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(54) **Method of operating a fork-lift truck, a fork-lift truck, a computer program product, and a method of modifying a fork-lift truck**

Verfahren zum Betrieb eines Gabelstaplers, Gabelstapler, Computerprogrammprodukt und Verfahren zum Verändern eines Gabelstaplers

Procédé d'exploitation d'un chariot élévateur à fourche, chariot élévateur à fourche, produit de programme informatique et procédé de modification de chariot élévateur à fourche

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(73) Proprietor: **Toyota Material Handling Manufacturing Sweden AB**
595 81 MJÖLBY (SE)

(72) Inventors:
- **Strand, Michael**
  595 52 Mjölby (SE)
- **Nåbo, Daniel**
  583 34 Linköping (SE)

(74) Representative: **Zacco Sweden AB**
P.O. Box 5581
114 85 Stockholm (SE)

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Description

TECHNICAL FIELD

[0001] The present disclosure relates to a method of operating a fork-lift truck to provide a constant maximum lifting height independent of the position of its support arms, a fork-lift truck with support arms and a mast structure arranged to provide a constant maximum lifting height independent of the position of the support arms

[0002] The disclosure also relates to a computer-readable storage medium, having stored thereon a computer program and a method of modifying a fork-lift truck, with support arms and a mast structure, such that the fork-lift truck is able to provide a constant maximum lifting height independent of the position of the support arms.

BACKGROUND

[0003] When operating fork-lift trucks, the fork-lift truck is handled by an operator that either rides with the fork-lift truck or walks along the fork-lift truck. Generally pallets and/or goods are moved by the fork-lift truck by means of a lifting device, in general it is a pair of forks that enters in two slots of a pallet and then the forks are lifted and the pallet is lifted together with the forks. Then the fork-lift truck can travel a distance and the operator maneuvers the fork-lift truck to lower its forks and then place the pallet and leave this position without a load. The fork-lift truck is then driven by the operator without any pallet and/or goods, to a new location. During travel, the operator generally needs to raise/lift the load carrier/forks a small distance, in order to avoid unnecessary wear or damages to the forks by touching the ground.

[0004] In general tiller arm trucks have a platform on which the operator can stand while operating the truck. Some fork-lift trucks are provided with protective side guards that protect the operator. The protective side guards can be in their protective position in which they protect the operator. The protective side guards can also be in their non-protective position in which the protective side guards do not protect the operator. On some fork-lift trucks there is a demand that the lifting device is limited to a maximum lifting height when the protective side guards are in their protective position. On fork-lift trucks which has movable support arms this means that the lifting device only can provide the maximum lifting height minus the lifting height of the support arms. This is a problem for operators that want to reach the maximum lifting height without having to raise the support arms.

[0005] There is also another problem with fork-lift trucks that only can lift a maximum lifting height when the protective side guards are in in their protective position. When the lifting device is lifted with high speed and the lifting device has to stop at the maximum lifting height, the lifting device will not immediately stop since the hydraulic pump will not immediately stop and due to natural dynamics of the hydraulic fluid. If there is no load on the lifting device, the lifting device may continue e.g. 8 centimeters or more. If there is load on the lifting device, the lifting device will stop faster. However, this means that the maximum lifting height will vary depending on the load on the lifting device. EP2251298 discloses an industrial truck comprises a lifting frame and a pair of support arms. EP2251298 does not disclose any solution to the problem with lifting height associated with support arms.

[0006] There is therefore a need for an improved fork-lift truck, which fork-lift truck solves or at least mitigates at least one of the above mentioned problems.

SUMMARY

[0007] It is an object of the present disclosure to provide embodiments solving the problem providing a fork-lift truck that can reach a maximum lifting height when the support arms are in a lowered position. Another object of the present disclosure is to provide a fork-lift truck where the maximum lifting height will not vary depending on the load on the lifting device.

[0008] The disclosure presents a fork-lift truck with support arms and a mast structure, arranged to provide a constant maximum lifting height independent of the position of the support arms, wherein the fork-lift truck further comprises, a lifting device, carried by the mast structure and movable along the mast structure. The fork-lift truck further comprises an elongated element comprising a magnetic or ferromagnetic material arranged on the lifting device. A sensor arranged on the mast structure is configured to sense a presence/absence of the elongated element; wherein the fork-lift truck is operative to stop an upward movement of the lifting device when the senor sense the presence of the elongated element in a case where the support arms are in an upright position, to provide the constant maximum lifting height, or ramp down the speed of the upward movement of the lifting device in a case where the support arms are in a lowered position and stop the movement of the lifting device when the lifting device has moved upwards a predetermined distance wherein the sensor sense the absence of the elongated element, to provide the constant maximum lifting height.

[0009] The present disclosure also relates to embodiments of a method of operating a fork-lift truck to provide a constant maximum lifting height independent of the position of the support arms, wherein the fork-lift truck comprises a lifting device, carried by a mast structure and movable along the mast structure. The method comprising the steps of: sensing the presence/absence of an elongated element comprising a magnetic or ferromagnetic material arranged on the lifting device. Stopping an upward movement of the lifting device when sensing the presence of the elongated element in a case where the support arms are in an upright position, or ramping down the speed of the upward movement of the lifting device in a case where the support arms are in a lowered position and stopping the movement of the lifting device when the lifting device has moved upwards a predetermined distance wherein the sensor sense the absence of the elongated element.

[0010] The present disclosure also relates to embodiments of a method of modifying a fork-lift truck, with support arms and a mast structure, such that the fork-lift truck is able to provide a constant maximum lifting height independent of the position of the support arms, wherein the method comprising the steps of: providing a lifting device carried by the mast structure and movable along the mast structure with an elongated element comprising a magnetic or ferromagnetic material. Providing the mast structure with a sensor configured to sense a presence/absence of the elongated element, and providing a computer-readable storage medium in the fork-lift truck with a computer program which, when run in a processor of the fork-lift truck causes the fork-lift truck to perform the disclosed method.

[0011] An advantage with embodiments of the present disclosure is that a maximum lifting height can be provided even if the support arms are in lowered position.

[0012] Another advantage with embodiments of the present disclosure is that a fork-lift truck is provided where the maximum lifting height will not vary depending on the load on the lifting device.

[0013] The present disclosure also presents a computer program, comprising computer readable code which, when run in a fork-lift truck causes the fork-lift truck to perform the disclosed method.

[0014] The method of operating the fork-lift truck, and the computer program each display advantages corresponding to the advantages already described in relation to the method performed in the fork-lift truck.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] Further objects, features, and advantages of the present disclosure will appear from the following detailed description, wherein some aspects of the disclosure will be described in more detail with reference to the accompanying drawings, in which:

Figure 1 schematically illustrates a fork-lift truck according to an exemplary embodiment of the present disclosure.

Figure 2 schematically illustrates a fork-lift truck according to an exemplary embodiment of the present disclosure.

Figure 3 is a flow chart illustrating the proposed methods performed in the fork-lift truck.

Figure 4 schematically illustrates a fork-lift truck according to an exemplary embodiment of the present disclosure.

DETAILED DESCRIPTION

[0016] Aspects of the present disclosure will be described more fully hereinafter with reference to the accompanying drawings. The methods and fork-lift truck disclosed herein can, however, be realized in many different forms and should not be construed as being limited to the aspects set forth herein. Like numbers in the drawings refer to like elements throughout.

[0017] The general object or idea of embodiments of the present disclosure is to address at least one or some of the disadvantages described above as well as below. The various steps described below in connection with the figures should be primarily understood in a logical sense.

[0018] Figure 1 schematically illustrates a fork-lift truck 1 according to an embodiment of the present disclosure, arranged to provide a constant maximum lifting height independent of the position of support arms 5. The fork-lift truck has a mast structure 2 and is thus able to fetch and leave a cargo on a shelf. A lifting device 4 is carried by the mast structure 2 and is movable along the mast structure 2. According to exemplary embodiments of the present disclosure the fork-lift truck 1 comprises a tiller arm 8.

[0019] The fork-lift truck 1 is controlled by an operator. The operator travels with the fork-lift truck, for example by means of a pivotable platform 3. The fork-lift truck 1 is preferably an electrically powered fork-lift truck 1 that has an electrical drive motor (not shown) and an electrical pump motor (not shown) for pumping hydraulic fluid.

[0020] The lifting device 4 is preferably as seen in the Figures 1, a pair of forks. The lifting device 4 can comprise more than two forks and fewer than two forks if desired. The fork-lift truck 1 further comprises support arms 5. The support arms 5 can be in an upright position or in a lowered position. In figure 1 the support arms 5 are in an upright position. When the support arms 5 are in a lowered position, as shown in figure 2, it is possible to lower the lifting device 4 to the ground. In order to be able to lift a pallet, the support arms 5 have to be in the lowered position, or close to the ground, so it is possible to move the lifting device 4 close to the ground. The lifting device 4 has to be close to ground in order to make it possible to position the lifting device 4 in the slots of the pallet.

[0021] The position of the support arms 5 is in an exemplary embodiment of the present disclosure senses by a support arm position sensor (not shown). The support arm position sensor gives information to the processor 110, shown in figure 4, if the support arms 5 are in an upright position, in a lowered position or in a position in between.

[0022] The lifting device 4 according to an exemplary embodiment of the present disclosure comprises an elongated element 6. The elongated element 6 according to one exemplary embodiment of the present disclosure comprises a magnetic or ferromagnetic material. The elongated element 6 can be position on many different positions on the lifting device 4. The elongated element 6 is preferably positioned close to the mast structure 2, so that the elongated element 6 can be sensed by a senor 7 on the mast structure 2, as will be described next. The sensor 7 is as described above positioned on the mast structure 2 and configured to sense a presence/absence of the elongated element 6.

[0023] According to embodiments of the present disclosure the fork-lift truck 1 is operative to stop an upward movement of the lifting device 4 when the senor 7 sense the presence of the elongated element 6 in a case where the support arms 5 are in an upright position. This enables the fork-lift truck 1 to always provide a constant maximum lifting height. When the support arms 5 are in an upright position the lifting device 4 and the mast structure 2 are in their respective highest position. The fork-lift truck is therefore, in this case operative to stop an upward movement of the lifting device 4 when the sensor 7 senses the presence of the elongated measuring 6 element. The position of the elongated element 6 on the lifting device 4 and the position of the sensor 7 on the mast structure 2 can according to embodiments of the present disclosure be changed. Depending on the position of the elongated element 6 on the lifting device 4 and the sensor 7 on the mast structure 2 different constant maximum lifting heights can be provided.

[0024] According to one exemplary embodiment of the present disclosure the constant maximum lifting height is a maximum lifting height according to the International Standard for safety requirements of Industrial trucks, i.e. EN ISO 3691-1:2012. This constant maximum lifting height can be a maximum lifting height of 1800 mm from the floor.

[0025] Now turn to figure 2. In figure 2 the support arms 5 of the fork-lift truck 1 is in a lowered position. As mentioned above, in this position it is possible to lower the lifting device 4 to a position close to the ground which makes it possible to position the lifting device 4 under e.g. a pallet. When the support arms 5 are in a lowered position the fork-lift truck 1 is operative to ramp down the speed of the upward movement of the lifting device 4, when the sensor 7 sense the presence of the elongated element 6. In this case the fork-lift truck 1 is also operative to stop the movement of the lifting device 4 when the lifting device 4 has moved upwards a predetermined distance wherein the sensor 7 sense the absence of the elongated element 6. Thus is the constant maximum lifting height also provided in this case.

[0026] Now will embodiments of the present disclosure be described in which the mast structure 2 comprises several mast elements. These embodiments are not shown in the figures.

[0027] In one exemplary embodiment of the present disclosure the mast structure 2 comprises a first mast element, which carries the lifting device 4 and a second mast element, by which the first mast element is carried and along which the first mast element is movable.

[0028] In yet another exemplary embodiment of the present disclosure the mast structure 2 further comprises a third mast element, by which the second mast element is carried and along which the second mast element is movable.

[0029] In a further exemplary embodiment of the present disclosure the mast structure 2 further comprises a fourth mast element, by which the third mast element is carried and along which the third mast element is movable.

[0030] The fork-lift truck 1 according to exemplary embodiments of the present disclosure is a pedestrian-controlled fork-lift truck 1 with protective side guards, not shown. The protective side guards protect the operator from falling of the fork-lift truck 1, when the protective side guards are in their protective position. According to one exemplary embodiment of the present disclosure the fork-lift truck is further arranged to provide the constant maximum lifting height when the protective side guards are in their protective position.

[0031] Figure 3 is a flowchart schematically illustrating embodiments of method steps of operating a fork-lift truck 1 to provide a constant maximum lifting height independent of the position of support arms 5, wherein the fork-lift truck 1 comprises a lifting device 4, carried by a mast structure 2 and movable along the mast structure 2.

[0032] In a first step S1, the fork-lift truck 1 sense the presence/absence of an elongated element 6 comprising a magnetic or ferromagnetic material arranged on the lifting device 4.

[0033] In a next step S2, the fork-lift truck 1 stops an upward movement of the lifting device 4 when sensing the presence of the elongated element 6 in a case where the support arms 5 are in an upright position.

[0034] In a further step S3, the fork-lift truck 1 ramps down the speed of the upward movement of the lifting device 4 in a case where the support arms 5 are in a lowered position and stops the movement of the lifting device 4 when the lifting device 4 has moved upwards a predetermined distance wherein the sensor 7 sense the absence of the elongated element 6.

[0035] The method of operating a fork-lift truck 1 to provide a constant maximum lifting height independent of the position of support arms 5, wherein the fork-lift truck 1 comprises a lifting device 4, can be performed by a fork-lift truck wherein the mast structure 2 comprises a first mast element, which carries the lifting device 4 and a second mast element, by which the first mast element is carried and along which the first mast element is movable 4.

[0036] According to another embodiment of the present disclosure, the method of operating a fork-lift truck 1 to provide a constant maximum lifting height independent of the position of support arms 5, wherein the fork-lift truck 1 comprises a lifting device 4, can be performed by a fork-lift truck, wherein the mast structure further comprises a third mast element, by which the second mast element is carried and along which the second mast element is movable.

[0037] In a yet another embodiment of the present disclosure, the method of operating a fork-lift truck 1 to provide a constant maximum lifting height independent of the position of support arms 5, wherein the fork-lift truck 1 comprises a lifting device 4, can be performed by a fork-lift truck, wherein the mast structure further comprises a fourth mast element, by which the third mast element is carried and along which the third mast element is movable.

[0038] The fork-lift truck 1 according to an embodiment of the present disclosure is a pedestrian-controlled truck with protective side guards, and wherein the constant maximum lifting height is provided when the protective side guards are in their protective position.

[0039] According to an exemplary embodiment of the method of operating a fork-lift truck 1 to provide a constant maximum lifting height according to the present disclosure, the constant maximum lifting height is a maximum lifting height according to the International Standard for safety requirements of Industrial trucks, i.e. EN ISO 3691-1:2012.

[0040] According to another exemplary embodiment of the method of operating a fork-lift truck 1 to provide a constant maximum lifting height according to the present disclosure, the constant maximum lifting height is 1800 mm from the floor.

[0041] Turning now to figure 4, a schematic diagram is disclosed illustrating an exemplary embodiment of a fork-lift truck 1 with support arms and a mast structure, arranged to provide a constant maximum lifting height independent of the position of the support arms. The fork-lift truck 1 comprises a processor 110 and a memory 120, the memory 120 containing instructions executable by the processor 110. The processor 110 is a Central Processing Unit, CPU, microcontroller, Digital Signal Processor, DSP, or any other suitable type of processor capable of executing computer program code. The memory 120 is a Random Access Memory, RAM, a Read Only Memory, ROM, or a persistent storage, e.g. a single or combination of magnetic memory, optical memory, or solid state memory or even remotely mounted memory.

[0042] The processor 110 and the memory 120 are here disclosed as being situated in the body of the fork-lift truck, but the processor 110 and the memory 120 can also preferably be located in the tiller arm 8 or the tiller head of the fork-lift truck 1. In another embodiment of the present disclosure, the processor 110 and the memory 120 is an external unit. This means that the fork-lift truck 1 must communicate with the processor 110 and the memory 120 by means of a communication device (not shown). This can preferably be a wire-less link. The communication device comprises in this embodiment an antenna.

[0043] According to one aspect, the disclosure further relates to a computer program, comprising computer readable code which, when run on the fork-lift truck 1 causes the fork-lift truck 1 to perform any of the aspects of the method described above.

[0044] When the above-mentioned computer program code is run in the processor 110 of the fork-lift truck 1 it causes the fork-lift truck 1 to sense the presence/absence of an elongated element 6 comprising a magnetic or ferromagnetic material arranged on the lifting device 4.

[0045] The computer program codes further causes the fork-lift truck 1 to stop an upward movement of the lifting device 4 when sensing the presence of the elongated element 6 in a case where the support arms 5 are in an upright position, or ramp down the speed of the upward movement of the lifting device 4 in a case where the support arms 5 are in a lowered position and stop the movement of the lifting device 4 when the lifting device 4 has moved upwards a predetermined distance wherein the sensor 7 sense the absence of the elongated element 6.

[0046] The present disclosure also relates to a method of modifying a fork-lift truck, with support arms and a mast structure, such that the fork-lift truck is able to provide a constant maximum lifting height independent of the position of the support arms. The method comprising the steps of; providing a lifting device carried by the mast structure and movable along the mast structure with an elongated element comprising a magnetic or ferromagnetic material; providing the mast structure with sensor configured to sense a presence/absence of the elongated element; and providing a computer-readable storage medium in the fork-lift truck with a computer program which, when run in a processor of the fork-lift truck causes the fork-lift truck to perform any of the method as disclosed above.

[0047] Aspects of the disclosure are described with reference to the drawings, e.g., block diagrams and/or flowcharts. It is understood that several entities in the drawings, e.g., blocks of the block diagrams, and also combinations of entities in the drawings, can be implemented by computer program instructions, which instructions can be stored in a computer-readable memory, and also loaded onto a computer or other programmable data processing apparatus. Such computer program instructions can be provided to a processor of a general purpose computer, a special purpose computer and/or other programmable data processing apparatus to produce a machine, such that the instructions, which execute via the processor of the computer and/or other programmable data processing apparatus, create means for implementing the functions/acts specified in the block diagrams and/or flowchart block or blocks.

[0048] In some implementations and according to some aspects of the disclosure, the functions or steps noted in the blocks can occur out of the order noted in the operational illustrations. For example, two blocks shown in succession can in fact be executed substantially concurrently or the blocks can sometimes be executed in the reverse order, depending upon the functionality/acts involved. Also, the functions or steps noted in the blocks can according to some aspects of the disclosure be executed continuously in a loop.

Claims

1. A fork-lift truck (1) with support arms (5) and a mast structure (2), arranged to provide a constant maximum lifting height independent of the position of the support arms (5), wherein said fork-lift truck (1) further comprises:

    - a lifting device (4), carried by the mast structure (2) and movable along the mast structure (2); **characterized by:**
    - an elongated element (6) comprising a magnetic or ferromagnetic material arranged on the lifting device (4);
    - a sensor (7) arranged on the mast structure (2) configured to sense a presence/absence of the elongated element (6); wherein said fork-lift truck (1) is operative to stop an upward movement of the lifting device (4) when the senor (7) sense the presence of the elongated element (6) in a case where the support arms (5) are in an upright position, to provide the constant maximum lifting height, or ramp down the speed of the upward movement of the lifting device (4) in a case where the support arms (5) are in a lowered position and stop the movement of the lifting device (4) when the lifting device (4) has moved upwards a predetermined distance wherein the sensor (7) sense the absence of the elongated element (6), to provide the constant maximum lifting height.

2. A fork-lift truck (1) according to claim 1, wherein the mast structure (2) comprises a first mast element, which carries the lifting device (4) and a second mast element, by which the first mast element is carried and along which the first mast element is movable.

3. A fork-lift truck (1) according to claim 2, wherein the mast structure (2) further comprises a third mast element, by which the second mast element is carried and along which the second mast element is movable.

4. A fork-lift truck (1) according to any of claims 1 to 3, wherein the fork-lift truck (1) is a pedestrian-controlled fork-lift truck with protective side guards, and wherein the fork-lift truck is further arranged to provide the constant maximum lifting height when the protective side guards is in their protective position

5. A fork-lift truck according to any of claims 1 to 4, wherein the constant maximum lifting height is a maximum lifting height according to the International Standard for safety requirements of Industrial trucks.

6. Method of operating a fork-lift truck (1) to provide a constant maximum lifting height independent of the position of support arms 5, wherein the fork-lift truck (1) comprises a lifting device (4), carried by a mast structure (2) and movable along the mast structure (2), the method is **characterized by** the steps of:

    - sensing the presence/absence of an elongated element (6) comprising a magnetic or ferromagnetic material arranged on the lifting device (4);
    - stopping an upward movement of the lifting device (4) when sensing the presence of the elongated element (6) in a case where the support arms (5) are in an upright position, or
    - ramping down the speed of the upward movement of the lifting device (4) in a case where the support arms (5) are in a lowered position and stopping the movement of the lifting device (4) when the lifting device (4) has moved upwards a predetermined distance wherein the sensor (7) sense the absence of the elongated element (6).

7. Method of operating a fork-lift truck (1) according to claim 6, wherein the mast structure (2) comprises a first mast element, which carries the lifting device (4) and a second mast element, by which the first mast element is carried and along which the first mast element is movable.

8. Method of operating a fork-lift truck (1) according to claim 7, wherein the mast structure (2) further comprises a third mast element, by which the second mast element is carried and along which the second mast element is movable.

9. Method of operating a fork-lift truck (1) according to any of claims 6 to 8, wherein the fork-lift truck (1) is a pedestrian-controlled truck with protective side guards, and wherein the constant maximum lifting height is provided when the protective side guards is in their protective position

10. Method of operating a fork-lift truck according to any of claims 6 to 9, wherein the constant maximum lifting height is a maximum lifting height according to the International Standard for safety requirements of Industrial trucks.

11. A computer-readable storage medium, having stored there on a computer program which, when run in a processor of a fork-lift truck (1), causes the fork-lift truck to perform the method as claimed in any of claims 6-10.

12. Method of modifying a fork-lift truck 1, with support arms (5) and a mast structure (2), such that the fork-lift truck (1) is able to provide a constant maximum lifting height independent of the position of the support arms (5), wherein the method comprising the

steps of:

- providing a lifting device (4) carried by the mast structure (2) and movable along the mast structure (2) with an elongated element (6) comprising a magnetic or ferromagnetic material;
- providing the mast structure (2) with a sensor (7) configured to sense a presence/absence of the elongated element (6); and
- providing a computer-readable storage medium in the fork-lift truck with a computer program which, when run in a processor of the fork-lift truck causes the fork-lift truck to perform the method as claimed in any of claims 6-10.

Patentansprüche

1. Gabelstapler (1) mit Stützarmen (5) und einer Maststruktur (2), die so angeordnet ist, dass sie unabhängig von der Position der Stützarme (5) eine konstante maximale Hubhöhe vorsieht, wobei der Gabelstapler (1) ferner aufweist:

- eine Hebeeinrichtung (4), die von der Maststruktur (2) getragen ist und beweglich entlang der Maststruktur (2) ist; **gekennzeichnet durch:**
- ein längliches Element (6), das ein magnetisches oder ferromagnetisches Material aufweist, das an der Hebeeinrichtung (4) angeordnet ist;
- einen Sensor (7), der an der Maststruktur (2) angeordnet ist, der so gestaltet ist, dass er eine Anwesenheit/Abwesenheit des länglichen Elements (6) erkennt; wobei der Gabelstapler (1) betriebsfähig ist, um eine Aufwärtsbewegung der Hebeeinrichtung (4) zu stoppen, wenn der Sensor (7) die Anwesenheit des länglichen Elements (6) in einem Fall erkennt, in dem die Stützarme (5) in einer stehenden Position sind, um die konstante maximale Hubhöhe vorzusehen, oder um die Geschwindigkeit der Aufwärtsbewegung der Hebeeinrichtung (4) in einem Fall, in dem sich die Stützarme (5) in einer abgesenkten Position befinden, zu reduzieren und die Bewegung der Hebeeinrichtung (4) zu stoppen, wenn die Hebeeinrichtung (4) sich um einen vorbestimmten Abstand nach oben bewegt hat, wobei der Sensor (7) die Abwesenheit des länglichen Elements (6) erfasst, um die konstante maximale Hubhöhe vorzusehen.

2. Gabelstapler (1) nach Anspruch 1, wobei die Maststruktur (2) ein erstes Mastelement, das die Hebeeinrichtung (4) trägt und ein zweites Mastelement aufweist, durch welches das erste Mastelement getragen wird und entlang dem das erste Mastelement beweglich ist.

3. Gabelstapler (1) nach Anspruch 2, wobei die Maststruktur (2) ferner ein drittes Mastelement aufweist, durch das das zweite Mastelement getragen wird und entlang dem das zweite Mastelement beweglich ist.

4. Gabelstapler (1) nach einem der Ansprüche 1 bis 3, wobei der Gabelstapler (1) ein handgeführter Gabelstapler mit Seitenschutz ist und wobei der Gabelstapler ferner so angeordnet ist, dass er die konstante maximale Hubhöhe vorsieht, wenn der Seitenschutz in seiner Schutzposition ist

5. Gabelstapler nach einem der Ansprüche 1 bis 4, wobei die konstante maximale Hubhöhe eine maximale Hubhöhe gemäß dem Internationalen Standard für Sicherheitsanforderungen von Flurförderzeugen ist.

6. Verfahren zum Betreiben eines Gabelstaplers (1), um eine konstante maximale Hubhöhe unabhängig von der Position der Stützarme (5) vorzusehen, wobei der Gabelstapler (1) eine Hebeeinrichtung (4) aufweist, die von einer Maststruktur (2) getragen ist und beweglich entlang der Maststruktur (2) ist, wobei das Verfahren durch folgende Schritte **gekennzeichnet ist:**

- Erkennen der Anwesenheit/Abwesenheit eines länglichen Elements (6), das ein magnetisches oder ferromagnetisches Material aufweist, das an der Hebeeinrichtung (4) angeordnet ist;
- Stoppen einer Aufwärtsbewegung der Hebeeinrichtung (4) wenn die Anwesenheit des länglichen Elements (6) erkannt wird, in einem Fall, in dem die Stützarme (5) in einer stehenden Position sind, oder
- Reduzieren der Geschwindigkeit der Aufwärtsbewegung der Hebeeinrichtung (4) in einem Fall, in dem sich die Stützarme (5) in einer abgesenkten Position befinden und Stoppen der Bewegung der Hebeeinrichtung (4) wenn die Hebeeinrichtung (4) sich um einen vorbestimmten Abstand nach oben bewegt hat, wobei der Sensor (7) die Abwesenheit des länglichen Elements (6) erfasst.

7. Verfahren zum Betreiben eines Gabelstaplers (1) nach Anspruch 6, wobei die Maststruktur (2) ein erstes Mastelement aufweist, das die Hebeeinrichtung (4) trägt und ein zweites Mastelement, durch welches der erste Mastelement getragen ist und entlang dem das erste Mastelement beweglich ist.

8. Verfahren zum Betreiben eines Gabelstaplers (1) nach Anspruch 7, wobei die Maststruktur (2) ferner ein drittes Mastelement umfasst, durch welches das zweite Mastelement getragen ist und entlang dem das zweite Mastelement beweglich ist.

9. Verfahren zum Betreiben eines Gabelstaplers (1) nach einem der Ansprüche 6 bis 8, wobei der Gabelstapler (1) ein handgeführter Gabelstapler mit Seitenschutz ist und wobei die konstante maximale Hubhöhe vorgesehen ist, wenn der Seitenschutz in seiner Schutzposition ist

10. Verfahren zum Betreiben eines Gabelstaplers nach einem der Ansprüche 6 bis 9, wobei die konstante maximale Hubhöhe eine maximale Hubhöhe gemäß dem Internationalen Standard für Sicherheitsanforderungen von Flurförderzeugen ist.

11. Computerlesbares Speichermedium, das darauf ein Computerprogramm gespeichert hat, das, wenn es in einem Prozessor eines Gabelstaplers (1) ausgeführt wird, den Gabelstapler veranlasst, das Verfahren nach einem der Ansprüche 6 bis 10 auszuführen.

12. Verfahren zum Modifizieren eines Gabelstaplers 1 mit Stützarmen (5) und einer Maststruktur (2), so dass der Gabelstapler (1) in der Lage ist, eine konstante maximale Hubhöhe unabhängig von der Position der Stützarme (5) vorzusehen, wobei das Verfahren die folgenden Schritte umfasst:

- Vorsehen einer Hebeeinrichtung (4), die von der Maststruktur (2) getragen ist und beweglich entlang der Maststruktur (2) ist, mit einem länglichen Element (6), das ein magnetisches oder ferromagnetisches Material aufweist;
- Vorsehen der Maststruktur (2) mit einem Sensor (7), der so gestaltet ist, dass er eine Anwesenheit/Abwesenheit des länglichen Elements (6) erfasst; und
- Vorsehen eines computerlesbaren Speichermediums in dem Gabelstapler mit einem Computerprogramm, das, wenn es in einem Prozessor des Gabelstaplers ausgeführt wird, den Gabelstapler veranlasst, das Verfahren nach einem der Ansprüche 6 bis 10 auszuführen.

Revendications

1. Chariot élévateur à fourche (1) avec des bras de support (5) et une structure de mât (2), agencée pour fournir une hauteur de levage maximum constante indépendante de la position des bras de support (5), dans lequel ledit chariot élévateur à fourche (1) comprend en outre :

un dispositif de levage (4), porté par la structure de mât (2) et mobile le long de la structure de mât (2) ; **caractérisé par** :

un élément allongé (6) comprenant un matériau magnétique ou ferromagnétique agencé sur le dispositif de levage (4) ;
un capteur (7) agencé sur la structure de mât (2) configurée pour détecter une présence / absence de l'élément allongé (6) ;
dans lequel ledit chariot élévateur à fourche (1) est opérationnel pour arrêter un mouvement ascendant du dispositif de levage (4) lorsque le capteur (7) détecte la présence de l'élément allongé (6) dans le cas dans lequel les bras de support (5) sont dans la position droite, pour fournir la hauteur de levage maximum constante, ou abaisser la vitesse du mouvement ascendant du dispositif de levage (4) dans le cas dans lequel les bras de levage (5) sont dans une position abaissée et arrêter le mouvement du dispositif de levage (4) lorsque le dispositif de levage (4) s'est déplacé vers le haut sur une distance prédéterminée, dans lequel le capteur (7) détecte l'absence de l'élément allongé (6), pour fournir la hauteur de levage maximum constante.

2. Chariot élévateur à fourche (1) selon la revendication 1, dans lequel la structure de mât (2) comprend un premier élément de mât, qui porte le dispositif de levage (4) et un deuxième élément de mât, grâce auquel le premier élément de mât est porté et le long duquel le premier élément de mât est mobile.

3. Chariot élévateur à fourche (1) selon la revendication 2, dans lequel la structure de mât (2) comprend en outre un troisième élément de mât, grâce auquel le deuxième élément de mât est porté et le long duquel le deuxième élément de mât est mobile.

4. Chariot élévateur à fourche (1) selon l'une quelconque des revendications 1 à 3, dans lequel le chariot élévateur à fourche (1) est un chariot élévateur à fourche commandé par une personne à pied avec des protections latérales, et dans lequel le chariot élévateur à fourche est en outre agencé pour fournir la hauteur de levage maximum constante lorsque les protections latérales sont dans leur position de protection.

5. Chariot élévateur à fourche (1) selon l'une quelconque des revendications 1 à 4, dans lequel la hauteur de levage maximum constante est une hauteur de levage maximum selon la norme internationale de sécurité des chariots industriels.

6. Procédé pour actionner un chariot élévateur à fourche (1) afin de fournir une hauteur de levage maximum constante indépendante de la position des bras de support (5), dans lequel le chariot élévateur à fourche (1) comprend un dispositif de levage (4), porté par une structure de mât (2) et mobile le long de la structure de mât (2), le procédé est **caractérisé par** les étapes consistant à :

détecter la présence / absence d'un élément allongé (6) comprenant un matériau magnétique ou ferromagnétique agencé sur le dispositif de levage (4) ;
arrêter un mouvement ascendant du dispositif de levage (4) lors de la détection de la présence de l'élément allongé (6), dans le cas dans lequel les bras de support (5) sont dans une position droite, ou bien
réduire la vitesse du mouvement ascendant du dispositif de levage (4) dans le cas dans lequel les bras de support (5) sont dans une position abaissée et arrêter le mouvement du dispositif de levage (4) lorsque le dispositif de levage (4) s'est déplacé vers le haut sur une distance prédéterminée, dans lequel le capteur (7) détecte l'absence de l'élément allongé (6).

7. Procédé pour actionner un chariot élévateur à fourche (1) selon la revendication 6, dans lequel la structure de mât (2) comprend un premier élément de mât, qui supporte le dispositif de levage (4) et un deuxième élément de mât, grâce auquel le premier élément de mât est porté et le long duquel le premier élément de mât est mobile.

8. Procédé pour actionner un chariot élévateur à fourche (1) selon la revendication 7, dans lequel la structure de mât (2) comprend en outre un troisième élément de mât, grâce auquel le deuxième élément de mât est porté et le long duquel le deuxième élément de mât est mobile.

9. Procédé pour actionner un chariot élévateur à fourche (1) selon l'une quelconque des revendications 6 à 8, dans lequel le chariot élévateur à fourche (1) est un chariot commandé par une personne à pied avec des protections latérales, et dans lequel la hauteur de levage maximum constante est fournie lorsque les protections latérales sont dans leur position de protection.

10. Procédé pour actionner un chariot élévateur à fourche selon l'une quelconque des revendications 6 à 9, dans lequel la hauteur de levage maximum constante est une hauteur de levage maximum selon la norme internationale de sécurité des chariots industriels.

11. Milieu de stockage lisible par ordinateur ayant, stocké sur ce dernier, un programme informatique qui, lorsqu'il fonctionne avec un processeur du chariot élévateur à fourche (1), amène le chariot élévateur à fourche à réaliser le procédé selon l'une quelconque des revendications 6 à 10.

12. Procédé pour modifier un chariot élévateur à fourche (1), avec des bras de support (5) et une structure de mât (2), de sorte que le chariot élévateur à fourche (1) peut fournir une hauteur de levage maximum constante indépendante de la position des bras de support (5), dans lequel le procédé comprend les étapes consistant à :

prévoir un dispositif de levage (4) porté par la structure de mât (2) et mobile le long de la structure de mât (2) avec un élément allongé (6) comprenant un matériau magnétique ou ferromagnétique ;
prévoir la structure de mât (2) avec un capteur (7) configuré pour détecter une présence / absence de l'élément allongé (6) ; et
prévoir un milieu de stockage lisible par ordinateur dans le chariot élévateur à fourche avec un programme informatique qui, lorsqu'il fonctionne avec un processeur du chariot élévateur à fourche, amène le chariot élévateur à fourche à réaliser le procédé selon l'une quelconque des revendications 6 à 10.

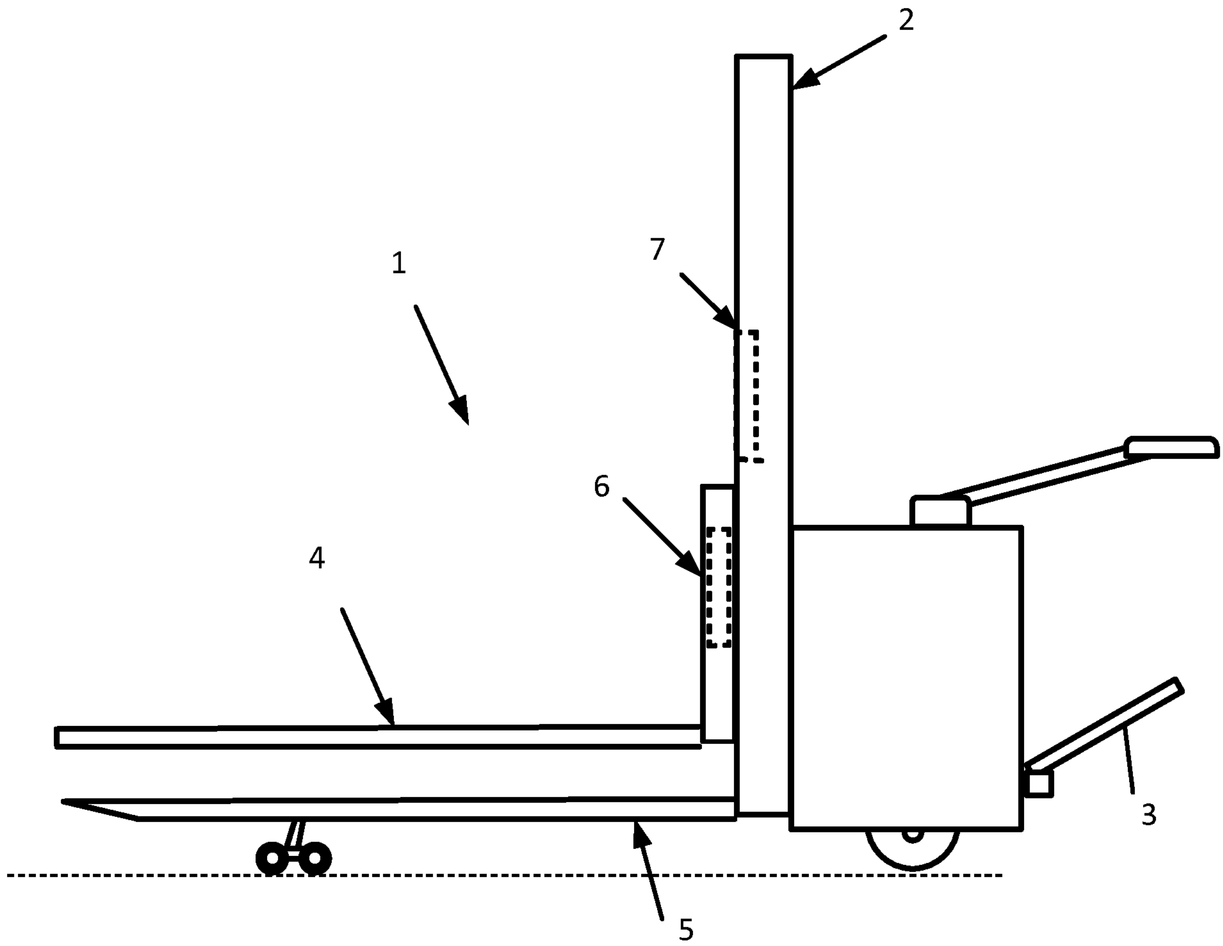

Figure 1

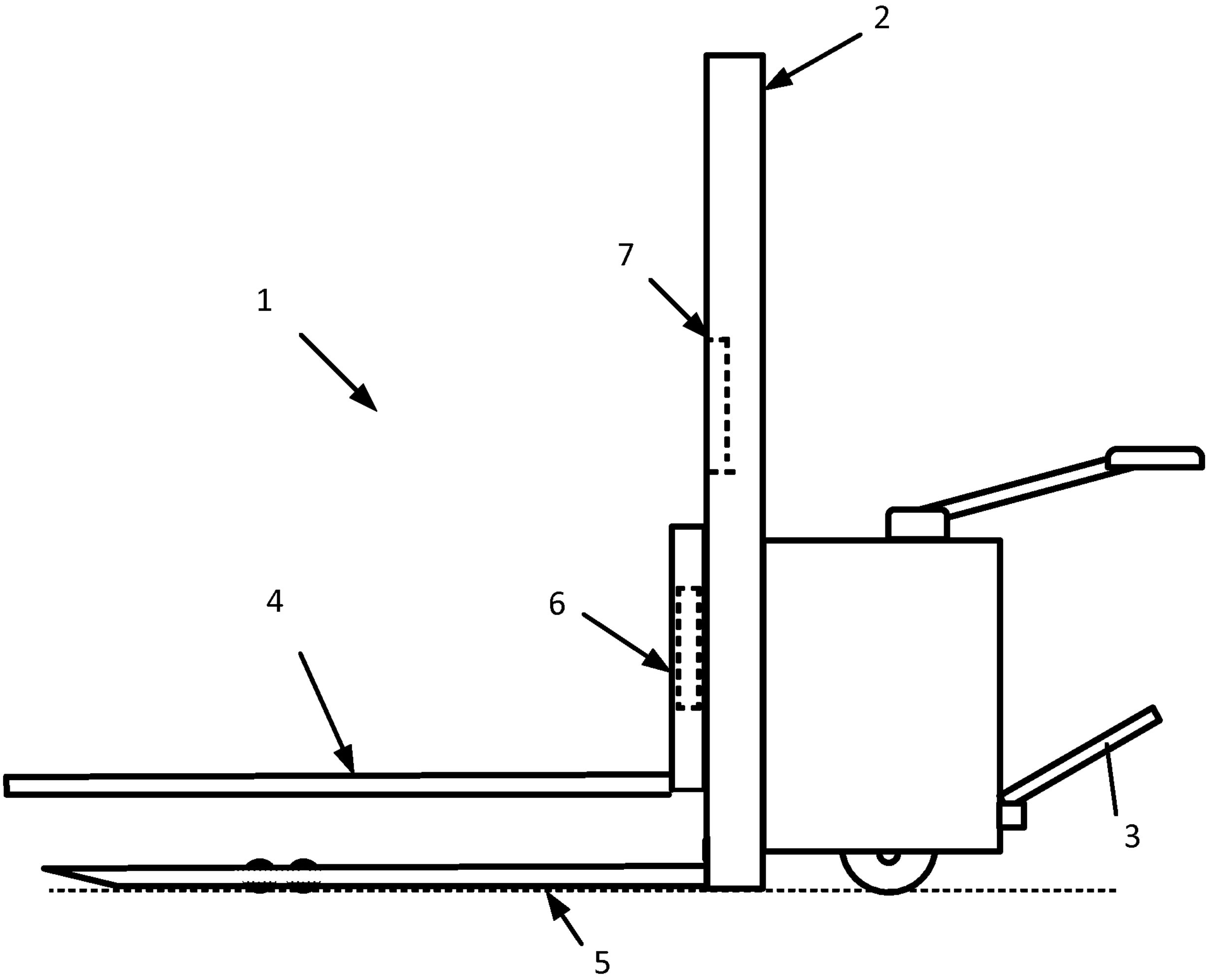

Figure 2

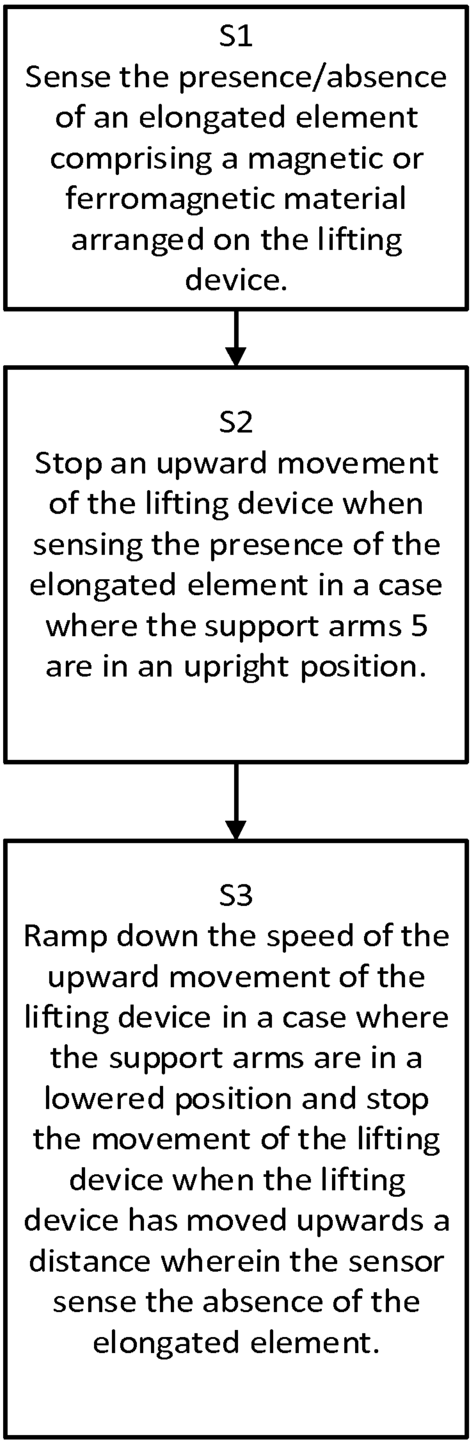
S1
Sense the presence/absence of an elongated element comprising a magnetic or ferromagnetic material arranged on the lifting device.
S2
Stop an upward movement of the lifting device when sensing the presence of the elongated element in a case where the support arms 5 are in an upright position.
S3
Ramp down the speed of the upward movement of the lifting device in a case where the support arms are in a lowered position and stop the movement of the lifting device when the lifting device has moved upwards a distance wherein the sensor sense the absence of the elongated element.

Figure 3

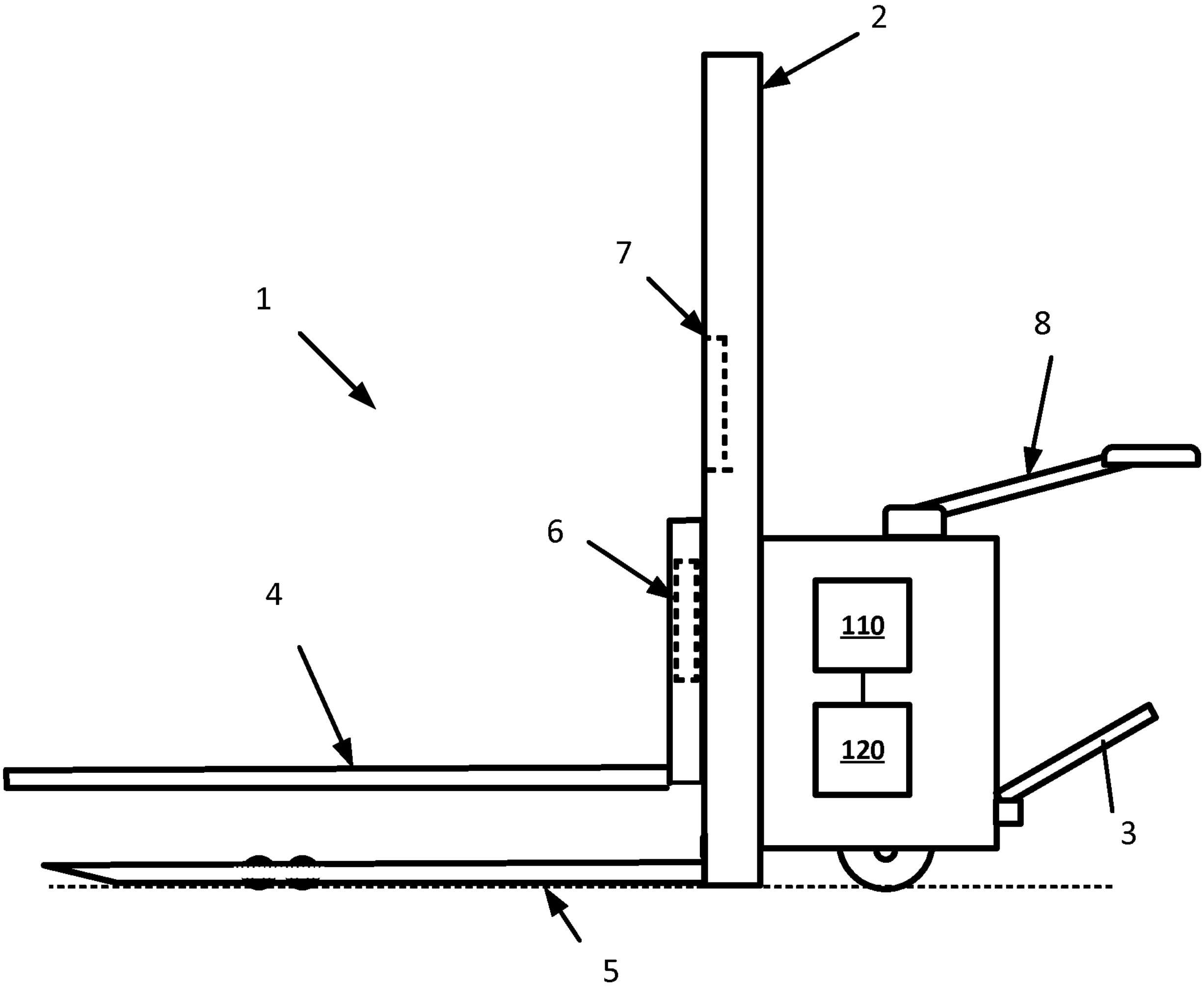

Figure 4

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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