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(54) System and method for selecting pallets out of different pallet types

(57) The invention relates to a system (1) for selecting and forwarding pallets (2) comprising a carrier means (3) suitable to randomly transport pallets (2) of different types of pallets, at least one pallet selection unit (4) arranged within the carrier means (3) and at least one pallet receiving unit (5) connected to the pallet selection unit (4) to receive selected pallets (2) from the pallet selection unit (4), wherein the pallet selection unit (4) is suitable to select one or more pallets (2) according to at least one type of the pallets out of multiple pallets (2) of different pallet types passing the pallet selection unit (4), to forward (FS) the selected pallet (2) to the pallet receiving unit (5) and to forward (FN) the non-selected pallets (2) along the carrier means (3) and wherein the pallet selection unit (4) comprises size detection means (41) arranged to identify the geometrical size and/or the alignment of the pallet (2) relative to the pallet receiving unit (5) and/or weight detection means (42) arranged to identify the weight of the pallets (2) in order to select the pallet (2) of at least one pallet type. The invention further relates to a method to operate such a system.

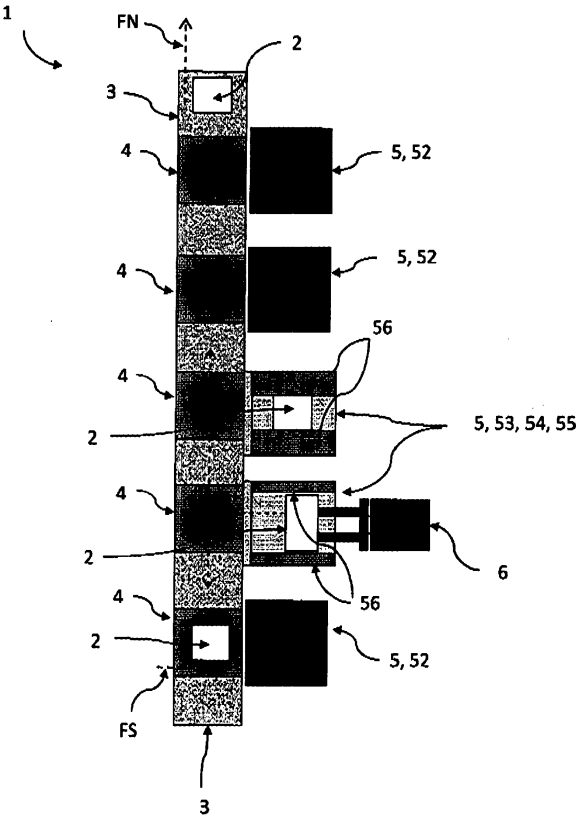


Fig.1

EP 2 340 894 A1

Description

FIELD OF THE INVENTION

[0001] The invention relates to a cage and pallet storage system for selecting and forwarding pallets and to a method to operate such a system.

BACKGROUND OF THE INVENTION

[0002] Pallets are commonly used as carrier for transporting goods. Pallets can have different sizes and weights. It is a large logistic effort for transport companies handling a large number of goods to provide a suitable number of pallets of the right size at the right place in order to be loaded with goods. There is a demand to reduce the logistic effort to provide the right pallet at the right place in time. WO 97/39968 discloses a pallet stacker for up-stacking (stacking of single pallets for storage purposes) or down-stacking (forwarding single pallets from a stack of pallets) of pallets, resting on each other in a stack. The pallet stacker comprises a lift mechanism being disposed to lift the lower pallet one or more pallet heights enabling up-stacking of pallets or enabling the removal of the lowest pallet of the stack and thus down-stacking from beneath. Such a stacker stores a larger number of pallets covering only a small floor area slightly larger than one pallet size. However, only one type of pallets can be stored in the pallet stacker. Therefore at least one stacker per pallet type is required to provide each type of pallet when needed. Additionally, the area in front of each stacker has to be large enough to enable forklifts to deliver empty pallets to be stacked in the stacker and vice versa. Even if the stackers require only a small area, the handling of pallets with forklifts requires a large working area around the pallet stackers resulting in required large factory building. There is a further demand to reduce the floor area required to provide this service.

SUMMARY OF THE INVENTION

[0003] It is an object of the present invention to provide a system for selecting and forwarding pallets, which reduces the logistic effort to provide the right pallet at the right place in time and the floor area required to provide this service.

[0004] The object is solved by a system for selecting and forwarding pallets comprising a carrier means suitable to randomly transport pallets of different types of pallets, at least one pallet selection unit arranged within the carrier means and at least one pallet receiving unit connected to the pallet selection units to receive selected pallets from the pallet selection unit, wherein the pallet selection unit is suitable to select one or more pallets according to at least one type of the pallets out of multiple pallets of different pallet types passing the pallet selection unit, to forward the selected pallet to the pallet receiving unit and to forward the non-selected pallets along the carrier means and wherein the pallet selection unit comprises size detection means arranged to identify the geometrical size and/or the alignment of the pallet relative to the pallet receiving unit and/or weight detection means arranged to identify the weight of the pallets in order to select the pallet of at least one pallet type. Preferably at least one pallet receiving unit is connected to each of the pallet selection unit.

[0005] The present invention provides a system, where pallets of different types can be loaded into the system in a random sequence at a few pallet entry terminals (pallet receiving units) picking-up the pallets, preferably at only one pallet entry terminal picking-up the pallets. Such a system requires the fewest floor area with respect to pallet handling via forklifts. The few or the single pallet entry terminal reduces the total floor area required for forklift transport of pallets to only one or a few suitable avenues for the forklifts regardless on the number of pallet receiving units arranged as pallet storage magazines or pallet stackers present within the system. The carrier means distribute the pallets in a space saving manner to one or more pallet selection units for further sorting of the pallets according to the pallet types. The pallet forwarding requires only the floor area occupied by the carrier means. The pallets can be stored in multiple pallet receiving units (e.g. pallet stackers or pallet magazines for vertical pallet stacking) in a space saving manner. The pallet receiving units can be arranged directly beside the pallet selection units without any required space for forklifts to bring the pallets to the pallet receiving units. For larger logistic centers with a larger number of pallets handled per time, there may be more than one pallet entry terminal with corresponding additional avenues for forklifts. However, even in this case the required floor space for the system according to the present invention is significantly smaller compared to logistic centers according to prior art handling the same amount of pallets of different pallet types. Also the logistic effort is strongly reduced due to the simple picking-up (inserting pallets into the system or obtaining pallets from the system) of pallets of any type in a random sequence. Any kind of pre-sorting is not necessary. The sorting will be carried out within the system by the pallet selection units. The reverse process provides pallets of any kind from the pallet receiving units via the pallet selection units to the pallet entry terminals serving In a second mode also as pallet exit terminal for the pallets handled by the system according to the present invention.

[0006] The term "carrier means" denote any kind of means able to carry pallets from one place to another place automatically without any further action of an operator. Carrier means according to the present invention might be conveyor belts of any type, for example equipped with rollers, roles, or a moving carrier surface like luggage conveyor belts. The pallet selection unit is arranged within the carrier means. This term denotes an arrangement, where the pallet selection unit is a compo-

nent within the carrier means, able to be just passed by the pallets on their way to their final destination within the system. The term "passing" denotes the forwarding of the pallets along the carrier means to its initial destination. In contrast to "passing", the term "selecting" denotes a change of the initial destination of the pallets within the system into another destination within the system by the pallet selection unit. The carrier means is connected to one side of the pallet selection unit and continues on the other side of the pallet selection unit seen in the transporting direction of the carrier means.

[0007] The term "pallets" comprises any carrier for goods, which can be loaded with goods to transport the goods on top of the carrier. As an example, pallets may be common wood pallets such as ISO- and/or EUR-pallets or cages such a plastic cages or metal cages, which could be foldable or non-foldable. The type of pallets (or pallet type) denotes the geometrical dimensions (length, depth, height of the pallet), material, weight, load capacity specific for a certain pallet. As an example, so-called ISO pallets of the international organization of standards may have dimensions (length / depths) of 1000 x 1200 mm^2 or 800 x 1200 mm^2 in Europe (other dimensions are used in North America or Australia), European (EUR) pallets may have the same dimensions or in same versions dimensions of 800 x 600 mm^2, 600 x 400 mm^2, or 400 x 300 mm^2. Additionally, there are several versions of transport cages with different height in use. The pallet material may differ between pallet types leading to a different load capacity of the specific pallet types. For example, applied pallet materials are wood, steel, aluminum, plastic, cardboard etc. The different pallet materials lead to different pallet weights ranging between 10 kg and more than 100 kg. The worldwide integration of transport logistic makes it necessary to provide and handle a large number of different pallet types at the same place requiring an effective storing of empty pallets and a random access the any specific pallet type on demand. The system according to this invention exactly provides this support with the fewest required floor space.

[0008] The connection of the receiving unit to the pallet selection unit might be achieved via a carrier means, e.g. a conveyor belt. A connection in this context may comprise more than one pallet selection units arranged within the connecting carrier means. Alternatively, the pallet receiving unit may be arranged directly beside the pallet selection unit without any gap in between avoiding any carrier means to connect both units. In the latter case, the pallets are directly transferred from the pallet selection unit into the pallet receiving unit. The term "receiving" denotes a pallet transport from the pallet selection unit into the pallet receiving unit. In an embodiment, the pallet receiving unit is suitable to reverse the transport direction in order to forward pallets from the pallet receiving unit towards the pallet selection unit.

[0009] The pallet selection unit may select pallets of one type of pallets or a certain number of types of pallets to forward the pallets to the receiving unit. Alternatively, the pallet selection unit may forward a stack of a certain number of pallets of the same type to the pallet receiving unit. The forwarding may be directed to the pallet receiving unit, from the pallet receiving unit to another pallet selection unit.

[0010] Size detection means may be any suitable means to determine the geometrical size of the pallet either directly by measurements or indirectly by detecting (reading) information, from which the geometrical size of the pallet can be derived. The term "identifying the geometrical size" is the generic term for both possibilities. The alignment of the pallet denotes the side of the pallet facing towards the pallet receiving unit. The alignment of pallets may vary. For symmetric pallets, the alignment is the same for all sides. However, for non-symmetric pallets, the alignment of the pallets might be important to fit into the pallet receiving unit. As an example, a pallet having sides with different length and width may only fit into the pallet receiving unit, if one particular side (long side or short side) faces towards the pallet receiving unit. The weight detection means denote any suitable means to identify the weight of the pallets. Here again, the weight of the pallet may be determined either directly by measurements (e.g. with a scale) or indirectly by detecting information, from which the weight of the pallet can be derived. The information to derive geometrical size and/or weight of a pallet may be a coding applied to the pallet specifying the pallet type characteristic to the geometrical size and weight of the pallet. The information may be coded as a barcode and may be read by a barcode reader.

[0011] In an embodiment the pallet selection unit further comprises alignment means to align the selected pallet relative to the receiving unit. As an example the alignment means may be mechanical sliders pushing and/or turning the pallet in the right position. Alternatively the alignment means might be a rotatable upper surface of the pallet selection unit carrying the pallet and being connected to a motor rotating the upper surface by 90°, 180°, 270° relative to its original orientation in order to align a certain side of the pallet facing towards the pallet receiving unit. People skilled in the art may consider other alignment means within the scope of the present invention.

[0012] In another embodiment the size detection means comprise reading means suitable to read coded information attached to the pallet specifying the pallet type and/or the alignment of the pallet and/or optical detection means to measure the geometrical size and/or the alignment of the pallet, preferably multiple optical sensors and/or an array of optical sensors and/or a CCD camera. As previously disclosed, one possibility to identify the size of a pallet is to derive the pallet size from information present on the pallet. The information might be coded information, e.g. a barcode or a RFID tag or any other machine-readable information. The reading means are suitable means adapted to the type of coding to read the coded information, such as bar code reader,

receiver for the RFID signal or optical sensors like CCD cameras or CCD chips to recognize and analyze an image. The coded information may be applied to the pallet at a certain side at a certain position. With reading means applied to each side of the pallet, the coded information represents also the alignment of the pallet with respect to the pallet receiving unit. The pallet can subsequently be aligned with the desired side towards the pallet receiving unit. Alternatively, the pallet size and/or the alignment of the pallet might be detected by optical techniques such as image recognition, e.g. applying a CCD camera or a CCD chip. In other embodiment, optical sensors such as photo sensors establishing one or more light barriers are used to detect the geometrical dimensions of the pallet. From the dimensions in case of asymmetric pallets (different length and width), the alignment of the pallet with respect to the pallet receiving unit can be derived and adjusted if necessary. The optical sensors might be arranged as a one-dimensional array parallel to the carrying surface of the pallet selection unit on one, two or all sides of the pallet selection unit to detect the length of one, two or all sides of the pallet. In case of optical sensor (single sensors or sensors arranged as an array) arranged on one side of the pallet selection unit, the pallet selection unit able to rotate the pallet may rotate the pallet as an example by 90° in order to measure the length of two different sides of the pallet. This procedure may continue for 180°, 270° etc. The array of the sensors might be arranged at a height sufficiently above the upper surface of the pallet not to hamper forwarding of the pallet along the carrier means and/or to the pallet receiving unit. People skilled in the art may consider alternative size detection means within the scope of this invention.

[0013] In another embodiment the pallet selection unit or parts of the pallet selection unit are arranged as the weighting means, preferably as a floor scale or platform scale, more preferably as a ball top scale or a roller top scale. In this case, the weight of the pallets is measured and not derived from any coded information. This prevents pallet type identification failures in case of damaged and/or non-readable coded information applied to the pallets. Also some pallet types may not carry any coded information. The direct measurements of the weight (and also of the geometrical size) of the pallets enables to process (forwarding and/or selecting) all kind of pallets applied worldwide without any required additional effort such as inspecting pallet, whether they carry code information and eventually applying such information to pallets not carrying such coded information. The complete pallet selecting unit might be placed on a floor scale as the weighting means, or parts of the pallet selection unit might be placed on a scale as the weighting means as part of the pallet selection unit, or the upper surface of the pallet selection unit carrying the pallets is the upper surface of the weighting means, e.g. a scale.

[0014] In an embodiment the pallet selection unit comprises an upper surface to carry the pallets, preferably where at least a part of the upper surface is arranged rotatable around an axis vertical to the upper surface. The rotatable upper surface or at least the part of the upper surface allows the alignment of the pallets relative to the receiving unit without any further mechanical arrangements above the surface of the pallet selection unit. A rotatable upper surface (or a part of it) supports forwarding the pallets to any desired direction without the risk of any collisions with further alignment means arranged above the upper surface.

[0015] In a preferred embodiment the pallet selection unit is arranged to lower the non-rotatable part below the upper surface or to lift the rotatable part above the upper surface. The non-rotating parts at the lowered position have no mechanical contact to the pallet. Therefore the non-rotating parts cannot apply any friction force to the pallet eventually hampering or preventing the rotation of the pallet. It would be sufficient to lower the level of the non-rotating parts of a few millimeters to a few centimeters below the upper surface established by the rotating parts of the upper surface the same applies, if the rotatable part is lifted above the upper surface together with the pallet laying on top of the rotatable part.

[0016] In an embodiment the upper surface comprises by an array of 360° pivot-mounted balls or two vertically arranged arrays of alternatively operational carrier means both being able to be lowered to a level below the upper surface independently. The mounting of the 360° pivot-mounted balls, for example plastic or metal balls, might be similar or equal to a trackball mounting for computers or the ball mounting of a mechanical computer mouse, where a part of the balls (or spheres) is mounted in an adapted cavity, where a smaller part of the balls protrude from the cavity. The protruding parts of the balls establish the upper surface of the pallet selecting unit. Insight the cavity the balls or a certain number of balls might by driven by a motor in order to move, align or forward the pallets into a desired direction. The pallet selection unit may comprise a control unit in order to drive the balls. A suitable driving scheme will also allow rotating the pallet on top of the balls. This embodiment will provide the highest variability of possible movements of the pallet on top of the pallet selection unit. Alternatively, the pallet may be forwarded into one direction with one array of carrier means as part of the upper surface of the pallet selection unit, while the other vertically arranged array is lowered below the upper surface in order not to hamper the forwarding into this direction. The forwarding of pallets into the vertical direction is executed by the formally lowered array now at the level of the upper surface, while the formerly upper array is lowered below the upper surface not to hamper the forwarding of the pallet into the vertical direction. Both arrays are arranged to be able to forward the pallet in both directions, back and forth. The latter embodiment can be realized with lesser mechanical and driving effort compared to the array of the 360°pivot-mounted balls.

[0017] In an embodiment the pallet receiving unit comprises positioning means, preferably arranged at two side

above a loading surface of the pallet receiving unit, to position the selected pallets inside the pallet receiving unit, more preferably the positioning means are adjustable to different pallet types. The loading surface of the pallet receiving unit is the surface carrying the pallet after receiving it from the pallet selection unit. The positioning means might be vertically arranged plates made of any suitable material, e.g. plastic or metall. The positioning means may be shaped to broaden at the side facing towards the pallet selection unit. Such positioning means are able to correct the pallet position even in case of slight miss-alignments of the pallet at the pallet selection unit. The positioning means may be any kind of suitable positioning means. Preferably, the positioning means are at least mounted on two sides of the pallet receiving unit parallel to the moving direction of the pallet during transfer of the pallet from the pallet selection unit to the pallet receiving unit.

[0018] This positioning means might be movable in a vertical direction to the moving direction of the pallet during transfer to the receiving unit in order to be adjusted to the width of the pallets. The pallet selection unit may be arranged to control the movement of the positioning means of the pallet receiving unit as a function of the identified pallet type. The pallet receiving unit may also comprise positioning means mounted at the side of the pallet positioning unit opposite to the pallet selection unit in order to prevent the pallet passing the pallet receiving unit. This particular positioning means might be arranged as able to be lifted above the upper surface of the pallet in order to access the pallet from the opposite side of the pallet receiving unit with respect to the pallet selection unit. The access may be executed with a forklift.

[0019] In another embodiment the pallet receiving unit is arranged as a vertical pallet lift, a pallet storage magazine, a pallet pre-stacker, a pallet entry terminal and/or a pallet exit terminal. The term "pattet lift" denotes all devices able to move pallets vertically from a first level of height to a second level of height in order to forward the pallet out of the pallet lift to a carrying means connected to the pallet lift at the second level of height. The second level of height can be above or below the first level of height. In a preferred embodiment the loading surface of the pallet lift is arranged to be lifted or lowered to a second level of height in order to forward the pallet via second carrier means arranged at a second level of height. A pallet storage magazine denotes all kinds of magazines suitable for storing pallets for a longer period of time, e.g. a vertical pallet stacker according to prior art. In a preferred embodiment the pallet storage magazine comprises multiple movable pick-up elements to support at least one pallet and a lifting unit suitable to vertically lift the movable pick-up elements and to hold the pick-up element at a storing level in order to vertically stack the pallets one upon the other each supported by at least one movable pick-up element inside the pallet storage magazine. A pallet pre-stacker denotes a unit, where a stack of the pallets can be delivered, e.g. from a forklift, in order to forward the pallets to a pallet storage magazine. The pre-stacker forwards single pallets to the carrier means of the system by down-stacking the stack of pallets directly after receiving the stacked pallet, e.g. from a forklift, or in the opposite process the pre-stacker might be able to stack a certain number of pallets (up-stacking) of the same type of pallets to be subsequently removed from the pre-stacker, e.g. by a forklift. The pallet receiving unit may comprises similar size and/or weight identification means as present at the pallet selection unit in order to be able to up-stack, down-stack or further forward pallets. The term "pallet entry terminal" denotes a pallet receiving units, where pallets can be inserted (entry) into the system for further forwarding the pallets along the carrier means. Correspondingly the term "pallet exit terminal" denotes a pallet receiving unit, where pallets can be received from the system for being further transported within the logistic center, e.g. via a forklift. The pallet entry and exit terminals may have the same functionality as the pre-stacker without the functionality to be able to up-stack and/or down-stack pallets. A pallet pre-stacker is an embodiment of pallet entry and exit terminals with the additional functionality being able to up-stack and/or down-stack pallets or stacks of pallets. Preferably the pallet pre-stacker and/or the pallet entry terminal and/or the pallet exit terminal comprise a cavity suitable to insert the fork of a forklift below an insert and/or exit level of the pallets, preferably a cavity with a U-shape. The term "forklift" comprises any suitable means to transport pallet comprising a fork as the loading surface for the pallets, e.g. forklift trucks or pallet carrier, either motor driven or carried by hand.

[0020] The invention further relates to a method to operate a system for selecting and forwarding pallets according to the present invention comprising the steps of

- transporting pallets of different pallet types via carrier means to a pallet selection unit arranged with the carrier means,
- selecting one or more pallets according to at least one type of pallets out of multiple pallets of different types of pallets passing the pallet selection unit on the pallet selection unit,
- forwarding the selected pallet to a pallet receiving unit connected to the pallet selection unit, and
- forwarding the non-selected pallets along the carrier means.

The selection process of particular pallet for further forwarding may be controlled by a system control unit or by a control unit as part of the pallet selection unit, where e.g. a control program running on said control unit comprises a look-up table specifying the desired destination of each pallet type.

[0021] In an embodiment of the method the step of selecting the pallet on the pallet selection unit comprises indentifying the geometrical size and/or the alignment of the pallet relative to the pallet receiving unit by size de-

tection means and/or detecting the weight of the pallets by weight detection means.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] These and other aspects of the invention will be apparent from and elucidated with reference to the embodiments described hereinafter.

Fig.1: System according to the present invention in a top view

Fig.2: pallet selection unit and pallet receiving unit in a top view

Fig.3: pallet selection unit with weighting means in a side view

Fig.4: pallet selection unit with rotatable alignment means in (a) top view and (b) side view

Fig.5: pallet selection unit with two arrays of carrier means in (a) top view and (b) side view

Fig.6: pallet receiving unit as a pallet lift

Fig.7: pallet receiving unit as a pallet storage magazine

Fig.8: pallet receiving unit as a pallet pre-stacker, entry / exit terminal

DETAILED DESCRIPTION OF EMBODIMENTS

[0023] Fig.1 shows a system 1 for selecting and forwarding pallets 2 comprising a carrier means 3 to randomly transport pallets 2 of different types of pallets with five pallet selection units 4 arranged within the carrier means 3. The number of pallet selection units 4 shown in this figure is only one example. The number of required pallet selection means depends on the particular logistic requirements of the system. Several pallet receiving units 5 are directly connected to the pallet selection units 4 to receive selected pallets 2 from the pallet selection units 4. In this example, three pallet receiving units 5 are arranged as pallet storage magazines 52, and two pallet receiving units 5 are arranged as pallet pre-stacker 53, pallet entry terminals 54 and/or pallet exit terminals 55. The last three embodiments of a pallet receiving unit 5 are suitable for inserting (entry) pallets from the outside world and/or suitable to provide (exit) pallets from the system to the outside world. The term "outside world" denotes all logistic processes outside the system according to the present invention. The pallet receiving unit 5 could also be a pallet lift 51 not shown in Fig. 1. Each pallet selection unit 4 is suitable to select one or more pallets 2 according to at least one type of the pallets out of multiple pallets 2 of different pallet types passing the pallet selection unit 4, to forward FS the selected pallet 2 to the pallet receiving unit 5 and to forward FN the non-selected pallets 2 along the carrier means 3. In alternative embodiments, additional carrier means 3 may be connected to the pallet selection units 4. Also the pallet receiving units 5, 51, 52, 53, 54, 55 might not be connected directly to the pallet selection units 4, but being connected to the pallet selection units 4 via a carrier means 3 located between the pallet selection unit 4 and the pallet receiving unit 5, 51, 52, 53, 54, 55.

[0024] Fig.2 shows a pallet selection unit 4 and pallet receiving unit 5 in a top view. The carrier means 3 on both sides of the pallet selection unit 4 is indicated by the dashed grey area 3. The pallet selection unit 4 carries a pallet 2 on top of its upper surface 44 previously forwarded F to the pallet selection unit 4 by the connected carrier means 3. The pallet 2 shall be further forwarded (FS) as a selected pallet 2 to the neighbored pallet receiving unit 5, 51, 52, 53, 54, 55. In order to be able to select the pallet 2 out of multiple pallets 2 passing the pallet selection unit 4, the pallet selection unit comprises size detection means 41 arranged to identify the geometrical size and/or the alignment of the pallet 2 relative to the pallet receiving unit 5. Here, the size detection means 41 are arranged as a horizontal array of optical detection means 412 (e.g. optical sensors) in order to detect the length of the pallet side located in front of the optical detection means 412. In other embodiment, the size detection means may be arranged at more than one side of the pallet 2 in order to determine the length of all pallet sizes simultaneously. Here, the pallet 2 has to be rotated by 90° in order to determine the length of the other pallet side. The size detection means 41 further comprise reading means 411 to read coded information (e.g. a bar code or a RFID tag) eventually present on the pallet 2 indicating the pallet type and/or the pallet sizes and/or the pallet weight. Pallet size and pallet weight might be derived from the pallet type. The upper surface 44 of the pallet selection unit 4 is established by an array of 360° pivot-mounted balls 47 also acting as a alignment means 43 for the pallet 2, because the pallet 2 can be moved or rotated by the 360° pivot-mounted balls 47, preferably being moved or rotated automatically by a control unit (not shown in this figure) as part of the pallet selection unit 4 driving motors and/or actuators arranged in the cavity, where the balls are mounted. A suitable driving scheme will also allow rotating the pallet on top of the balls, The mounting of the 360° pivot-mounted balls might be similar to a trackball mounting for computers or the ball mounting of a mechanical computer mouse, where a part of the balls (or spheres) is mounted in an adapted cavity, where a smaller part of the balls protrude from the cavity. The protruding parts of the balls establish the upper surface 44 of the pallet selecting unit 4.

[0025] The pallet receiving unit 5, 51, 52, 53, 54, 55 in fig. 2 comprises positioning means 56 arranged at three sides above a loading surface 57 of the pallet receiving unit 5 to position the selected pallets 2 inside the pallet

receiving unit 5, 51, 52, 53, 54, 55. The positioning means 56 are adjustable to different types of pallets by moving the positioning means 56 along the direction A indicated by the dashed arrow to adjust the width of the positioning means to the particular selected pallet 2 to be forwarded FS to the pallet receiving unit 5. In this embodiment the control unit of the pallet selection unit 4 provided a signal to the pallet receiving unit 5 specifying the width of the selected pallet 2, e.g. either measured directly or derived from coded information specifying the pallet type, and the pallet receiving unit 5 adjusts the positioning means 56 accordingly. The adjustment of the positioning means 56 may be controlled by a second control unit as part of the pallet receiving unit 5. The end of the positioning means 56 facing towards the pallet selection unit 4 comprise rotatable parts, which can be rotated along the arrow B to widen the opening of the pallet receiving unit 5 to still be able to receive even slightly misaligned pallets 2. The positioning means 56 at the side of the pallet receiving unit 5 facing away from the pallet selection unit 4 shall prevent the pallet from passing the pallet receiving unit 5. If a later transfer of the pallet to this side is desired, this particular positioning means 56 might be able to be lifted.

[0026] Fig. 3 shows a pallet selection unit 4 with weighting means 42 in a side view. Here the upper surface 44 carrying a pallet 2 is mounted on top of a scale located underneath the upper surface 44. The vertical movement of the upper surface 44 corresponds to the weight of the pallet 2. Such a direct measurement of the weight of the pallet 2 is able to distinguish several kinds of pallet types from each other. As an example, metal cages may have weights more than 100 kg, e.g. 120 kg. In contrast to that, ISO or EUR pallets have weight of approximately 15 kg. The weight measurements can be executed very accurate. Therefore even pallet types with small weight differences can be distinguished. Additionally or alternatively, the weight of a pallet can be derived from reading coded information attached to the pallet 2 using suitable reading means 411.

[0027] Fig.4 shows a pallet selection unit 4 with rotatable alignment means 43 in (a) top view and (b) side view. The upper surface 44 of the pallet selection unit 4 is divided into a rotating part R and a non-rotating part NR. The pallet 2 is only located on the rotating part R by lifting the rotating part R above the upper surface 44. Alternatively, also the non-rotating part can be lowered below the upper surface 44 (not shown here). The pallet 2 can be aligned to the pallet receiving unit 5 by rotating the rotatable part R along the rotation axis RA, see also the arrow indicating the rotation in view (a).

[0028] Fig.5 shows a pallet selection unit 4 with two arrays 45, 46 of carrier means in (a) top view and (b) side view. The arrays 45, 46 are aligned vertically to each other in order to be able to forward the pallet either in X-direction or in Y-direction. In order to forward a pallet along the X,Y directions (indicated by the dashed arrows in figure 5a), one of the arrays has to be lowered to a lower level LL below the upper surface 44 established by the other array of carrier means not lowered. As an example in figure 5b, the array 45 is lowered to the lower level LL, while the pallet 2 can be forwarded along the moving direction of array 46 now establishing the upper surface 44 of the pallet selection unit 4. Both arrays can be operated in back and forth direction (as indicated by the dashed double arrows).

[0029] Fig.6 shows a pallet receiving unit 5 as a pallet lift 51. The pallet 2 selected by the pallet selection unit 4 is forwarded FS to the loading surface 57 of the pallet lift 51. The positioning means 56 are arranged above the pallet 2 for ease of understanding. However, to position the pallet 2, the positioning means 56 have to be arranged at the same height as the pallet 2. The loading surface 57 of the pallet lift 51 is arranged to be lifted or lowered to a second level of height SL in order to forward the pallet 2 via second carrier means 32 arranged at a second level of height SL. In this example the second level SL of height is above the first level of height FL. In other embodiment, the pallets may be transferred to basements, where the second level of height SL is below the first level of height FL. The lifting process is indicated by the vertical dashed arrow. To lift the pallets, the pallet lift comprises suitable lifting means, which could be identical to the lifting unit 522 shown in figure 7 for pallet storage magazines.

[0030] People skilled in the art may choose other lifting means within the scope of this invention.

[0031] Fig.7 shows a pallet receiving unit 5 as a pallet storage magazine 52. The pallet storage magazine 52 comprises multiple movable pick-up elements 521 to support at least one pallet 2 stored in the pallet storage magazine and a lifting unit 522 suitable to vertically lift the pallets 2 to a storing level STL in order to vertically stack the pallets 2 one upon each other. The lifting unit 522 comprises all required mechanical parts and electrical parts for lifting the pallets 2. The lifting unit may comprise 2-4 synchronized lift elements including 1-2 pick-up units, which take hold of the pallet to-be-lifted. As an example, the pick-up unit may comprise two movable bolds arranged on two opposite sides of the lifting unit 522 at the same height. The movable bolds will be arranged under the pallet formally inserted into the pallet lift 52 in order to carry the pallet 2 during lifting the pallet 2 to the storing level STL. The lifting unit 522 can be operated either with electrical motors or as a pneumatic system or as a combination of these two. Through suitable programming, the lifting unit 522 of the pallet storage magazine 52 can handle multiple pallets 2 at the same time. All details of the lifting unit shown for the pallet storage magazine can also be applied for the pallet lift 51. At the storing level STL, the movable pick-up elements 521 overtake supporting of the pallet from the pick-up unit (here movable bolds). The moveable bolds are removed from their supporting position and lowered to their initial position in order to lift the next pallet 2 to the next storing level. The movable pick-up elements 521 may be

rotatable in order to support or release a pallet 2 entering or leaving its storing level inside the pallet storage magazine 52. Alternatively the movable pick-up elements 521 may be arranged as movable back and forth or may be rotatable around a horizontal rotation axis to achieve the same purpose. The movable pick-up elements 521 and the movable pick-up units might be controlled by a pallet lift control unit.

[0032] Fig.8 shows a pallet receiving unit 5 as a pallet pre-stacker 53 or as an entry / exit terminal 54, 55 comprising a cavity 58 suitable to insert the fork 61 of a forklift 6 below the entry and/or exit level EL of the pallets 2 denoting the level, at which the pallet 2 rests for further handling. The cavity 58 may have any suitable shape allowing placing of a forklift 6 underneath the pallet 2 present at the exit/entry level EL. However, a cavity 58 with a U-shape has the advantage to guide the fork 61 of a forklift 6 into the pallet receiving unit 5 resulting in a proper placing of the pallet 2 on top of the forklift 6 for taking the pallet 2 out of the system 1 according to the present invention. For inserting the pallet 2 into the system 1, the U-shaped cavity 58 is also beneficial, because the position of the pallet 2 is determined and further positioning to forward the pallet 2 to the carrier means 3 is not required.

[0033] While the invention has been illustrated and described in details in the drawings and foregoing description, such illustration and description are to be considered illustrative or exemplary and not restrictive; the invention is not limited to the disclosed embodiments.

[0034] Other variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing the claimed invention, from a study of the drawings, the disclosure, and the appended claims. In the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage. Any reference sign in the claims should not be construed as limiting the scope.

LIST OF REFERENCE SIGNS

[0035]

1	System for sorting and shipping objects
2	pallet
3	carrier means
32	second carrier means
4	pallet selection unit
41	size detection means
411	reading means
412	optical detection means
42	weight detection means
43	alignment means
44	upper surface
45	first array, pallet selection unit
46	second array, pallet selection unit
47	array of 360°pivot-mounted balls
5	pallet receiving unit
51	pallet receiving unit as vertical pallet lift
52	pallet receiving unit as vertical pallet storage magazine
521	movable pick-up element
522	lifting unit
53	pallet receiving unit as vertical pallet pre-stacker
54	pallet receiving unit as vertical pallet entry terminal
55	pallet receiving unit as vertical pallet exit terminal
56	positioning means
57	loading surface of the pallet receiving unit
58	cavity for forks of forklifts
6	forklift
61	fork of forklift
R	rotatable part of the pallet selection unit
NR	non-rotatable part of the pallet selection unit
RA	rotation axis
LL	lower level, pallet selection unit
F	forwarding direction of pallets
FS	forwarding direction of selected pallets
FN	forwarding direction of non-selected pallets

A adjusting of positioning means

B broadening of positioning means

FL first level of height

SL second level of height

STL storing level insight the pallet storage magazine

EL entry or exit level for pallets in pallet pre-stacker, entry terminal, exit terminals

Claims

1. System (1) for selecting and forwarding pallets (2) comprising a carrier means (3) suitable to randomly transport pallets (2) of different types of pallets, at least one pallet selection unit (4) arranged within the carrier means (3) and at least one pallet receiving unit (5) connected to the pallet selection unit (4) to receive selected pallets (2) from the pallet selection unit (4), wherein the pallet selection unit (4) is suitable to select one or more pallets (2) according to at least one type of the pallets out of multiple pallets (2) of different pallet types passing the pallet selection unit (4), to forward (FS) the selected pallet (2) to the pallet receiving unit (5) and to forward (FN) the non-selected pallets (2) along the carrier means (3) and wherein the pallet selection unit (4) comprises size detection means (41) arranged to identify the geometrical size and/or the alignment of the pallet (2) relative to the pallet receiving unit (5) and/or weight detection means (42) arranged to identify the weight of the pallets (2) in order to select the pallet (2) of at least one pallet type.

2. System (1) for selecting and forwarding pallets (2) according to claim 1, **characterized in that** the pallet selection unit (4) further comprises alignment means (43) to align the selected pallet (2) relative to the pallet receiving unit (5).

3. System for selecting and forwarding pallets according to claim 1 or 2, **characterized in that** the size detection means (41) comprise reading means (411) suitable to read coded information attached to the pallet (2) specifying the pallet type and/or the alignment of the pallet (2) and/or optical detection means (412) to measure the geometrical size and/or the alignment of the pallet (2), preferably multiple optical sensors and/or an array of optical sensors and/or a CCD camera.

4. System (1) for selecting and forwarding pallets (2) according to any of the preceding claims, **characterized in that** the pallet selection unit (4) or parts of the pallet selection unit (4) are arranged as the weighting means (42), preferably as a floor scale or platform scale, more preferably as a ball top scale or a roller top scale.

5. System (1) for selecting and forwarding pallets (2) according to any of the preceding claims, **characterized in that** the pallet selection unit (4) comprises an upper surface (44) to carry the pallets, preferably where at least a part (R) of the upper surface (44) is arranged rotatable around an axis vertical to the upper surface (44).

6. System (1) for selecting and forwarding pallets (2) according to claim 6, **characterized in that** the pallet selection unit (4) is arranged to lower the non-rotatable part (NR) below the upper surface (44) or to lift the rotatable part (RP) above the upper surface (44).

7. System for selecting and forwarding pallets according to claim 5 or 6, **characterized in that** the upper surface (44) comprises by an array of 360° pivot-mounted balls (47) or two vertically arranged arrays (45, 46) of alternatively operational carrier means both being able to be lowered to a level (LL) below the upper surface (44) independently.

8. System (1) for selecting and forwarding pallets (2) according to any of the preceding claims, **characterized in that** the pallet receiving unit (5) comprises positioning means (56), preferably arranged at two sides above a loading surface (57) of the pallet receiving unit (5), to position the selected pallets (2) inside the pallet receiving unit (5), more preferably the positioning means (56) are adjustable to different types of pallets.

9. System (1) for selecting and forwarding pallets (2) according to any of the preceding claims, **characterized in that** the pallet receiving unit (5) is arranged as a vertical pallet lift (51), a pallet storage magazine (52), a pallet pre-stacker (53), a pallet entry terminal (54) and/or a pallet exit terminal (55).

10. System for selecting and forwarding pallets according to claim 9, **characterized in that** the loading surface (57) of the pallet lift (51) is arranged to be lifted or lowered to a second level of height (SL) in order to forward the pallet (2) via second carrier means (32) arranged at a second level of height (SL).

11. System for selecting and forwarding pallets according to claim 9, **characterized in that** pallet storage magazine (52) comprises multiple movable pick-up elements (521) to support at least one pallet (2) and a lifting unit (522) suitable to vertically lift the movable pick-up elements (521) and to hold the pick-up element at a storing level (STL) in order to vertically

stack the pallets (2) one upon the other each supported by at least one movable pick-up element (521) inside the pallet storage magazine (52).

12. System for selecting and forwarding pallets according to claim 9, **characterized in that** the pallet prestacker (53) and/or the pallet entry terminal (54) and/or the pallet exit terminal (55) comprises a cavity (58) suitable to insert the fork (61) of a forklift (6) below an entry and/or exit level (EL) of the pallets (2), preferably a cavity with a U-shape.

13. Method to operate a system (1) for selecting and forwarding pallets (2) according to claim 1 comprising the steps of

- transporting pallets (2) of different pallet types via carrier means (3) to a pallet selection unit (4) arranged with the carrier means (3),
- selecting one or more pallets (2) according to at least one type of pallets out of multiple pallets (2) of different types of pallets passing the pallet selection unit (4) on the pallet selection unit (4),
- forwarding (FS) the selected pallet (2) to a pallet receiving unit (5) connected to the pallet selection unit (4), and
- forwarding (FN) the non-selected pallets (2) along the carrier means (3).

14. Method according to claim 13, **characterized in that** the step of selecting the pallet (2) on the pallet selection unit (4) comprises indentifying the geometrical size and/or the alignment of the pallet (2) relative to the pallet receiving unit (5) by size detection means (41) and/or detecting the weight of the pallets by weight detection means (42).

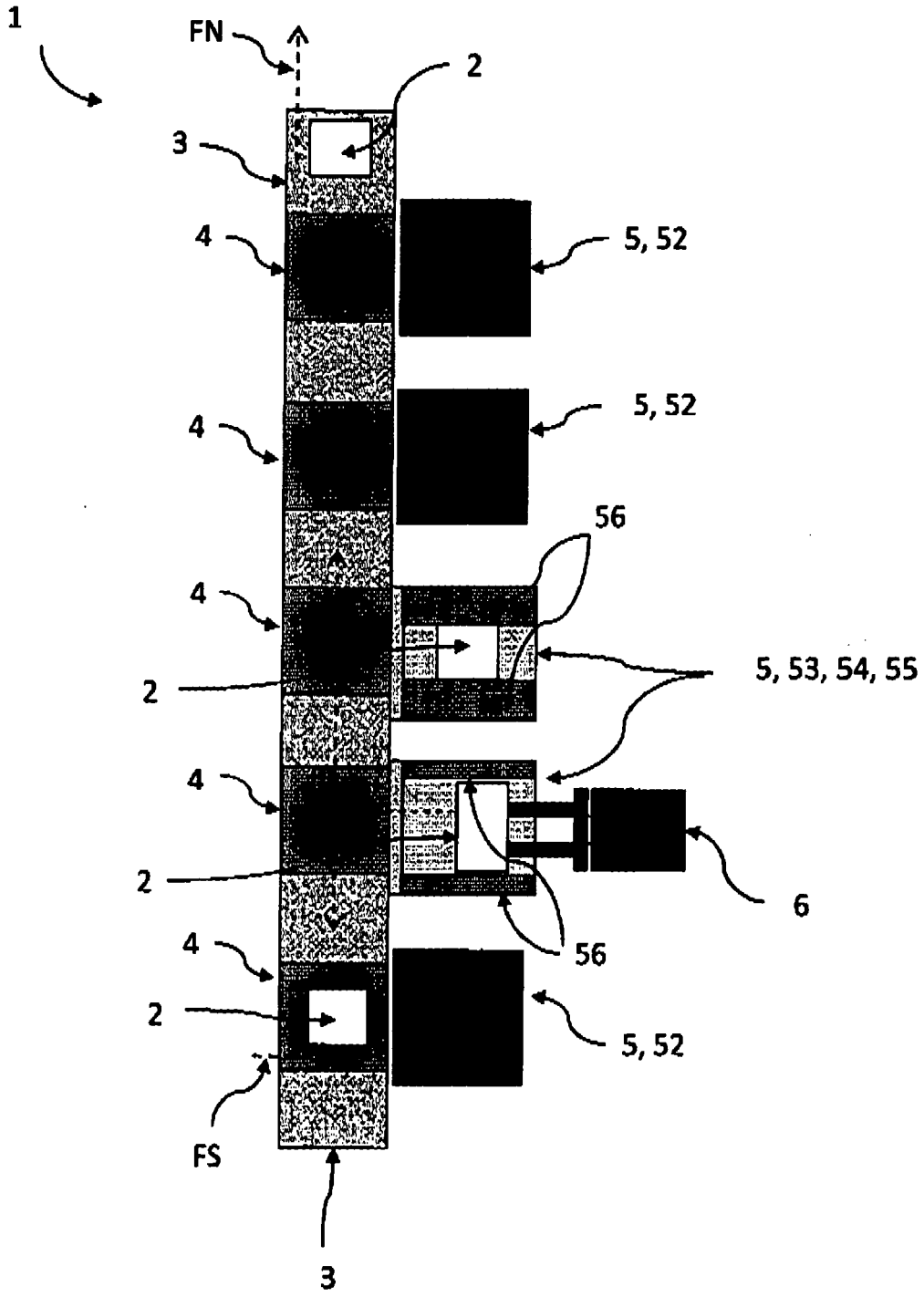
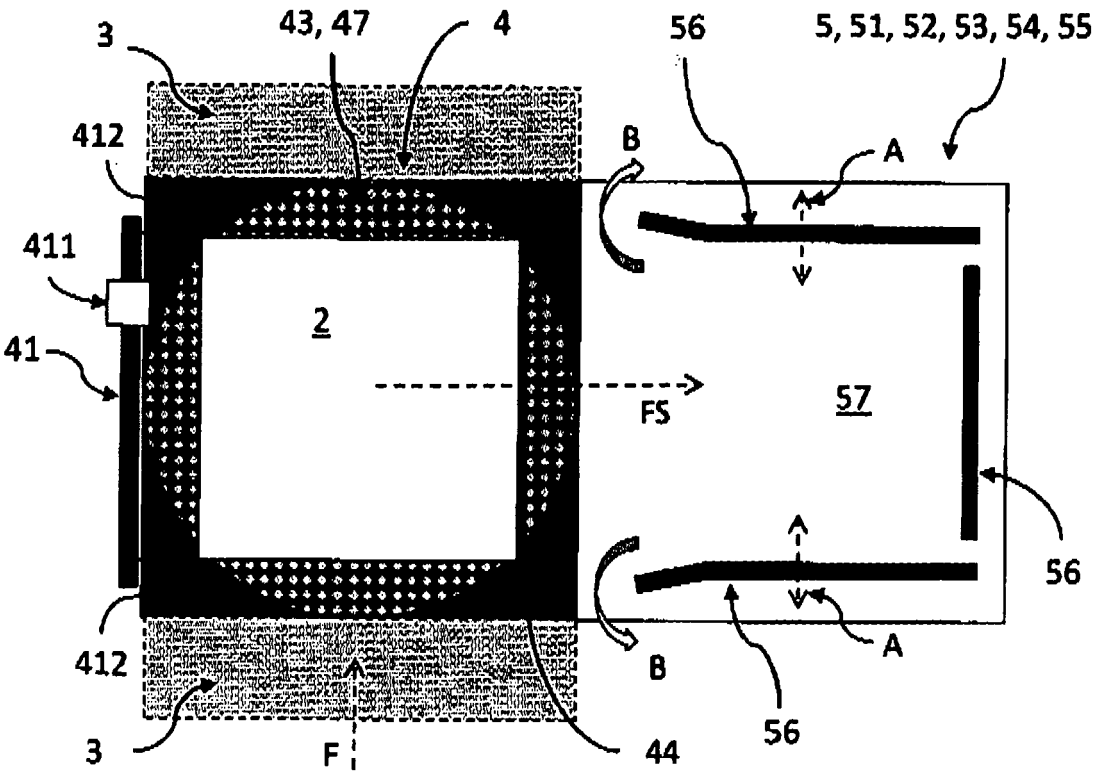


Fig.1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43, 47
4
56
5, 51, 52, 53, 54, 55
412
B
A
411
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41
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57
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412
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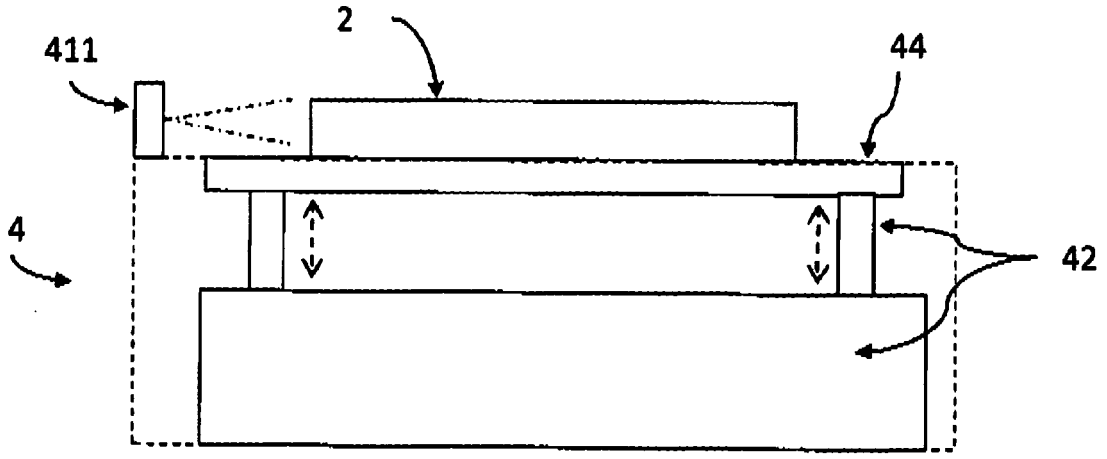
3
F
44
56

Fig.2


411
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44
4
42

Fig.3

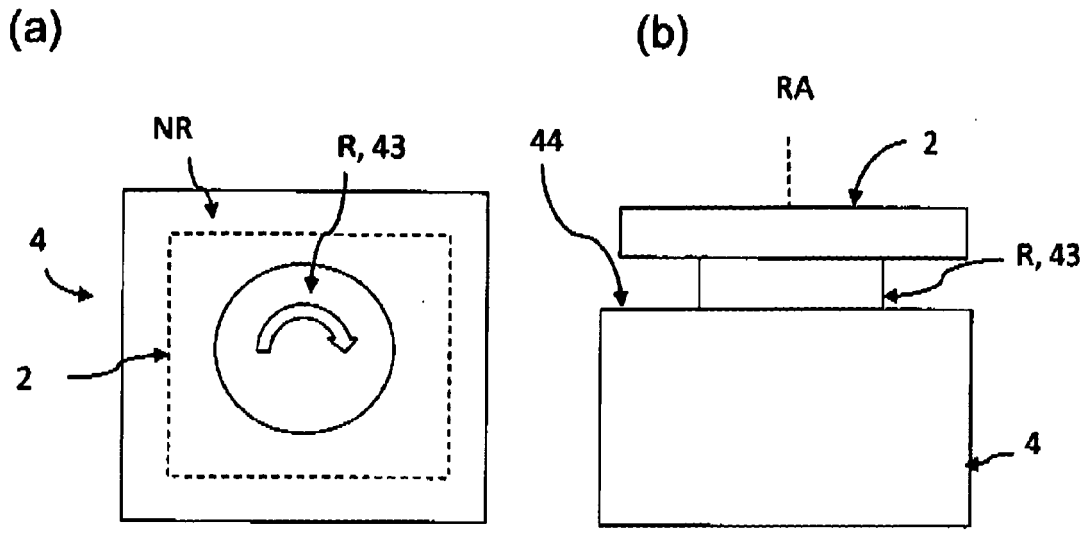

Fig.4

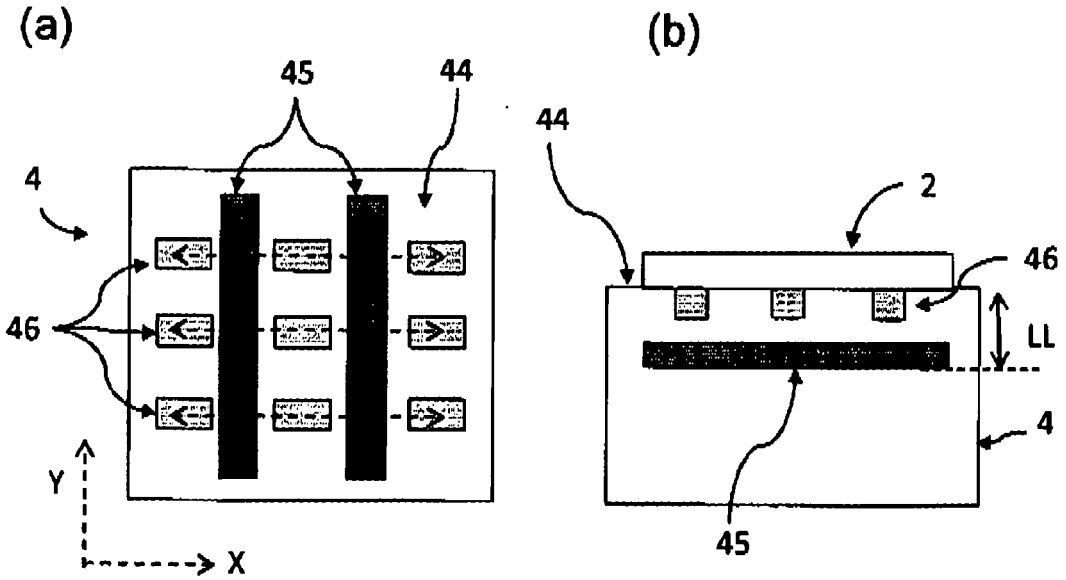

Fig.5

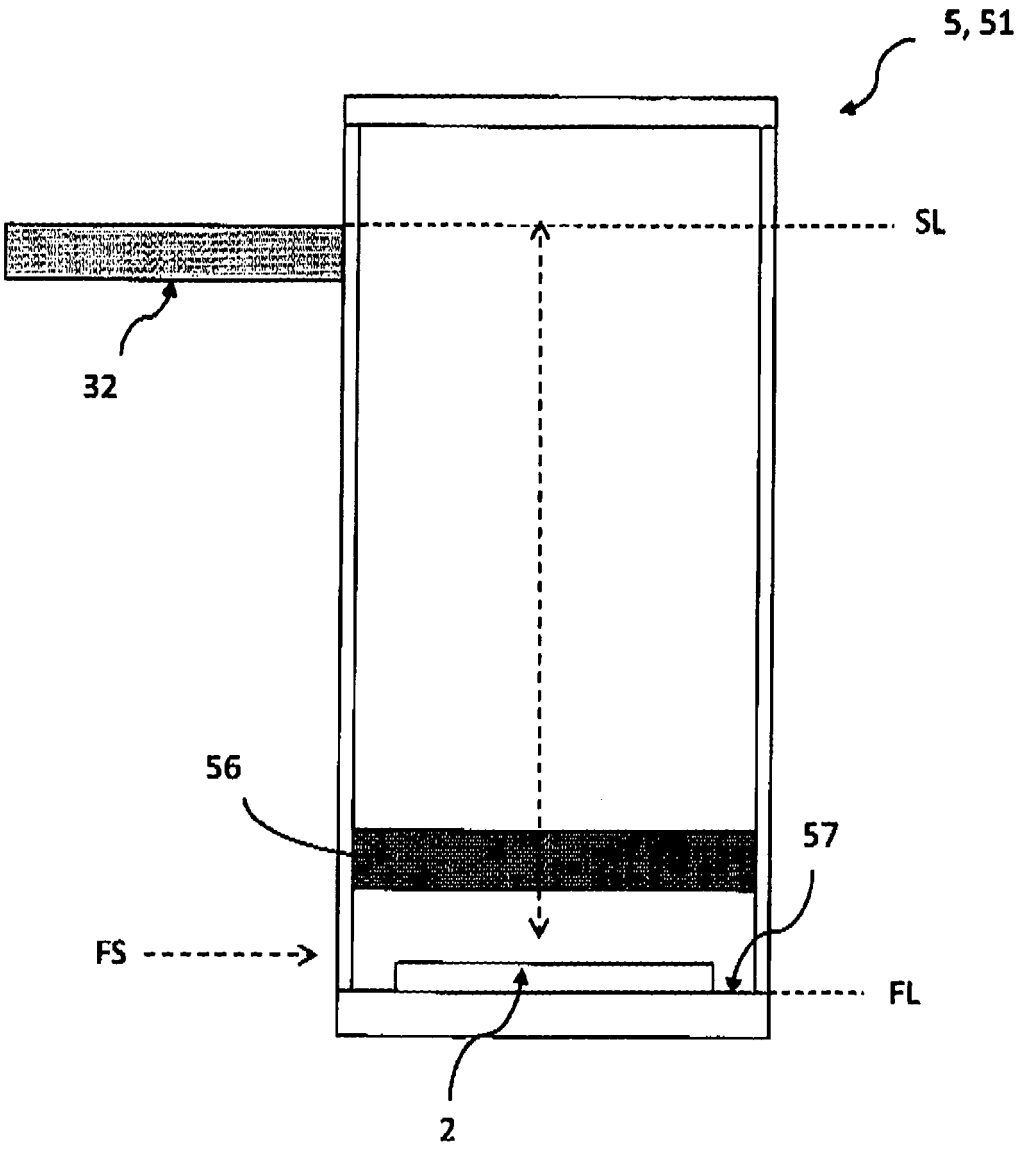

Fig.6

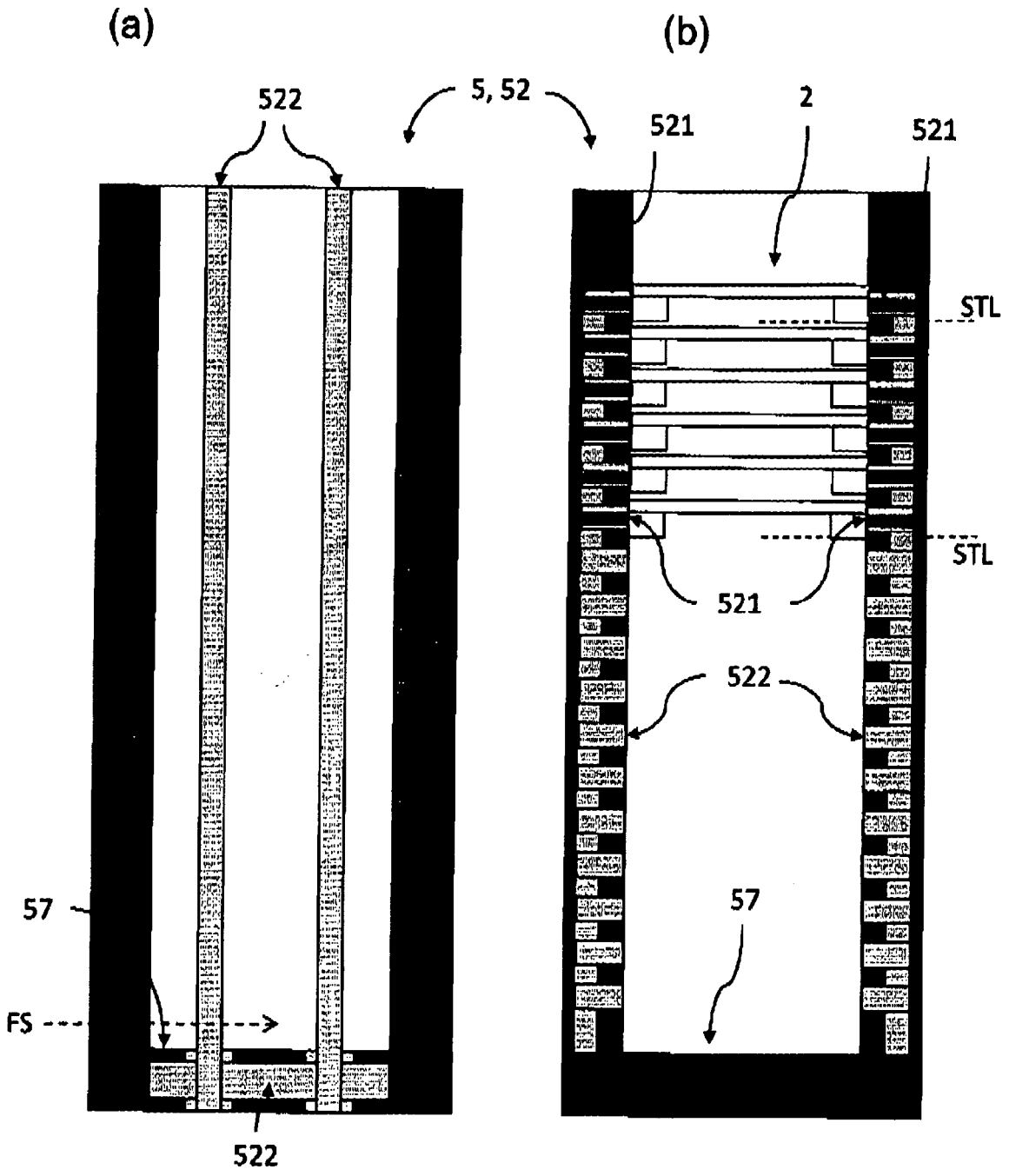

Fig.7

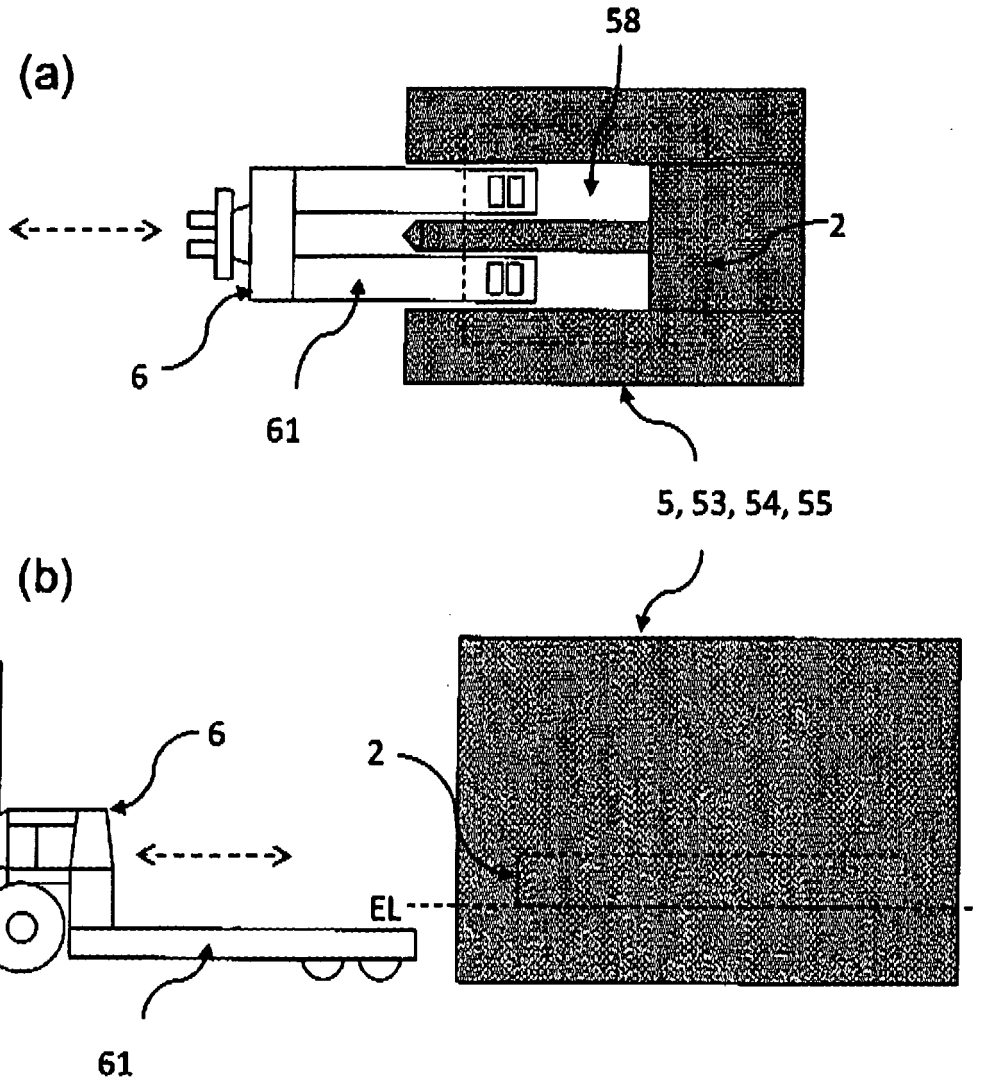

Fig.8

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EUROPEAN SEARCH REPORT

Application Number
EP 09 01 6081

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	ES 2 283 173 A1 (LOGIFRUIT S L [ES]) 16 October 2007 (2007-10-16) * abstract; figures * -----	1,13,14	INV. B07C5/08
X	JP 2000 321215 A (ASAHI BREWERIES LTD; WATANABE TEKKO KK) 24 November 2000 (2000-11-24) * abstract; figures * -----	1,13,14	
X	ES 2 283 174 A1 (LOGIFRUIT S L [ES]) 16 October 2007 (2007-10-16) * column 3, line 21 - column 4, line 41; figures * -----	1,13,14	

TECHNICAL FIELDS SEARCHED (IPC)

B07C

~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
Munich	7 June 2010	Wich, Roland

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

Europäisches Patentamt
European Patent Office
Office européen des brevets

Application Number
EP 09 01 6081

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

2, 13(completely); 1, 14(partially)

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 09 01 6081

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 2, 13(completely); 1, 14(partially)

   Geometrical size
   ---

2. claims: 13(completely); 1, 14(partially)

   Alignment of the pallet relative to the pallet receiving unit
   ---

3. claims: 4, 13(completely); 1, 14(partially)

   Identification of the weight of the pallets
   ---

4. claim: 3(partially)

   Reading coded information
   ---

5. claim: 3(partially)

   Measure size or allignment
   ---

6. claims: 5-7

   Pallet selection
   ---

7. claim: 8

   Positioning means of receiving unit
   ---

8. claims: 9-12

   Lift, mazazine, pre-stacker, entry/exit

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 09 01 6081

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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07-06-2010

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
ES 2283173 A1	16-10-2007	NONE	
JP 2000321215 A	24-11-2000	NONE	
ES 2283174 A1	16-10-2007	NONE	

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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Patent documents cited in the description

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