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(54) BATTERY POWERED LIFT TRUCK

(57) The object of the invention is a battery powered lift truck comprising a body (1), a drive unit connected to a drawbar or a steering wheel or a control joystick and at least two parallel pairs of forks characterized in that at least one pair of forks (3.1) is lifted and moved parallel to the body (1) by means of a lifting system and a longitudinal movement mechanism and the other pairs of forks

(3.2) are placed on the elongated arms (1.1) of the body (1) and are mounted on cross-type mechanisms consisting of two perpendicular mechanisms: a lifting mechanism and a linear travel mechanism perpendicular to the body, enabling their lifting, retracting and extending, and the elongated arms (1.1) of the body (1) contain side supporting wheels (6).

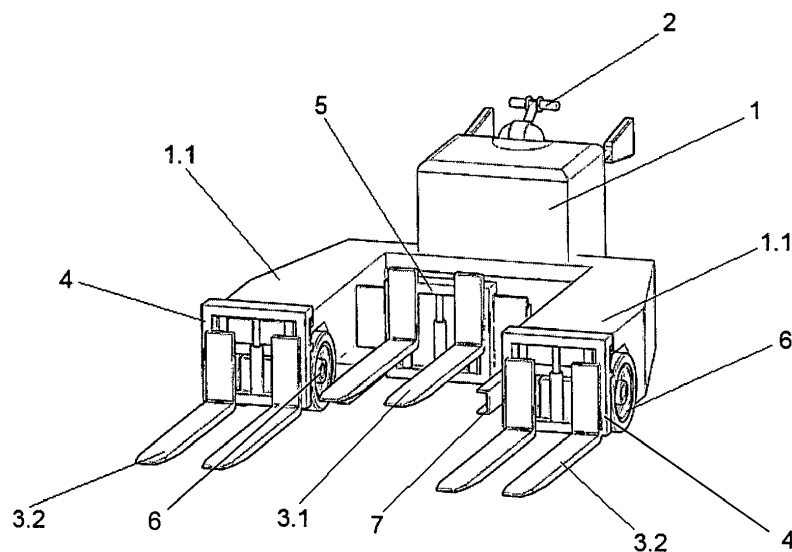


Fig. 1

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Description

[0001] The object of the invention is a battery powered lift truck used in logistics.

[0002] Prior art forklift trucks differ in construction and technical solutions depending on their intended use. Forklift trucks designed for heavy loads have a counterweight and this in turn eliminates the possibility of such a truck entering the means of transport. On the other hand, trucks designed for light loads have limited capacity to transport more loads in one unloading and loading cycle.

[0003] An example of a prior art forklift truck disclosed in the description of the invention P.373662 is a device for carrying items that can be lifted, comprising a forklift component provided with teeth for lifting objects, means of transport connected to the component, means for moving the fork component vertically and regulating means for transporting and means of movement. The device shall have at least one pair of adjacent teeth of the forklift component which shall be fitted with one movable carrier fixed on each tooth and sliding in the longitudinal direction relative to the teeth. When the pots are set, this carrier can transmit a certain speed to the pots such that the distance between the two rows of the set pots that are perpendicular to the direction of the teeth can be adjusted in a mobile manner by setting the speed of the carrier.

[0004] In the prior art, a device has also been found that is suitable for moving several pallets simultaneously. It is a battery powered lift truck, disclosed in the description of the invention P.463860, comprising a body, a fork lever mechanism linked to a drawbar and a drive unit characterized by the fact that it also contains at least two pairs of forks, one pair of which is stationary and provided with a sliding longitudinal conveyor and at least one pair of forks is movable and connected to the truck body by means of horizontal linear guides enabling its lifting, retracting and extending, in addition, each pair of forks contains a set of longitudinal support wheels for longitudinal travel and additional wheels for transverse travel. However, despite the fact that the device disclosed in the invention P.463860 is suitable for transporting more goods than other forklifts known from the prior art, it has become necessary to provide a transport device with a relatively light structure which would allow the equipment to enter the means of transport without having to change the warehouse infrastructure and at the same time allow for an acceleration of the process of unloading and loading goods.

[0005] The essence of the invention is a battery powered lift truck comprising a body, a drive unit connected to a drawbar or a steering wheel or a control joystick and at least two parallel pairs of forks characterized in that at least one pair of forks is lifted and moved parallel to the body by means of a lifting system and a longitudinal movement mechanism and the other pairs of forks are placed on the elongated arms of the body and are mounted on cross-type mechanisms consisting of two perpen-

dicular mechanisms: a lifting mechanism and a linear travel mechanism perpendicular to the body, enabling their lifting, retracting and extending, and the elongated arms of the body contain side supporting wheels.

[0006] Preferably, the battery powered lift truck comprises three parallel pairs of forks, of which one pair of forks - the middle one - is lifted and moved parallel to the body by means of a lifting system and a longitudinal travel mechanism and the other two pairs of forks are placed on the elongated arms of the body and are mounted on cross-type mechanisms enabling their lifting, retracting and extending in a direction perpendicular to the body, and the elongated arms of the body contain side supporting wheels.

[0007] Preferably, the longitudinal travel mechanism is in the form of a cable system and horizontal linear guides.

[0008] Preferably, the battery powered lift truck comprises three parallel pairs of forks, of which one pair of forks - the middle one - is linked to the elongated body by means of a lifting mechanism, and the other pairs of forks are placed on longitudinal rails and are equipped with cross-type mechanisms for lifting and transverse travel of the forks in relation to the body, in addition, the longitudinal guides are built into the body arms that contain the side supporting wheels.

[0009] Preferably, the battery powered lift truck comprises three pairs of forks, one of which one pair of forks - the middle one - is suspended from the longitudinal conveyor by a cross-type mechanism, while the other two pairs of forks are connected to the body of the truck by means of cross mechanisms enabling their lifting, retracting and extending, supported on support wheels.

[0010] The drive for retracting and extending the forks via cross-type mechanisms is optionally implemented by a hydraulic, electric or pneumatic cylinder built inside the travel mechanism.

[0011] The drive of each pair of forks is synchronized.

[0012] The drive of each pair of forks is independent of the drive of the other pairs of forks.

[0013] Optionally, the drive of the forks with transverse travel and the forks with longitudinal travel is manual.

[0014] Optionally, the control of the drive for sliding in and out of each pair of forks is automated.

[0015] The pair of forks with longitudinal travel is suspended from a rolling guide and is driven by a hydraulic cylinder connected to the body of the truck.

[0016] Optionally, the pair of forks with longitudinal travel is suspended from a rolling guide and is driven by cable system located in the body of the truck.

[0017] Optionally, the pair of forks with longitudinal travel is suspended from a rolling guide and is driven by a screw mechanism or a toothed bar.

[0018] The longitudinal travel drive system of the pair of forks is hydraulic, electric or pneumatic.

[0019] The object of the invention has been achieved by the application of an adjustable width of extension of the pairs of forks with a transverse travel in a forklift truck

of relatively light weight, and by the absence of the need to place an additional point of support such as the wheels used on each pair of forks in the prior art. In order to standardize the definition of the individual pairs of forks in the following parts of the description, irrespective of their number in the battery powered lift truck as invented, the following expressions are used: "forks with longitudinal travel" refers to the pair of forks which moves parallel to the body of the battery powered lift truck, the "cross-type mechanism" refers to a set of two perpendicular mechanisms for lifting and transverse travel in the direction perpendicular to the body of the truck. In the embodiment of the invention which uses three pairs of forks, the "longitudinal travel forks" are arranged as the middle pair of forks. The phrase "forks with transverse travel" refers to the pair of forks that moves perpendicularly to the body of the battery powered lift truck.

[0020] In prior art lifting forklifts, a counterweight was required to lift several pallets simultaneously that increased the weight of the truck considerably, which in turn prevented the forklift truck with the load from entering the means of transport. By using the fork lifting mechanism in the battery forklift as invented, with simultaneous longitudinal travel of one pair of forks and transverse travel of subsequent pairs of forks in order to reduce the width, it is possible to shift a part of the load towards the body of the forklift and thereby balance the forklift without the need for a counterweight. Also due to the fact that the load which is placed on the pair of forks with longitudinal travel balances the weight of the load on the remaining forks, it was possible to use forks without support wheels. The absence of support wheels on the forks allows the battery powered forklift truck to run freely through architectural barriers, surface defects or the gap between the loading platform and the means of transport.

[0021] In the battery powered lift truck as invented, each of the pairs of forks with transverse travel can move any distance in relation to the body of the truck, or in another embodiment of the invention the travel distance of the individual pairs of forks with transverse travel is the same.

[0022] By using extensible forks and at the same time a travel of the pair of forks with longitudinal travel behind the side support wheels of the battery powered lift truck as invented, a light construction of the forklift with increased load capacity is obtained.

[0023] The longitudinal travel of one pair of forks of the battery operated lift truck as invented, allows the load placed on the same pair of forks to be backed out so that when the other forks are retracted, it is behind the load placed on the other forks. This allows to slide the load off and freely enter the means of transport where the pairs of forks with a transverse travel are moved apart, the pair of forks with a longitudinal travel with the load is extended and the goods are then placed on the means of transport and the forklift truck is moved away.

[0024] Raising of all pairs of forks and the body of the trolley during loading or unloading is carried out by inde-

pendent drives. The longitudinal travel of the pair of fork is possible when the forks are fully raised. The lifting mechanism used on the battery powered lift truck as invented, is known in the prior art and is used in forklift trucks.

[0025] The drive system of the battery powered lift truck as invented, is known in the prior art and is used in pallet/hand-operated forklifts.

[0026] By using preferably three pairs of lifted forks, of which at least one is able to move longitudinally and two of which can move transversely in the battery powered lift truck as invented, results in an approximately three-fold reduction in the time of loading and unloading of trucks with goods stacked on pallet carriers, e.g. Euro type by picking up and putting away three pallets with goods in one cycle.

[0027] The construction of the battery powered lift truck with longitudinally sliding and retracting and extending forks and a light-weight body of the truck, without the need to use a large counterweight, makes it possible to load and unload on all standard semi-trailers, i.e. platforms, tarpaulins, isotherms, cold stores - without the need to adapt them to the construction of the forklift truck as invented. The weight of the battery powered lift truck as invented, is similar to the devices used for unloading and loading in the prior art. This has a significant impact on the safety of the process and the elimination of damage to trucks, trailers and other vehicles on which goods are loaded or unloaded.

[0028] There is also no need to modify the infrastructure of warehouse buildings, halls in which battery powered lifting trucks as invented, are used.

[0029] The process of driving, extending, retracting, and displacement of the pair of forks with longitudinal travel of the battery powered lift truck as invented can be carried out manually by the operator of the device or automatically with the possibility of operator intervention in the event of an electronic failure or other circumstances in which the control system cannot complete the process.

According to the invention, a fully automatic process of driving, extending, retracting, and displacement of the pair of forks with longitudinal travel of the battery powered lift truck is also possible. The automation of the process means that once the pallets are picked up on the individual pairs of forks, the step of longitudinal insertion of the pair of forks and the retraction of the remaining forks as well as the step of spreading of forks during the loading process and the longitudinal extension of the pair of forks during the unloading process is automatic.

[0030] However, it is also possible to control these steps manually.

[0031] The weight of the battery powered lift truck as invented and the loads carried on it is distributed over two sets of side support wheels with a large contact surface with the ground, placed on the extended arms of the truck body directly next to the forks with a transverse travel, and in front of the retracted pair of forks with longitudinal travel, and the rear torsion pair. Such a layout

allows to minimize the weight of the counterweight and thus drastically reduce the weight of the device.

[0032] The battery powered lift truck according to the invention is shown in the embodiments in the drawing in which:

- Fig. 1 shows the battery powered lift truck as invented, in a perspective view;
- Fig. 2 shows a schematic drawing of the drive mechanisms of the battery powered lifting truck as invented;
- Fig. 3 shows the battery powered lift truck as invented, with the forks 3.1 retracted, in a perspective view;
- Fig. 4 shows the battery powered lift truck as invented, with the forks 3.1 extended and raised, in the perspective view;
- Fig. 5 shows the battery powered lift truck as invented, with the forks 3.1 retracted and raised and the forks 3.2 retracted and raised, in the perspective view;

[0033] Fig. 1 shows a battery powered lift truck as invented, which consists of a body 1 to which a drawbar 2 is attached on one side and three pairs of forks on the other side via a lever system. The pair of forks 3.1 with longitudinal travel is connected to the body 1 of the forklift truck via the lifting mechanism 5 and the longitudinal travel mechanism 7. The pairs of forks 3.2 with transverse travel are movably mounted to the body 1 of the battery powered lift truck by means of cross-type mechanisms 4 enabling their lifting, retracting and extending. The side support wheels 6 are located on the arms 1.1 of the body 1 directly behind the pairs of forks 3.2 with transverse travel.

[0034] Figure 2 shows a schematic drawing of the driving mechanisms of the forks 3.1 with longitudinal travel, with the visible lifting mechanism 5 and the longitudinal travel mechanism 7 implemented by means of a belt or chain transmission.

[0035] Fig. 3 shows the battery lift truck with extended forks 3.2 with transverse travel and the forks 3.1 with longitudinal travel with the longitudinal travel mechanism 7 retracted towards the body 1 of the battery powered lift truck.

[0036] The picking up and loading of goods onto the means of transport by the battery powered lift truck as invented takes place in several steps. When loading the goods placed on pallets, after positioning the battery powered lift truck as invented parallel to a row of pallets, three parallel pallets are picked up at the same time by raising three pairs of forks 3.1, 3.2 simultaneously.

[0037] Figure 4 shows a raised pair of forks 3.1 with longitudinal travel and the extended pair of forks 3.2 with transverse travel. Pallets (P) are loaded both on the forks 3.2 with transverse travel and on the forks 3.1 with longitudinal travel.

[0038] Then, after the pallets have been picked up on the battery powered lift truck as invented, the longitudinal

travel mechanism 7 (not visible in Fig. 4) is retracted and the forks 3.2 with transverse travel are retracted in the direction of the forks 3.1 with longitudinal travel. In this way, the pallet on the forks 3.1 with longitudinal travel is partially covered by the pallets on the forks 3.2 with transverse travel, and the width of battery powered lift truck is reduced. In such a position, the battery powered lift truck as invented enters a means of transport, e.g. a semi-trailer or the loading part of a truck or other means of transport intended for the transport of goods. Figure 5 shows the forks 3.2 with transverse travel and the forks 3.1 with longitudinal travel with the pallets (P), the forks 3.2 with transverse travel being in the retracted position.

[0039] The process of putting down the pallets (P) is done in the opposite way to taking them up. First, after reaching the destination, for example a semi-trailer, the forks 3.2 with transverse travel of the battery powered lift truck as invented spread apart, then the pallet (P) placed on the forks 3.1 with longitudinal travel is positioned between the pallets (P) set on the forks 3.2 with transverse travel by extending the longitudinal travel mechanism 7. The last step is to lower the forks 3.2 with transverse travel and the forks 3.1 with longitudinal travel. The cycle is repeated each time until the semi-trailer is properly filled.

[0040] Due to the considerable reduction of the width of the entire battery powered lift truck as invented, it is easy to manoeuvre on the truck semi-trailers. The necessary space for handling is obtained and a safe distance from the side is kept and three pallets with goods are loaded simultaneously.

[0041] The cross-type mechanisms of forks with transverse travel can be driven, for example, by means of hydraulic cylinders, electric or pneumatic drives. The drive and spacing of the pair of forks with longitudinal travel and pairs of forks with transverse travel can be both synchronized and independent, which means that each pair of forks can move a different distance.

[0042] The pair of forks with longitudinal travel can be fixed on the cross-type mechanism which means that the pair of forks with longitudinal travel can be raised and moved laterally over a given distance.

[0043] The invention can be used in all areas, both warehouse and production, speeding up the movement of loads inside plants as well as loading and unloading. This is done by increasing the number of pallets transported in one cycle. In addition, the system allows the installation of technical components for complete automation of processes.

Claims

1. A battery powered lift truck comprising a body (1), a drive unit connected to a drawbar or a steering wheel or a control joystick and at least two parallel pairs of forks **characterized in that** at least one pair of forks (3.1) is lifted and moved parallel to the body (1) by

- means of a lifting system and a longitudinal movement mechanism and the other pairs of forks (3.2) are placed on the elongated arms (1.1) of the body (1) and are mounted on cross-type mechanisms consisting of two perpendicular mechanisms: a lifting mechanism and a linear travel mechanism perpendicular to the body, enabling their lifting, retracting and extending, and the elongated arms (1.1) of the body (1) contain side supporting wheels (6).
2. The battery powered lift truck according to claim 1, **characterized in that** it comprises three parallel pairs of forks, of which one pair of forks (3.1) - the middle one - is lifted and moved parallel to the body (1) by means of a lifting system and a longitudinal travel mechanism and the other two pairs of forks (3.2) are placed on the elongated arms (1.1) of the body (1) and are mounted on cross-type mechanisms enabling their lifting, retracting and extending in a direction perpendicular to the body (1), and the elongated arms of the body (1) contain side supporting wheels (6).
 3. The battery powered lift truck according to claim 1, **characterized in that** the longitudinal travel mechanism is in the form of a cable system and horizontal linear guides.
 4. The battery powered lift truck according to claim 1, **characterized in that** it comprises three parallel pairs of forks, of which one pair of forks (3.1) - the middle one - is linked to the elongated body (1) by means of a lifting mechanism, and the other pairs of forks (3.2) are placed on longitudinal rails and are equipped with cross-type mechanisms for lifting and transverse travel of the forks in relation to the body (1), in addition, the longitudinal guides are built into the body arms (1.1) that contain the side supporting wheels (6).
 5. The battery powered lift truck according to claim 1, **characterized in that** it comprises three pairs of forks, of which one pair of forks (3.1) - the middle one - is suspended from a longitudinal conveyor by a cross-type mechanism, while the other two pairs of forks (3.2) are connected to the body (1) of the truck by means of cross-type mechanisms enabling their lifting, retracting and extending, supported on support wheels (6).
 6. The battery powered lift truck according to claim 1, **characterized in that** the drive for retracting and extending the forks through the cross-type mechanisms is provided by a hydraulic, electric or pneumatic cylinder built into the sliding mechanism.
 7. The battery powered lift truck according to claim 1, **characterized in that** the drive for lifting the forks is
- synchronized.
8. The battery powered lift truck according to claim 1, **characterized in that** the drive of each pair of forks is independent of the drive of the other pairs of forks.
 9. The battery powered lift truck according to claim 1, **characterised in that** the control of the drive for the forks (3.2) with transverse travel and for the forks (3.1) with longitudinal travel is manual.
 10. The battery powered lift truck according to claim 1, **characterized in that** the control of the drive for the forks (3.2) with transverse travel and for the forks (3.1) with longitudinal travel is automated.
 11. The battery powered lift truck according to claim 1, **characterized in that** the pair of forks (3.1) with longitudinal travel is suspended from a rolling guide and is driven by a hydraulic cylinder connected to the body (1) of the truck.
 12. The battery powered lift truck according to claim 1, **characterized in that** the pair of forks (3.1) with longitudinal travel is suspended from a rolling guide and is driven by a cable system located in the body (1) of the truck.
 13. The battery powered lift truck according to claim 1, **characterized in that** the pair of forks (3.1) with longitudinal travel is suspended from a rolling guide and is driven by a screw mechanism or a toothed bar.
 14. The battery powered lift truck according to claim 1, **characterized in that** the drive system of the longitudinal travel mechanism of the forks (3.1) is hydraulic, electric or pneumatic.

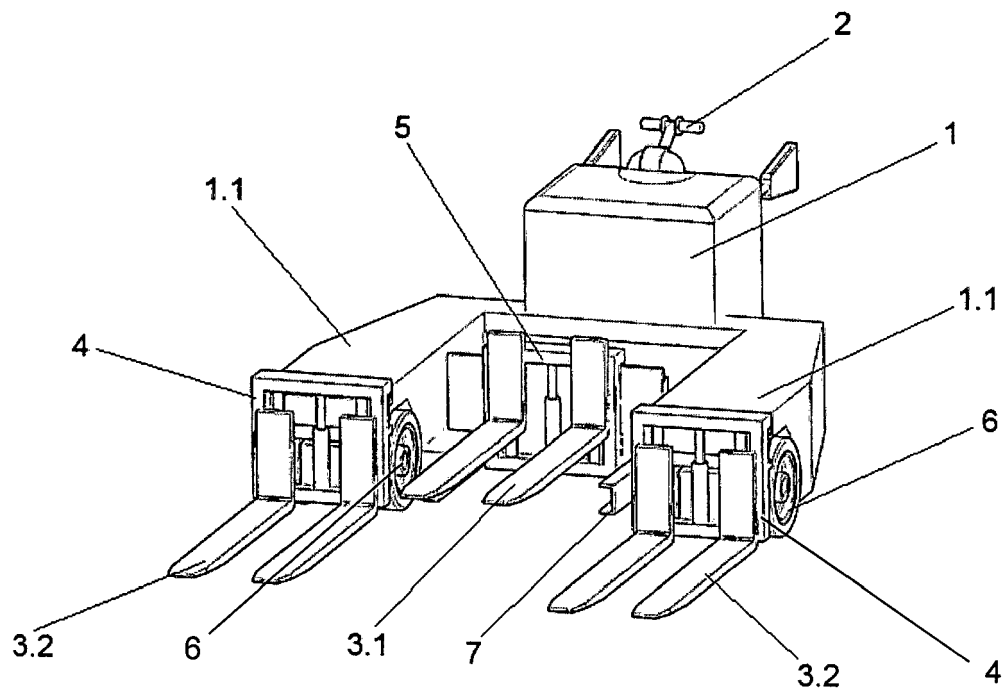


Fig. 1

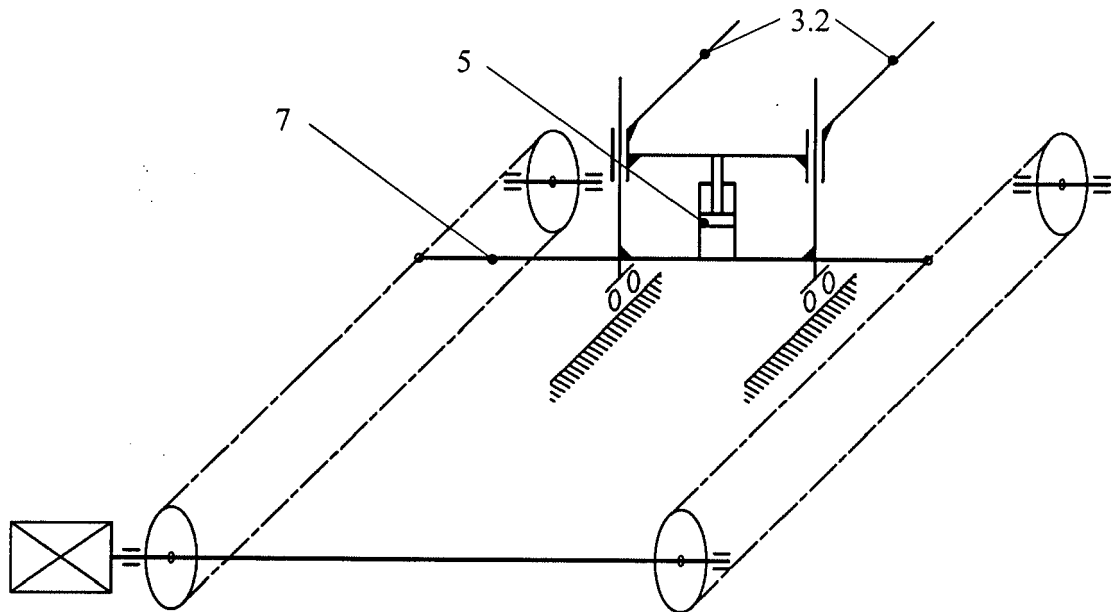


Fig. 2

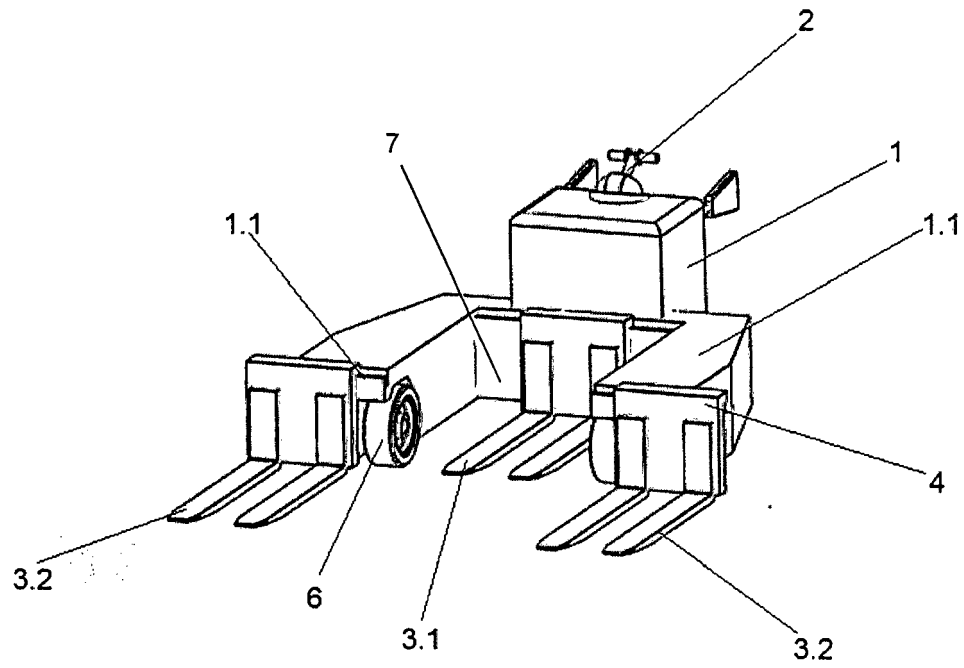


Fig. 3

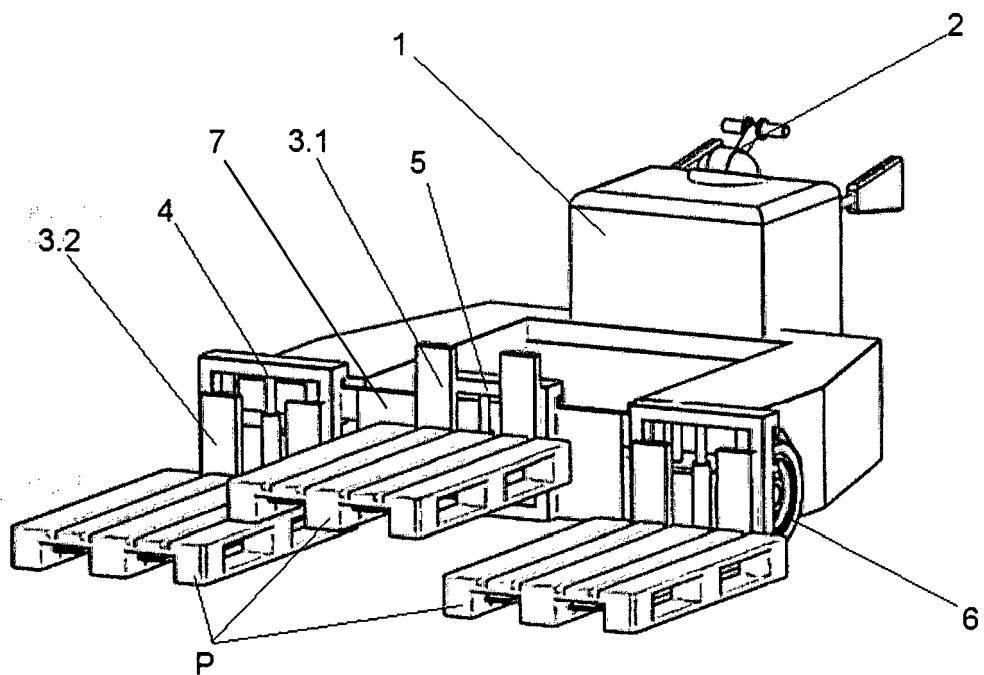


Fig. 4

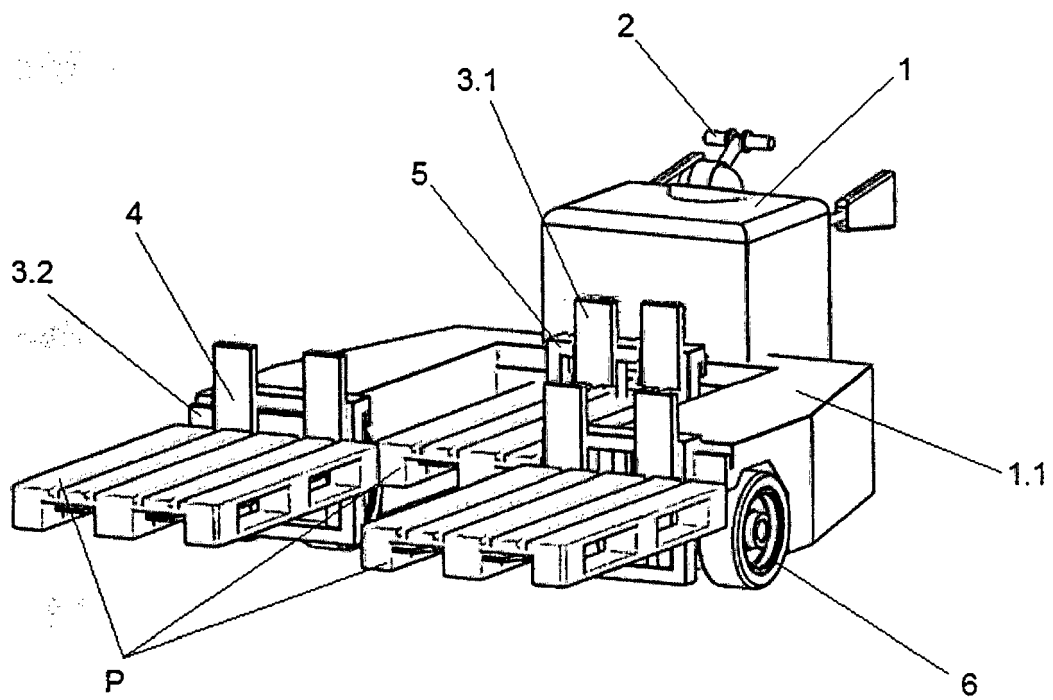


Fig. 5



EUROPEAN SEARCH REPORT

Application Number
EP 21 46 0016

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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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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 9 August 2021	Examiner Colletti, Roberta
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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