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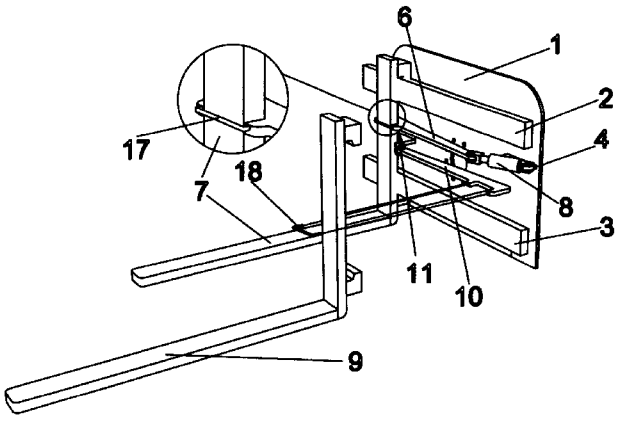

Fig. 2

(57) Abstract: A cargo box block arrangement for forklift truck, with forklift means, comprising forklift means (1-3,7,9) provided with fork arms (7,9), adapted to be engaged with a cargo box (12) for its lifting and lowering, gripping means associated to forklift means (1-3,7,9) for locking the cargo box (12) to said fork arms (7,9). The invention is characterized in that the gripping means comprise spreading out means (4-6,8,10,11, 17,18) associated with said forklift means (1-3,7,9) for gripping the fork arms (7.9) to perimetral elements (13,14) of the cargo box (12).

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CARGO BOX BLOCK ARRANGEMENT FOR FORKLIFT TRUCK WITH FORKLIFT MEANS AND RELATED FORKLIFT TRUCK

DESCRIPTION

This invention concerns a cargo box block arrangement for forklift truck, of a typology that employs forklift means, as well as a forklift truck provided with the related cargo box block arrangement.

Main application field of this invention is agricultural machinery. In this field, lift trucks provided with forklift means, more easily called forklift trucks, are generally used for loading and unloading cargo boxes containing agricultural products, such as olives or tomatoes.

Notwithstanding, the invention may be applied to other technique fields where the use of cargo boxes has the same handling and tipping necessities.

In the field of agriculture, employing of cargo boxes for agricultural products of a pallet type or pallet cargo box, i.e. with a base structured as pallet, became ever more functional and used. Such cargo boxes are very large and, above all, easily movable by forklift trucks. These forklift truck can easily move a cargo box by forking it down-top, and load it on a truck, for example, for transport to the next destination.

In the prior art there are different accessories for forklift trucks which make use of a forklift truck hydraulic circuit controlling the fork lifting mechanism in order to be able to perform other operations, in addition to the cargo box lifting, such as its overturn to empty the cargo box out directly in the truck, or in a truck trailer where the goods have to be collected. This is effective thanks to tipping devices that take the cargo box and tip it in order to empty it out completely in the truck or in any other destination site. Then, the tipping phase can be accomplished only if the cargo box is firmly and safely grasped.

Nowadays, there are cargo box block arrangement as illustrated and described in the Italian documents IT1354640, IT1383934, IT0266934U e BA2011U00013, which show forklift trucks, with movable or stationary forks being provided with side pockets from which protrude locking bodies; by operating against the internal and coplanar faces with each other of the first two forked feet of tipping pallets, the locking bodies block the cargo box on the fork arms by the aid of a

further gripping arm moving top-down and operating in a downward push on the cargo box upper edge closest to the forklift truck, thus allowing the subsequent tipping.

These solutions include evident drawbacks: first, they are not safe at all. In fact, once the cargo box is tipped, it is blocked only in the part closest to the forklift and this causes a compression action of the related container wall, which will inevitably cause a bending of the entire box body. This stress makes the grip unstable inasmuch the cargo box is completely free to move in the front; moreover, it hardly forces it to bending as the configuration obtained is schematized as a constrained beam fixed at just one end. The cargo box, when blocked and tipped, is locked on the back only, remaining free on the front. It follows that the tipping phase is unstable and unsafe and the cargo box risks to collapse and break down over time because it is cyclically stressed by dangerously bending his entire body.

Another drawback of the known locking devices is their complexity and lack of practicality in their configurations: forklift trucks provided with such devices, in fact, require specific forks being configured for locking the rear feet of the cargo box: this fact not allows the use of the same forks as genuinely supplied to the forklift truck and requires the purchase of an additional pair of forks provided with specific grip assembly.

The present invention aims to solve the above mentioned drawbacks of prior art and to indicate a cargo box block arrangement for forklift trucks with forklift means and related forklift truck, which ensure handling and tipping of cargo boxes in total safe and efficiency.

A purpose of the invention is to realize handling and tipping of cargo boxes by means of an easy, reliable and handy to be implemented solution.

To achieve these purposes, the object of the present invention is a cargo box block arrangement for forklift truck with forklift means and related forklift truck, according to the features of the enclosed claims.

The cargo box block arrangement, according to the invention, is of a type comprising forklift means provided with fork arms, adapted to be engaged with a cargo box for its lifting and lowering, as well as comprising gripping means associated to the forklift means for locking the cargo box to said fork arms.

In a first claim, the device is characterized in that the gripping means comprise spreading out means associated with said forklift means for gripping the fork arms to perimetral elements of the cargo box, in particular inside the cargo box feet in case of a cargo box of a pallet type.

Advantageously, this solution allows the total safe and stable locking of the cargo box as the grip of the block arrangement is realized by the fork arms on the perimetral elements of the cargo box; therefore, related stresses acting during the rotation and/or tipping operations is evenly relieved along the entire perimeter and then on the complete structure of the cargo box.

Furthermore, the invention allows to use substantially the same fork arms usually and genuinely supplied in the forklift trucks inasmuch the spreading out means interlink efficiently to the original arms, with no need for their replacement, as it will be cleared hereafter. So, the invention is useful, easy and unexpensive to be implemented.

These advantages of simplicity, practicality and low cost are further evident due to additional peculiarities of the invention, i.e. that the spreading out means are of an exclusively mechanically and hydraulically operated type, in particular by applying a branch of the same operative hydraulic circuit as supplied with forklift trucks.

Further objects, features and advantages of the present invention will be evident with the following detailed description of a preferred embodiment thereof, provided just as an explanatory and non restrictive example, with the contribute of the enclosed figures, in which:

- Figure 1 shows a perspective view of a forklift truck provided with a cargo box block arrangement according to the invention, during the tipping operation of a cargo box;
- Figure 2 shows a partially exploded perspective view of a cargo box block arrangement of the invention of figure 1;
- Figures 3 and 4 illustrate, in bottom view, the cargo box block arrangement of figure 2 in two different operative configurations of the forklift truck of figure 1, i.e. with cargo box block arrangement respectively being disabled and enabled;

With reference to figures 1 to 4, with 16 is indicated as a whole a forklift truck according to the invention, which in front is provided with a cargo box block arrangement with forklift means 1-11, 17, 18 associated with a tipping device 15 for tipping a cargo box 12, in particular of a pallet type as typically used in the agricultural field. Cargo box 12 is of a type provided with perimetral elements, in particular placed inferiorly to the cargo box 12 at the angular extremities of the related base, for example feet 13, 14 in a substantially parallelepiped structure, among which a pair of front feet 14 and rear feet 13 are present; front feet are meant the closest pair and rear feet are meant the more distant pair of feet with reference to the cab of the forklift 16 in an operative condition of lifting and / or tipping of the cargo box 12, as in figures 1, 3 and 4.

For simplicity, the tipping device 15 and the elements, devices and systems different from

the cargo box block arrangement being present on the forklift truck 16 are not further detailed and described as they are already known as prior art.

With particular reference to figure 2, the cargo box block arrangement comprises forklift means, being constituted for example of a support plate for fork bearer 1, associable with the tipping device 15 of the forklift truck 16 through known means and in such a way that it can be rotated with respect to an axis substantially orthogonal to the same plate 1, on which are fixed fork bearer means as sliding guide, for example a pair of fork bearer crosspieces 2, 3 being shaped in such a way to constitute sliding guides for a pair of fork arms 7, 9 being shaped to the purpose.

The coupling between the fork arms 7, 9 and the fork bearer means as sliding guides 2, 3 is realized with clearance, so as to permit rotation between said arms 7, 9 and the plate 1. More in detail, each arm fork 7, 9 is in shape of a rotated L , with a lower part aimed to support and lift the cargo box 12, and an elevated part which has, externally, a pair of beak guides aimed to be inserted, with clearance, in transverse sliding on protrusions being externally shaped to the crosspieces 2, 3.

Advantageously, the configuration of the forklift means as described and according to the invention allows the fork arms 7, 9 sliding on the fork bearer crosspiece 2, 3, then the fork arms 7, 9 widening which allows the cargo box block arrangement to be adapted to different width sizes, so contributing to maintain the same cargo box stable and safe when it is loaded on the fork arms of the forklift truck to be moved or tipped.

The above mentioned clearance of slide coupling between fork arms 7, 9 and fork bearer means as sliding guides 2, 3 as described, advantageously allows the fork arms 7, 9 to spread out the respective free extremities by means of spreading out means 4-6, 8, 10, 11, 17, 18 aimed to the purpose, which according to the present invention also constitute gripping means, as it will be clear hereinafter. The spreading out means 4-6, 8, 10, 11, 17, 18 are associated with the fork arms 7, 9 for the grip of the fork arms 7, 9 to the perimetral elements of the cargo box 12, in particular at the inside of the foot 13, 14 of the cargo box 12, in case of pallet box.

The above mentioned spreading out means comprise, more in detail:

- pivot means associated to the support plate 1 and usefully placed close to the lateral extremities of the same plate 1, with a rotation axis being substantially orthogonal to the gripping plane of the fork arms 7, 9, i.e. the plane as identified by the lower parts of the fork arms 7, 9, for example eyelets 4, 5 being integral with the plate 1 and positioned in a staggered way between the fork bearer crosspiece 2, 3, with the axes of the holes being substantially orthogonal to said

gripping plane;

- a pair of transmission arms 6, 10;

- linear displacement actuating means, preferably of a hydraulically operated type, being associated at one extremity to the pivot means and at the other extremity to the pair of transmission arms 6, 10, for example a pair of hydraulic pistons 8, 11 hinged at an extremity to the respective eyelets 4, 5 and at the other extremity to the corresponding transmission arm 6, 10;

- rotation locking means, associated to the transmission arms 6, 10 and the fork arms 7, 9 so as to prevent the relative rotation and preferably also the relative transverse translation of each fork arm 7, 9 with respect to the corresponding transmission arm 6, 10; for example they are locking rings 17, 18 shaped as to embrace, together with an end portion of the transmission arm 6, 10, a cross section of the respective fork arm 7, 9, the rings 17, 18 being fixed each one to its corresponding transmission arm 6, 10 by fastening means, for example threaded tie rods and lock nuts, so as to allow the transmission of the transverse force and angular torque from the transmission arms 6, 10 to the fork arms 7, 9.

Kinematic condition needed for the actual functionality of such spreading out means is that the movement/action line of the linear displacement actuating means (hydraulic pistons 8, 11) passes in front of the centre of the cross section of the respective fork arm 7, 9 embraced by the locking rotation means, i.e. the cross section enclosed by the locking rings 17, 18, where with "in front" is meant the space located between the support plate 1 and the lower part of the fork arms 7, 9. Such kinematic condition allows that the force explicated by the hydraulic pistons 8, 11 is transmitted, as well as transverse thrust, as further angular torque to open the fork arms 7, 9 so as to lock, by friction, before the internal faces of the frontal feet 14 and then the inner faces of the rear feet 13 of the perimetral elements of the cargo box 12, as it will be clarified with the description of related operation.

Advantageously, the spreading out means are of an exclusively mechanically operated type. This ensures greater reliability of the cargo box block arrangement as it has no electrical boxes and wiring, and therefore it is not subject to electrical failures, as well as greater simplicity of the control system and handling of the forklift truck. A further characteristic contributes to this advantage, i.e. that the spreading out means are of a hydraulically driven type, in particular by employing for its operation a branch of the hydraulic circuit outgoing from a control system of devices and systems as genuinely supplied to the forklift truck. Such branch, not shown for simplicity so as the mentioned system, is associated with the spreading out means, in particular

with the linear displacement actuating means, i.e. the hydraulic pistons 8, 11, so that the control system commands, through the lengthening or shortening of these actuators, the operation of the spreading out means between a first operating position of the support of figure 3, where the fork arms 7, 9 substantially maintain their typical configuration just as support (in the example shown in particular parallel to each other), i.e. the original one of assembly performing the sole function of supporting the weight of the cargo box 12, and a second operative position of gripping as per figure 1 and 4, where the fork arms 7, 9 are spread out to laterally interfere with the feet 13, 14 of the cargo box 12 so realizing its block.

Hereunder, the operation of the cargo box block arrangement is detailed. Starting from the first operating position of support of figure 3, when the control system commands the gripping of the cargo box 12 usually generates an increase of hydraulic pressure to the linear displacement actuating means, i.e. the hydraulic pistons 8, 11 which extend such as to allow transverse translation of the transmission arms 6, 10, of the rotation locking means and of the respective fork arms 7, 9. The hydraulic pistons 8, 11 apply a thrust force with a transverse component such as to widen laterally the fork arms 7, 9 until the fork arms come into contact with one or more internal parts of the perimetral elements of the cargo box 12, in the example primarily on the inner face of the rear feet 14 of the cargo box 12 close to it, producing a first grip strength; at the same time, due to the kinematic constraint produced by the inner surface 14 of the same rear feet, this induces a slight rotation to open the protruding extremities of the fork arms, so as to spread them out. In fact, once prevented traverse translation, thanks to the above mentioned required kinematic condition, the thrust action of the pistons 8, 11 leads to an increase of the longitudinal component directed towards the lower part of the fork arms 7, 9, in addition to the transverse component guaranteeing the grip of the rear feet 14. This component generates an angular torque aimed to open the fork arms 7, 9 which are able to rotate, thanks to their respective assembling with clearance on the fork bearer 2, 3; so, it is generated the opening of the lower extremities of the fork arms 7, 9 which spread out to form a large V. Then, these extremities intercept and push on the front internal faces of the pair of front feet 13 of the cargo box 12 (figure 4), thus achieving a further grip in the front part of the cargo box 12 and simultaneously blocking all four feet 13, 14 of the cargo box 12. The position as above mentioned corresponds to the operating gripping position of the cargo box block arrangement, according to the invention.

The cargo box 12 grip is advantageously carried out by loads being distributed on the entire perimeter of its base, i.e. in a poised, stable and balanced way.

The cargo box 12 may be further blocked by f top-down cargo box block means moving top-down and operating in pushing on one of its front wall, possibly being present in association with the tipping device 15 of the forklift truck 16 and not detailed for simplicity as already known, for example, in the same way as illustrated and described in the Italian document BA2011U00013. In such a configuration, the reversal and/or tipping of the cargo box 12 is carried out in total safety, i.e. without big bending stresses of its front wall bonded to the top-down grip.

Once you have performed eventual tipping operation of the cargo box 12, after re-positioning it upright on the fork arms 7, 9, and possibly after controlling disengagement of the top-down moving cargo box block means, when present, which are able to unlock on the upper part the front wall of the cargo box 12, it is possible to return to the first operating support position of the cargo box block arrangement: the control system commands the release of the cargo box 12 by generating a hydraulic pressure such in a way that the linear displacement actuating means, i.e. the hydraulic pistons 8, 11 are shortened, therefore retracting the respective transmission arms 6, 10 and fork arms 7, 9 so disengaging the front feet 13 and then the rear ones 14, and returning to the configuration of sole support of figure 3.

The operation of lifting and tipping of the cargo box, thanks to this innovative cargo box block arrangement according to the invention, simply adapts to different sizes and types of cargo boxes to be lifted. In fact, it is possible to lift and tip boxes of many different sizes inasmuch the excursion of the opening and then the gripping of the fork arms 7, 9 is substantially variable and adjustable thanks to the presence of the fork bearer 2, 3 shaped as transversal guides for said arms, so perfectly adapting to the lay of the perimetral elements, i.e. the feet 13, 14 of the cargo box 12. Since the fork arms spread out in a wide V shape, they move and rotate to open and intercept the perimetral elements along the whole extension of the base perimeter of the cargo box; therefore, as in the example taken into account, they exert pressure against all the feet of the cargo box with a respective external surface thereof till blocking them, so allowing the subsequent safely ad affordable movement in tipping.

Advantageously, the cargo box block arrangement, according to the invention, is provided with few simple elements which ensure the functionality, convenience and low-cost thereof.

Advantageously, the transmission arms 6, 10 are reciprocally similar and essentially interchangeable, thus allowing the free use of fork arms 7, 9 of different dimensions, with no need to change the whole support plate 1, so just employing transmission arms 6, 10 of the right length and with a respective portion of extremity shaped in order to embrace the cross-section of the

respective fork arm 7, 9 with their rings 17, 18; i.e. the cargo box block arrangement is implemented just by adapting and conforming the fork arms as genuinely provided with the forklift truck, with no need to replace them, therefore in a simple, practical and inexpensive way.

Advantageously, the interchangeability of the above mentioned transmission arms and their simplicity to be disassembled, make the cargo box block arrangement and the related forklift truck more easily transportable, less bulky and easier to handle than the traditional ones.

It is clear that different variations and embodiments are possible for the technician skilled in the art to the cargo box block arrangement for forklift truck with forklift means and related forklift truck according to the present invention; as it is clear that, in their practical implementation, the forms of the illustrated details may be different and be replaced with other technically equivalent elements.

For example, the spreading out means may be constituted of a kinematic arrangement associated with the support plate and with linear displacement actuating means in such a way that, connected by pulleys to the fork arms, it is able to spread them out forming a wide V under the action of an extension and/or a shortening of the actuating means, so as to generate an angular torque necessary for the stable locking of the perimetral elements of the cargo box by friction, similarly to what has been already described.

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CLAIMS

1. Cargo box block arrangement for forklift truck with forklift means, comprising forklift means (1-3,7,9) provided with fork arms (7,9) adapted to be engaged with a cargo box (12) for its lifting and lowering, gripping means associated to forklift means (1-3,7,9) for locking the cargo box (12) to said fork arms (7,9),

   characterized in that said gripping means comprise spreading out means (4-6,8,10,11, 17,18) associated with said forklift means (1-3,7,9) for gripping the fork arms (7.9) to perimetral elements (13,14) of the cargo box (12).

2. Arrangement, according to claim 1, characterized in that the spreading out means (4-6, 8,10,11,17,18) are of an exclusively mechanically operated type.

3. Arrangement, according to one of the previous claims, characterized in that the spreading out means (4-6,8,10,11,17,18) are of a hydraulically driven type.

4. Arrangement, according to one of the previous claims, characterized in that the forklift means comprise a support plate for fork bearer (1) being associable to a tipping device (15) of a forklift truck (16) so as to be able to be rotated with respect to an axis being substantially orthogonal to the same plate (1), on which fork bearer means as sliding guides (2,3) being shaped so as to constitute sliding guides for said fork arms (7,9) are fixed.

5. Arrangement, according to the previous claim, characterized in that the coupling between the fork arms (7,9) and the fork bearer means as sliding guides (2,3) is with clearance, so as to permit a rotation between said arms (7,9) and the plate (1).

6. Arrangement, according to the previous claim, characterized in that the spreading out means comprise:

   - pivot means (4.5) associated to the support plate (1), in particular placed close to the lateral extremities of the same plate (1), with a rotation axis being essentially orthogonal to the gripping plane of the fork arms (7, 9);

   - transmission arms (6.10);

   - linear displacement actuating means associated at one extremity to the pivot means (4.5) and at the other extremity to the transmission arms (6.10);

   - rotation locking means (6,10,17,18) associated to the transmission arms (6.10) and to the fork arms (7,9) so as to prevent relative rotation, and in particular also the related transverse translation of each fork arm (7.9) with respect to the corresponding transmission arm (6.10),

the movement/action line of the linear displacement actuating means (8,11) passing in front of the center of a transverse section of the corresponding fork arm (7,9) embraced by the rotation locking means (6,10,17,18) .

7. Arrangement, according to the previous claims, characterized in that the rotation locking means comprise locking rings (17,18) shaped to embrace, together with an extremity portion of the transmission arm (6,10), the transverse section of the respective fork arm (7,9), the rings (17,18) being fixed to each corresponding transmission arm (6.10) so as to allow the transmission of the transverse force and angular torque from the transmission arms (6, 10) to the fork arms (7.9).

8. Arrangement, according to claims 6 or 7, characterized in that the pivot means (4.5) are positioned staggered between the fork bearer means as sliding guides (2, 3).

9. Arrangement, according to claims 3 and 6, characterized in that the linear displacement actuating means are of a hydraulically operated type, in particular comprising hydraulic pistons (8,11).

10. Arrangement, according to one of claims 6-9, characterized in that the transmission arms (6,10) are reciprocally similar and substantially interchangeable.

11. Forklift truck with forklift means comprising a cargo box block arrangement according to one of the previous claims.

12. Truck, according to previous claim, characterized in that it comprises a control system of the forklift truck (16) devices and systems , in particular being hydraulically operated, a branch thereof is associated with the spreading out means (4,6.8,10,11,17,18) to command its operation between a first operating position of support (figure 3), where the fork arms (7,9) substantially maintain their assembling configuration, and a second operating position of gripping (figure 2) where the fork arms (7,9) are spread out to laterally interfere with the perimeter elements (13,14) of the cargo box (12).

13. Truck, according to claims 6 and 12, characterized in that said branch of the control system is associated with the linear displacement actuating means (8,11) in such a way that the control system commands, in particular through the lengthening or shortening of said actuators (8,11), the operation of the spreading out means (4-6,8,10,11, 17,18) between said gripping and support positions.

14. Truck, according to one of claims 11-13, characterized in that of comprising top-down moving cargo box block means for locking by top-down gripping on a front wall of the cargo box (12).

15. Truck, according to claims 4 and 14, characterized in that the top-down moving cargo box block means are associated with the tipping device (15) of the forklift truck (16).

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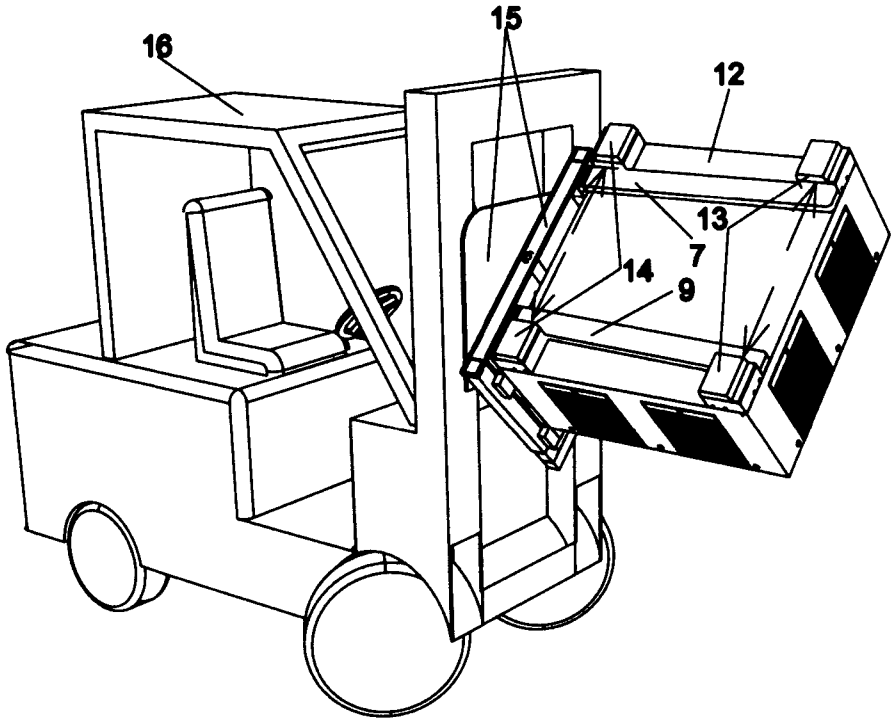

Fig 1

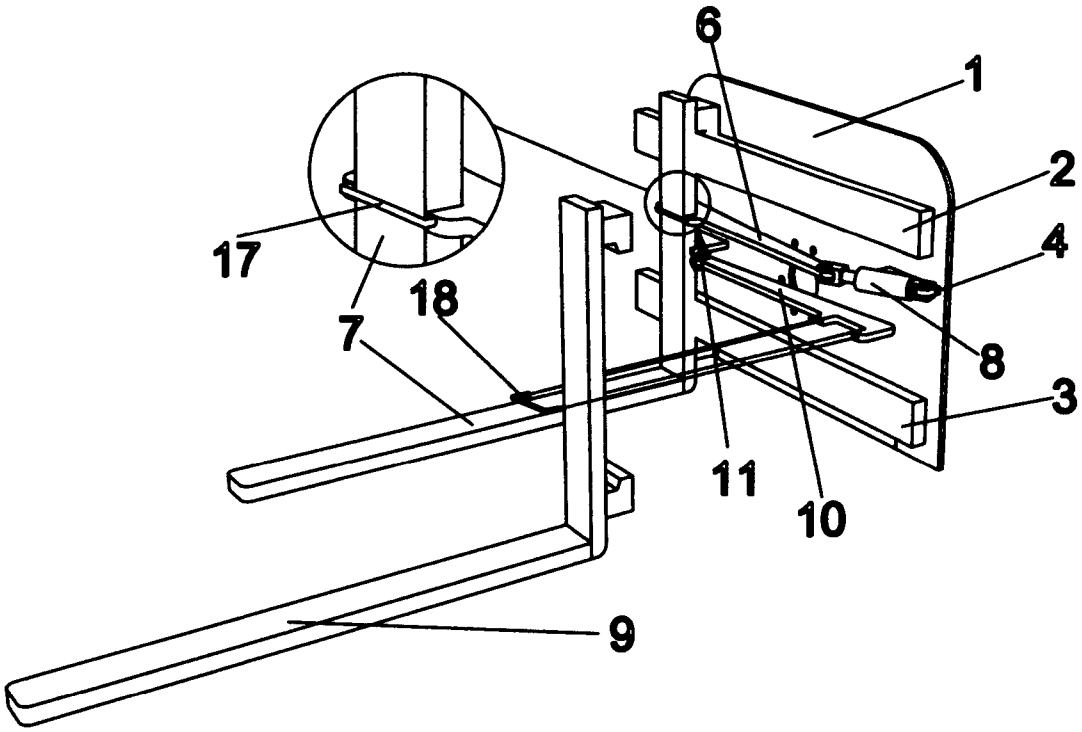

Fig 2

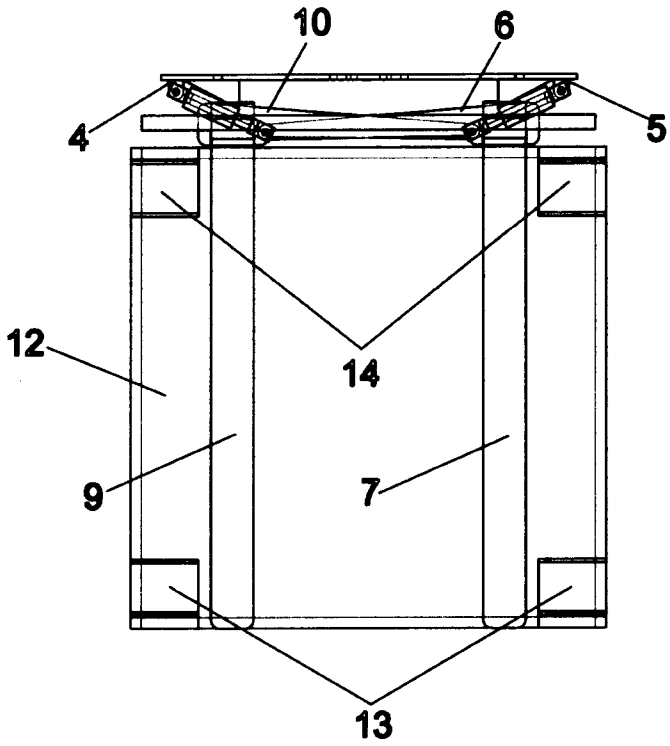
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Fig. 3

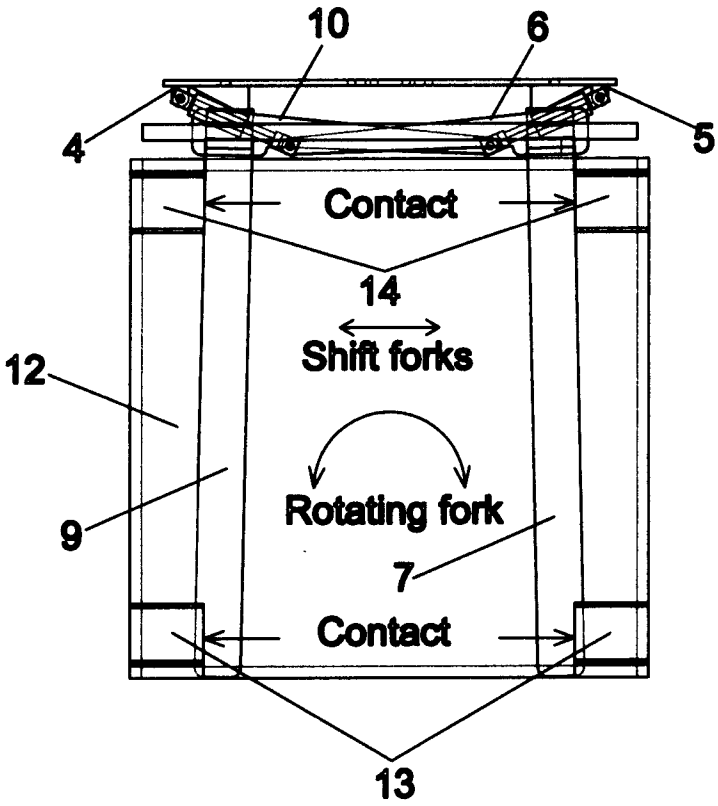
10
6
4
5
Contact
14
Shift forks
12
Rotating fork
9
7
Contact
13

Fig. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/IT2014/000090

A. CLASSIFICATION OF SUBJECT MATTER
INV. B66F9/12 B66F9/18 B66F9/14
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B66F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2 971 662 A (DUNHAM ELMER J) 14 February 1961 (1961-02-14)	1-3,
A	the whole document	11-15 4-10

X	US 2003/091419 A1 (HAAS RICHARD P [US]) 15 May 2003 (2003-05-15)	1-3,11
A	page 2 - page 3; figures 1-6	4-10, 12-15

A	US 4 272 217 A (SEFCIK ROBERT) 9 June 1981 (1981-06-09) abstract; figures 1-5	1-15

A	DE 20 2004 006091 U1 (TRANSORT GMBH [DE]) 9 June 2004 (2004-06-09) abstract; figures 1-6	1-15

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
8 August 2014	19/08/2014

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