

Description

Order-picking unit

It is known, from German journal fördern und
heben [conveying and lifting] 19 (1969) No. 12, pages 727
5 to 732, to use storage and retrieval units in dynamic
stores as storage units for the items coming from the
goods reception or directly from production or as
retrieval units for removing the items in accordance with
placed orders. In contrast, the so-called compart-
10 mentalized stores are divided up into individual rack
systems with aisles which are located therebetween and
through which storage and retrieval units can pass in
each case. The items arriving at the aisles in the trans-
verse direction from the goods reception or production on
15 a storage and retrieval conveyor are discharged upstream
of a predetermined aisle, received by the storage and
retrieval unit and deposited in the desired compartment.
Retrieval takes place in the opposite direction using the
same conveying elements. The storage and retrieval unit
20 fetches the desired item from the compartment and
transfers it to the storage and retrieval conveyor
leading to despatch in said direction.

The known storage and retrieval units used in
order-picking units comprise a carriage which can be
25 displaced on rails in the aisle between two rack systems
and bears a vertical mast. A lifting part, which can be
displaced in the vertical direction on the mast, bears,
then, the gripping system which is necessary for the
storage and/or retrieval of the items. When the rack
30 systems are very high, guide rails in the ceiling region
may also be provided in addition to the rails laid on the
floor. Due to the space which is necessary in the floor
region for carriage and lifting part and in the ceiling
region for the lifting part, the corresponding regions of
35 the rack systems cannot be utilized for compartments. The
floor and ceiling space which is required as a result of
the design of the storage and retrieval units and cannot be
utilized for compartments thus results, in particular in

areas of relatively low height, in a considerable reduction in storage capacity.

The problem faced by the invention specified in Claim 1 is to provide an order-picking unit which is of
5 simple construction and requires only a small amount of space to set up. Moreover, the cellular or modular construction is intended to make it possible to arrange two or more order-picking units in a row one beside the other.

10 The advantages achieved by the invention consist, in particular, in that, by virtue of the pivotable gripping system, the input conveyor and/or discharge conveyor may run so as to adjoin an aisle in the longitudinal direction. In such a space-saving arrangement,
15 the items may be received by the storage and retrieval unit directly from an input conveyor and discharged directly onto a discharge conveyor. Since said direct removal and supply operations also apply to conveyors running in the transverse direction, there is a high
20 degree of flexibility for the arrangement and orientation of input conveyors and discharge conveyors.

Advantageous configurations of the invention are specified in the subclaims.

Further significant advantages of the order-
25 picking unit result from the configuration of the storage and retrieval unit according to Claim 6. Only relatively narrow rack-system strips which cannot be utilized for compartments are covered by the guides, intended for the carriage of the storage and retrieval unit, which extend
30 in the horizontal direction at half the height of the two rack systems. Starting from said central strips, the lifting device arranged on the carriage can then displace the gripping system upwards to beneath the ceiling and downwards as far as the floor, i.e., in contrast to known
35 storage and retrieval units, both the ceiling region and the floor region can be utilized for compartments, which can be served by the

storage and retrieval unit, of the two rack systems. Moreover, input conveyors of an adjacent unit may be routed through the order-picking unit without difficulty in the transverse direction since the storage and retrieval unit can readily pass over them.

Exemplary embodiments of the invention are described in more detail hereinbelow and are represented in the drawing, in which:

- Figure 1 shows a plan view of a first embodiment of an order-picking unit,
- Figure 2 shows a plan view of a second embodiment of an order-picking unit,
- Figure 3 shows a plan view of a third embodiment of an order-picking unit,
- Figure 4 shows the basic principle of the storage and retrieval unit used in the order-picking units according to Figures 1 to 3,
- Figure 5 shows a side view of lifting device and gripping system of a storage and retrieval unit,
- Figure 6 shows a plan view of a complete storage and retrieval unit with lifting device and gripping system according to Figure 5, and
- Figure 7 shows a three-dimensional representation of an order-picking unit according to Figure 1.

Figure 1 shows, in a vastly simplified schematic representation, a plan view of a first embodiment of an order-picking unit for stackable items. Said order-picking unit comprises two rack systems RS1 and RS2 which are arranged in parallel at a distance from one another and are each equipped with a multiplicity of compartments RF,

a storage and retrieval unit RBG which can be displaced in the longitudinal direction X in the aisle between the two rack systems RS1 and RS2, an input conveyor EF which arrives from the right-hand side in the transverse direction Z, and a discharge conveyor AF which departs adjoining the aisle in the longitudinal direction X. A switchgear cabinet designated by SS is arranged in the rear region of the second rack system RS2. Moreover, an additional input conveyor ZEF which arrives from the right-hand side in the transverse direction Z and is routed through the order-picking unit to an adjacent unit (not shown in the drawing) is also represented.

The storage and retrieval unit RBG comprises a carriage W which can be displaced in the aisle in the longitudinal direction X, a lifting device HE which is arranged on the carriage W, and a gripping system GS which can be adjusted in the vertical direction Y with the aid of the lifting device HE. The vertical direction, which runs perpendicularly with respect to the plane of the drawing, is indicated in Figure 1 by a cross. The gripping system GS is fitted pivotably on the lifting device HE, with the result that it can be pivoted, through 90° or 180°, into three positions I, II and III. In the first position I, indicated by chain-dotted lines, the gripping system GS is oriented towards the first rack system RS1 in the transverse direction Z, i.e. the compartments RF of the first rack system RS1 can be loaded or unloaded in the position I. In the second position II, likewise indicated by chain-dotted lines, the gripping system GS is oriented in the longitudinal direction X, i.e. items can be supplied directly onto the discharge conveyor AF in the position II. In the third position III, represented by solid lines, the gripping system GS is oriented towards the second rack system RS2 in the transverse direction Z, i.e. the compartments RF of the second rack system RS2 can be loaded or unloaded in the position III. However, it is also possible for items arriving on the input conveyor EF to be received directly in the position III.

The second embodiment, represented in Figure 2, of an order-picking unit differs from the first embodiment, represented in Figure 1, in that, here, the input conveyor EF arrives in the longitudinal direction X, while the discharge conveyor AF departs in the transverse direction Z.

The third embodiment, represented in Figure 3, of an order-picking unit differs from the first two embodiments according to Figures 1 and 2 in that, here, the input conveyor EF arrives in the longitudinal direction X and, at the same time, the discharge conveyor AF departs in the longitudinal direction X. This makes it possible for a relatively large number of order-picking units to be arranged one beside the other. The input conveyor EF and the discharge conveyor AF are arranged one above the other, with the result that, as in the case of the first two embodiments, the aisle is also accessible here, for example, for maintenance work.

Figure 4 shows, in a vastly simplified schematic representation, a lateral view of the first rack system RS1 with the compartments RF, which are arranged one beside the other in the horizontal longitudinal direction X and one above the other in the vertical Y-direction. The Z-direction, indicated in Figure 4 by a cross, corresponds to the transverse direction running perpendicularly with respect to the plane of the drawing, i.e. it specifies the direction of the depth of the compartments RF. Extending in the longitudinal direction X at half the height H of the first rack system RS1 is a guide F for the carriage W, represented only schematically in Figure 4, of the storage and retrieval unit RBG. Arranged on said carriage W is the lifting device HE, which will be explained in more detail in conjunction with Figures 5 and 6 and whose driven member A, which can be adjusted in the vertical Y-direction, bears the gripping system GS which can be displaced in the transverse direction Z. It can be seen that the gripping system GS can advance up to each individual compartment RF by the carriage W being displaced in the longitudinal direction X and by the

lifting device HE being adjusted in the Y-direction. The item WA which is represented in Figure 4 by a dashed line

may then be stored or retrieved, once the gripping system GS has been advanced up to a predetermined compartment RF, by said gripping system being displaced in the Z-direction, said gripping system here having been
5 pivoted into the position I (see Figures 1 to 3).

Figures 5 and 6 respectively show a side view of the lifting device HE with the gripping system GS and a plan view of the complete storage and retrieval unit RBG with carriage W, lifting device HE and gripping system
10 GS. The storage and retrieval unit RBG is arranged in the aisle between the two rack systems RS1 and RS2 (see Figures 1 to 3) and thus comprises two U-shaped guides F which are arranged at a distance from one another at half the height of the associated rack systems RS1 and RS2. In
15 said two guides F, the carriage W, which is U-shaped in plan view, is guided in the X-direction with the aid of four rollers RO. On the inner side of the two legs of the carriage W, in each case one crank KU is arranged rotatably on a first, rotationally fixed articulation spindle
20 GA1. The other two ends of the crank KU are connected to one another in a rotationally fixed manner via a second articulation spindle GA2. Mounted rotatably on said second articulation spindle GA2, in the centre between the two cranks KU, is a connecting rod KO which, for its
25 part, bears a rotatably mounted, third articulation spindle GA3 at its other end. The driven member A, which is of a fork-like design, is connected in a rotationally fixed manner to said third articulation spindle GA3 and is thus mounted rotatably on the connecting rod KO.

30 The two cranks KU, the connecting rod KO and the driven member A form a link chain which is designed, and whose links are driven, such that the third articulation spindle GA3 executes a purely vertical movement in the Y-direction during a rotation of the cranks KU, and that
35 the driven member A maintains its horizontal three-dimensional orientation in the process. For this purpose, first of all the distances between the articulation spindles GA1 and GA2 of the crank KU and the distance between the articulation spindles GA2 and GA3 of the

connecting rod KO are of equal length. Moreover, the connecting rod KO is driven, via two first chain or belt drives

RT1, at a ratio of 2:1 by the cranks KU, while the driven member A is driven, via a second chain or belt drive RT2, at a ratio of 1:2 by the connecting rod KO. If relatively heavy items WA are to be handled, such as the stacks of paper which are to be handled in the exemplary embodiment represented, chain drives with single or double chains are preferred. Thus, each of the two first chain or belt drives RT1 comprises a large chain wheel KG1 connected in a rotationally fixed manner to the first articulation spindle GA1, a chain KE1, and a small chain wheel KK1 mounted rotatably on the second articulation spindle GA2 and connected in a rotationally fixed manner to the connecting rod KO. The second chain or belt drive RT2 comprises a small chain wheel KK2 arranged in a rotationally fixed manner on the second articulation spindle GA2, a chain KE2, and a large chain wheel KG2 mounted rotatably on the third articulation spindle GA3 and connected in a rotationally fixed manner to the driven member A. The small chain wheel KK2 and the large chain wheel KG2 are arranged within the slit end region of the connecting rod KO.

The gripping system GS is mounted on a trolley SL such that it can be pivoted through a total of 180°, as is indicated in Figure 6 by a double arrow DPF1. The gripping system GS, which is represented in the position III, can thus be pivoted, by a pivot movement through 180°, into the position I (see Figures 1 to 3). In the case of a likewise possible pivot movement through 90°, the gripping system GS extends in the position II (see Figures 1 to 3) in the X-direction, i.e. in the direction of the corresponding aisle. For its part, the trolley SL is arranged such that it can be displaced in the transverse direction Z on a trolley guide SF fitted on the forked driven member A. The items WA which are to be handled by the gripping system GS, these items being stacks of paper indicated by chain-dotted lines in the exemplary embodiment represented, are received between a lower jaw BU and an upper jaw BO which can be adjusted relative to said lower jaw BU. This makes active gripping

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possible, in the case of which the gripping system GS
clamps the stacks of paper

and thus ensures absolutely reliable handling. The lower jaw BU is designed as a fork with a plurality of tines, with the result that the items WA can be lowered on a conveying device with correspondingly spaced-apart belts or else can be lifted by a conveying device of this type. Furthermore, the fork-like design of the lower jaw BU has the advantage that, during loading of the compartments RF (see Figures 1 to 4) with items WA, likewise forked removal and retaining elements retain the items WA as the gripping system GS is drawn back into the compartments RF. In this arrangement, the tines of the removal and retaining elements are pivoted or displaced in between the tines of the lower jaw BU. For this purpose, the upper jaw BO may likewise be configured as a fork with a plurality of tines.

For reasons of simplifying the illustrative representation and improving clarity, the drives of the carriage W, of the lifting device HE, of the trolley SL and of the gripping system GS are not represented in any more detail in Figures 5 and 6. The carriage W may be driven, for example, via toothed belts or chains or else via a pinion or a rack. The lifting device HE may be driven via a geared motor which is arranged on the carriage W and drives the cranks KU. The trolley SL may be adjusted in the Z-direction via a motor and a threaded spindle. The upper jaw BO is adjusted, for example, pneumatically relative to the lower jaw BU of the gripping system GS.

Figure 7 shows an order-picking unit for the intermediate storage and order-picking of stacks of paper corresponding to the first embodiment, represented in Figure 1. This three-dimensionally represented order-picking unit comprises the rack systems RS1 and RS2, which have already been presented schematically in Figure 1, the storage and retrieval unit RBG, which can be displaced in the aisle on the two guides F arranged at half the height of the racks, the switchgear cabinet SS, arranged in the rear region of the second rack system RS2,

the input conveyor EF, and the discharge conveyor AF.

The items WA discharged in the form of stacks of paper, if appropriate, from a plurality of printing machines (not shown in Figure 7) (see Figures 4 to 6) are collected on the input conveyor EF and supplied, via a curved piece KS, to a toothed belt/lifting transfer apparatus ZHU. The items WA arriving in the longitudinal direction X on the toothed belt/lifting transfer apparatus ZHU are supplied in the Z-direction to a first belt conveyor RIF1 by virtue of the two toothed belts designated by ZR being lifted, said first belt conveyor being arranged in a passageway DF of the second rack system RS2. Said passageway DF is made up of two normal compartments RF of the second rack system RS2 between which the corresponding shelf has been removed. The toothed belt/lifting transfer apparatus ZHU also makes manual input of the items WA possible. Provided for this purpose is a manual-input conveyor HEF which transfers the items WA in the Z-direction to the toothed belt/lifting transfer apparatus ZHU, which then, for its part, transfers the items WA to the first belt conveyor RIF1 by lifting the toothed belts ZR.

The items WA provided on the first belt conveyor RIF1 in the passageway DF of the second rack system RS2 can be gripped there by the gripping system GS of the storage and retrieval unit RBG. For this purpose, the gripping system GS is pivoted into the position III (see Figure 1) and, by virtue of the carriage W being displaced in the longitudinal direction X and the lifting device HE being adjusted in the Y-direction, is moved into a position on the inner side of the passageway DF. By virtue of the gripping system being displaced in the Z-direction, the respective item WA may then be clamped between the jaws BO and BU (see also Figure 5). Prior to the active gripping of the items WA, the individual tines of the lower jaw BU are located in the gaps between the belts of the first belt conveyor RIF1. The storage and retrieval units RBG can then, in the present position III of the gripping system GS, store the gripped item WA in

one of the compartments RF of the second rack system RS2. However, by virtue of the gripping system GS being pivoted through 180° in the direction of the arrow PF2, the stor-age and retrieval unit RBG can also store the gripped item WA in one of the compartments RF of the first rack system RS1.

In the event of order-picking, i.e. in the event of items WA being put together in accordance with a placed order, the storage and retrieval unit RBG moves the gripping system GS, in the position II (see Figure 1), in front of the corresponding compartments RF of the first rack system RS1 or, in the position III (see Figure 1), in front of the corresponding compartments RF of the second rack system RS2, whereupon the items WA stored intermediately there are actively gripped. This gripping and the removal of an item WA from an upper compartment RF of the first rack system RS1 is presented in Figure 7. After the item WA has been removed from the compartment RF, the gripping system GS is then pivoted through 90° into the position II (see Figure 1) and is subsequently displaced downwards in the Y-direction. In the bottom position US of the gripping system GS, indicated in Figure 7 by dashed lines, the item WA may then be transferred to a second belt conveyor RIF2, which is oriented in the longitudinal direction X and is arranged, in the end region of the aisle, in front of the first rack system RS1. In the event of this transfer too, the tines of the lower jaw BU are located between the belts of the belt conveyor. After the transfer of the items WA to the second belt conveyor RIF2, said items are transferred to the discharge conveyor AF, which adjoins the end of the belt conveyor RIF2 and runs in the longitudinal direction X. The discharge conveyor AF then transports the items WA through a wall opening MD to a pick-up location (not shown in Figure 7). At said pick-up location, the items WA which have been put together in accordance with customer requirements may be picked up or passed on for despatch to the appropriate customer.



Patent claims

1. Order-picking unit, in particular for stackable items (WA), having
 - two rack systems (RS1, RS2) which are arranged in parallel at a distance from one another and are each equipped with a multiplicity of compartments (RF),
 - a storage and retrieval unit (RGB) [sic] which can be displaced in the longitudinal direction (X) in the aisle between the two rack systems (RS1, RS2) and is provided with a gripping system (GS) for storing and retrieving items (WA),
 - an input conveyor (EF) for the supply of items (WA), and having
 - a discharge conveyor (AF) for the discharge of the picked items (WA),
 - it being possible for the gripping system (GS) to be pivoted towards the first rack system (RS1) in the transverse direction (Z) into a first position (I), in the longitudinal direction (X) into a second position (II), and towards the second rack system (RS2) in the transverse direction (Z) into a third position (III), and
 - the input conveyor (EF) and/or the discharge conveyor (AF) being oriented so as to adjoin the aisle in the longitudinal direction (X).
2. Order-picking unit according to Claim 1, characterized in that the input conveyor (EF) is oriented so as to adjoin a passageway (DF) of a rack system (RS2) in the transverse direction (Z), and in that the discharge conveyor (AF) is oriented so as to adjoin the aisle in the longitudinal direction (X).
3. Order-picking unit according to Claim 1, characterized in that the input conveyor (EF) is oriented so as to adjoin the aisle in the longitudinal direction (X), and in that the discharge conveyor (AF) is oriented so as to adjoin a passageway (DF) of a rack system (RS2) in the transverse direction (Z).



4. Order-picking unit according to Claim 1, characterized in that the input conveyor (EF) and the discharge conveyor (AF) is [sic] oriented so as to adjoin the aisle in the longitudinal direction (X).
- 5 5. Order-picking unit according to Claim 4, characterized in that the input conveyor (EF) and the discharge conveyor (AF) are arranged one above the other.
6. Order-picking unit according to one of Claims 1 to 5, characterized by a storage and retrieval unit (RBG)
- 10 having
- two guides (F) which extend in the horizontal direction (X) at half the height (H) of the rack systems (RS1, RS2),
 - a carriage (W) which can be displaced on the guides

15 (F),

 - a lifting device (HE) which is arranged on the carriage (W) and whose driven member (A) can be adjusted in the vertical direction (Y), and having
 - a gripping system (GS) which is arranged on the driven

20 member (A) of the lifting device (HE), can be pivoted into the three positions (I,II,III) and can be displaced in the transverse direction (Z).
7. Order-picking unit according to Claim 6, characterized in that the lifting device (HE) is formed by a link
- 25 chain.
8. Order-picking unit according to Claim 7, characterized in that the lifting device (HE) comprises two cranks (KU) mounted to be synchronously rotatable on the carriage (W), a connecting rod (KO) mounted rotatably
- 30 between the cranks (KU), and the driven member (A), which is mounted rotatably on the connecting rod (KO).



9. Order-picking unit according to Claim 8, characterized in that the connecting rod (KO) is driven such that the driven member moves in the vertical direction (Y).
10. Order-picking unit according to Claim 9, characterized in that the connecting rod (KO) is driven at a ratio of 2:1 by the crank (KU).
11. Order-picking unit according to Claim 10, characterized in that the connecting rod (KO) is driven by the crank (KU) via a first chain or belt drive (RT1).
- 10 12. Order-picking unit according to one of Claims 7 to 11, characterized in that the driven member (A) is driven such that it maintains its three-dimensional orientation during a rotation of the crank (KU).
13. Order-picking unit according to Claim 12, characterized in that the driven member (A) is driven at a ratio of 1:2 by the connecting rod (KO).
- 15 14. Order-picking unit according to Claim 13, characterized in that the driven member (A) is driven by the connecting rod (KO) via a second chain or belt drive (RT2).
- 20 15. Order-picking unit according to one of Claims 8 to 14, characterized in that the distances between the articulation spindles (GA1,GA2,GA3) of cranks (KU) and connecting rod (KO) are of equal length in each case.



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16. Order-picking unit according to one of Claims 6 to 15, characterized in that a trolley (SL) which can be displaced in the transverse direction (Z) and is intended for the gripping system (GS) is fitted on the driven
- 5 member (A), and in that the gripping system (GS) is arranged on the trolley (SL) such that it can be pivoted into the three positions (I,II,III).