(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 520 708 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
12.03.2025 Bulletin 2025/11

(21) Application number: **24188908.8**

(22) Date of filing: **16.07.2024**

(51) International Patent Classification (IPC):
B66F 9/075 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
B66F 9/0755

(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

(30) Priority: **06.09.2023 IT 202300018297**

(71) Applicant: **Toyota Material Handling Manufacturing Italy S.p.A**
40132 Bologna (IT)

(72) Inventor: **Deliallisi, Bruno**
40132 Bologna (IT)

(74) Representative: **Hoffmann Eitle**
Hoffmann Eitle S.R.L.
Piazza Sigmund Freud 1
20154 Milano (IT)

(54) INDUSTRIAL TRUCK WITH AN IMPROVED CONTROL OF THE MOVEMENT OF THE LIFTING DEVICE

(57) An industrial truck (10) comprises:
-a mast (11),
-a lifting device (12) which is able to slide along the mast and which is adapted to manipulate a load (13),
-control means configured to control the movement of the lifting device (12) relative to the mast (11).

The industrial truck comprises:
-an emitting device (15) configured to emit a light beam (14) along an orientation direction;
-actuating means associated with the emitting device (15) and configured to vary the position of the light beam (14) relative to the lifting device;
-a user interface configured to receive an aiming command from a user to aim/direct the light beam.

The user interface and the actuating means are connected to the control means; said control means being configured to command the actuating means so as to vary the position of the light beam in accordance with the aiming command received from the user interface;
said control means being configured to control the movement of the lifting device based on a position of the light beam following the variation of the position of the light beam in accordance with the aiming command.

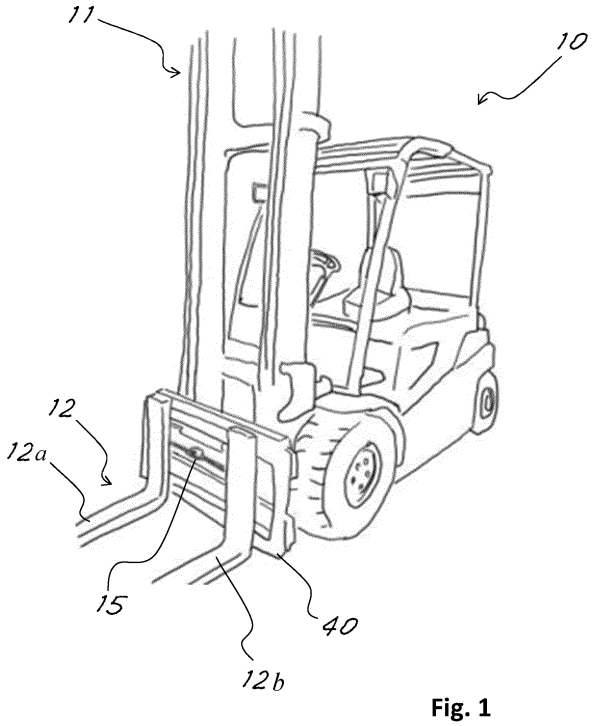

Fig. 1

EP 4 520 708 A1

Description

Field of the invention

[0001] The present invention relates to an industrial truck provided with improved control of the lifting device.

Technical background

[0002] The production of industrial trucks, for example forklift trucks, for handling loads for example in a warehouse, industrial environments, ports or the like is known in the art. Industrial trucks typically include a substantially vertical front mast and a lifting device (for example a pair of forks) intended to lift a load by sliding along the mast. The loads can typically be stored in a shelving system, for example with a matrix structure. After the lift truck has been positioned in proximity to the load to be picked up by driving the truck, in order to pick up the load from the respective section in the shelving system, the forks of the lift truck must be brought into the correct position aligned with the load (for example aligned with the pallet carrying a load) by activating specific actuators designed to raise the forks and if necessary translate them horizontally, in the event that the lift truck is endowed with this function.

[0003] To date, the operations of aligning the forks (or another lifting device) with the load to be picked up have been performed manually, which can cause delays in pick-up, and an incorrect engagement of the forks in the pallet supporting the load; furthermore, it is necessary for the user to be expert and capable of quickly and precisely manoeuvring the movement of the forks in order to have an efficient manipulation of the loads. The same problem occurs when it is necessary to unload a load in a certain position, for example in a certain compartment of a storage unit with shelves, as it is difficult to quickly and precisely align the lift forks with the pre-selected compartment.

Summary of the invention

[0004] In the light of the problems highlighted above, one object of the present disclosure is to provide an industrial truck that allows for facilitating the manoeuvre of picking up a load by means of the lifting device. A further object is to provide a system that makes it possible to increase the efficiency and speed of performing loading/unloading operations by means of a lifting device; a further object is to provide a system that makes it possible to increase the reliability and safety of the loading/unloading operations.

[0005] This object is achieved by means of an industrial truck comprising:

- a mast,
- a lifting device which is able to slide along the mast and which is adapted to manipulate a load,
- control means configured to control the movement of the lifting device relative to the mast, characterized in that it comprises:

- an emitting device configured to emit a light beam along an orientation direction;
- actuating means associated with the emitting device and configured to vary the position of the light beam relative to the lifting device;
- a user interface configured to receive an aiming command from a user to aim/direct the light beam;

wherein the user interface and the actuating means are connected to the control means; said control means being configured to command the actuating means so as to vary the position of the light beam in accordance with the aiming command received from the user interface;

said control means being configured to control the movement of the lifting device based on a position of the light beam following the variation of the position of the light beam in accordance with the aiming command.

[0006] Preferably, the emitting device is a laser rangefinder configured to measure a distance from a point of arrival of the light beam on a strike surface of a target object, wherein the control means are configured to control the movement of the lifting device also based on the measured distance.

[0007] Preferably, the lifting device is mounted on the mast so as to be able to translate horizontally along a direction transverse to the mast; preferably the control means are configured to control the movement of horizontal translation and/or the movement along the mast based on a position of the light beam following the variation of the position of the light beam in accordance with the aiming command. The control means are configured to determine a horizontal and/or vertical movement of the lifting device with respect to the mast based on a position of the light beam following the variation of the position of the light beam in accordance with the aiming command.

[0008] Preferably, the user interface is further configured to receive a confirmation command from the user, wherein the control means are configured to control the movement of the lifting device based on the position of the light beam and/or on the distance measured at the time the confirmation command is entered.

[0009] Preferably, the control means are configured to control the movement of the lifting device until a position of loading/unloading from/to a storage compartment pointed at by the light beam or a storage compartment accommodating a load pointed at by the light beam is reached.

[0010] Preferably, the control means are configured to set limit stop positions of the lifting device based on the position of the light beam and/or on the distance measured following the variation of the position of the light

beam in accordance with the aiming command.

[0011] Preferably, the emitting device is mounted on a support so as to be able to rotate about a horizontal axis under the action of the actuating means.

[0012] Preferably, the support is fixedly mounted with respect to the lifting device, preferably fixedly mounted on a fork carriage sliding on the mast.

[0013] Preferably, the emitting device is mounted on the support so as to be able to rotate about a vertical axis under the action of the actuating means.

[0014] Preferably, the support is mounted on the industrial truck so as to be horizontally translatable with respect to the lifting device, in a direction parallel to the direction of horizontal translation of the lifting device.

[0015] In a further aspect, there is provided a method for controlling the movement of a lifting device of an industrial truck up to a desired position for loading/unloading a load from/to a storage compartment, wherein the industrial truck comprises a mast, the lifting device sliding along the mast and being adapted to manipulate a load, and an emitting device configured to emit a light beam along an orientation direction, the method comprising:

- varying the position of the light beam emitted by the emitting device so as to illuminate a portion of a load or a portion of the storage compartment,
- controlling the movement of the lifting device based on a position of the light beam following the variation of the position of the light beam.

Brief description of the drawings

[0016] This and other advantages of the present invention will be illustrated with reference to an example embodiment of the invention described with reference to the appended drawings.

[0017] In the drawings:

- figure 1 illustrates a lift truck according to the present disclosure;
- figure 2 illustrates a top view of a lift truck in proximity to a load to be picked up;
- figure 3 illustrates a side view of a lift truck in proximity to a load to be picked up;
- figure 4 illustrates a schematic view of the logic units that cooperate with the control means of the industrial truck;
- figure 5 illustrates a view of the emitting device and of the control board thereof;
- figure 6 illustrates an example of a hardware architecture of the lift truck.

Detailed description

[0018] With reference to the figures, figures 1-3 show an industrial truck 10 comprising a mast 11 and a lifting device 12 which is able to slide along the mast and which is adapted to manipulate a load 13. The industrial truck 10 can include a driver's cabin, in which a seat and a control interface, such as, for example, a steering wheel and/or other user interfaces for controlling the truck, are arranged. The load 13 can be any object whatsoever, an object 13a supported by a pallet 13b (fig. 3), a package, a material on a reel, or anything else. The industrial truck 10 can be equipped with three or four wheels, which can be driven by a drive system comprising, for example, an internal combustion engine or an electric motor or a hybrid system. Any known system of locomotion can be used in an industrial truck according to the present disclosure.

[0019] In a preferred embodiment, the industrial truck 10 is a lift truck; preferably, the lift truck 10 comprises a pair of forks 12a, 12b, which constitute the lifting device 12. The forks 12a, 12b are mounted on a fork carriage 40, which in turn is slidingly mounted along the mast 11. However, other types of lifting devices can be used in conjunction with the industrial truck according to the present disclosure, such as, for example, an arbour for lifting a material on a reel, a gripper, or for example any other equipment mountable on the mast of a lift truck.

[0020] The mast 11 is positioned in the front portion of the industrial truck 10. In a preferred embodiment, the mast 11 can be able to pivot, i.e. rotate about a vertical axis, located in proximity to the front axle of the industrial truck. The mast 11 has a substantially vertical position and, preferably, can pivot in an interval of angular positions around a vertical position.

[0021] Preferably, the lifting device 12 is mounted on the mast 11 so as to be able to translate horizontally in a direction transverse to the mast. For example, the fork carriage 40 can be mounted so as to be able to horizontally translate with respect to the mast 11 and in a direction transverse to the direction of travel of the truck 10. For this purpose, the lift truck 10 includes specific actuators, for example hydraulic ones, to cause the movement of vertical and/or horizontal translation of the lifting device 12.

[0022] The industrial truck 10 further includes an emitting device 15 configured to emit a light beam 14 (shown in figures 2 and 3) along an orientation direction. For example, the light beam 14 can be a laser beam. The emitting device 15 can be preferably made as a laser rangefinder configured to measure a distance from a point of arrival 80 of the light beam on a strike surface of a target object. For example, a target object could be a pallet 13b that supports an object 13a (see figure 3), or a shelf that supports the load, or even the load itself. The emitting device 15 is positioned in the front part of the industrial truck 10 so as to emit the light beam in a forward direction relative to the industrial truck. In one embodiment, the emitting device 15 is mounted on the fork carriage 40 of the truck, for example in a position substantially equidistant from the two forks 12a, 12b.

[0023] The industrial truck 10 comprises control means 51 configured to control the movement of the lifting device

12 relative to the mast 11. The control of the movement of the lifting device 12 can take place automatically, semi-automatically or manually, in the manners described below.

[0024] Figure 4 schematically shows the control means 51, connected to a user interface 50 and to actuating means 53, 54, which include actuating means configured to impart a vertical and/or horizontal movement to the lifting device 12. The control means 51 can be made with any hardware and/or software configuration; the control means 51 can include a single controller device or a plurality of devices connected together in a distributed architecture.

[0025] The industrial truck 10 further comprises actuating means 52 associated with the emitting device 15 and configured to vary the position of the light beam 14 relative to the lifting device 12. The actuating means 52 are connected to the control means 51; the actuating means 52 can be configured to be activated based on the commands for aiming the light beam entered by a user via the user interface 50.

[0026] The industrial truck 10 in fact comprises a user interface 50 configured to receive an aiming command from a user to aim/direct the light beam 14; the user interface 50 can be made in any form, for example a joystick, a touchscreen, a keypad, or other devices.

[0027] The user interface 50 is connected to the control means 51 in order to provide an input entered by the user, based on which the control means 51 gives a command to the actuators 52 associated with the emitting device 15. The user interface 50 can also include a plurality of input devices, configured to receive also other commands from the user besides that of aiming the light beam. For example, the user interface 50 can also be configured to receive a command input for the movement of the lifting device and/or a command for driving the industrial truck. Alternatively, separate user interfaces can be provided to perform the different driving and/or load manipulation functions. The control means 51 are configured to command the actuating means 52 so as to vary the position of the light beam 14 in accordance with the aiming command received from the user interface 50.

[0028] The control means 51 are further configured to control the movement of the lifting device 12 based on a position of the light beam 14 following the variation of the position of the light beam in accordance with the aiming command. Preferably, the control means 51 are configured to control the movement of the lifting device 12 also based on the distance measured by the laser rangefinder, i.e. a distance equal to the length of the light beam 14 from the emitting device 15 to the point of incidence 80 of the light beam on a target object. The control means 51 can thus command the horizonal translation of the lifting device 12 and the raising of the lifting device 12 along the mast based on the orientation (or more in general the position) of the light beam 14 and/or the length thereof after the position has been varied by the user. The control means 51 can command the movement of the lifting device 12 to align it with a compartment 20 for loading/unloading the load 13 in a storage unit, for example a storage unit with shelves.

[0029] In one example, with reference to figures 2-3, the user of the industrial truck 10 can initially drive the industrial truck into a position in proximity to the load 13 to be picked up. The load 13 can be positioned on a shelving structure 30, for example in a section (or compartment) 20 of a shelving structure 30 which includes a plurality of sections arranged in a matrix. In the example in figures 2-3, the load 13 is an object 13a positioned on a pallet 13b, which is in turn supported by the shelf 21 of the shelving structure 30, i.e. a flat element constituting the rest surface for the load 13 when it is accommodated in the compartment 20.

[0030] After having reached a position in proximity to the load 13, the truck 10 remains in a fixed position (i.e. without further locomotion of the truck on wheels) with the front portion thereof facing towards the load 13 to be picked up and, more in general, towards the shelving structure 30 in which the load is stored. In this phase, the user of the truck 10 can activate the emitting device 15. As a result of the activation, the emitting device 15 emits a light beam that strikes the shelving structure 30 in front of the truck 10 or one of the loads stored therein. By using the user interface 50 (for example a joystick or a keypad), the user can give a command to aim the light beam 14 until pointing at a position 80 (or point of incidence) associated with the load 13 to be picked up. For example, the position 80 can correspond to a central portion of the pallet 13b which supports an object 13a and is part of the load 13 to be picked up. Alternatively, the position 80 could also be a central portion of the shelf 21 of the shelving structure that supports the load 13. The position of the light beam 14 can be changed by varying the orientation of the emitting device 15. Preferably, the emitting device 15 is mounted so as to be able to rotate about a vertical axis and about a horizontal axis relative to the lifting device 12. For example, the emitting device 15 can have a substantially fixed absolute position relative to the lifting device 12, as it is connected to the fork carriage 40, but with the possibility of varying its orientation relative to the fork carriage 40. In the example in figures 2-3, the light beam 14 is oriented based on the commands given by the user so as to form an angle α relative to a substantially vertical plane in which the mast 11 lies when seen from the top, i.e. a vertical plane transverse to the direction of travel of the truck 10 (see figure 2); moreover, the light beam 14 is oriented based on the commands given by the user so as to form an angle β relative to a horizontal plane when seen from the side of the industrial truck 10 (figure 3).

[0031] After having varied the orientation (or more in general the position) of the light beam 14, the control unit 51 detects the position of the light beam relative to the lifting device 12, for example by measuring the angles α and β. In particular, the user can enter a confirmation command via the user interface 50 to confirm that the light

beam 14 is correctly pointed towards the load 13 to be picked up. The confirmation command is received by the control means 51, which detects the position of the light beam 14 and/or the distance measured by the laser rangefinder 15 in the instant in which the confirmation command is entered. The measured distance corresponds to the length of the light beam 14, starting from the emitting device 15 up to the point of incidence 80, i.e. the position associated with the load to be picked up that is pointed at by the light beam 14. The distance measured by the laser rangefinder is designated as "d".

[0032] Knowing the distance d and the angles α and β, the control means 51 can determine the vertical and horizontal movement that the lifting device 12 must carry out to align itself with the load 13 to be picked up and/or with the compartment 20. For example, the height "h" (shown in figure 3) can be calculated as:

$$\text{formula (1): } h=d*\sin(\beta).$$

[0033] Moreover, the horizontal movement "l" (shown in figure 2) can be calculated as:

$$\text{formula (2): } l=d*\cos(\alpha).$$

[0034] Knowing h and l, and also knowing the position of the emitting device 15 relative to the lifting device 12 (this being a known parameter, for example knowing the height h1 of the emitting device 15 relative to the supporting surface of the lifting device 12 and knowing that the emitting device 15 is positioned in a central position relative to the fork carriage and, therefore, relative to the lifting device 12), the control means 51 can determine the overall movement to be imparted to the lifting device 12 in order to align it with the load 13 to be picked up.

[0035] After having determined the vertical and horizontal movements as indicated above, the control means 51 can automatically give a command to the actuators 53, 54 which control the movement of the lifting device 12 so as to align it with the load 13. Therefore, the control means are configured to control the movement of the lifting device until it reaches a position of loading/unloading from/to a storage compartment 20 pointed at by the light beam or a storage compartment 20 accommodating a load 13 pointed at by the light beam. Alternatively, the control means are configured to set limit stop positions of the lifting device 12 (for example vertical and/or horizontal) based on the position of the light beam and/or distance measured following the variation of the position of the light beam in accordance with the aiming command; in such a case, the user can give a horizontal translation and/or lift command to the lifting device 12 until reaching a limit stop set by the control means 51 based on the movements determined previously for the alignment with the load 13.

[0036] After the command for the vertical and/or horizontal translation of the lifting device 12, the industrial truck 10 can continue travelling forward to engage the load, for example by placing the forks 12 underneath the pallet 13b.

[0037] In one embodiment, the emitting device 15 is mounted on a support so as to be able to rotate about a horizontal axis under the action of the actuating means. Figure 5 shows an example in which the emitting device 15 is mounted on the support 16 so as to be able to rotate about a horizontal axis 71. Preferably, the support 16 is fixedly mounted with respect to the lifting device 12, for example it is mounted fixedly on a fork carriage 40 sliding on the mast 11.

[0038] The support 16 can preferably comprise two elements 17 and 18, as shown in figure 5. The element 17 supports the emitting device 15 by means of hinging on a horizontal axis to allow rotation about the axis 71. The element 17 is in turn mounted so as to be able to rotate about an axis 70 that is vertical relative to the base 18. The base 18 is advantageously fixed with respect to the lifting device 12, and/or to the fork carriage 40. The above-described rotations for varying the orientation of the emitting device are imparted by actuating means 52 associated with the emitting device 15, for example by means of a motorised electrical drive of any known type.

[0039] In an alternative embodiment, the support 16 could be mounted on the industrial truck so as to be horizontally translatable relative to the lifting device 12, along a direction parallel to the direction of horizontal translation of the lifting device. In such a case, it is possible that the possibility of rotating about a vertical axis is omitted for the emitting device 15, since the horizontal translation of the support 16 can replace a variation of the angle α as shown in figure 2 in order to point at the target object via the light beam.

[0040] Figure 6 shows a possible implementation of the control means 51 and of the components connected thereto from a hardware viewpoint. In this example, the industrial truck 10 includes a bus 61, for example a CAN bus, though other types of buses can also be provided.

[0041] In an example embodiment, the above-described control means 51 can be implemented with a main control board 51a connected to the bus 61 and with a board 60 for controlling the emitter of a light beam. It should be noted that the functions performed by the above-described control means 51 can be performed by various devices and/or boards, with software and/or hardware solutions, without going outside the scope of the present disclosure.

[0042] The user interface intended to receive the command to aim the beam 14 can be connected to the bus 61 by means of a joystick board 50a to enter commands, for example to impart an orientation of the light beam or to enter a confirmation command to confirm that the load to be picked up has been correctly pointed at with the light beam. Other devices can be connected to the bus 61 by means of a specific interface and/or control board 62. Furthermore, the laser meter board 60 of the laser ran-

gefinder 15 can be connected to the bus 61.

[0043] The laser meter board 60 controls the movement of the actuators associated with the emitting device 15, commands the emission of the light beam and reads the distance measured by the laser rangefinder 15. The laser meter board 60 communicates with the other boards connected to the bus 61 in order to perform the above-described controls. The laser meter board 60 controls the sensor of the laser rangefinder, so it reads and manages the information thereof, such as: laser measurement of the target, angle of inclination of the sensor, angle of rotation of the sensor (or lateral shift in the event that it was desired to move it sideways instead of rotating it). The laser meter board 60 processes the three above-mentioned data items and calculates the lifting and lateral translation parameters for the alignment of the forks with the target. As the other machine logics directly actuate the hydraulic system, the laser meter board 60 has the task of communicating via software (or via hardware if so desired) the lifting and lateral translation parameters. In order to improve the system and the alignment, it is possible optionally to share the fork height and sideshift (horizontal translation) values with the laser meter board 60; in this manner, the sensor 15 will know its position in space and can integrate these measurements into the operation thereof in order to carry out feedback measurements during the alignment.

[0044] The reference numbers 53, 54 indicate the actuators that impart movements to the lifting device 12, for example a pump inverter and an oil distributor which constitute the hydraulic actuators for the activation of the forks 12.

[0045] The above-described hardware architecture is only an example embodiment; in particular, the control means 51 and the above-described functions of the control means could be implemented also outside main control board and/or the control board of the laser rangefinder in an architecture with a bus.

[0046] In an alternative embodiment, another type of light emitter could be used as opposed to a laser rangefinder. For example, other sensors could be intended to measure a distance of the industrial truck (and in particular of the fork carriage) from the load to be lifted. In this manner, knowing the orientation of the light beam pointed towards the load target and knowing the distance of the forks (or of the fork carriage) from the load (or from a shelving unit), it is possible to calculate the movement of the forks for alignment with the load even without knowing the length of the light beam, i.e. without a measurement of the distance of the light emitter from the point of incidence of the beam on the load pointed at.

[0047] In an alternative embodiment, the emitting device 15 could be horizontally and slidably mounted with respect to the fork carriage 40, for example along a support guide 41 shown in figure 2. The guide 41 can be fixed onto the fork carriage 40 so as not to interfere with the space for loading onto the forks 12. In such a case, there can be provided a hydraulic jack (or hydraulic actuator) that imparts the horizontal movement of the emitter 15; this further hydraulic actuator can be controlled by means of an input entered by the user via the user interface 50 to point the light beam at the load to be picked up.

[0048] In one embodiment, during the alignment of the lifting device 12 it is possible to perform a re-calibration to verify whether the control of alignment is proceeding correctly. In such a case, in an intermediate position of movement of the forks 12 (for example, halfway along the travel provided for and initially calculated), the system can again point the light beam towards the load to be picked up automatically based on the information relating to the part of the movement already completed; the user can thus verify whether the light beam is still pointed at the load to be picked up and enter a confirmation input via the user interface 50; in such a case, by means of the user feedback it is verified that the control of alignment is proceeding correctly, and the alignment can proceed automatically.

[0049] The proposed solution has various effects:

- It offers the operator a great deal of assistance in the loading and unloading phase, since it is sufficient to move in front of the shelving unit and aim at the desired load with the laser pointer;
- It enables automatic alignment of the forks, decreasing the possibility of human error.

[0050] In the above-described examples, reference has mainly been made to the operation of picking up a load, for example from a shelving unit. However, the present disclosure can also be applied to the case in which the load must be unloaded in a certain position, for example into a section or compartment of a storage unit. In such a case, the light beam can be pointed by the operator towards the section or the supporting shelf of a section in a storage unit with a shelf structure and the control means of the lift truck can be configured to automatically align the lifting device with the pre-selected section.

Claims

1. An industrial truck (10) comprising:

- a mast (11),
- a lifting device (12) which is able to slide along the mast and which is adapted to manipulate a load (13),
- control means configured to control the movement of the lifting device (12) relative to the mast (11),

characterized in that it comprises:

- an emitting device (15) configured to emit a

light beam (14) along an orientation direction to illuminate a portion of the load (13) or a portion of a storage compartment (20);
- actuating means associated with the emitting device (15) and configured to vary the position of the light beam (14) relative to the lifting device;
- a user interface configured to receive an aiming command from a user to aim the light beam;

wherein the user interface and the actuating means are connected to the control means;
said control means being configured to command the actuating means so as to vary the position of the light beam in accordance with the aiming command received from the user interface;
said control means being configured to control the movement of the lifting device based on a position of the light beam after the variation of the position of the light beam in accordance with the aiming command.

2. An industrial truck according to claim 1, wherein the emitting device (15) is a laser rangefinder configured to measure a distance from a point of arrival of the light beam on a strike surface of a target object, wherein the control means are configured to control the movement of the lifting device (12) also based on the measured distance.

3. An industrial truck according to claim 1 or 2, wherein the lifting device (12) is mounted on the mast (11) so as to be able to translate horizontally along a direction transverse to the mast.

4. An industrial truck according to one of the preceding claims, wherein the user interface is further configured to receive a confirmation command from the user, wherein the control means are configured to control the movement of the lifting device (12) based on the position of the light beam (14) and/or on the distance measured at the time the confirmation command is entered.

5. An industrial truck according to one of the preceding claims, wherein the control means are configured to control the movement of the lifting device until a position of loading/unloading from/to a storage compartment (20) pointed at by the light beam or a storage compartment (20) accommodating a load (13) pointed at by the light beam is reached.

6. An industrial truck according to one of the preceding claims, wherein the control means are configured to set limit stop positions of the lifting device (12) based on the position of the light beam and/or the distance measured as a result of varying the position of the light beam in accordance with the aiming command.

7. An industrial truck according to one of the preceding claims, wherein the emitting device (15) is mounted on a support (16) so that it can rotate about a horizontal axis under the action of the actuating means.

8. An industrial truck according to claim 7, wherein the support (16) is fixedly mounted with respect to the lifting device (12), preferably fixedly mounted on a fork carriage sliding on the mast (11).

9. An industrial truck according to one of claims 7 or 8, wherein the emitting device (15) is mounted on the support (16) so as to be able to rotate about a vertical axis under the action of the actuating means.

10. An industrial truck according to claims 3 and 7, wherein the support (16) is mounted on the industrial truck so as to be horizontally translatable with respect to the lifting device (12), in a direction parallel to the direction of horizontal translation of the lifting device.

11. An industrial truck according to one of the preceding claims, wherein the user interface configured to receive the aiming command is one of: a touchscreen, a joystick, a keyboard.

12. An industrial truck according to one of the preceding claims, wherein the control means are configured to control the direction of the light beam based on the aiming command entered by the user so as to form an angle (β) between the light beam and a substantially horizontal plane.

13. An industrial truck according to one of the preceding claims, wherein the control means are configured to detect the position of the light beam relative to the lifting device after having varied the position of the light beam based on the aiming command and to control the movement of the lifting device based on the detected position of the light beam.

14. An industrial truck according to one of the preceding claims, wherein the control means are configured to determine a horizontal translation of the lifting device with respect to the mast and/or a vertical movement of the lifting device along the mast based on a position of the light beam after the variation of the position of the light beam in accordance with the aiming command.

15. Method for controlling the movement of a lifting device (12) of an industrial truck (10) up to a desired position for loading/unloading a load from/to a storage compartment (20), wherein the industrial truck comprises a mast (11), the lifting device (12) sliding along the mast and being adapted to manipulate a load (13), and an emitting device (15) configured to

emit a light beam (14) along an orientation direction, the method comprising:

- varying the position of the light beam (14) emitted by the emitting device (15) so as to illuminate a portion of a load (13) or a portion of the storage compartment (20) based on an aiming command entered by a user via a user interface of the industrial truck,
- controlling the movement of the lifting device (12) based on a position of the light beam (14) following the variation in the position of the light beam.

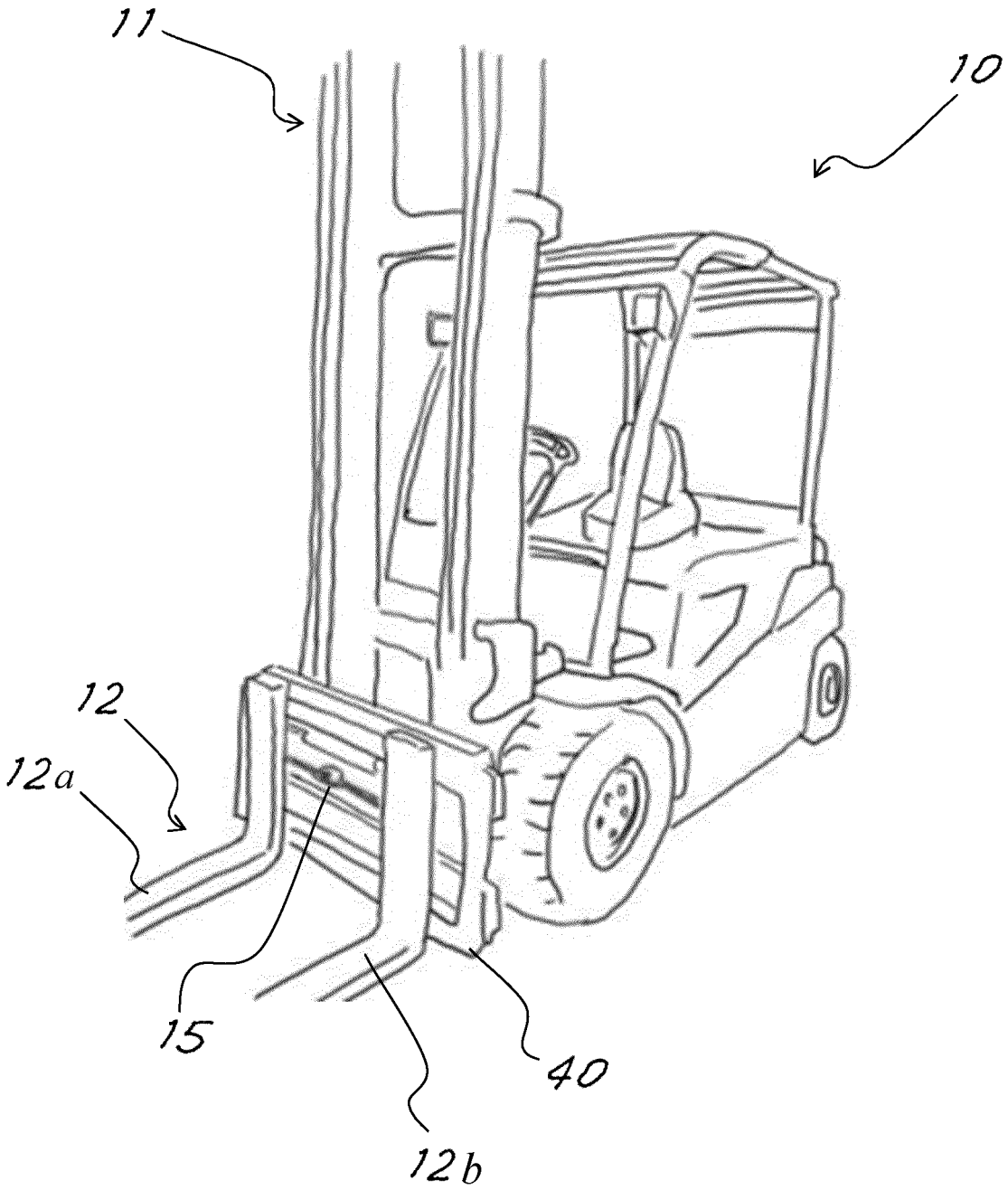

Fig. 1

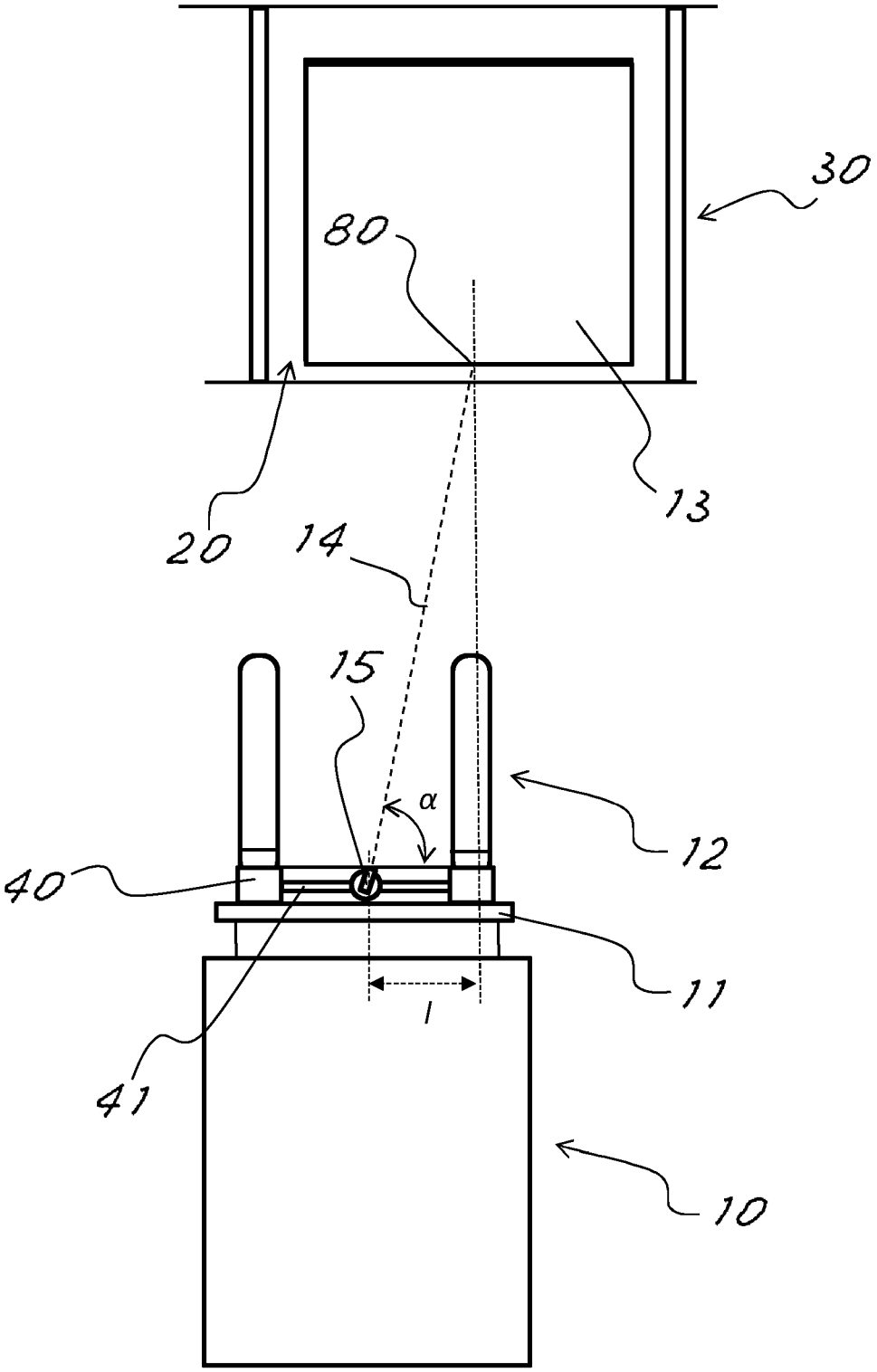

Fig. 2

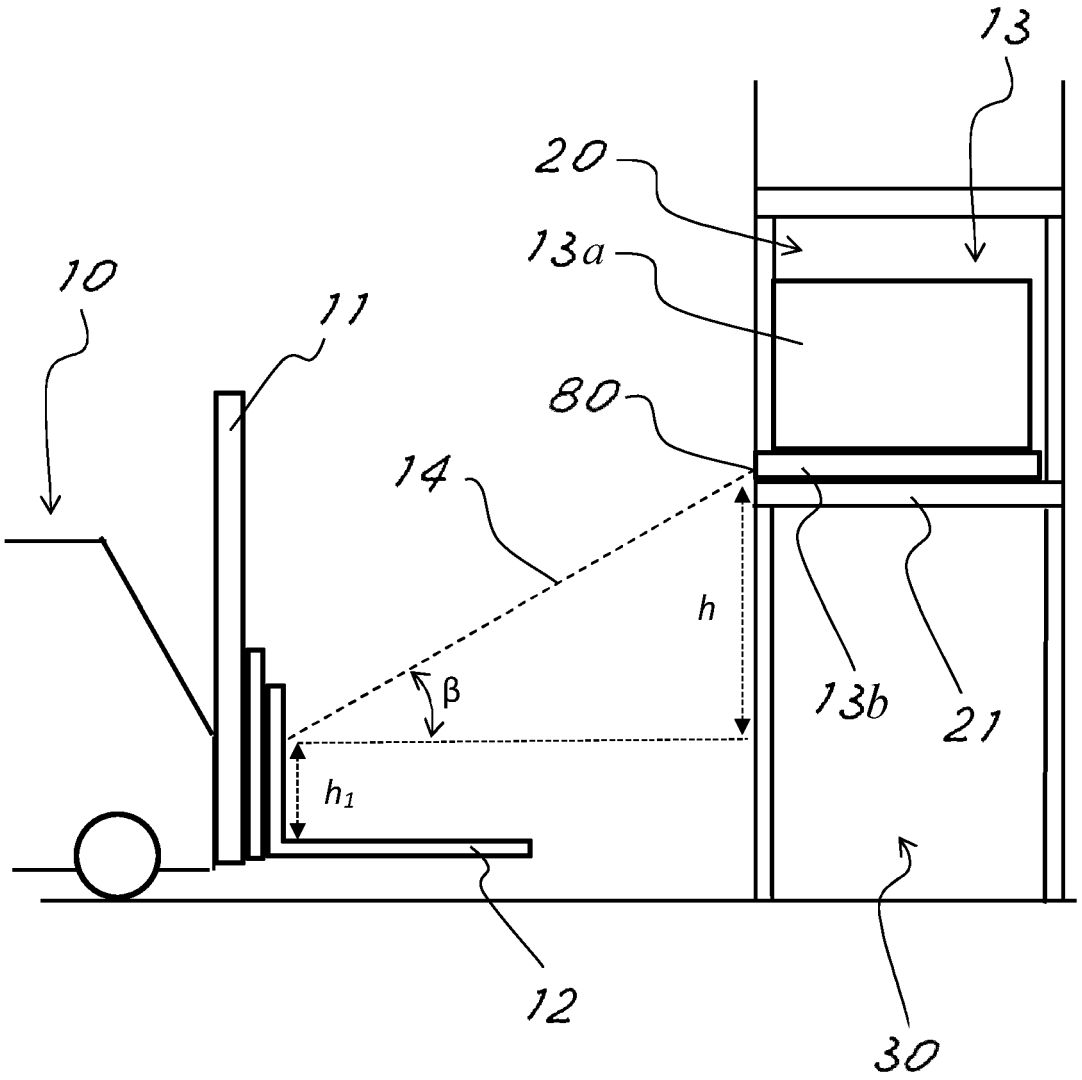

Fig. 3

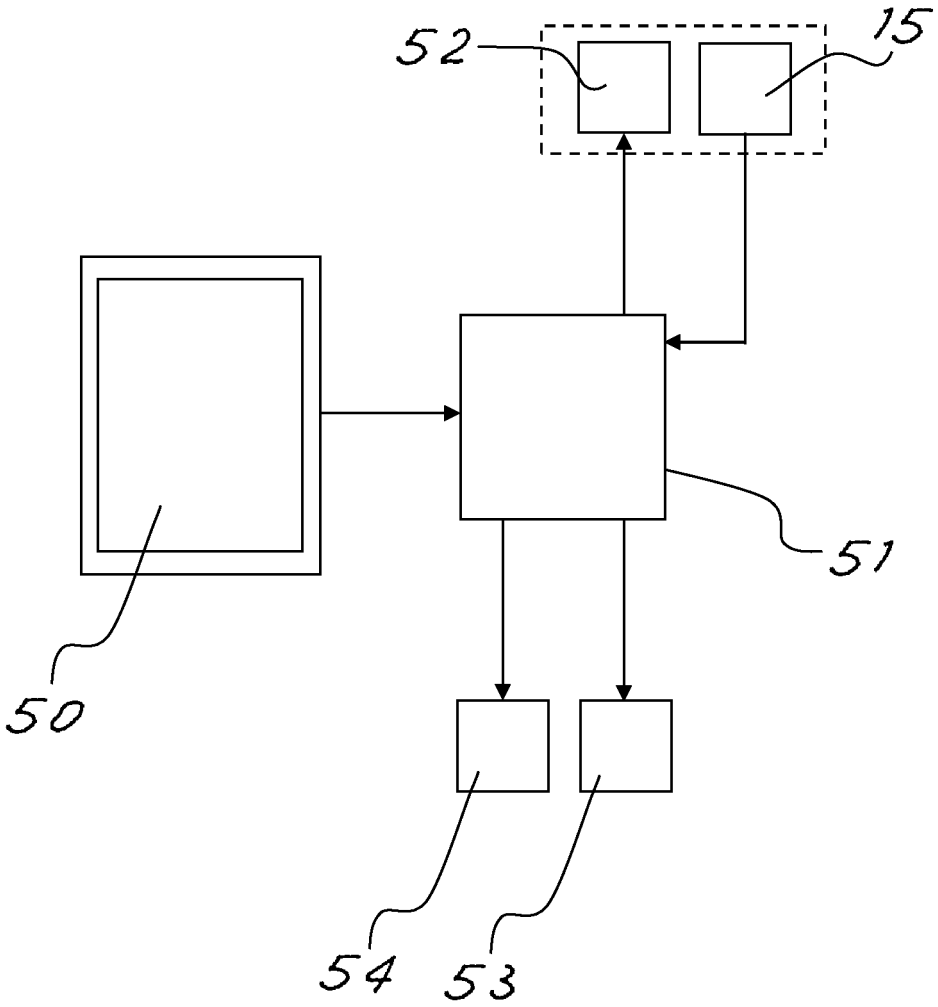

Fig. 4

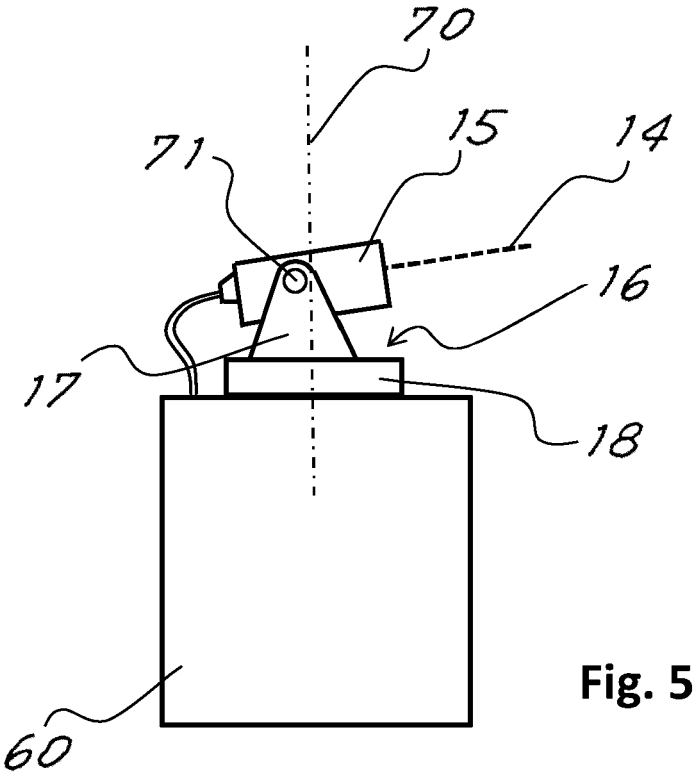
70
71
15
14
16
17
18
60

Fig. 5

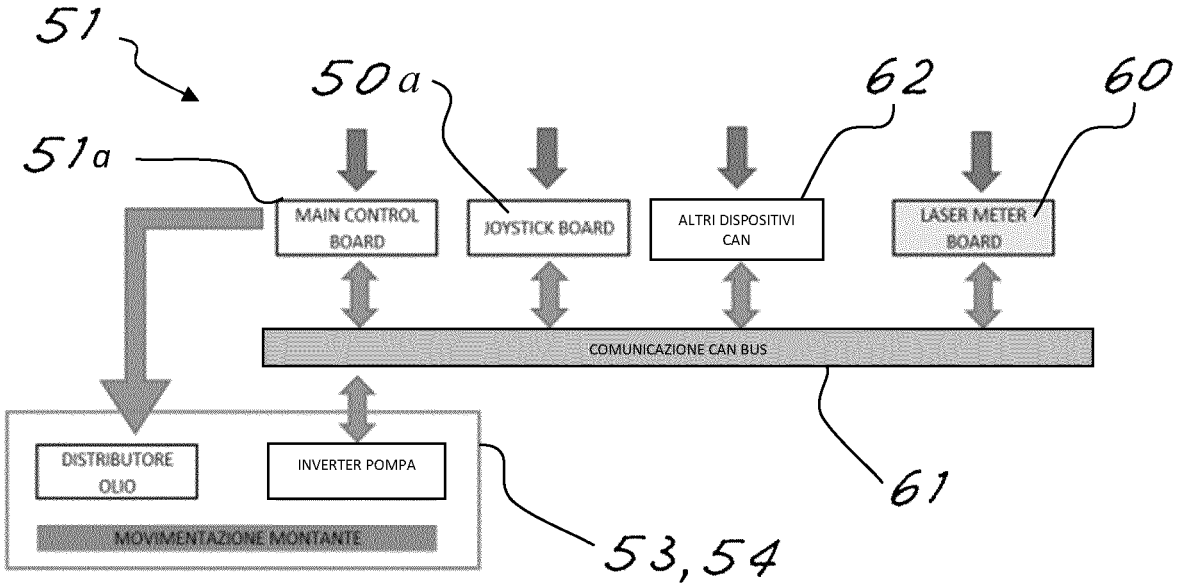
51
50a
62
60
51a
MAIN CONTROL BOARD
JOYSTICK BOARD
ALTRI DISPOSITIVI CAN
LASER METER BOARD
COMUNICAZIONE CAN BUS
61
DISTRIBUTORE OLIO
INVERTER POMPA
MOVIMENTAZIONE MONTANTE
53,54

Fig. 6

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 24 18 8908

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 Y	US 2008/011554 A1 (BROESEL RALF [DE] ET AL) 17 January 2008 (2008-01-17) * the whole document *	1,2,4-9, 11,12,15 3,10	INV. B66F9/075
Y A	US 2022/089420 A1 (FAIMALI ANNALISA [IT] ET AL) 24 March 2022 (2022-03-24) * paragraphs [0039], [0044], [0049]; figure 1 *	3,10 1	
A	CA 2 144 886 A1 (DOHERTY WILLIAM J [CA]) 18 September 1996 (1996-09-18) * page 4, paragraph 4 *	1,4,9	
A	US 11 650 074 B2 (SICK AG [DE]) 16 May 2023 (2023-05-16) * track guide sensors 108; column 8, line 46 - line 54 *	1,15	

TECHNICAL FIELDS SEARCHED (IPC)
B66F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	16 December 2024	Verheul, Omiros

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 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 24 18 8908

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.

16-12-2024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2008011554 A1	17-01-2008	AT E446276 T1	15-11-2009
		DE 10323641 A1	05-01-2005
		EP 1641704 A1	05-04-2006
		JP 2006528122 A	14-12-2006
		US 2008011554 A1	17-01-2008
		WO 2004103882 A1	02-12-2004
US 2022089420 A1	24-03-2022	NONE	
CA 2144886 A1	18-09-1996	NONE	
US 11650074 B2	16-05-2023	DE 102019123659 A1	04-03-2021
		EP 3795949 A1	24-03-2021
		US 2021063201 A1	04-03-2021

EPO FORM P0459

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