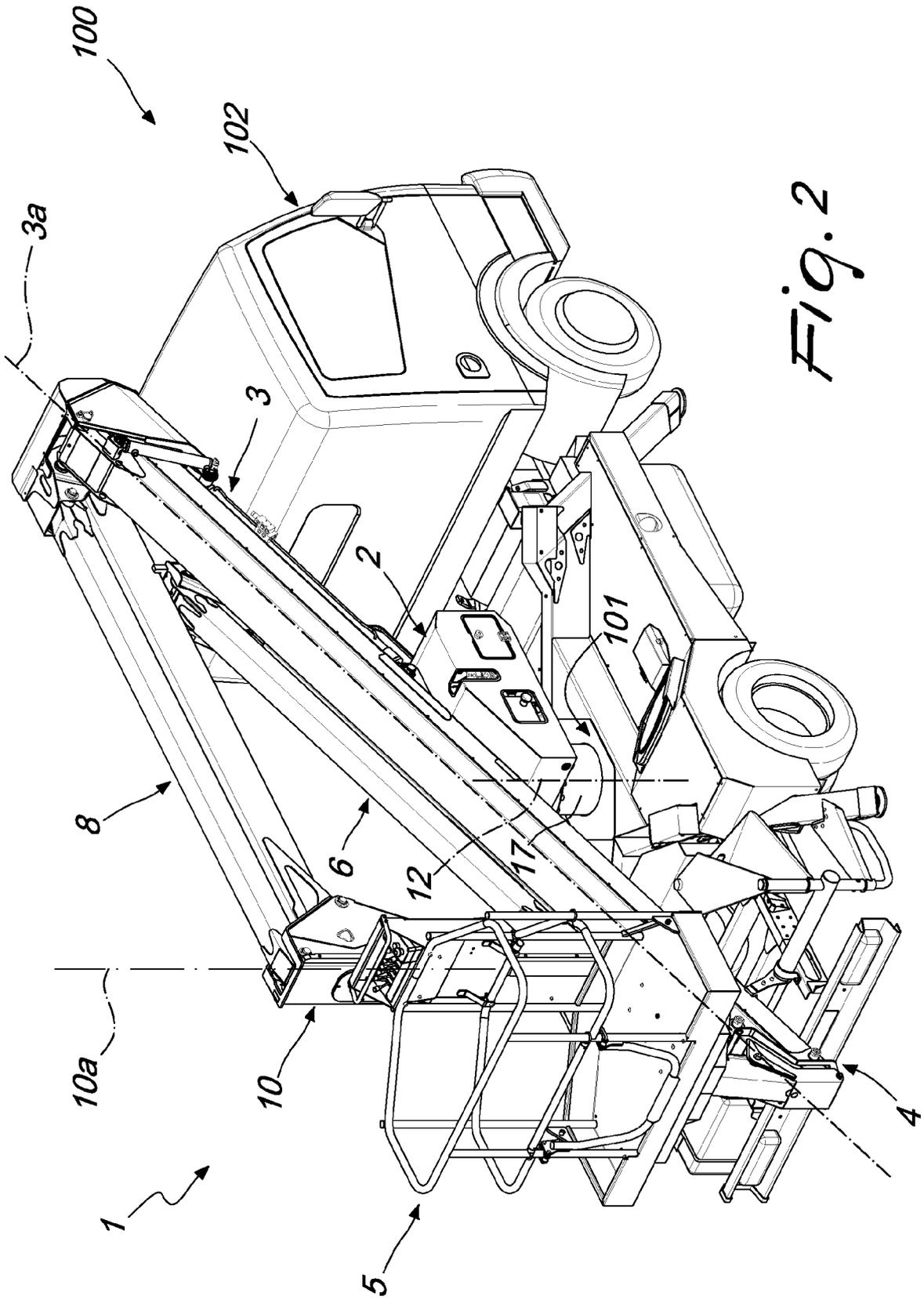
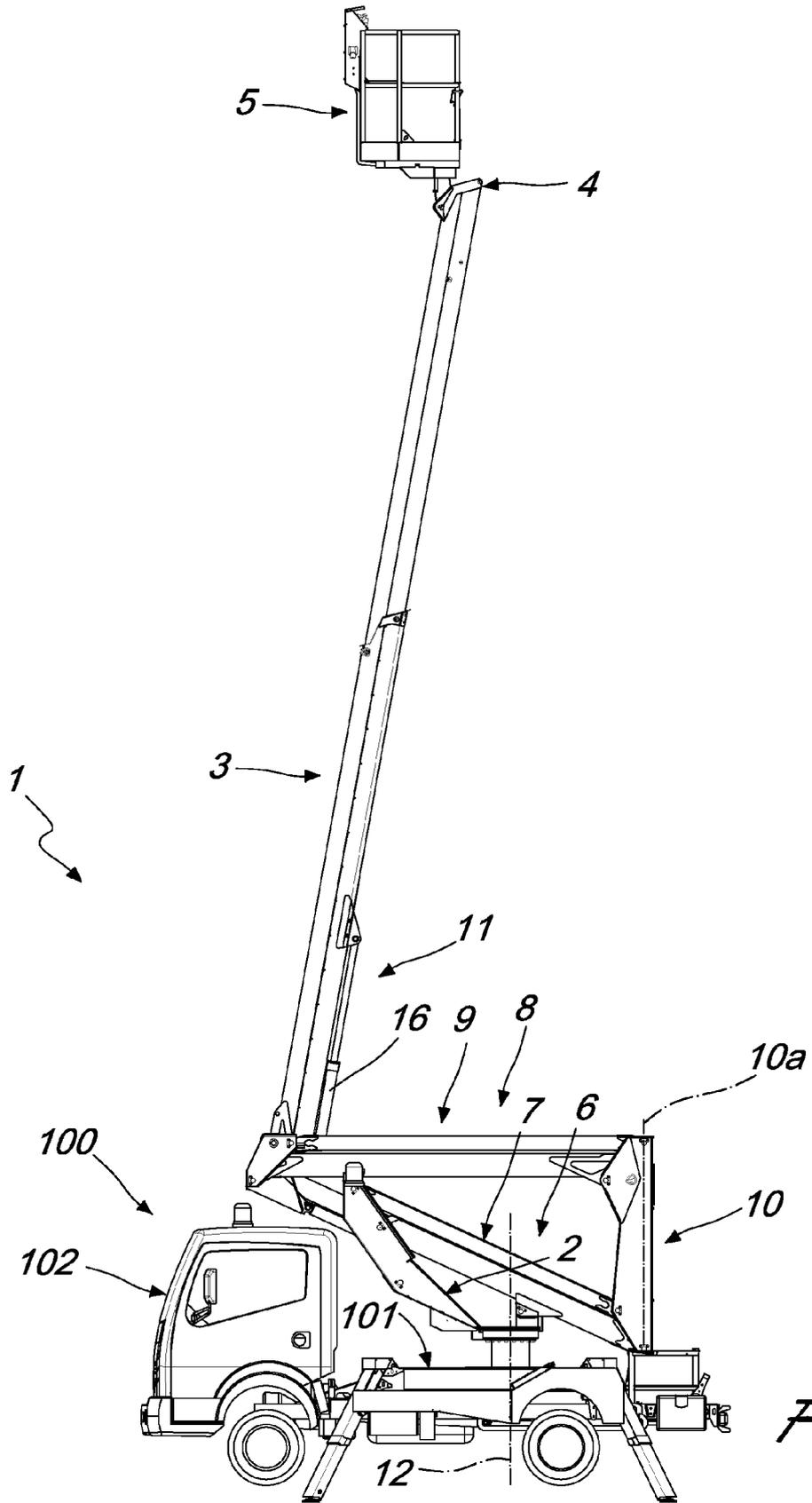


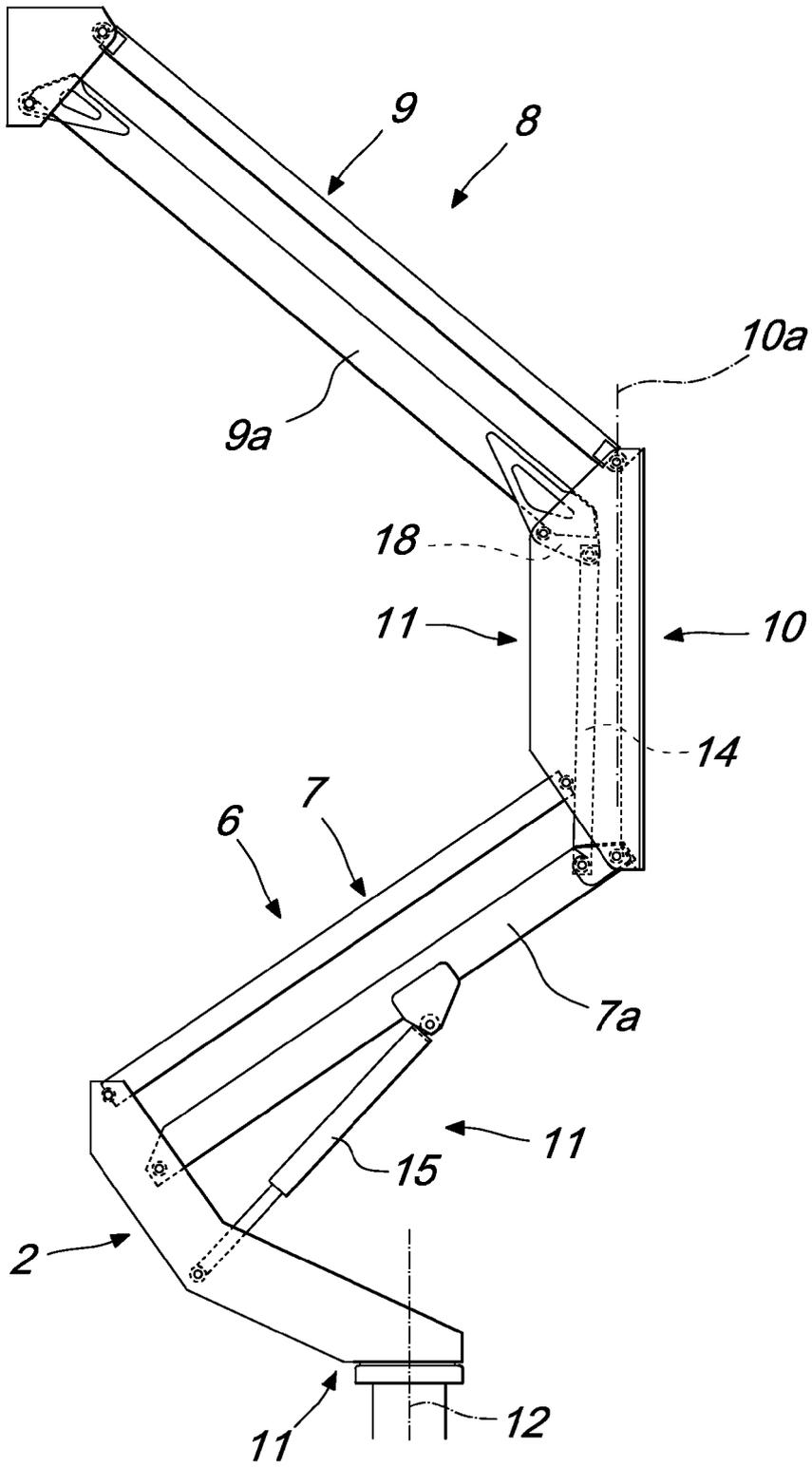
Fig. 2



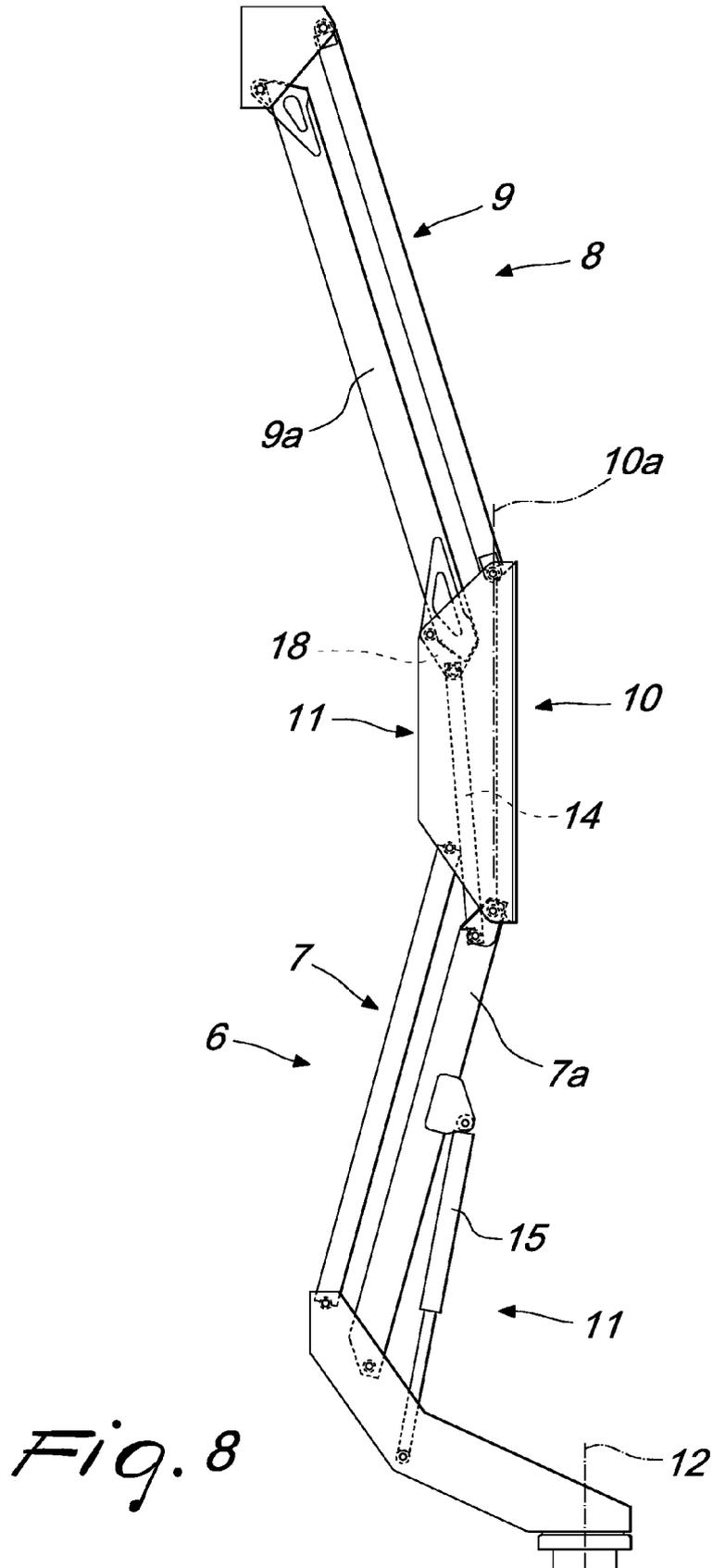


*Fig. 4*





*Fig. 7*



*Fig. 8*



EUROPEAN SEARCH REPORT

Application Number  
EP 14 16 3599

5

10

15

20

25

30

35

40

45

50

55

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	DE 202 02 256 U1 (HEMATEC ARBEITSBUEHNEN GMBH [DE]) 6 June 2002 (2002-06-06) * page 4, paragraph 2 - page 5, paragraph 1; figures *	1-4,6-8,10	INV. B66F11/04
X	EP 1 340 711 A1 (GROVE US LLC [US] JLG IND INC [US]) 3 September 2003 (2003-09-03) * paragraphs [0016] - [0021]; figures 1,2 *	1,2,4,5,8,9	
X	US 6 173 810 B1 (CITRON STEVEN D [US] ET AL) 16 January 2001 (2001-01-16) * page 4, lines 15-35; figures 1,2 *	1,2,4,5,10	
X	FR 2 732 001 A1 (MANITOU BF [FR]) 27 September 1996 (1996-09-27) * pages 4-5; figure 1 *	1,2,7,10	
			TECHNICAL FIELDS SEARCHED (IPC)
			B66F
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 30 April 2014	Examiner Özsoy, Sevda
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document	

EPO FORM 1503 03/82 (P04/C01)

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

EP 14 16 3599

5

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.

30-04-2014

10

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
DE 20202256	U1	06-06-2002	NONE	
EP 1340711	A1	03-09-2003	EP 1340711 A1 EP 1340712 A1	03-09-2003 03-09-2003
US 6173810	B1	16-01-2001	AU 745786 B2 AU 7146298 A CA 2295068 A1 EP 0991583 A1 JP 3263090 B2 JP 2001503004 A US 5934409 A US 6173810 B1 WO 9900319 A1	28-03-2002 19-01-1999 07-01-1999 12-04-2000 04-03-2002 06-03-2001 10-08-1999 16-01-2001 07-01-1999
FR 2732001	A1	27-09-1996	NONE	

15

20

25

30

35

40

45

50

55

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**

*This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.*

**Patent documents cited in the description**

- IT MO20130095 A [0025]