(19) Europäisches Patentamt
European Patent Office
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(11) **EP 2 650 251 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
16.10.2013 Bulletin 2013/42

(51) Int Cl.:
B66F 9/075 *(2006.01)*

(21) Application number: **12164152.6**

(22) Date of filing: **13.04.2012**

(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

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(54) **Forklift truck**

(57) Forklift truck 1,1', comprising power consuming units to be supplied from an energy source, comprising a holding device 2 provided with compartments 3 for receiving at least two battery elements 10 for providing said energy source, wherein said holding device 2 is adapted such that a received battery element 10 can power said forklift truck 1, 1' on its own, wherein the said holding device 2 is arranged to receive a battery element 10 in a horizontal arrangement such that the applied weight of a received battery is essentially on the centre of a longitudinal symmetry axis 30 of the forklift truck 1,1'. The invention also relates to a battery element 10 and a weight (20).

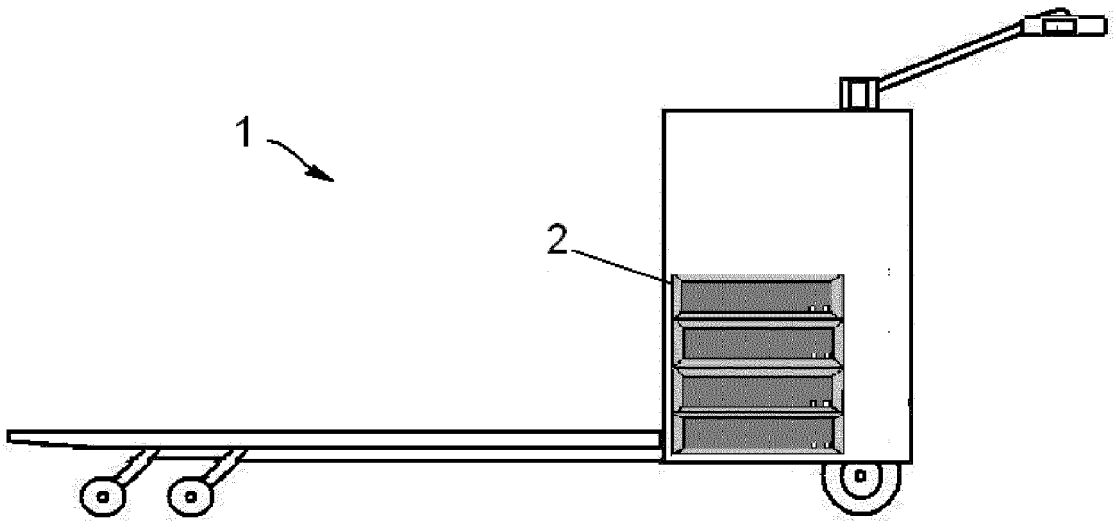

Fig. 1

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Description

[0001] The present invention relates to a forklift truck comprising, power consuming units to be supplied from an energy source, a holding device provided with compartments for receiving at least two battery elements for providing said energy source, wherein said holding device is adapted such that a received battery element can power said forklift truck on its own. The invention also relates to a battery element and a weight for the fork lift truck.

PRIOR ART

[0002] A battery module system for a floor conveyor is known from the document EP 2 261 167 A1. This document describes a floor conveyor having a device for receiving several battery units which each can provide the floor conveyor with electrical power. The presented floor conveyor has battery packs in the size of 35 Ah per battery pack. The floor conveyor of the document is presented as a low lifting floor conveyor

SHORT DESCRIPTION OF THE INVENTION

[0003] The object of the present invention is to improve arrangement of batteries suggested in the prior art such that it is more flexible and can be used for forklift trucks in any size and such that the forklift trucks using such a system can be easily adapted to different sizes of loads and/or load lifting heights.

[0004] This object is achieved by arranging a fork lift truck comprising, power consuming units to be supplied from an energy source, a holding device provided with compartments for receiving at least two battery elements for providing said energy source, wherein said holding device is adapted such that a received battery element can power said forklift truck on its own, wherein the said holding device is arranged to be able to receive a battery element in a horizontal arrangement such that the applied weight of a received battery element is essentially on the centre of a longitudinal symmetry axis of the forklift truck.

[0005] The advantage of this fork lift truck is that the centre of gravity is not affected with regard to its horizontal position in particular in the transversal direction of the fork lift truck when a battery element is inserted. Thus the properties for example of turning are not affected if the weight of a used battery element differs from another battery element that has been used or will be used. Another advantage is that the battery element can be made larger as a horizontal receiving of the battery element, allows displacement of the battery by an operator without needing to lift the battery element during the displacement in the holding device. According to a further development of the forklift truck the holding device is arranged such that a first and a second battery element that are received in the holding device are arranged essentially on top of each other such that the position of the forklift truck's centre of gravity remains unchanged with regard to a longitudinal symmetry axis of said truck.

[0006] This is particularly advantageous if battery elements are used in parallel in the said fork lift truck. Thus an operator can ad several battery elements without risking altering the horizontal position of the centre of gravity. This is also an advantage if two battery elements of different weight are used at the same time in the holding device.

[0007] According to a further development the said holding device is arranged such that it can accommodate a weight.

[0008] By arranging the holding device, such that a weight can be accommodated the industrial truck can be arranged such that higher lifting heights can allowed, thus the lift height properties of the fork lift truck can for example be altered easily allowing for using many components in common for a low lifting fork lift truck and a fork lift stacker.

[0009] According to a further development, in a forklift truck according to the above the said holding device is arranged such that a received weight results in that the position of the forklift truck's centre of gravity remains unchanged with regard to a transversal direction to the longitudinal symmetry axis of said truck.

[0010] The advantage of this is that the stability in the transversal direction is unchanged. This means that the weight can be considerably heavier than the battery elements to be received in the holding device without that the stability is jeopardized.

[0011] According to a further development according to the above said holding device is arranged such that a received weight can be fixedly arranged in the forklift truck.

[0012] This arrangement has the advantage that the operator cannot easily himself remove the said weight, for example in a desire to ad an even further battery element, thus altering unintentionally the properties of the said fork lift truck.

[0013] In a further development the holding device comprises transport means for facilitating horizontal displacement of a battery element within said holding device, preferably in the form of wheels, and/or rolls and/or a slide track.

[0014] This has the advantage that it facilitates the removal and insertion of a battery element. This is particularly important if the battery element is heavy. It also improves the security for the operator as he handles the battery element as the friction is lowered he can easier control the movement and prevent the battery from being needed to be actuated upon with excessive forces that could result in that the battery element drops out of the holding device unintentionally.

[0015] The invention also deals with the battery elements to be used in the mentioned forklift truck.

[0016] In particular these battery elements must allow a horizontal handling in the holding device.

[0017] The battery element preferably has a weight/Ah

ratio that is lower, than 2. This is particularly advantages with the above invention as the batteries can accommodate more energy. A type of battery elements having these characteristics are Lithium technology batteries. These types of batteries have the advantage that they are light and don't evaporate gases during charging. Nor do they need to be discharged before they can be charged, they don't have a memory in that respect.

[0018] According to a further development the battery element comprises means for transportation preferably in the form of at least one wheel, and/or roll and/or low friction surface.

[0019] By adding means for transportation to the battery element the handling of the battery element with in the holding device is further improve.

[0020] It is also possible to provide the battery element with a handle.

[0021] According to the invention is also provided a weight for a forklift truck according to the above. The weight is arranged such that it can be received in said holding device.

[0022] The invention will be further understood by the accompanying drawings.

LIST OF DRAWINGS

[0023]

Fig. 1 discloses a forklift truck of low lifting type according to the invention.

Fig. 2 discloses a forklift truck according to Fig. 1 from above.

Fig. 3 discloses a forklift truck of reach type according to the invention

Fig. 4 discloses a holding device comprising three occupied compartments of a forklift truck according to the invention.

Fig. 5 discloses a holding device according to fig 3, but where the compartments are empty.

Fig. 6 discloses a battery element for use in the holding device of Fig. 3 and Fig 4.

Fig. 7 discloses a holding device for a truck according to the invention comprising fastening means for fixing a weight.

Fig. 8 discloses a weight for use in a holding device according to Fig. 6.

DETAILED DESCRIPTION

[0024] Fig.1 discloses a low lifting forklift truck 1 comprising a holding device 2. The holding device 2 is arranged such that it can receive one or several battery elements 10, as shown in fig. 4. The holding device 2 is as can be seen in the drawings arranged such that a battery element 10 can be inserted horizontally. The disclosed holding device 2 has four compartments 3 for receiving battery elements 10. The compartments 3 are designed such that a battery element 10 can be slid into each compartment 3. The design of this is performed in a know manner to the person skilled in the art. The compartment 3 is preferably performed as having a floor and a bottom and side walls. Thus a battery element 10 inserted in the compartment 3 can reside with its full bottom surface on the bottom of the respective compartment 3. However it is of course thinkable to arrange rails on each side wall on which a battery element 10 can reside. Even though the holding device 2 is disclosed as having four compartments, any number of compartments is thinkable. As can be understood from the description below the compartments 3 can also hold a weight 20. The exemplified fork lift truck 1 is shown with compartments 3 empty. In use the fork lift truck 1 should be provided with at least one battery element 10.

[0025] At the far end of each compartment 3 there are disclosed electrical connections 4 for each battery element 10. Even though the electrical connections 4 is disclosed as being at the far end of each compartment 3 it is thinkable that the electrical connections 4 is arranged in any suitable way such that a good connection to a received battery element 10 is achieved. The advantage of the connection 4 in the far end is that the battery element 10 is easily connected and the compartment perimeter aids in positioning the battery element 10 for a correct connection. It is possible to arrange a connection that uses a cable connection that can be attached once the battery element 10 has been inserted, in particular using a gasket. The advantage of this is that it is easier to disconnect a faulty battery element 10 during operation, or if the operator desires to transport the battery element 10 to another place of the work place for transfer to another forklift truck 1, 1', he need not connect it.

[0026] The holding device 2 can in each compartment be provided with transport means in the form of wheels, rolls, or a low friction surface. These can be applied to the floor, and or walls. The Transport means can be arranged such that they can interact with transport means 13 of inserted battery elements 10.

[0027] Fig. 7 discloses a holding device 2 which is provided with fastening means 5, 6. These fastening means 5, 6 is in the form of an opening 5 and a pin 6. The pin 6 is arranged to be able to be received by in particular a weight 20 according to fig. 8. The weight 20 has in turn an opening 21, in the form of a boring, for receiving the pin 6. Thus a weight 20 can be fixedly arranged in the compartment 3 provided with the fastening means 5, 6. As the weight 20 is provided in the fork lift truck 1, 1' for changing the properties of the fork lift truck 1, 1', an operator should not easily be able to remove the weight 20. The fastening means 5, 6 is only exemplified, and could

be constituted by any other fastening means. In particular the compartment 3 could be provided with a hatch that closes the compartment. The hatch could in turn be provided with a lock, for example a key lock that needs a key to be opened. Thus the control of removal of the weight 20 could be controlled for example by the manufacturer of the fork lift truck 1, 1'. The discussed fastening means is also applicable to the battery elements 10. In particular it should be understood that battery elements 10 received in the compartments are locked in place such that the battery elements 10 cannot be displaced unless desired by the operator. If the compartments are provided with hatches the hatch for the compartments 3 that are intended for receiving battery elements 10 should have different lock and key. Thus the operator could be provided with a key that can be used to open the battery element 10 compartment hatches such that battery elements 10 can be handled by an operator and the weight 20 can only be operated by for example a service person or the manufacturer of the fork lift truck 1, 1'. It should be understood that also battery elements 10 could be fixedly arranged in the holding device by similar attachment means as described above together with the weight 20.

[0028] Although charging of the battery element 10 can be performed when removed from the forklift truck 1, the holding device 2 can allow charging of battery elements 10 in the holding device 2. The holding device 2 could for this reason be adapted with needed electrical couplings etc.

[0029] In Fig. 3 a fork lift truck 1' of comprising a holding device 2 is disclosed. This fork lift truck 1' is of the reach truck type. This fork lift truck 1' is intended for lifting loads high above the floor level. As it can be provided with different types of masts the alteration of the stability properties or the centre of gravity is of importance. Thus the holding device 2 can be provided with more than one weight 20. In the disclosed example of Fig.3 there could as seen for example be fitted two weights 20, that can be fastened by fastening means provided in the compartments 3. One should understand that it in theory would be possible to fill all compartments 3 with weights 20. However this would of course leave the fork lift truck 1' without energy source and thus would be of little or no interest for the normal operation of the fork lift truck 1'. It is preferred that the weights are positioned in the holding device 2 from bottom up such that the center of gravity is kept as low as possible.

[0030] As described above in connection with Fig. 3 the same is applicable to most fork lift trucks, in particular to the fork lift truck 1 of Fig. 1 -2. Thus also the forklift truck 1 of Fig. 1 can have a desirable number of weights 20 applied to it should it be desirable. In particular for a tiller arm truck of Fig. 1 when designed with a mast for stacker purposes, a different number of weights 20 would be desirable than for a low lifting fork lift truck 1 as the one disclosed in Fig. 1-2.

[0031] It should be understood for all embodiments above, that an industrial truck can be provided with and without a weight 20. Thus a weight 20 is not mandatory. At least one battery element 10 is still necessary for normal operation of the fork lift truck 1, 1'.

[0032] Fig 6 discloses a battery element 10 for use in the described fork lift truck 1, 1', as exemplified in Fig. 1 and Fig. 3. The battery element is provided with a handle 11 for handling and transport of the battery element 10. The battery element 10 is of the voltage and capacity such that it can on its own power the fork lift truck 1, 1' that it is used in. The battery element 10 further comprises electrical contacts 12 for connection with the contacts 4 of the respective compartment 3. As mentioned above the contacts 12 could be altered to any suitable connection device, in particular as mentioned a cable connection device using a gasket for connection of the battery element 10 with the electrical system of the fork lift truck 1, 1'.

[0033] The battery element 10 of Fig. 6 is also provided with transport means in the form of a pair of wheels 13 at one end of the battery element 10. The wheels 13 facilitates the pushing and dragging of the battery element 10 in the compartment 3. The wheels 13 could be replaced by rolls or a low friction surface. The position of the transport means is not to be understood as being only possible in the corner of the battery element 10. The transport means can be positioned in essentially any suitable position of the battery element 10. It should also be possible to arrange the battery element 10 without any transport means. In this case it is preferred that each compartment 3 is provided with transport means.

[0034] The battery element 10 is preferably a battery element that has a weight/Ah ratio that is lower than 2. The battery element 10 should be based on technology that doesn't evaporate gases during charging. The preferred battery type is Lithium technology batteries. These types of battery elements fulfil the weight/Ah requirement. With Lithium technology should be understood any battery based on Lithium, such as Lithium Ion, Lithium Polymer batteries, and Lithium combined with other chemical elements such as Phosphor or even Li-air. These types of batteries are advantageous in that they have low or non existing charging memory and thus need not be fully discharged before charging can be begun again. However other battery types are thinkable for use as battery elements 10 in the holding device 2, such as Ni-MH-, Ni-Cd-, NaNiCI-technology based battery elements 10.

[0035] For the described fork lift trucks 1, 1' above it should also be understood that batteries of different type could be applied to the compartments 3 should this be desired. However it should be understood that it is necessary that the different types of battery elements 10 have essentially the same Voltage output.

[0036] Fig. 8 discloses a weight 20 for use in the holding device 2. The weight 20 in particular has a lifting device 22, which should be arranged to be able to receive a lifting device 22 such as an overhead crane. And as mentioned the weight 20 can comprise means 21 in the form of a boring for receiving a fastening pin 6, for fixedly

arranging the weight 20. The weight can however be arranged for any conventional fastening in the holding device 2 of the fork lift truck 1, 1'. The weight 20 could also be provided with transport means as the battery elements 10. However generally this is not needed as the weight 20 is installed when manufacturing the fork lift truck 1, 1'.

[0037] For all embodiments above it should be understood that the centre of gravity 31 of the fork lift truck 1, 1' is essentially not displaced horizontally, when battery elements 10 or weights 20 are provided in the holding device 2. In particular the transversal position of the centre of gravity 31 is maintained on the centre axis 30. However it should be understood that the vertical position of the centre of gravity 31 will of course be altered if weights 20 or battery elements 10 is added or removed from the holding device 2. As mentioned above weights are preferably positioned from the bottom up, where as battery elements 10 of light type, such as the Lithium technology batteries can be allowed to be positioned a little more freely as they impact the centre of gravity 31 less than the weights 20. Thus with a Lithium technology battery element it is possible to take away a battery element 10 for charging even though it is positioned above a remaining battery element 10. And as battery elements 10 will be received on each other and on a received weight in the holding device 2, the centre of gravity is not altered in the transversal direction. This is of course valid for any sort of battery element of low weight, not only lithium technology batteries should other light batteries be available.

[0038] The holding device 2 as described above could also house a charging device in one of the compartments 3. Thus charging could be facilitated and the charging device could be removed if not needed. The charging device should have essentially the same dimensions as the battery elements 10 or weights 20, such that the usual compartments 3 could be used.

[0039] It would also be possible to house other equipment in an empty compartment 3. For example it is thinkable to house computer equipment, for example for providing the fork lift trucks 1, 1' with capability of unmanned operation, or a control unit for RTLS systems, i.e. Real Time Location System.

[0040] The usage of the forklifts trucks 1, 1' as disclosed above could be described as follows.

[0041] The user removes the battery element 10 at a charging station. He transports the battery element 10 to the fork lift truck 1, 1' to be used. He then installs the battery element 10 in the holding device 2 of the fork lift truck 1, 1' that he intends to use. The battery element 10 is locked in place by the operator. He can then operate the fork lift truck 1, 1' supplied from the battery element 10. When he has finished operating the fork lift truck 1, 1' he can remove the battery element 10 and position it at a charging station. Another operator can then after sufficient charging use the same battery element 10 in another forklift truck 1, 1'.

[0042] A company operating fork lift trucks 1, 1' can order a fork lift truck with different capacities, in terms of operating time, lifting heights etc. The fork lift manufacturer or service company, then ads or removes the number of weights 20 that is needed for the particular specification.

Claims

1. Forklift truck (1, 1') comprising, power consuming units to be supplied from an energy source, a holding device (2) provided with compartments (3) for receiving at least two battery elements (10) for providing said energy source, wherein said holding device (2) is adapted such that a received battery element (10) can power said forklift truck (1, 1') on its own, **characterized in that** the said holding device (2) is arranged to receive a battery element (10) in a horizontal arrangement such that the applied weight of a received battery element (10) is essentially on the centre of a longitudinal symmetry axis (30) of the forklift truck (1, 1').

2. Forklift truck (1, 1') according to claim 1, **characterized in that** the holding device (2) is arranged such that a first and a second battery element (10) that are received in the holding device (2) are arranged essentially on top of each other such that the position of the forklift truck's (1, 1') centre of gravity (31) remains unchanged with regard to the longitudinal symmetry axis (30) of said truck (1, 1').

3. Forklift truck (1, 1') according to claim 1 or 2, **characterized in that** the said holding device (2) is arranged such that it can accommodate a weight (20).

4. Forklift truck (1, 1') according to claim 3, **characterized in that** the said holding device (2) is arranged such that a received weight (20) results **in that** the position of the forklift truck (1, 1')'s centre of gravity (31) remains unchanged with regard to a transversal direction from the longitudinal symmetry axis (30) of said truck (1, 1').

5. Forklift truck (1, 1') according to any of the claims 3 - 4, **characterized in that** said holding device (2) is arranged such that a received weight (20) can be fixedly arranged in the forklift truck (1, 1').

6. Forklift truck (1, 1') according to any of the claims above, **characterized in that** the holding device (2) comprises transport means for facilitating horizontal displacement of a battery element (10) within said holding device (2), preferably in the form of wheels, and/or rolls and/or a slide track.

7. Battery element (10) for use in a forklift truck (1, 1') according to any of the claims above.

8. Battery element (10) according to claim 7, wherein the battery element (10) has a weight/Ah ratio that is lower than 2.

9. Battery element (10) according to claim 8, wherein the battery element (10) is a Lithium technology battery.

10. Battery element (10) according to any of the claims 7 - 9, **characterized in that** said battery element (10) comprises means for transportation (13) preferably in the form of at least one wheel (13), and/or roll and/or low friction surface.

11. Battery element (10) according to any of the claims 7-10, **characterized in that** said battery element (10) comprises a handle that allows the battery element (10) to be inserted into said holding device (2).

12. Weight (20) for a forklift truck (1, 1') according to any of the claims 1 -6, **characterized in that** it is arranged such that it can be received in said holding device (2) in order to change the characteristics of a forklift truck (1, 1') carrying said weight (20).

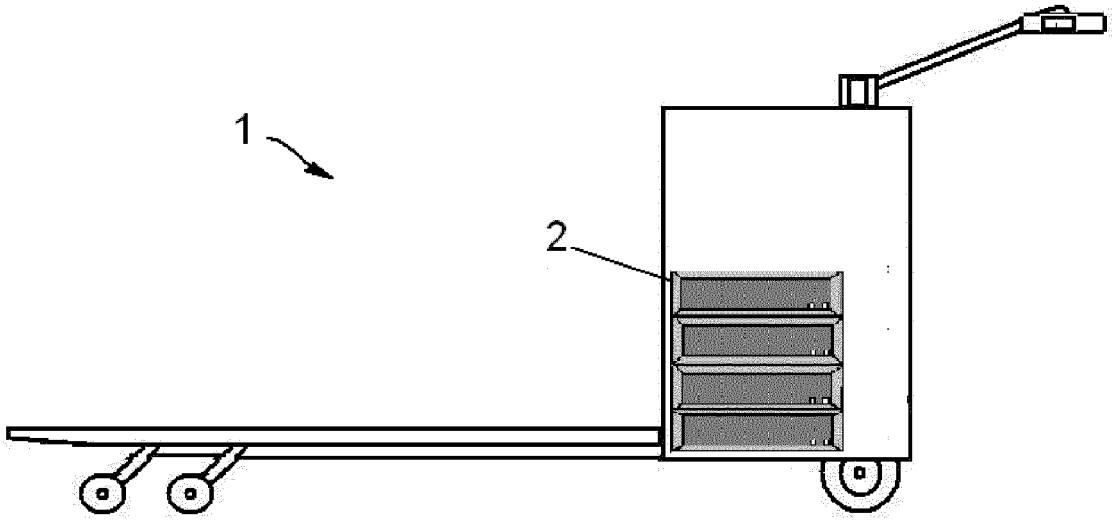

Fig. 1

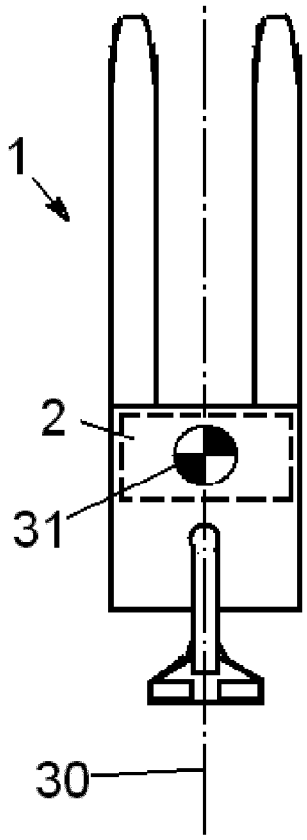

Fig. 2

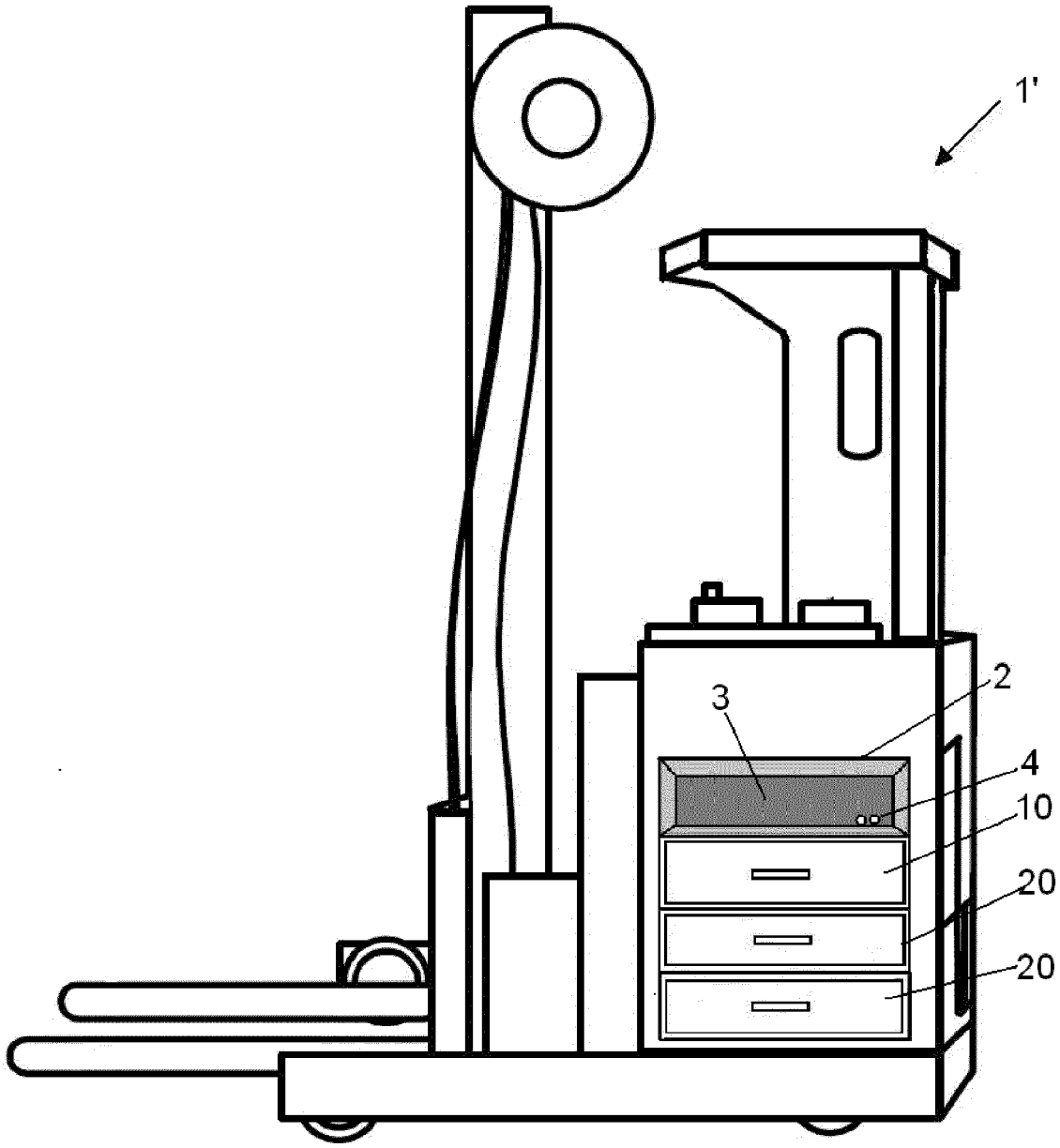

Fig. 3

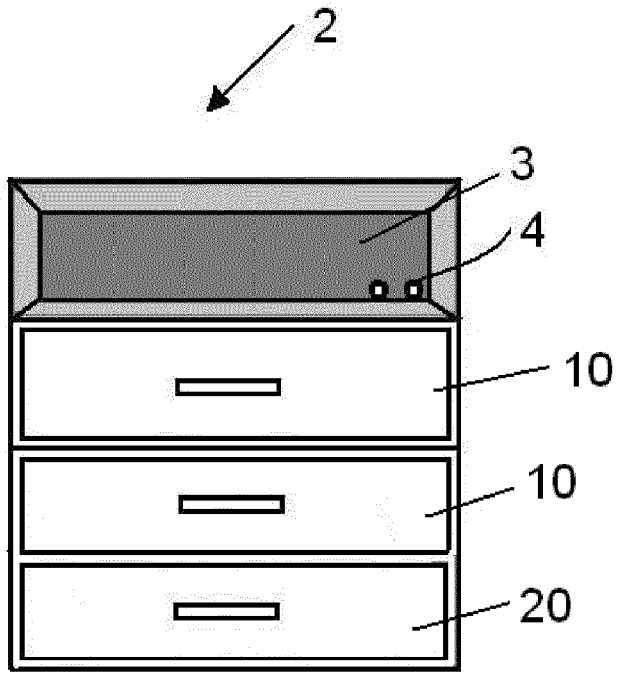

Fig. 4

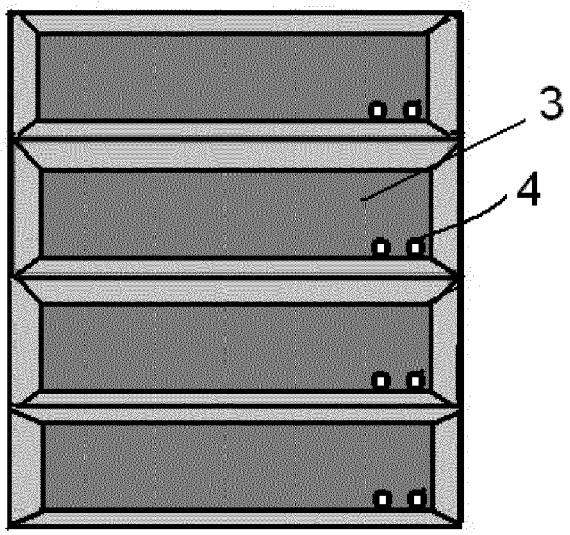

Fig. 5

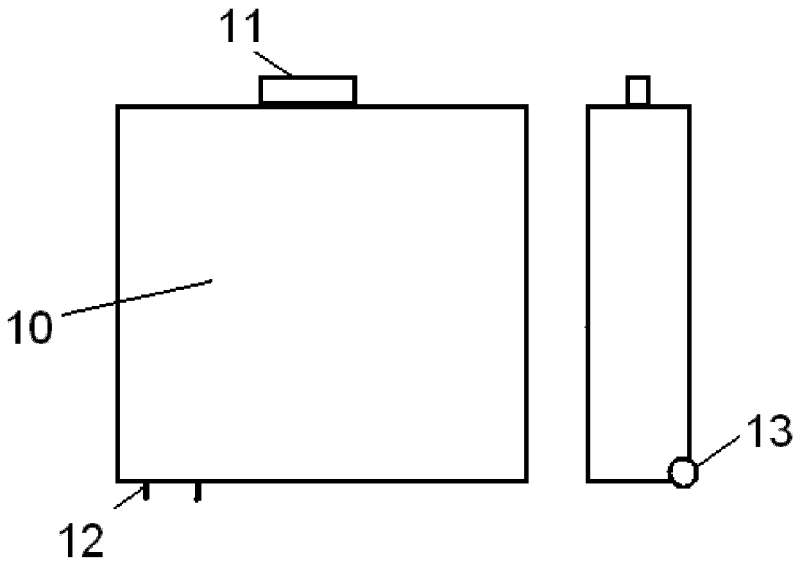

Fig. 6

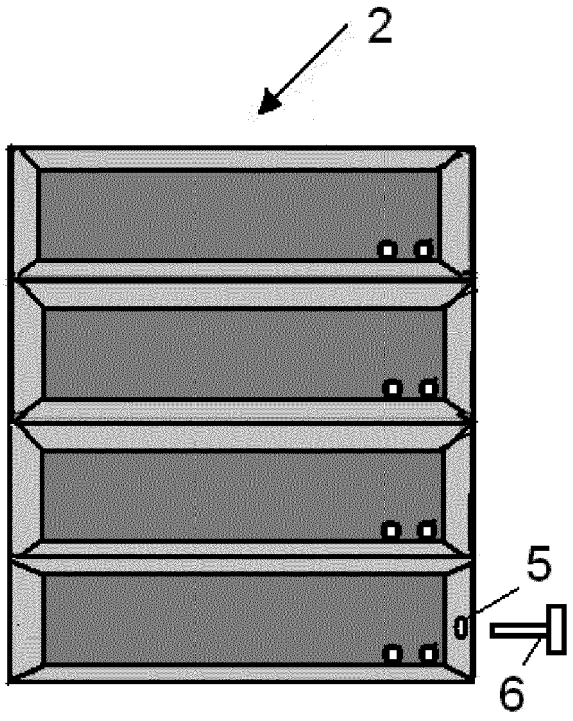

Fig 7

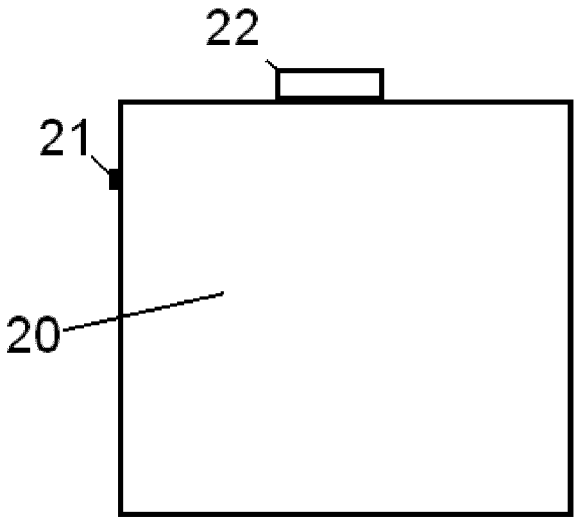

Fig. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 12 16 4152

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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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	12 September 2012	Verheul, Omiros

CATEGORY OF CITED DOCUMENTS

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12-09-2012

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

REFERENCES CITED IN THE DESCRIPTION

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